Planning to Save and Executive Function in Preschool Children

by

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Abstract

Preschoolers' ability to create, and implement, a plan to save a limited resource for future use was examined. Children were given five marbles then spent 3 minutes with a less-desirable opportunity to use them (for most, a simple marble run), then 3 minutes with a more-desirable opportunity (a complex marble run), for two trials. Half of the children were given the opportunity to create an explicit plan by allocating their marbles between bowls (similar to budgeting their resource). The opportunity to plan facilitated saving on Trial 1. Children not given the opportunity to plan performed poorly on Trial 1, but learned to save by Trial 2. All children in the Planning condition, regardless of whether they planned to save, performed similarly on a measure of planning ability. Saving was not correlated with measures of inhibitory control, indicating that something beyond these skills may account for performance on the Savings task.

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Planning to Save and Executive Function in Preschool Children

The ability to save has been investigated in both the economic and the psychological literature. More recently, the field of economic psychology has emerged and has attempted to merge economic and psychological aspects of savings behaviours. This approach focuses on people's understanding of the value of saving because both saving and failing to save have short- and long-term consequences. People have to learn how to save for all sorts of things. In the short-term, they have to save money to pay the rent, buy groceries, and pay utility bills. In the long-term, they have to save up for far-off goals such as retirement. Also, it's not just money that needs to be saved. We often have to 'save time' to enable us to complete a job or save resources to complete a task (e.g., save some milk for tomorrow's breakfast, or some candy for another day). People who do not save often have to deal with negative consequences and experience stress. Therefore, the ability to save is an important one.

Due to the importance placed on the ability to save, it is essential to examine the development of saving abilities in children. Research in children's ability to save is important for a number of reasons. If the ability to save begins to develop during the preschool years this could inform academic institutions, as well as parents, with respect to financial and economic education. Research has shown that early savings education for children is related to financial success. However, because the majority of economic socialization occurs in the home, knowledge gaps can exist that can prove detrimental to financial performance (Grinstein-Weiss, Spader, Yeo, Taylor & Freeze, 2011). Research has shown that possessing savings and participation in the savings process may increase one's educational expectations and may lead to improved academic achievement (Elliott,

2008; Sherraden, Johnson, Elliott, Porterfield & Rainford, 2007). Overall, the ability to save is an extremely important life skill and can dramatically affect social, educational and emotional outcomes.

There is some consensus regarding the definition of saving. Traditionally, saving was defined in terms of the "excess of income over consumption expenditure in a period" (Warneryd, 1999, p. 42). Thus, decisions related to spending now and spending in the future is directly related to an individual's available income. More recent definitions have focused on the saving of resources, as opposed to strictly one's income. Following common economical themes, Warneryd (1999) describes saving in terms of 'deferment of consumption to the future' (p. 159), while Metcalf and Atance (2011) characterize saving in terms of reserving resources for enjoyment at some point in the future. The overarching theme of these definitions is the postponement of consumption of a limited resource to a point in the future.

These definitions capture saving outcomes without taking into account the processes involved in saving. Successful saving requires more than postponement: it requires the decision to save, the creation of a plan to save, and the implementation of that plan. Planning refers to the ability to recognize the steps required to reach a goal and following those steps n order to reach that goal (Guavain & Rogoff, 1989). While researchers are beginning to attend to the issue of planning (e.g., Rabinovich & Webley, 2007), the definitions provided in the research literature are lacking. Therefore, the current study adopts aspects of both Warneryd's and Metcalf and Atance's definitions of saving while connecting the plan to save with the saving behaviour. As such, saving will be defined as involving both the creation of a plan to postpone the consumption of a

limited resource to a future point in time and the successful implementation of that plan. The current study will focus on both aspects of saving – planning and implementation.

Some adult literature has examined methods to facilitate, or encourage, saving for the future, often with an emphasis on retirement (Bernheim, Skinner & Weinberg, 2001; van Schie, Donkers & Dellaert, 2012). Other adult studies have emphasized the factors associated with the accrual of debt or attitudes towards saving, including level of education, age, self-control (impulsivity), net wealth and work status (Fisher & Montalto, 2010; Furnham, 1985; Ottavani & Vandone, 2011). Although most of the factors addressed in these studies cannot be directly applied to children, one area can be used to inform research investigating the factors that may predict saving ability in children: that addressing the role of self-control in saving (e.g., Shefrin & Thaler, 1988). Definitions of self-control are varied and include concepts such as self-regulation, delay of gratification, and inhibition of impulses (Cournoyer & Trudel, 1991; Kendall & Wilcox, 1979; Mischel & Mischel, 1983). A number of studies have found robust connections between the behavioural trait of self-control, as displayed in childhood (for example, using the classic 'marshmallow task'), and adult outcomes (e.g., Mischel, Ebbesen & Zeiss, 1972; Moffitt et al., 2011). Thus, it is reasonable to expect self-control in children to be related to saving in childhood.

Using reports from parents, teachers, researcher observations and the participating children, Moffit et al. (2011) found that those children who displayed poorer self-control (measured at 3, 5, 7, 9 and 11 years of age) were less financially stable and had more difficulty with money and debt management at age 32, independent of social class and IQ. Given the strong relation between the development of self-control in children as

young as 3-years-old and saving outcomes as an adult (Moffitt et al., 2011; Shoda, Mischel & Peake, 1990), it makes sense to study savings in children between the ages of 3- and 5-years old, an age range during which children's self-control skills demonstrate significant improvement (Mischel & Metzner, 1962; Sonuga-Barke, Lea & Webley, 1989).

There is some research done with young children, but it is very limited and mostly deals with children 6 years of age and older. This research has investigated children's savings strategies, primarily using tokens in the place of money (e.g., Otto, Schots, Westerman & Webley, 2006; Webley, Levine & Lewis, 1991). It has found that strategies used to achieve saving goals increase in sophistication between the ages of 6 and 12 years, with 6-year-olds often making no attempt to save in testing situations to 9- and 12-year-olds often creating strategies that involve saving until the goal is reached, then spending or completing calculations to determine the appropriate level of spending. Taken together, these studies provide evidence that the ability to exhibit saving behaviours increase from age 6 to age 12 (e.g., Otto et al., 2006; Sonuga-Barke & Webley, 1991; Webley et al., 1991). However, they do not provide information about children's saving practices during the preschool years.

The first study to investigate the saving behaviour of younger children (i.e., in the preschool years) was conducted by Sonuga-Barke and Webley (1991) with 4-, 6-, 9- and 12-year-old children. The authors examined children's ability to save tokens, in a game setting, for a toy when faced with the temptation to spend those tokens on less desirable rewards. They found that 4-year-old children tend to provide seemingly random

responses to saving in this particular environment. The performance of children improved from age 6- to 12-years-old.

This research can be interpreted in two ways. First, it may indicate that children younger than 6 years of age are not capable of saving. However, this cannot be definitively concluded with the small amount of research with this age group and is unlikely given the immense developmental gains made during the preschool years. Second, it may tell us that the methods typically employed to measure children's saving behaviours and children's understanding of saving are not sensitive to saving behaviours in preschool children. For example, it is not clear that 4-year-olds understand the token economy employed by researchers. Tokens are an abstract representation of value, and children of this age may not be able to deal with this level of sophistication. Therefore, more developmentally sensitive techniques may better capture the behaviour of interest (i.e., ones that do not require this level of abstraction). The research conducted with children 6 years and older can be used to inform the development of age-appropriate tasks that are sensitive to the ways in which young children demonstrate savings behaviours.

More recently, Metcalf and Atance (2011) created an experimental paradigm that appears to be a more appropriate measure of saving for preschool children. They found that children as young as 3-years-old are capable of saving a resource (marbles), as opposed to a token (symbolic of a resource), for future use. However, there are some limitations with this study that make it difficult to conclude that children in this age group understand both the planning and implementation aspects of saving (see below). The task

has been demonstrated to work with the age group of interest and has therefore been modified for use in the current study.

As indicated, the research surrounding children's saving behaviour has focused on how children 6 years and older save when placed in experimental situations. Given the recent evidence presented by Metcalf and Atance (2011) that preschoolers do possess some ability to save, it is necessary to further investigate savings behaviours in this population. Specifically, the ability of preschool children to create a plan to save and follow through by implementing that savings plan has previously gone unexplored. Children may understand what it means to save but fail when it comes to creating a successful plan, or fail when implementing that plan. It is also possible that children are capable of creating a plan to save, but are incapable of displaying the saving behaviour (by not following through with the implementation of that plan due to limitations in self-control). Therefore, the goal of this study was to determine (a) whether preschool children can create a plan to save; (b) whether the creation of a plan facilitates saving behaviour; and (c) which factors are associated with the successful implementation of that plan.

Prior to describing the current study in detail, a brief overview of the relevant adult literature will be presented, with a focus on saving financial resources, as there is relatively little developmental work in this area. The literature surrounding the development of savings behaviours in children will be then be reviewed, focusing on saving limited resources (as opposed to strictly financial saving). This analysis will provide information about the developmental period during which the emergence of saving behaviours occurs and will illustrate the current state of the developmental

literature of savings behaviours, including connections to the adult literature. Additionally, this review will highlight the need for research examining the development of savings behaviours in the preschool years. Next, an overview of the cognitive factors that I believe are important for the development of an understanding of saving in preschool children, but have not yet been addressed by researchers, is presented. The rationale for the current study and description of its methodology will be outlined, followed by the hypotheses and results. Lastly, the practical implications, as well as the limitations and suggestions for future research will be discussed.

Research on Saving

Research with adults.

A large number of studies have examined the factors that impact saving behaviour in adults and distinguish between those who save and those who do not (e.g., Lundt & Livingstone, 1991; Ottaviani & Vandone, 2011; Tam & Dholakia, 2011). Results from these studies indicate that savers compared to non-savers: (a) have more disposable income; (b) are older; (c) are more likely to be men; and (d) are more likely to have an internal locus of control and believe in hard work being rewarded (Lundt & Livingstone, 1991).

Other researchers have examined the motivations underlying saving (Fisher & Montalto, 2010; Furnham, 1985; Furnham, 1999). These motivations have been found to vary with age group. For example, young adults are more likely to save for future education or future purchases (Erskine, Kier, Leung & Sproule, 2006), whereas older adults are more likely to report saving for their children's needs and education, retirement or emergencies (Katona, 1975). These studies capture the motivations surrounding

savings behaviours, but have not addressed the role of other psychological factors that impact savings behaviours.

The Behavioural Lifecycle Hypothesis.

Shefrin and Thaler (1988) created the Behavioural Lifecycle Hypothesis (BLCH) in an attempt to integrate both psychological and economic factors of savings behaviours. Three main factors are incorporated into the model: (1) self-control and the relation to planning; (2) mental accounts (current income, current assets and future income); and (3) framing (how one describes and compares alternatives). This model is relevant to the current thesis because the authors make reference to the importance of distinguishing between planning and implementation in saving behaviours, and they specifically consider the role of self-control and planning in savings. Self-control consists of three elements: (1) the ability to deal with internal conflict (between planning to save and wanting to immediately spend); (2) the ability to deal with temptation (to delay gratification); and (3) willpower (the psychological cost resisting temptation; Shefrin & Thaler, 1988; Warneryd, 1999). To date, the BLCH has not been fully tested, but there is some indirect empirical support for the role of planning in saving and the contribution of self-control and impulsivity.

Savings goals, self-control, and impulsivity.

Rha, Montalto and Hanna (2006) sought to determine the effect of having saving goals and rules on the saving behaviour of sample of 4305 American households. Overall, having a saving goal, or goals, increased the likelihood that a household would save. Examples of saving goals include saving for a vacation or for children's education. Saving rules included: (a) saving the income of only one family member; (b) spending

regular income and saving anything beyond that; and (c) saving a set amount of money monthly. These rules were found to significantly increase a household's saving behaviour. The authors suggest that saving rules are one mechanism by which a household can exercise self-control over household saving (Rha et al., 2006). In this case however, it can also be argued that creating saving rules is analogous to creating a plan to save. Therefore, these results can be taken as support for the benefits of creating a plan to save when implementing saving goals.

Ottaviani and Vandone (2011) found that an individual's level of impulsivity, or lack of self-control, predicts their level of unsecured debt (i.e., consumer credit). That is, those who display more impulsive behaviours are more likely to have higher levels of debt, and presumably, lower levels of saving behaviours. Additional research has identified a number of factors, such as 'ego depletion' and lack of goal monitoring, which undermine self-control and lead to impulsive spending (see Baumeister, 2002 for a review). Ego depletion refers to diminishing cognitive resources. According to Baumeister (2002), the cognitive resources that one has available become more depleted each time self-control must be exercised. As these resources become depleted you are less likely to be capable of showing self-control. Goal monitoring involves being aware of and appropriately adjusting the behaviours that are directly related to achieving one's goal (Beaumeister, 2002). Finally, Koehler, White and John (2011) demonstrated that individuals often underestimate the extent to which they require help to control spending. These results can be taken as partial support for the contribution of self-control to savings described in Shefrin and Thaler's (1988) Behavioural Lifecycle Hypothesis.

Planning to save.

Rabinovich and Webley (2007) argue that researchers have failed to examine the gap between intending to save and actually saving by making the assumption that simply having a goal or plan to save will lead to actual savings. The importance of the implementation of the savings plan has been overlooked (Rabinovich & Webley, 2007). To address this limitation the authors conducted a study comparing individuals who planned to save and realized their savings goal versus individuals who planned to save but failed to do so. Results revealed that those who were able to create long-term plans of saving and spending were more likely to successfully implement their savings plan. Additionally, the use of automatic saving techniques, such as automatic transfers to savings accounts (a form of contractual saving), was positively related to the ability to implement savings plans (Rabinovich & Webley, 2007). Thus, it is clear that an accurate picture of savings behaviours must include the implementation of savings plans (as the current thesis does).

In summary, these studies provide support for the role of planning and self-control as suggested by the BLCH (Shefrin & Thaler, 1988). The distinction between planning to save and actually saving made by Rabinovich and Webley (2007) highlights the need for empirical studies addressing role of planning in savings behaviours. However, the likely influence of self-control on saving has not been addressed. Planning abilities have been shown to improve significantly between the ages of 3- and 5-years-old (Atance & Jackson, 2009; Carlson, Moses & Claxton, 2004). The contribution of planning ability to saving in both children and adults warrants investigation. The children's literature will be reviewed next.

Research with children.

The majority of the existing literature on children's saving behaviour has involved children aged six years or older. Researchers have investigated relatively few topics related to children's saving. Webley et al. (1991) examined how children save tokens in a game setting and Otto et al. (2006) examined motivations and strategies for saving. Though this research is not with the age group of interest (preschool children), some of the research makes distinctions, or reports findings, that are pertinent to the current study. These studies will be reviewed in some detail.

Research using play economies.

Sonuga-Barke and Webley (1991) examined 4- to 12-year-old children's ability to display 'functional saving'. This type of saving is viewed as deferring consumption and it involves combining resources over time to achieve a goal (e.g., saving money to allow for the purchase of an expensive toy; Sonuga-Barke & Webley, 1991). Children exhibit 'functional saving' when they are able to demonstrate an understanding of three concepts believed to be precursors: (1) present spending leads to future restrictions on spending; (2) learning to resist temptation; and (3) the benefits of saving strategies.

In order to determine whether children can display functional saving, the authors created a 'play economy' consisting of: a room containing a board game to be played by the children and experimenter; a token machine that distributed tokens to the children; a toy store and candy store that provided temptation, by presenting an opportunity to spend their tokens; a bank where children could deposit their tokens; and a robber and toll gate that required payment of one token. Each facility was represented by a square on the game board. Children were provided with a number of tokens at the outset of the game

then faced with opportunities to spend their tokens or save them for a larger purchase at the end of the game. Through the use of this play economy, Sonuga-Barke and Webley sought to examine the role of: (1) facilitation or inhibition of impulsive behaviour; (2) the level of commitment of saving; (3) the use of savings boxes; (4) the level of temptation; and (5) income uncertainty.

Their first study, which included children 4-, 6-, 9- and 12- years-old, was conducted to examine factors 1 and 2 (above) that were hypothesized to play a role in children's functional saving. A bank (series of small boxes) was used as a way to facilitate or inhibit impulsive behaviour by the children. Children were given the option of using boxes with clear doors (thought to facilitate impulsive behaviour) or boxes with solid wooden doors as their bank (thought to inhibit impulsive behaviour). The level of commitment (access to tokens) was varied by creating rules surrounding the points at which the children were allowed to retrieve tokens from their savings box. Children were also given the choice between being able to retrieve tokens from savings boxes after one complete circuit of the board (high commitment with less opportunity to spend) or at various occasions during each circuit (low commitment; Sonuga-Barke & Webley, 1991).

The goal of the game was to save enough tokens over three circuits of the board to purchase a toy from the toy store. Toys were divided into four price categories (costing between 25 and 200 tokens) based on a colour system. A blackboard with 200 squares (one for each token) was created according to the price level and colour system to keep track of the children's tokens and to provide them with an indication of the toy they would be able to purchase with that quantity of tokens. If the children lost or spent a token, the appropriate square would be erased.

Results indicated that there was no effect of age in the number of visits the children made to the bank or the average size of candy purchase. Children of each age spent equally. Functional use of the savings boxes was defined as having all one's tokens in the savings box when they passed the robber and the candy store on the game board. Performance on this measure increased significantly between 4 and 12 years of age. The savings boxes were used effectively if the children withdrew tokens prior to reaching the toll gate, thereby ensuring that they were able to pass through the gate. Again, performance on this measure increased with age. There was an increased preference for the savings box with the solid wooden door, and decreased preference for the savings box with the clear door, as age increased. The authors report the most significant improvements in functional saving between 6- and 9-year-olds, with the savings responses of 4-year-olds appearing to be random (Sonuga-Barke & Webley, 1991).

Results from this study suggest that 9- and 12-year-olds understood that the inability to see the contents of the saving boxes aids in reducing temptation and leads to more savings. The superior performance demonstrated by these age groups indicates that they have some understanding of the three precursors described by Sonuga-Barke and Webley (1991). However, it remains unclear as to the extent to which these children understand each of these concepts and the relationships amongst them.

While these findings provide some insight into the development of functional saving behaviour, there were a few limitations. One limitation to this study was the use of the blackboard to account for children's tokens. This method was potentially much too complex for younger children to understand. Additionally, the children were

provided with up to 200 tokens. The younger children likely lack the understanding of quantity necessary to save or spend their tokens effectively.

While providing four options for purchasing toys at the end of the game is not unreasonable, the price range and accounting system was also too complex. It is possible that this complexity was contributing to masking 4-year-old children's ability to save. Thus, the results, as they pertain to the youngest group studied, could be a product of complexity, rather than the result of an inability of children of this age to show functional saving. What is needed is a simplified savings situation that is more accessible to 4-year-olds. As will be seen below, the current study used just such a situation.

Sonuga-Barke and Webley (1991) conducted Study 2 to examine the use of savings boxes by 6-, 9- and 12-year-old children. The authors sought to evaluate the impact of temptation on saving by having the children predict the number of candies they would buy and then comparing that to the actual expenditure once faced with temptation during the game. The overall goal, savings boxes, presence of a 'robber' and toll booth, colour-coding, pricing and accounting system remained the same as in Study 1. Lastly, the children were provided with a 'detour' as a way to deal with temptation by bypassing the candy store and the robber. Presumably, children who use the detour route are doing so to avoid the temptation, or threat in the case of the robber, inherent in these facilities.

Results from Study 2 revealed significant age effects in performance, with 6-year-olds losing significantly more tokens to the robber than older children. Again, age-related increases were found, with older children displaying more functional use of the savings boxes than younger children. The majority of children underestimated the amount of candy they would purchase, with no clear age-related changes (Sonuga-Barke

& Webley, 1991). This finding in particular replicates the finding that adults often underestimate the amount of help they need to control their own spending (Koehler et al., 2011). Finally, there were no age differences with respect to the number of times the detour route was used to pass the candy store. All children used the detour more frequently to bypass the robber (Sonuga-Barke & Webley, 1991).

Study 2 supports the authors' previous findings that functional saving increases with age. However, it does not provide a clear interpretation of the children's responses to differing levels of temptation. The authors interpret the detour results to suggest that children of each age group do not understand that the candy store is a temptation that should ideally be avoided. This seems in conflict with the results of Study 1 which appeared to indicate that there was at least some understanding of temptation (identified by the authors as a precursor to functional savings). It is likely that the use of the detour as a means of managing temptation was mainly interpreted by the children as a way to avoid needlessly losing coins to the robber that could otherwise be spent on candy or toys. It is possible that measuring resistance to temptation in a different way would yield more conclusive results across the age groups being studied.

Limitations of a play economy.

While the paradigm of a play economy does provide some insight into some aspects of children's saving behaviours, it is not without limitations. For example, the way in which children are presented with saving and spending opportunities in this situation is not representative of the way in which children interact with money, or other limited resources. Often children receive allowances, or maintain piggy banks, knowing that their parents may provide additional funds if they spend too much or save too little.

A play economy is a constrained environment with rules and outcomes that are not typical of a child's of world. A more naturalistic setting is necessary in order to accurately investigate the saving and spending opportunities of children in the target age group. The quantity of tokens provided is not likely to accurately portray the amount of money children typically receive, or they ways in which they receive it, especially in the younger age groups. Finally, play economies require the symbolic understanding that tokens are items that can be traded for different items (i.e., trading tokens for a toy). This type of sophisticated reasoning is necessary for success. While this type of task may be appropriate for older children, it is not suitable for younger children who are unlikely to understand the symbolic nature of money/tokens. Thus, a new paradigm is needed.

The play economy extended.

The use of the play economy was further modified by Webley and colleagues (1991) in order to address some of the aforementioned limitations and to create a more naturalistic approach to studying the savings behaviours of 6-, 9- and 12-year-olds. This play economy consisted of four adjoining rooms representing various opportunities to save or to spend. Room 1 consisted of 'home', a toy store and a bank. Rooms 2-4 each contained three activities: one costing ten tokens, one of varying cost, and was free. The authors argue that the use of separate rooms and the removal of the board game provide a less restrictive environment in which saving can be studied (Webley et al., 1991). Again, the goal was to save enough tokens (70 out of 90) to purchase a toy at the end of the game. At the start of the game, children were asked to open a 'bank account' for which they received 30 tokens. Two 30 minute sessions required children to spend 10 minutes in each of three activity rooms. Upon entry into each room children were given 10

tokens. At the end of each session, children were given the option to purchase a small toy with their 30 tokens, or to save them to buy a toy at the end of the game. Semi-structured interviews were conducted during each testing session (Webley et al., 1991).

Results indicated that no 6-year olds were able to successfully save for their chosen toy at the end of the game. Seventy percent of 9-year-olds and 90% of 12-year-olds were successful. The authors categorized the children according 5 different strategies: (1) no attempt to save; (2) saving by spending a little each day; (3) saving by not spending at all during the game; (4) saving until the target reached then spending; and (5) calculated saving (determining at the outset how many tokens they could spend while still getting their chosen toy and what activities they could do with those tokens). Half of 6-year-olds adopted Strategy 1, while the other half chose Strategy 2, which led to overspending. An additional 20% of 9- and 12-year-olds also adopted Strategy 2. While this strategy was not successful, it can nevertheless be interpreted as demonstrating a type of saving behaviour. Twenty percent of 9-year-olds chose Strategy 3 and 20% chose Strategy 4. The remaining 20% of 9-year-olds and 80% of the 12-year-olds succeeded in the task by choosing Strategy 5 (Webley et al., 1991).

This study demonstrated that, with the exception of children who employed Strategy 1 (no attempt to save), 6- to 12-year-olds are capable of demonstrating savings behaviours in a variety of ways. Even children who were not successful in saving for the toy can be said to have made an attempt to save, and displayed an understanding that they could save by not spending all of their tokens. Importantly, the children who chose to calculate their savings can be said to not only have created a savings plan, but to have

successfully implemented that plan. This aspect of saving has been previously unexplored in the literature and was further investigated in the current study.

The way in which the activities were presented to children may be problematic and may therefore limit the generalizations that can be drawn. While the children were aware of the relative value assigned to each activity by the researchers, they may not have viewed the more expensive activities as more attractive. The researchers did not determine which activities each of the children deemed more desirable. Therefore, it is possible that children did save for their most desired toy, it just wasn't the experimenter's predicted toy. Thus, the addition of a free activity in each room to provide a way of dealing with temptation may not be effective in the way it was intended, if it was any of the children's preferred activity.

The saving strategies employed by children between 6 and 12 years were further examined by Otto and colleagues (2006) using a novel economic board game. Again, children were given the goal to save a specific number of tokens (24) to purchase a toy at the end of the game. Results support those of Sonuga-Barke and Webley (1991) in that the 12-year-old children demonstrated functional use of the bank. The number of 6- and 9-year-olds that successfully saved for the toy did not differ, but the strategies they used to save did (Otto et al., 2006). Three strategies were identified: (1) no attempt to save at all (two 6-year-olds adopted this strategy); (2) saving and spending at the same time throughout the game; and (3) thrift (saving by not spending at all or saving very little, saving after the first three stores or saving until the target was reached). Children employing thrift strategies were more likely to successfully save for the target toy than children who chose a strategy of saving and spending (Otto et al., 2006). These strategies

are comparable to those reported in Webley et al. (1991). Similarly, each of these techniques, with the exception of not saving at all, can be taken as evidence of at least an emerging understanding of saving.

This study provides additional support for the results obtained in previous studies (e.g., Sonuga-Barke & Webley, 1991; Webley et al., 1991). However, it is unclear whether the children in this study were creating a plan to save and were successful in the implementation of that plan. It is possible that certain strategies (e.g., spending and saving at the same time) involved the creation of a plan, but are sometimes unsuccessful when it comes to implementing that plan. Without explicitly testing for this, it remains unclear what the role of planning to save has in children's actual saving behaviours in this study.

Overall, these studies indicate that saving increases with age and that the strategies children employ become increasingly sophisticated. However, only two studies have included children under the age of 6 years. Until recently, the saving behaviour of children in the preschool years has been neglected. The studies presented above report that most 6-year-olds appear to have difficulty demonstrating an understanding of saving. Given the restricted range of experimental designs used to address this behaviour, it is plausible that more age-appropriate techniques could produce very different results. The use of play economies and the large quantity of tokens needed to achieve a specific level of saving may be too complex for use with children between the ages of 3- and 5-years-old. To address these limitations, Metcalf and Atance (2011) developed a paradigm intended to measure saving behaviour in preschool children in a novel way.

A new savings paradigm.

Metcalf and Atance (2011) created a novel, age-appropriate, approach to studying the savings behaviours in children between the ages of 3- and 5-years-old. As the current study's main task has been adapted from the authors' savings paradigm, a detailed review will be provided.

Metcalf and Atance (2011) developed a new savings paradigm to assess whether: (1) children can save a limited resource for future use; (2) children can learn to save across trials (i.e., learn from experience); and (3) there are age-related increases in saving in this age range. The development of saving behaviours was expected to be related to children's ability to mentally project themselves into the future to experience events before they occur (known as 'episodic future thinking'; Atance & O'Neill, 2001). Specifically, improvements in episodic future thinking were hypothesized to be positively related to the ability to save a resource for the future (Metcalf & Atance, 2011).

Instead of using a variant of the complex play economies outlined earlier, the researchers designed a simpler, more straightforward saving situation that was appropriate for use with preschool children. In this task, children did not save tokens, which were symbolic, but instead directly saved the consumable resource of interest. In other words, children did not have to save one thing in order to trade it in for another (such as saving money to buy candy later), but instead saved the resource itself for later use (akin to saving some of the candy they had in order to eat it later). This change alone makes it significantly less abstract and more likely to be understood by preschoolers.

Children were shown two rooms: (1) one room that contained a simple, relatively boring, marble run structure, consisting of only one run (pathway that the marble can be dropped down); and (2) another room that contained a much more complex, and

interesting, marble run structure, consisting of three different runs. Children were told that each marble could be used only once (marbles disappeared into an opaque box at the bottom of each structure). The experimenter demonstrated how the two marble runs worked while participants watched. This was done to make clear that the marbles were a limited resource (i.e., they couldn't be 'used' over and over again). Children were informed that they would receive only three marbles, and that they would stay in each room for three minutes. The task consisted of two conditions, each with two trials.

Children were randomly divided into two conditions: (1) the more-rewarding-future in which children visited the room with the simple marble structure, followed by the room with the complex marble structure; or (2) the more-rewarding-present in which children visited the rooms in the other order. To be counted as successfully saving, children were required to keep at least one marble for use in the second room (regardless of the order of the rooms).

This design was implemented in order to determine whether children saved more in the more-rewarding-present condition because they actually preferred the simple marble structure and to address the possibility that children in this condition may save marbles for the second structure in response to the boredom they would feel when faced with three minutes in the second room (still a type of savings). Children were in the same condition for both trials[1].

More-rewarding-future condition.

In Trial 1, after the introduction to the rooms outlined above, children were given three marbles and brought into the room with the simple marble structure for three minutes. During this time, the experimenter sat at the back of the room and did not

interact with the children. Next, the children were brought into the room with the complex marble structure for three minutes, regardless of whether they had saved any marbles. To begin Trial 2, the experimenter informed the children that she had found three more marbles and they would again spend three minutes in the room with the simple structure, followed by three minutes in the room with the complex structure.

Results revealed that 39% of children saved at least one marble for use in the second, presumably more desirable, room on Trial 1. This number increased to 72% on Trial 2. This result demonstrates that children were able to learn across trials. Thirty-nine percent of children who did not save on Trial 1 were able to save on Trial 2. This suggests that children were able to learn from the experience of being disappointed in the second room, after using all of their marbles in the first room. No age effects were found, with an equal number of children of each age (3-, 4-, and 5-year-olds) saving at least one marble for the second room.

More-rewarding-present condition.

The more-rewarding-present condition differed only in that children assigned to this condition spent 3 minutes in the room with the complex marble run first, followed by three minutes in the room with the simple marble run. The remainder of the testing session proceeded exactly as that of the more-rewarding-future condition.

Results from this condition indicated that 29% of children saved at least one marble on Trial 1. Again, children demonstrated an effect of learning across trials, with 63% saving on Trial 2. Forty-five percent of children who did not save on Trial 1 chose to save on Trial 2. Again, there was no effect of age, with 3-, 4- and 5-year-olds savings equally. Fewer children saved on Trial 2 in this condition, when compared to the number

of children who saved on Trial 2 in the more-rewarding-future condition, although it is not clear if this difference reached significance.

The authors attribute the increased saving on Trial 2 when compared to Trial 1 for both conditions to learning effects. However, it remains unclear what this learning effect really is. It is possible that children are learning, on the basis of a single trial, to create a plan to save their marbles. It is also possible that the children are simply better at delaying the use of their marbles once given the opportunity to interact with each of the marble runs. This effect remains open to interpretation, as based on the information provided it is not clear what effect 'learning' is capturing. The current study addressed this effect through the comparison of the Baseline and Planning condition.

The authors report that a number of children did not use all of their saved marbles on either Trial 1 or 2. Seven children in each condition were left with at least one marble at the end of the testing session. Due to the way in which this particular result was reported, it is unclear how many children did not use all of their marbles on Trial 1, compared to Trial 2. However, the authors interpret this result in two ways: children may have been saving for beyond the task, or children may have saved but then simply lost interest (Metcalf & Atance, 2011).

The authors explain the fact that relatively few children engaged in saving on Trial 1 in two ways. They propose that the inability to anticipate a novel future event interfered with children's performance on the task. The authors also suggest that poor inhibitory control (inability to suppress a typical response in favour of a conflicting response) could account for the lack of actual saving behaviour in both trials. Finally, the small number of marbles provided could account for the lack of variability in the savings

behaviours demonstrated by these children. This study is valuable because it has established that even 3- to 5-year-old children can demonstrate some savings behaviour, and learn from experience, when given the appropriate opportunity.

There are a number of limitations to Metcalf and Atance's (2011) work that were addressed by the current study. They defined the behaviour of saving the marbles as the only indicator of children's understanding of saving. However, another indicator that was necessary to examine was the children's ability to plan to save. What this study may have been measuring, especially in Trial 1, was children's the ability to defer immediate satisfaction to a later point in time (this is known as delay of gratification (DoG; Mischel, 1974; see below for discussion). This study does not create an accurate picture of which of the children know how to save, plan to save, or have the intention to save. It may have only captured the children's ability, or inability, to stop themselves from using all of their marbles in the first room. Thus, children may have understood something about saving that was not captured by Trial 1. Performance on Trial 2 may be a better indicator of children's understanding of saving and some children may have created a plan to save some marbles after having learned from experience. However, since this was not systematically tested, we cannot be sure.

It is worth noting that the authors do acknowledge that saving and delaying gratification may share similarities, but maintain that they are distinct from one another. Specifically, they argue that saving a marble for future enjoyment comes with the immediate cost of present enjoyment. The child is saving their resource for a point in the future when it will yield a greater reward than if that resource is used in the present moment. However, this is very similar to DoG. In DoG paradigms the price of larger

reward is the time spent waiting. Drawing on definitions provided by Sonuga-Barke and Webley (1991), Metcalf and Atance (2011) argue that saving requires integrating a number of choices over a period of time, whereas delay of gratification requires just one choice of a small reward now or a large reward in the future. However, we cannot conclude that these concepts are different on the basis of their study. The authors recommend comparing performance on their savings task to measures of DoG, and the current study has done just that.

Another limitation of Metcalf and Atance (2011) is that when introducing the children to the rooms, the experimenter demonstrated how the marble runs work. The children were not provided the opportunity to try each marble run themselves and therefore, to determine which marble run they preferred. Ideally, the children would be able to put at least one marble down each marble run in order to determine their preference, as it would cost the children two out of their three marbles simply to try each marble run once. An additional limitation is that the children were provided with only three marbles to use per trial placing large restrictions on the ways in which children could spend their marbles. These factors may have potentially influenced the children's behaviour once they were in the first room. Providing this small number of marbles did not provide the children with enough of an opportunity to determine their preference and then choose to save their marbles accordingly. Additionally, the children may have been be influenced by the novelty of the first marble run and may not have been able to resist trying it out a couple of times, regardless of the toy in the other room. This may account for some of the increased saving on Trial 2 as the children had been familiarized with the marble runs and were able to determine their preference and whether they would like to

save their marbles for the preferred run. These factors effectively limit the ways in which children could have use their marbles and leaves room for very little variability in saving behaviours.

The task designed by Metcalf and Atance (2011) has a lot of strengths. First, it allows the measurement of children's saving behaviours in a manner that is age-appropriate. Second, it measures children's ability to save consumable resources instead of a symbolic representation of a resource. Finally, it demonstrates that young children save with this paradigm. However, given the limitations outlined above, it is clear that some modifications were necessary to more clearly investigate children's understanding of savings behaviour. More specifically, it was necessary to design a version of the task that could allow for more variability in saving behaviours. The current study allowed the children to try each marble run prior to the commencement of the testing session to help the children to determine their preferred toy and to remove some of the novelty associated with the marble runs. Additionally, the children were provided with more marbles (five instead of three). This was to provide the children with more of an opportunity to demonstrate saving behaviours. Previous research (see Resnick, 1989 for a review) has found that, at 3- and 4-years-old, children are capable of understanding that materials are additive and that removing some material results in less of that material being available. Additionally, children's ability to count has been shown to improve during the preschool years (Resnick, 1989). The use of five marbles was to allow the marbles to remain enough of a limited resource without children reaching the point of saturation. Finally, the current study includes a condition in which the children could create a plan to save their marbles before entering the testing situation. This was to allow

for comparison against a Baseline group (who were not asked to create a plan to save) to determine the effect that planning to save has on the actual saving behaviour.

In order to succeed on the modified Savings task used in the current study, children need a number of constituent skills. They need to be able to: (1) plan future behaviours; (2) inhibit the impulse to put all of their marbles down the less preferred toy immediately; (3) delay gratification in order to save marbles for the preferred marble run; and (4) remember the task, the order in which they are provided access to the marble runs, which marble run they preferred and why they want to save their marbles. There is research examining children's emerging skills in each of these areas in the target age group, and they fall under the heading known as Executive Function (EF) skills. A description of these skills, and their relationship to the creation of savings plan and development of saving behaviours is presented next.

Executive Function

Executive function refers to a set of cognitive skills required to accomplish goal-directed behaviour (e.g., Gioia, Isquith & Guy, 2001). This umbrella term has come to encompass a number of factors. The main factors of EF assessed in children between the ages of 3- and 5-years-old are: planning, delay of gratification, conflict inhibitory control (IC) and working memory (WM). Inhibitory control involves suppressing a prepotent (typical) response in favour of a novel response, according to the task demands (Frye, Zelazo & Palfai, 1995). It is typically divided into conflict inhibition (replacing a desired response with a conflicting response) or delay inhibition (withholding a desired response until a later point in time). Delay of gratification refers to the ability to defer immediate satisfaction to a later point in time because of the future consequence associated with that

delay (Shoda et al., 1990) and falls under the category of delay inhibitory control. Working memory refers to the ability to temporarily store and manipulate information (Baddeley, 2003).

Although early emerging EF skills have been reported in children as young as 8 months of age (Diamond, 1988; Diamond, 2002; Espy, 2004), significant developmental gains in executive functioning are evident during the preschool years (e.g., Carlson, 2005; Hongwanishkul, Happaney, Lee & Zelazo, 2005; Zelazo, Müller, Frye & Marcovitch, 2003). The importance of research on EF can be emphasized through its connection to many major aspects of development. Specifically, EF has been associated with theory of mind development (Hughes & Ensor, 2007), future thinking (Atance & O'Neill, 2005), social understanding/competence (Carlson & Moses, 2001; Hughes, 1998), reading and mathematical skills (Bull, Espy & Wiebe, 2008; Locascio, Mahone, Eason & Cutting, 2010; Sesma, Mahone, Levine, Eason & Cutting, 2009) and general academic achievement (Willoughby, Blair, Wirth & Greenberg, 2011). These studies provide overwhelming evidence of the contribution of EF to human development. Conceptually, planning, delay of gratification, inhibitory control and working memory were hypothesized to be directly linked to the development of savings behaviours. Therefore, an elaboration on each of these and their connections to my version of the Savings task will be provided, beginning with planning.

Planning.

Guavain and Rogoff (1989) define planning as "the process of devising and coordinating actions aimed at achieving a goal and of monitoring the effectiveness of the actions for reaching the goal as the plan is executed" (p. 140). More recently, aspects of

this definition can be seen throughout the literature by researchers who define planning in terms of the ability to accomplish a desired outcome or solve a problem by determining the steps necessary to reach that goal and then following those required steps (Anderson, 2008). Thus, planning requires the representation of a future goal, preparation for that goal (Atance & Jackson, 2009), organization of resources, as well as maintenance of the steps involved and the ability to alter that plan, if necessary (Anderson, 2008). Stated this way, it is clear that this skill is a critical one for success on the planning portion of the current study.

Planning is essential to accomplishing daily tasks, as well as establishing future goals and actions. Children with deficits in this ability have been shown to have difficulty initiating a task, are more likely to use inefficient planning strategies and have difficulty with complex and lengthy tasks (Howard, Anderson & Taylor, 2008). This skill emerges during the preschool years, with 5-year-olds often outperforming 3-year-olds on planning tasks (Hudson & Fivush, 1991).

Hudson and Fivush (1991) examined the ability of children between 3- and 5-years-old to construct and execute plans. Specifically, the authors varied the level of complexity associated with the plan using 3 levels: (1) plans that involve carrying out familiar sequences of events; (2) single-goal plans; (3) multiple-goal plans; and (4) coordinated event plans (a series of sub-goals arranged hierarchically). Results revealed that 3-year-olds had difficulty in the creation and execution of plans, while 4-year-olds could construct plans as well as 5-year-olds, but performed at lower levels than 5-year-olds when it comes to plan execution. Finally, 5-year-olds reached the multiple-goal

level of planning, while 4-year-olds were able to complete only single-goal plans (Hudson & Fivush, 1991).

This research is important in that it provides evidence that young children have the ability to create single-goal plans and highlights their difficulty implementing plans that require coordinating two or more goals. It tells us that preschool children can create a plan to save, but may fail when it comes to the execution of that plan, but does not tell us why they fail when it comes to plan execution. The current study evaluated just this ability to determine the factors connecting plan creation to plan execution, at least in the area of saving a limited resource.

Planning plays a direct role in savings behaviours. The ability to create a plan, and follow through with that plan is essential to successful saving. Specifically, saving is aided dramatically by the ability to plan your current spending or consumption now while maintaining your future savings goals. However, it is not yet clear what impact planning has on younger children's ability to save. By measuring planning ability, it is possible to determine whether children in the preschool years can demonstrate the understanding necessary to create a savings plan. Evaluating this ability also provides the opportunity to determine whether children can adhere to a savings plan, thus providing a distinction between planning to save and demonstrating savings behaviours.

Planning is often measured through the administration of tasks that require children to follow a number of steps in order to reach a desired solution. One example of this type of task is the Tower of Hanoi (Welsh, Pennington & Grossier, 1991). In this task, there is a set of three pegs, each of a different height. The first peg contains three discs of different size and colour, stacked on top of one another, from largest (on the

bottom) to smallest (on the top). The goal is to move the discs, one step at a time, from the first to the third peg without placing a larger disc on top of a smaller disc. Success on this task is taken as a measure of planning ability. However, this task is typically rather difficult for young chidren.

The Truck Loading task is a simpler planning task (Carlson, Moses & Claxton, 2004; Fagot & Gauvain, 1997). It has been used to assess planning ability in children between the ages of 3- and 5-years-old. During this task, children take on the role of a mail carrier delivering colour-coded party invitations to up to five homes on a one-way street. The child is asked to load up a delivery truck so each house receives the correct invitation. However, limitations are placed on the delivery, requiring the child to do some careful planning in order to succeed. Four-year-olds typically outperform 3-year-olds on this task, with less than 40% of 4-year-olds reaching the final level of 5 houses compared to 80% of 5-year-olds (Atance & Jackson, 2009; Carlson et al., 2004). The role of planning was assessed in the current study through the administration of this task. However, the contribution of EF to the development of savings behaviours would not be complete without addressing the contribution of inhibitory control.

Inhibitory control.

Inhibitory control (IC) can be divided into tasks that measure delay of gratification (DoG; also known as delay IC) and conflict IC. DoG tasks require children to suppress or delay an impulsive behaviour when faced with a situation in which a delay is more beneficial to them than the impulsive response. This ability is measured through two types of tasks: those which require children to wait for a period of time before arriving at a desirable outcome (e.g., Shoda et al., 1990) and those that require children to

choose between a small immediate reward and a larger, delayed reward (e.g., the 'marshmallow task'; Mischel et al., 1972). Conflict IC tasks also involve suppressing an impulsive response (Carlson & Moses, 2001). However, these tasks also dictate that the child provides a response that directly conflicts with the initial, prepotent response (as opposed to simply delaying it). Performance on both DoG and conflict IC tasks improves through the preschool years (e.g., Carlson & Moses, 2001). Both delay of gratification and conflict inhibitory control will now be discussed in further detail.

Delay of gratification.

Given the description above, it becomes clear how the skills that are required to succeed on delay of gratification tasks are the very same ones required for success when required to save. As previously mentioned, successful saving requires the ability to delay current consumption to a later point in time when that consumption is more rewarding. This ability to delay consumption is directly influenced by one's ability to delay immediate gratification. Although a readily available option may be desirable, the option available after delaying gratification is more desirable and provides a greater reward. A number of tasks have been designed to assess this ability.

Delay of gratification tasks are generally classified as either waiting paradigms or choice paradigms. Waiting paradigms require that an individual wait a specified period of time in order to receive the reward, whereas choice paradigms involve the choice between a lesser reward now or a greater reward later (Lemmon & Moore, 2007; Schwartz, Schrager & Lyons, 1983; Shoda et al., 1990).

A classic example of a waiting paradigm is the Gift Delay task. This task was developed to assess the ability of preschool children to delay gratification when faced

with a tempting stimulus (Kochanska, Murray, Jaques, Koenig & Vandegeest, 1996). The Gift Delay requires that the children sit facing the opposite direction as the researcher and wait while a gift is loudly wrapped for them. In order to successfully complete the task, the children must inhibit their prepotent (typical) response of looking and delay it until it is appropriate to do so. Typically, the number of peeking attempts decreases, and the latency to peek increases with age (Kochanska et al., 1996).

The Choice Delay paradigm was developed in a series of studies by Mischel and colleagues (Mischel, et al., 1972; Mischel & Mischel, 1983; Mischel & Underwood, 1974). These paradigms present children with a choice between having a smaller reward immediately or waiting to receive a reward of greater value. In order to succeed on this task, children have to delay their prepotent response (to take the reward immediately) to a later point in time in order to get the larger reward (Mischel & Ebbesen, 1970). The original version of this task involves having the children sit at a table with a cake tray and a bell on it. The children are shown that there are three marshmallows under the tray (two clustered together and one separate) and are told that they can have two marshmallows if they wait until the experimenter returns to the room or one marshmallow if they choose to ring the bell to have the experimenter return to the room early. Results from these studies have indicated that when presented with the conflict between choosing a smaller reward now, or greater reward later, children younger than 4 years of age typically choose the smaller reward, while older children are able to delay receipt of the larger reward (Mischel, 1974). It is important to note that both the Choice Delay paradigm and the current Savings task require forgoing a less desirable reward in the present in order to get a more desirable reward in the future.

Researchers have developed other choice delay measures that allow for more efficient administration of multiple trials (the marshmallow task requires up to 17 minutes to administer a single trial). For example, Thompson, Baresi and Moore (1997) adapted the choice delay paradigm in an attempt to test future-oriented prudence and altruism in children between the ages of 3 and 5 years. During this modified choice delay task children are told they are going to receive stickers and are provided with a sticker book for immediate use and two envelopes (one to put their stickers in until the end of the game and to hold the experimenter's stickers until the end of the game). In a series of 12 trials, the children are asked to choose the recipient of the stickers (all for themselves or sharing with the experimenter), the number of stickers received (1 or 2) and the point at which they are distributed (for use now by putting them in the sticker book or for later at the end of the game). Results from this study revealed that 3-year-olds more often chose the immediate reward whereas 4- and 5-year-olds more often preferred the delayed (larger) reward (Thompson et al., 1997).

Lemmon and Moore (2007) further modified the choice delay paradigm by varying the size of the rewards presented to the children. Three- and four-year-olds were given the choice between an immediate reward of one sticker (to be immediately 'consumed' by placing it in a sticker book) or a greater number of stickers (2, 3, 4, or 5) at a later time (put into an envelope for 'after the game'). Children indicated their choice with an arrow (designed to reduce the impulse to reach for stickers). This task did not require that children choose between allocating stickers to themselves and/or an experimenter. The 3-year-olds selected the immediate reward more often than would be expected by chance. However, the 4-year-olds chose the larger, future reward more often

than 3-year-olds across all trial types. Interestingly, the 4-year-olds were only more likely to choose the future than the immediate reward when they were choosing between one sticker now and four or five stickers later (Lemmon & Moore, 2007). So while the 4-year-olds could demonstrate the ability to choose more for later, this effect was limited to situations when the later reward was considerably larger than the immediate reward. This type of choice delay task, relative to the marshmallow delay task, has the advantage of making it possible to administer multiple trials in a relatively constrained time period.

Given the findings reported above, Metcalf and Atance (Metcalf, personal communication, August 23, 2011) further modified Lemmon and Moore's (2007) choice delay task by only administering trials that provide the choice between one sticker now and four, or five, stickers later. The current study utilizes this modification, with a few other minor adjustments. First, the main problem with the task as it was administered by others (e.g., Lemmon & Moore, 2007; Metcalf, personal communication, August 23, 2011) is that the sticker book was given to the children only when they chose the immediate reward. This is problematic because it provides the children with what seems like a large reward for consuming the sticker immediately: many children interpret the choice as 1 sticker *and* the sticker book now versus X number of stickers in an envelope for later (Metcalf, personal communication, August 23, 2011). Even when the researchers attempt to be clear, some children do not seem to understand. For the children who misunderstand, their choices may not be indicative of their ability to delay gratification. As such, in the current study, the sticker book was replaced with a sticker page which was included in both the immediate and delayed choices. This was clearly communicated to the children at the outset of the task. Finally, it was decided that the

use of an arrow board to indicate choice (as a way to assist impulse control) creates an additional strain on the working memory capabilities of the children. This aspect of the paradigm increases unnecessary task demands and was therefore removed for the current study.

Although it has been argued that DoG and savings are distinct concepts (Metcalf & Atance, 2011), their relationship to one another has not yet been tested. As was suggested by Metcalf and Atance (2011), it is possible that their newly developed savings task represents a variant of DoG. This seems quite likely as both the ability to choose more stickers for later and the ability to stop oneself from putting marbles in the less-rewarding marble run so there are more for the more-rewarding marble run later require one to defer enjoyment to a later point. Therefore, it is expected that performance on the Modified Choice Delay task would be positively correlated to children's ability to save marbles in the first room (as distinct from *planning* to save marbles).

Conflict inhibitory control.

Another EF skill that is relevant to the current study is conflict inhibitory control (conflict IC). The research literature surrounding the savings behaviours of adults points to a link between savings intention and realisation of that goal. Specifically, the level of inhibitory control has been identified as a major contributor to achieving, or failing to achieve savings goals (Rabinovich & Webley, 2007). However, this relation has not been examined in the children's saving literature.

The classic example of this conflict IC, as measured in older children and adults, is the Stroop task (Stroop, 1935). In this task, colour words are presented in the ink of another colour (i.e., the word 'green' printed in yellow ink) and participants must provide

the color the word is printed in by inhibiting the prepotent response (reading the word; Stroop, 1935). Young children are not yet fluent readers, so different inhibitory tasks have been designed for use with them.

The Black/White Stroop task (Podjarny, Vendetti, Eisen & Kamawar, 2008) is a developmentally appropriate measure of conflict inhibition for preschool-aged children. It was adapted from Gerstadt, Hong and Diamond's (1994) Day/Night Stroop task. In this task children are presented with black and white cards and must respond by saying the opposite colour name ('white' and 'black' respectively). This task requires that participants inhibit the prepotent response (stating the actual colour of the card), and instead respond according to the rules of the experimenter (state the opposite colour). Performance on this task improves during the preschool years, with 3-year-olds typically being unable to inhibit their prepotent response and 5-year-olds doing quite well (Podjarny et al., 2008).

The Dimensional Change Card Sort (DCCS) is a widely used measure of conflict inhibition in preschool children (e.g., Frye et al., 1995). It is a child-appropriate modification of the Wisconsin Card Sorting Task (WCST). Children are presented with target cards, which vary according to two dimensions (shape and colour). Children are required to sort the card along one dimension to build the prepotent response and then must switch and sort the cards along the previously irrelevant dimension. Successful performance on the post-switch phase of this task is taken as an indication of the ability to inhibit a prepotent response in favour of a conflicting one. Typically, there are significant improvements on the DCCS between the ages of 3 and 6 (Frye et al., 1995).

Younger children will perseverate on the pre-switch phase dimension leading to incorrect sorting, while by age 5, most children can successfully inhibit the prepotent response.

It is as of yet still unclear whether children are able to successfully create a plan to save their resources, but fail when it comes to actually stopping themselves from spending when presented with a tempting, readily available, option. Increased inhibitory control skills were expected to lead to increased savings behaviours and successful adherence to a savings plan. Therefore, conflict IC was assessed through the administration of these two widely used tasks.

Both types of inhibitory control – DoG and conflict IC – are important to saving behaviour. In order to successfully save it is necessary to display a level of inhibitory control. If an individual has poor DoG skills, they are unlikely to be able to inhibit the desire to spend all of their resources at one time and will spend now versus saving for a future purpose. However, if an individual has superior DoG skills, they are more likely to inhibit the impulse to spend a resource and will be more likely to successfully save by waiting for the appropriate opportunity. Conflict IC is also of importance to saving behaviours. Specifically, in order to successfully save, the children must inhibit their natural impulse to play with the interesting toy in the room with them by using their marbles, and instead respond with an action that is in direct conflict with this impulse. That is, they must refrain from playing with a toy they have been provided with, which is in direct conflict with the response children typically display when given the opportunity to play with a toy. Inhibitory control is only one of many concepts under the category of executive function. Working memory, an integral part of EF, was also expected to contribute to saving behaviours.

Working memory.

It was expected that performance on the Savings task would be related to working memory (WM). As previously mentioned, WM refers to the ability to temporarily store and manipulate information (Baddeley, 2003). WM was expected to play a role in children's ability to adhere to a savings plan because in order to save for the future the child must hold in mind their plan to save and the sequence of events (e.g., that they would spend time in the less desirable room followed by the more desirable room). They have to do this while presented with a simple marble run, which while less desirable than the large marble run, is more interesting than simply doing nothing. Saving also requires holding in mind the amount of your resource, the motivation for saving and any future plans or goals. Deficits in working memory are likely to be detrimental to saving behaviours. The inability to hold in mind this information can result in poor spending decisions, or overspending so that a future goal can no longer be achieved. Therefore, it is worth considering WM in some detail.

Baddeley and Hitch (1974) proposed a model of WM that is widely accepted today. This model proposes that WM can be divided into three subsystems: the phonological loop, the visuo-spatial sketchpad and the central executive. The phonological loop consists of two subcomponents: verbal storage and the articulatory control system. The verbal storage system temporarily holds speech-based and acoustic information that decays over time. The articulatory control system is a subvocal rehearsal system that is used to refresh information in the verbal storage before it is subject to decay and aids in registering visual information (Baddeley, 2003).

The visuo-spatial sketchpad is responsible for the temporary storage and manipulation of visual information. The visuo-spatial sketchpad is important in the development of unified representation using spatial and visual information. Therefore, this aspect of WM is important in tasks involving the planning of spatial movements (Baddeley, 2003). The final component of Baddeley and Hitch's (1974) WM model is the central executive. The phonological loop and visuo-spatial sketchpad are the slave systems of the central executive, which operates as the flexible, but limited, attentional control of WM (Baddeley, 2003).

While this model of WM is widely accepted, there is evidence that verbal and visual-spatial memory may not yet be differentiated in young children (Hale, Bronik & Fry, 1997). These authors examined the development of verbal and visual-spatial memory in children between the ages of 5 and 10 years, as well as 19-year-olds, using an interference paradigm. Results supported their hypothesis that verbal and spatial WM are not independent in younger children. By age 10, however, children were performing at level of 19-year-olds suggesting that the central executive component of Baddeley's WM model reaches maturity by age 10 (Hale et al., 1997). Due to this lack of differentiation, it is worthwhile including both verbal and spatial measures of WM in the current study. These measures of WM were used to measure the relation between the level of WM, EF measures and the Savings task, and as a control.

One commonly-used measure of verbal WM with 3- to 5-year-olds is the Counting and Labeling task (Gordon & Olson, 1998). This task requires children to engage in two processes, simultaneously. First, the experimenter demonstrates the task by naming three objects, counting them, and finally counting and naming them

simultaneously. The child is then required to repeat this process with three novel objects for two trials. Children younger than 3.5 years of age typically perseverate on the counting phase of the task by counting each object as 'one' while labelling correctly (e.g., 'one is a tree, one is a cow, and one is a gift'). Typically, by age 5, children can both count and label the items successfully (Gordon & Olson, 1998).

The Corsi Span, an age appropriate version of the Corsi Blocks task, is another frequently used to measure spatial WM in preschool children (e.g., Ramuseen & Bisanz, 2005). In this task, the experimenter presents the child with an array of lily pads (printed on paper) and tells her to pretend that her fingers are frogs that can jump on the lily pads. The child is then instructed to watch the order in which the experimenter's frog jumps on the lily pads, and copy that order with their own frog (their finger). A five-year-old is typically able to copy up to four movements successfully (Rasmussen & Bisanz, 2005).

The Current Study

Young children demonstrate savings behaviours in their everyday lives, yet research has not yet sought to understand the processes that underlie this behaviour, or their relationship to cognitive development in this population. This is a significant limitation within the literature and merits further investigation. The aspects of EF that are especially interesting and have been alluded to in the literature as most likely to impact young children's savings behaviours have not yet been empirically tested.

The present study seeks to address these gaps in our understanding of the early emergence of savings behaviour. As previously mentioned only two studies have attempted to determine whether children between 3 and 5 years of age are capable of demonstrating saving behaviours (Metcalf & Atance, 2011; Sonuga-Barke & Webley,

1991), but they are limited. Presently, in children, the act of saving has been taken as an understanding of saving. However, it can be argued that children that are able to create a plan to save are demonstrating an understanding of saving, regardless of whether that savings plan is implemented. Research has not focused on the ability of children of this age to create a *plan* to save and then follow through by *implementing* that savings plan, an issue that has been raised in the adult research in this area. These aspects of saving warrant considerable attention. For example, it is unclear whether young children posses the basic understanding of savings but are unable to stop themselves when faced with a moment of temptation. In this case, the ability to delay gratification may interfere with their ability to save. Additionally, it is unclear whether children could demonstrate an understanding of saving (i.e., by planning to save) and if that aspect of saving is distinct from the implementation of the savings behaviour. By disentangling these aspects of saving behaviours, it is possible to produce a clearer and more accurate picture of children's understanding of saving.

The current study employed a between-subjects design, adapted from Metcalf and Atance (2011). As previously mentioned, the more-rewarding-future condition was used as a baseline of children's saving ability to compare against the second condition. Condition 2, the Planning condition, allowed children the opportunity to create a savings plan by allocating their marbles between two bowls. This condition was used to determine whether: (1) children could create a plan to save; (2) children would follow through with that plan; (3) children were better able to save when they had made a plan (in comparison to the Baseline condition); and (4) performance on the planning

component and the actual saving component of the key task were differentially predicted by performance on other cognitive measures. The specific hypotheses are described next.

Hypotheses

There were seven hypotheses for the current study. The first hypothesis was that more children in the Planning condition would be 'Savers' (i.e., would successfully save at least one marble for the second room) on Trial 1 of the Savings task. The creation of a savings plan by the children in the Planning condition was expected to aid in the achievement of savings behaviour by allowing the children to think about allocating their marbles prior to entering the first room. More specifically, it was expected that providing children with the opportunity to make an explicit decision to save marbles for their preferred marble run would help the children refrain from spending all of their resources on the less preferred marble run. Children in the Baseline condition were not provided with this opportunity and therefore, fewer children in this condition were expected to successfully save on Trial 1.

The second hypothesis was that children in the Planning condition would save more marbles for their preferred marble run when compared to children in the Baseline condition on Trial 1 of the Savings task. This was expected to be shown by the average number of marbles saved per child in each condition. As previously mentioned, the formulation of a plan was expected to support the implementation of that plan.

The third hypothesis was that there would be a significant increase in the number of Savers in both the Planning and Baseline conditions from Trial 1 to Trial 2. Given the finding of Metcalf and Atance (2011), it was expected that children would learn from their experience of Trial 1 to save for their preferred marble run.

The fourth hypothesis was that, within the Planning condition, for Trial 1, those who formulate a plan to save (as evidenced by their allocation of resources into the two bowls) would save more than those who do not plan to save something for their preferred marble run. That is, those children who allocated marbles for the second room, as opposed to those who do not, were expected to save more. This result was expected to be indicated by: (a) the number of children who created a plan and actually saved; and (b) the average number of marbles saved by these children. Again, having the opportunity to formulate a plan was expected to support the saving behaviours in that children were required to think about how they would like to spend their marbles and were then making the conscious decision to save at least one marble for their desired toy. Put another way, explicitly planning to save marbles was expected to facilitate saving.

Fifth, it was expected that, within the Planning condition, children who planned to save would show better planning skills, as evidenced by performance on the Truck Loading task. This was predicted because children who achieve higher scores on the planning measure are displaying a more advanced ability to plan and this skill was expected to facilitate performance on the Savings task.

The sixth hypothesis was that Savers, in both conditions, would have better DoG skills as evidenced by the Modified Choice Delay task and the Gift Delay task. It was expected that superior DoG skills would be demonstrated by the Savers. This was predicted because the children could not successfully save without the ability to delay using all of the marbles on the less desirable toy. As both saving and delay of gratification require refraining from an immediate reward to receive a more desirable

reward in the future, a positive relationship between these variables was expected. This factor was expected to help connect the plan to save to the saving behavior.

Lastly, the seventh hypothesis was that Savers in both the Planning and the Baseline condition on Trial 1 of the Savings task, would show greater inhibitory control skills, as indicated by performance on the conflict IC tasks. Specifically, savers were expected to be more likely to 'pass' the DCCS and have higher scores on the Black/White Stroop task. This was expected because the Savings task required that children respond with an action that was in direct conflict with their natural tendencies. That is, they were required to inhibit their impulse to play with a new toy they had been introduced to and were shown how to use. Instead, they were required to respond to the situation by refraining from the use of all of their marbles.

Method

Participants

A total of 33 children were recruited to participate in this study. Two children refused to participate in a number of tasks and were therefore excluded from further analysis. Children were randomly assigned to either the Baseline or the Planning condition of the Savings paradigm. There were 17 children in the Baseline condition between 41 and 65 months of age with a mean age of 52 months. The 16 children in the Planning condition were aged between 42 to 65 months with a mean age of 52 months. Each group consisted of approximately equal numbers of males and females.

Participants were recruited in a number of ways. A database of participants maintained by the Children's Representational Development Lab (CRDL) at Carleton University was used to recruit children who had previously participated in research or

any siblings of the appropriate age. Recruitment notices were placed in a local parenting magazine and community newspaper. Advertisements were also posted on online forums, as well as at numerous local retailers and public libraries. Information sheets were distributed to a number of local daycares and at community events (see Appendix A for a full list of recruitment efforts).

Procedure

All testing sessions took place at the CRDL at Carleton University. Parents were provided with a verbal or written consent form with an explanation of the study prior to attending the testing session. Before beginning the session written consent was obtained from each parent (Appendix B) and verbal consent was obtained from each child. All children were informed, using child-friendly language, that if at any time they wished to end a particular task or the testing session, they could do so by informing the experimenter. Regardless of the number of tasks completed, all children were given a book at the end of the session to thank them for their participation.

Each child participated in an individual testing session lasting approximately one hour. With parental permission all sessions were DVD recorded. Parents were able to watch the session via a television screen in the next room. Each parent was asked to complete a short questionnaire related to demographic information. A short break was provided approximately half way through the testing session during which children were able to visit their parent and have a snack. Free parking was provided for parents during the session and nine parents received a $10 gift card as a token of appreciation.

Children completed a series of measures: the Savings task, a receptive vocabulary measure (PPVT), and seven tasks assessing various aspects of EF. The aspects of EF

measured include DoG (Gift Delay and Modified Choice Delay Task), conflict IC (Black/White Stroop and the Dimensional Change Card Sort), spatial WM (Corsi Span), verbal WM (Count and Label) and planning (Truck Loading). All participants (except three children who initailly preferred not to leave their parent) received the Savings task first (Baseline or Planning condition), followed by the EF tasks in the same order. The Peabody Picture Vocabulary Test (PPVT-III) was administered last.

Measures

Saving paradigm.

Two marble runs were constructed for use during the Savings paradigm (see Appendix C for photo). The small marble structure consisted of a single run and the large marble structure consisted of three runs. Boxes were affixed at the bottom of each run to ensure that participants could not reuse or play with the marbles once they have been put down the run. The Savings paradigm (see Appendices D-F) was adapted from Metcalf and Atance (2011; personal communication). This task was created to assess two aspects of saving. First, for the children in the Planning condition, the task was used to evaluate children's ability to *plan* to save a limited resource (marbles) for future enjoyment (planning to save). For all children, this paradigm was used to examine the ability of children to save marbles for the more preferred room (saving behaviour). Participants were randomly assigned to one of two groups: Baseline or Planning.

The Baseline condition was used to determine the children's ability to save in the absence of a required savings plan. This condition was included to provide a baseline against which performance on the Planning condition could be compared, as well as to allow comparison to the results previously obtained by Metcalf and Atance (2011). The

Planning condition was employed to evaluate the ability of children to create a savings plan and to determine whether the children could adhere to their plan. Comparisons across conditions allowed for a better understanding of the impact that creating a savings plan had on children's savings behaviours. It also made it possible to determine whether performance on each aspect of the task was differentially predicted by the other cognitive measures.

Baseline condition.

Participants were first introduced to two rooms, each containing one of the marble runs (and nothing else of interest). Each room was introduced as either the red room or the blue room in order to further clarify the distinction between the rooms. The order in which the rooms were introduced, as well as the colors assigned to the rooms, was counterbalanced across participants (half were shown the red/blue room with the large marble run first, while half were shown the red/blue room with the small marble run first). Photos of each run were displayed on the corresponding door, outlined with the appropriate color (i.e., red or blue). The children were invited to put one marble down each run to familiarize them with how they work. At this time, the experimenter explained that each marble could be used only once and could not be removed from the boxes at the bottom of the run. Next, the children were guided into the hallway where they completed the preference check. This involved showing the children pictures of the marble runs and asking them to indicate which they preferred ("This is a picture of the big/little marble game. This is a picture of the little/big marble game. Which marble game do you like best?"). Placement of the photos was counterbalanced across participants. The children were then told that they would spend 3 minutes in the least

preferred room, followed by 3 minutes in the more preferred room. Next, the experimenter explained that they would be given a total of 5 marbles and they were given a box containing the marbles to take into the rooms with them. The children then spent 3 minutes in each room, beginning with their least preferred. The experimenter was present during this time and pretended to do work at the back of the room. If the children addressed the experimenter, she responded with neutral statements such as, "I have to do my work over here." The experimenter documented the children's behaviour based on the number of marbles used in each room. Trial 1 concluded after the child has spent 3 minutes in each room. Trial 2 followed immediately.

The procedure for Trial 2 was the same as that of Trial 1 but began with a reintroduction to the rooms, followed by the presentation of 5 additional marbles accompanied by the researcher stating "Guess what? I found 5 more marbles so you get to play again!" Again, participants first visited the least preferred room for 3 minutes, followed by the more preferred room. Preference was based upon the initial preference check to remove the possibility that the children would choose based on which room they preferred to visit first. If the children used all their marble in the first room, they were not required to stay in the second room for the remaining 3 minutes. The variables of interest were the same as those of Trial 1.

Planning condition.

The procedure for children in the Planning condition proceeded in the exact same manner as for the Baseline condition, but with one change. Prior to entering the rooms, the children were given the opportunity to create a savings plan. After being given the 5 marbles, they were provided with the opportunity to allocate marbles for each room by

distributing them amongst two bowls, one with a photo of the small marble run behind it and one with a photo of the large marble run. The color of the bowls matched the color of the photos on the door of the rooms containing the marble runs. Placement of the bowls on the tray was consistent with the order in which the preference check was presented. The children were introduced to the bowls "This is for the marbles for the little/big marble game. This is for the marbles for the big/little marble game. Here you go! Put them in!" A shallow box with 5 marbles was then placed on the tray. If the children chose not to put all available marbles into the bowls, they were not prompted to do so. After the marble allocation the whole tray was carried into the testing rooms. Participants were given access to the bowls during both 3 minute stays. This was done to allow the children the opportunity to deviate from their savings plan if they wished (or if they could not stop themselves). The experimenter documented the children's behaviour based on: (1) their plan to save as indicated by their allocation of marbles for each marble run; (2) the number of marbles they actually used from *each* box (i.e., if they 'borrowed' from the other box); and (3) whether the number of marbles used matched the number planned to be used for a given room. Again, two trials were completed following the same procedure outlined above.

Planning measure.

Truck Loading. The Truck Loading task was used as a measure of planning ability (Carlson et al., 2004; Fagot & Gauvain, 1997; Appendices G and H). During this task, children took on the role of a mail carrier delivering colour-coded party invitations to five solid-coloured homes (each with a distinct colour) on one side of a one-way street. The children were asked to load up a delivery truck (which held the invitations flat, piled

on top of each other). However, there were a number of limitations requiring the child to engage in careful planning. The limitations placed on delivery included: the colour of the invitation and the house must match, invitations could only be taken from the top of the pile, and the street is one way so only one trip can be made down the street. In order to succeed on the task, the children were required to load the invitations in the correct order, beginning with the invitation that was to be delivered last. The task consisted of four levels of difficulty beginning with two houses and ending with five houses. If the children did not pass a level on the first try the experimenter reminded them of which rule they had broken and instructed the child to try again. Children moved onto the next level if they successfully delivered the invitations on the first or the second attempt. Total scores ranged from 0 to 4, with children receiving a score of 1 for each level correctly completed.

Delay of gratification tasks.

Gift Delay. Kochanska et al. (1996) created the Gift Delay paradigm (Appendix I) as a measure of DoG in preschool children. During this task, participants were positioned in a chair facing away from the experimenter. The experimenter instructed the participants not to look while she wrapped a gift intended for them ("Remember, no peeking!"). For 60 seconds, the experimenter noisily wrapped the gift. Upon completion of the task the children were permitted to open the gift. Three measures were coded: (1) total number peeking attempts; (2) latency to peek (measured in seconds); and (3) peeking. Peeking was scored from 0 to 2 (0 = turning completely around to peek, 1 = over the shoulder peeking and 2 = no attempt to peek).

Modified Choice Delay Task. The Modified Choice Delay task (Appendix J) was adapted from Lemmon and Moore (2007) and from Metcalf and Atance (Metcalf, personal communication, August 23, 2011). The experimenter explained to the participant that were going to play a game that involved choosing between having one sticker now to put on the sticker page, or saving a larger quantity of stickers to take home by putting them into an envelope. Sticker choices were presented to the children in two shallow boxes (a 'now' box or a 'later' box). Test trials consisted of two choices presented three times each, for a total of 6 trials. Participants chose between 1 sticker now and 4 stickers later, or 1 sticker now and 5 stickers later. If the children chose the 'later' stickers, the stickers were placed into an envelope to go home with them. A sticker sheet was also provided for the 'later' trials and was placed with the envelope. If the child chose to use her sticker 'now' she was instructed to place the sticker on their sticker page before beginning the next trial. Scores were calculated based upon the number of 'later' choices made for each trial type. 'Now' choices received a score of 0 and 'later' choices received a score of 1. The score for the three trials of each type (i.e., 1 vs. 4 and 1 vs. 5) ranged from 0 to 3. Total scores were calculated by summing across the 6 test trials and ranged from 0 to 6.

Conflict inhibitory control tasks.

Dimensional Change Card Sort (DCCS). The DCCS (Appendix K; Frye et al., 1995) is a widely used measure of conflict IC in children. Children were presented with two target cards (e.g., a red rabbit and a blue boat) varying along two dimensions (i.e., color and shape) that were placed on the top of two identical boxes. First, to build the prepotent response, children were told that they must sort the test cards according to one

dimension (e.g., colour) by placing them in the appropriate box by explaining "If it's a blue one it goes here [pointing to the box with the blue boat] and if it's a red one it goes there [pointing to box with red rabbit]." Children completed eight of these 'pre-switch' trials. Cards were ordered such that no more of two of the same cards were presented simultaneously. Next, the children were informed that the rules of the game had switched and they were now required to sort the according to the previously irrelevant dimension (e.g. shape). There were eight 'post-switch' trials. Children were scored separately on pre- and post-switch performance. Performance was considered in terms of raw scores on the post-switch phase (out of 8) and on a pass or fail basis (to differ from chance, a 'pass' required $7^{+}/8$ trials).

Black/White Stroop. Developed by Podjarny et al. (2008), the Black/White Stroop task (Appendix L) is used to measure conflict IC in children. During this task children were presented with a black card and told to respond with white ("this card is black, right? When you see this card, I don't want you to say *black*. No, I want you to say *white*"). Similarly, when children were presented with white cards they were instructed to respond with 'black'. A maximum of three practice trials were allowed with feedback before completing the 21 test trials. Feedback was not provided during test trials. Correct responses were scored as 1 and incorrect responses were scored as 0. A total score out of 21 was determined by summing across all test trials.

Working memory.

Counting and Labeling. Gordon and Olson's (1998) Counting and Labeling task is used to measure verbal WM (Appendix M). First, the experimenter demonstrated the task. The children were presented with three objects and watched as the experimenter

counted them ("One, two, three"), labelled them ("Tree, cow, gift"), and finally, counted and labelled the objects at the same time ("One is a tree, two is a cow, three is a gift"). The children were then presented with two trials, both with three novel objects, and were asked to count them, label them, then count and label them. Correct trials were given a score of 1 and incorrect trials were given a score of 0. Total scores were based on the two test trials and ranged from 0-2.

Corsi Span. The Corsi Span (Appendix N; Rasmussen & Bisanz, 2005) is a child-appropriate measure of spatial WM that has been adapted from the Corsi Blocks (Corsi, 1972). Children were presented with a series of nine identical lily pads (printed on a sheet of paper) and told to pretend that their fingers were frogs jumping from lily pad to lily pad. The children were instructed to watch which lily pads the experimenter jumped on then to jump on "the same ones in the same order". The first two trials consisted of jumping on two lily pads. Feedback was provided for these trials only. The number of lily pads jumped on then increased by one after every two trials up to a maximum of six lily pads. Testing ended when the children made an error on both strings of the same length. Correct trials received a score of 0.5 with a possible total of 5.

Receptive language.

Peabody Picture Vocabulary Test – Third Edition (PPVT-III). The PPVT-III (Dunn & Dunn, 1997) is a standardized measure of children's receptive language abilities. Participants were shown a series of pictures and were required to match images to the word stated by the experimenter. The participant completed between 2 and 4 practice trials during which they were provided with feedback. Test trials consisted of sets of 12 pictures of increasing difficulty. Trials continued until the children made 8

errors in a set of 12. To determine the children's raw score, the number of errors made was subtracted from the ceiling item reached. The PPVT-III has demonstrated strong psychometric properties (Dunn & Dunn, 1997).

In order to ascertain the degree to which the participants' language abilities impacted their performance on the Savings task and EF tasks it was necessary to assess children's language ability. Previous research has shown that language deficits can negatively impact performance on EF tasks (Fuhs & Day, 2011; Hongwanishkul et al., 2005). The PPVT-III was used to measure the relation between general language ability and performance measures and as a control.

Results

Preliminary Analysis

There were a number of children who did not complete one or more tasks during the testing session (see Table 1). One child completed the Savings task only and one child did not complete 4 out of 9 tasks (Black/White Stroop, Gift Delay, Corsi and PPVT). These children were not included in the final sample. Ten children chose not to complete the PPVT. The majority of these children did not appear to be struggling with the task but chose to quit due to boredom or fatigue. These participants were excluded pairwise for each relevant analysis. The full sample was used for subsequent analyses unless otherwise noted. A total of 22 children completed all tasks.

Table 1

Number of Participants who did not Complete each Task

Measure	Number of Missing Participants
Savings	0

Modified Choice Delay	1
Gift Delay	2
DCCS	1
Black/White Stroop	2
Count and Label	1
Corsi	3
Truck Loading	2
PPVT	10

Preliminary analyses were conducted prior to examining performance on the Savings task to determine whether the two groups (Baseline and Planning) were matched on all cognitive measures and age. A series of one-way analyses of variance (ANOVA) revealed that there were no between group differences on these factors (see Table 2). Therefore, these variables were not controlled for in the subsequent analyses.

Table 2

Analysis of Between Group Differences on Age and all Common Measures

Measure	*F*	*p*
Age (months)	.002	.968
Modified Choice Delay	.442	.511
Gift Delay	.683	.415
DCCS Post-Switch Score	.037	.848
Black/White Stroop	1.68	.205
Count and Label	1.67	.206
Corsi	.024	.878
Truck Loading	.433	.516
PPVT	3.20	.089

Interrater Reliability

Interrater reliability was assessed for Savings task and the Gift Delay task. Using DVD recordings, a research assistant independently coded all testing sessions. Cohen's kappa was obtained for Trial 1 (0.95) and Trial 2 (0.96) of the Savings task, as well as for the Gift Delay (0.86). Any cases of disagreement were resolved through discussion between raters.

Performance on the Savings task

The distribution of scores for each trial, per condition of the main task, is shown in Figures 1 and 2. Of the 33 children who completed the Savings task, five children preferred the small marble run when completing the preference check.

Figure 1.

Distribution of the Number of Marbles Saved by each Condition on Trial 1 of the Savings Task.

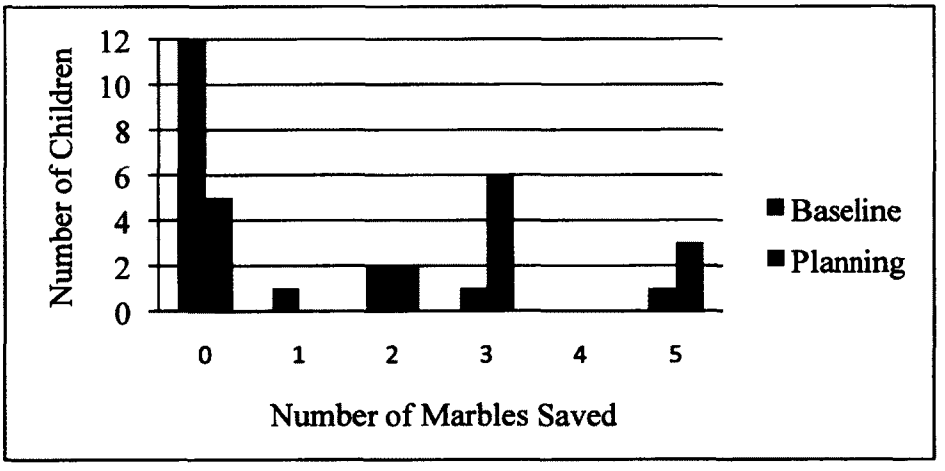
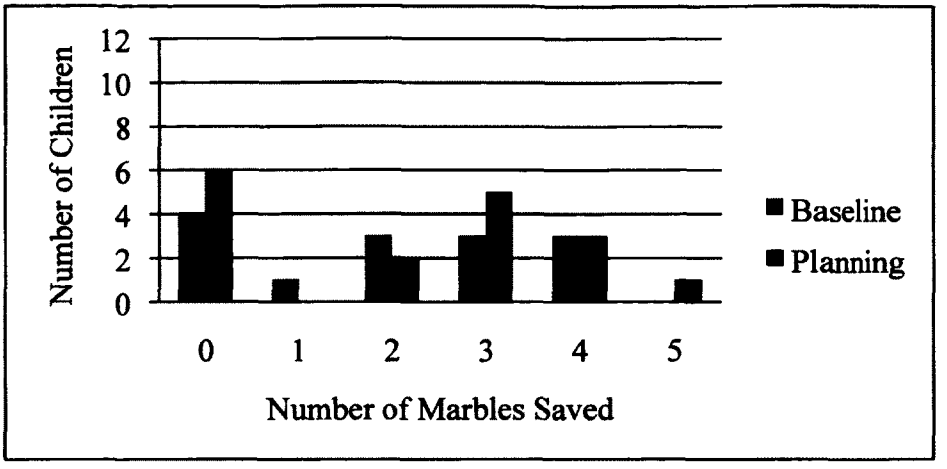


Figure 2.

Distribution of the Number of Marbles Saved by each Condition on Trial 2 of the Savings Task.



To test the primary hypothesis, that a greater number of children in the Planning condition would save at least one marble for the second room on Trial 1 relative to the Baseline condition, a Chi-square analysis was conducted. Children were first classified as 'Savers' (saved at least one marble for the second room) or 'non-Savers' (did not save any). Then, the two groups were compared to determine whether significantly more participants in the Planning condition were Savers. Support was found for this hypothesis, χ^2 (1, N = 33) = 5.11, p = .038, with results indicating that there were significantly more Savers in the Planning condition than in the Baseline condition on Trial 1. The number of Savers in each condition per trial is shown in Table 3.

Table 3

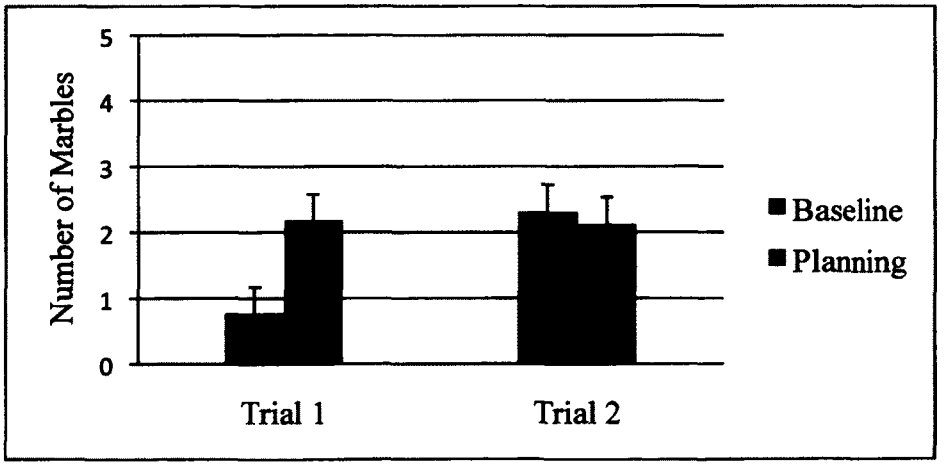
Number of Savers in each Condition across Trials

	Trial 1	Trial 2
Group (sample size)	Number of Savers	Number of Savers
Baseline (17)	5	13
Planning (16)	11	10

To test the second hypothesis, that the children in the Planning condition would save more marbles than those in the Baseline condition on Trial 1 (but not Trial 2), a 2x2 mixed ANOVA with Trial as the repeated measure and condition as the between-subjects factor was performed. Participants in the Baseline condition, on average, saved 0.77 marbles for the second room on Trial 1, compared to an average of 2.11 marbles saved in the Planning condition. There was no main effect of the number marbles saved $F(1, 31) = 2.76, p = .106$ indicating that there was no significant difference in the average number of marbles saved by each group (overall). However, results revealed a significant interaction between marbles saved and condition, $F(1, 31) = 4.71, p = .038$. As can be seen in Figure 3, the average number of marbles remained relatively constant for the Planning condition across trials. However, the average number of marbles saved in the Baseline increased from 0.77 to 2.31 from Trial 1 to Trial 2. This pattern of results provides support for this hypothesis.

Figure 3

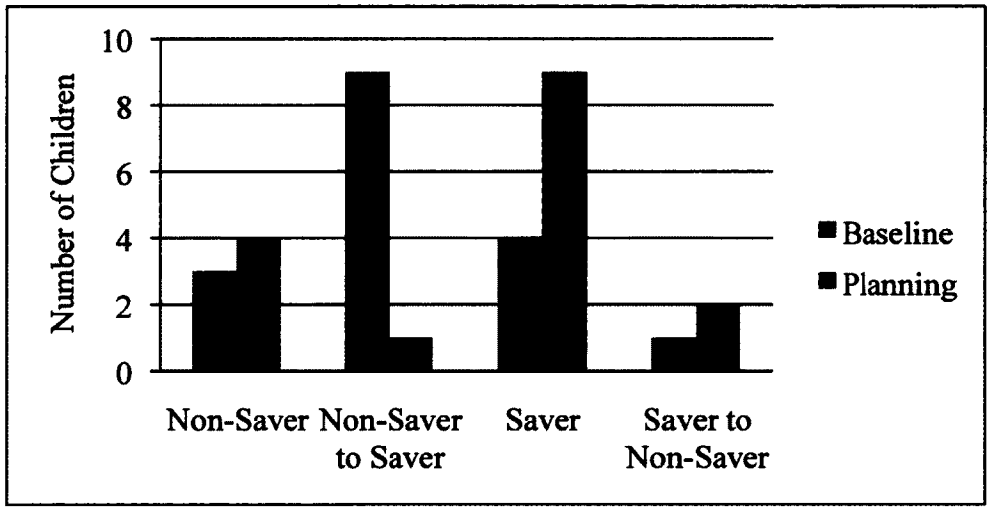
Interaction of the Average Number of Marbles Saved by Condition across Trials



Hypothesis 3 was that there would be significantly more Savers on Trial 2, when compared to Trial 1, for both conditions. In the Baseline condition, 30% of participants were Savers in Trial 1. This number increased to 77% on Trial 2 (see Table 3). McNemar's Test of Change (using the binomial distribution) revealed that the pattern of change across trials for the Baseline condition was significant, ($p = .021$), indicating that a significant number of non-Savers on Trial 1 became Savers on Trial 2. This pattern of change was not found for the Planning condition ($p = 1.00$), with 69% of participants saving on Trial 1 and 63% saving on Trial 2. Thus, these results provide only partial support for this hypothesis.

Figure 4

Pattern of Change across Trials for Savers and Non-Savers



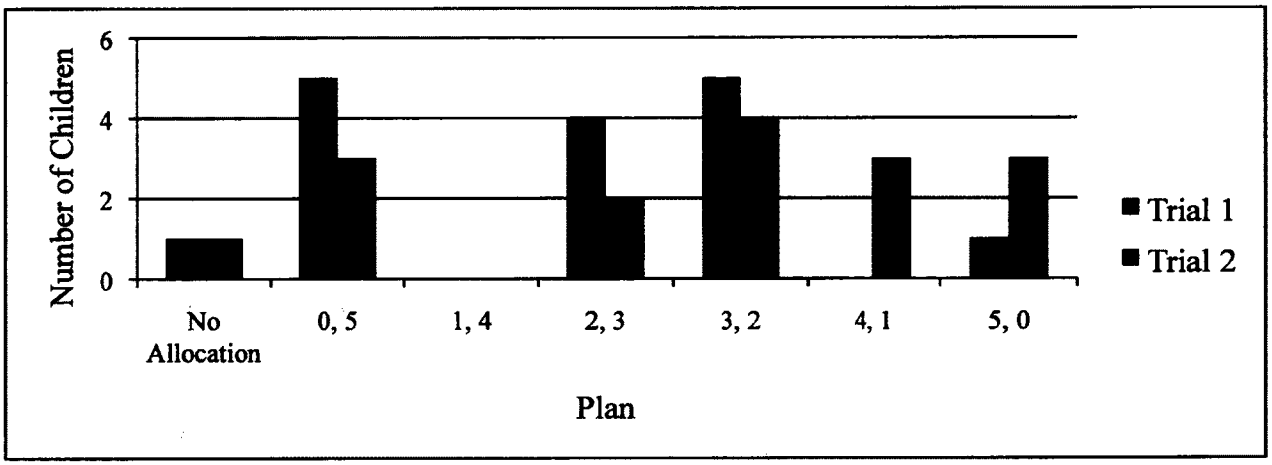
Performance within the Planning Condition

Recall that within the Planning condition children were given the opportunity to allocate marbles between two bowls on each trial of the Savings task. As such, there were a number of possible ways in which the marbles could be allocated. Figure 5 displays the number of children who chose each possible allocation for each trial. One

child chose not to use the allocation bowls on either trial. Seven children created the same plan for both trials, and 8 children altered their plan for Trial 2. In the actual testing situation, three children did not deviate from their plan on Trial 1, while 4 children did not deviate from their plan on Trial 2. Only one child adhered to the plan on both trials. Interestingly, this child chose to allocate 5 marbles to the least preferred marble run and was therefore, not required to save any marbles for the second room.

Figure 5

Marble Allocation by Children in Planning Condition, N = 16



Note. The first number represents the number of marbles planned for the least preferred marble run, followed by the number planned for the preferred marble run.

Comparing Planners and Non-Planners

The fourth hypothesis was that within the Planning condition ($N = 16$), those who create a plan to save at least one marble for their preferred marble run ('Planners'), as indicated by allocating their marbles into the appropriate bowl, would save more than those who did not create a plan ('non-Planners'). A one-way ANOVA did not provide support for this hypothesis, $F(1, 15) = .056$, $p = .817$, with the Planners ($M = 2.40$) and non-Planners ($M = 2.17$) saving an equal number of marbles for the second room on Trial

1. However, given the very small sample size here, the lack of a finding is not very informative.

It was also expected that more Planners would become Savers on Trial 1 of the Savings task. Due to the very limited sample size, this analysis (a Chi Square) could not be run. However, a visual inspection of the data revealed that of the 16 children in the Planning condition, 10 participants created a plan (see Table 4). Of those participants, 8 were successful in saving at least one marble for the second room. Of the 6 participants who did not create a plan, 3 were successful in saving.

Table 4

Number of Children who Created a Plan to Save and Saving Outcome on Trial 1

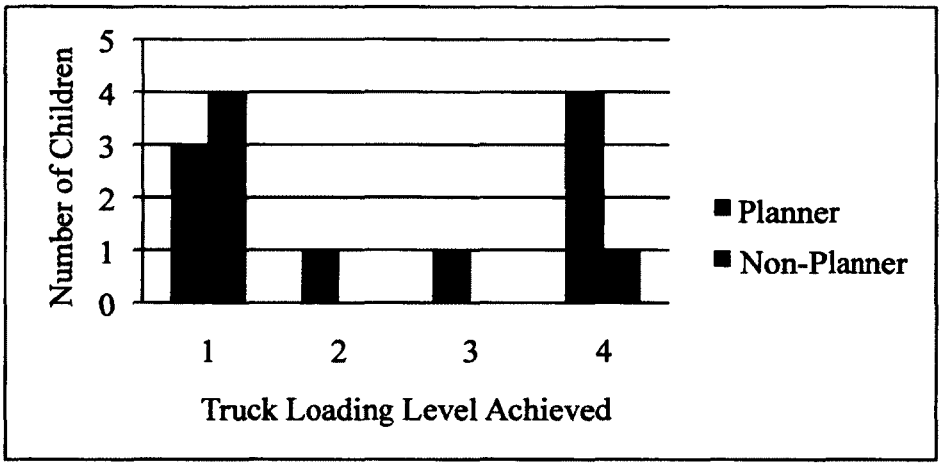
	Non-Saver	Saver	Total
No Plan	3	3	6
Plan	2	8	10
Total	5	11	16

Contribution of Planning Ability

The fifth hypothesis was that within the Planning condition, Planners on Trial 1 of the Savings task ($N = 14$) would show greater planning ability on the Truck Loading task, relative to non-Planners. While this analysis is based on too few participants, it was conducted to determine whether there were any emerging trends in the data. Results of a one-way ANOVA did not support this hypothesis, $F(1, 13) = 3.28, p = .093$. Children who created a plan and those who did not performed equally well, reaching similar levels on the Truck Loading task (see Figure 6). However, results showed an emerging marginal trend in the predicted direction.

Figure 6

Performance on the Truck Loading Task by Planners and Non-Planners, N = 14



Contribution of Delay of Gratification and Conflict Inhibitory Control

One child did not complete the DoG or conflict IC tasks and one child did not complete the Black/White Stroop or the Gift Delay task. Therefore, these children were excluded from these analyses, resulting in a sample of 31 children.

Zero-order correlations, using the entire sample, were obtained for all measures using raw scores (see Appendix O). Age (in months) was correlated with a number of measures, including the scores on the Modified Choice Delay task, performance on the DCCS, Counting and Labeling, and the PPVT, but not savings performance on either trial. Performance on the PPVT was also correlated with performance on Trial 2 of the Savings task, DCCS performance, and Count and Label. Therefore, it was necessary to control for both age (in months) and PPVT scores in the subsequent analyses.

The sixth hypothesis was that Savers, across both conditions, would demonstrate better DoG skills, as evidenced by performance on the Modified Choice Delay and Gift Delay tasks. The partial correlations, after controlling for age (in months) and general language ability (PPVT scores), appear in Table 5. Thus, this hypothesis was not

supported. However, given the very small sample size ($N = 19$), these results must be interpreted very cautiously.

Table 5

Partial Correlations between Savings task Performance and DoG and Conflict IC Measures Controlling for Age and General Language Ability, N = 19

		Measure	1	2	3	4	5	6
Saving	1	Trial 1	---	.207	.258	-.009	-.110	.196
	2	Trial 2		---	.182	-.091	.266	.019
DoG	3	Modified Choice Delay			---	-.134	.009	-.020
	4	Gift Delay				---	-.078	-.061
Conflict IC	5	DCCS					---	.037
	6	Black/White Stroop						---

The large number of children who chose not to complete the PPVT resulted in a limited sample size available for analysis. In order to investigate the patterns with a larger sample size, partial correlations, controlling only for age (in months) were conducted (see Appendix O). This analysis revealed a similar pattern of results to those previously obtained. There were no significant correlations between the Modified Choice Delay ($N = 29$), or the Gift Delay ($N = 28$), and performance on the Savings task. Again, Hypothesis 6 was not supported.

The final hypothesis was that the number of marbles saved in both conditions would be correlated to conflict IC, as evidenced by performance on the DCCS and the Black/White Stroop tasks. Partial correlations, controlling for age and general language ability ($N = 19$), revealed no significant correlations between post-switch performance on the DCCS and performance on Trial 1 or Trial 2 of the Savings task. Similarly, partial correlations indicate that the relationship between scores on the Black/White Stroop on

Trial 1 and Trial 2 of the Savings task were not significant (see Table 5). Therefore, there was no support for this hypothesis.

Partial correlations, controlling only for age, were conducted to examine the contribution of conflict IC to performance on the Savings task with a larger sample size (see Appendix O). A similar pattern of results was obtained for the Black/White Stroop ($N = 28$). However, post-switch performance on the DCCS ($N = 29$) was significantly correlated with performance on Trial 2 of the Savings task ($r = .405$) for both conditions.

Discussion

The goal of the present study was to investigate children's ability to create a plan to save a limited resource for future use, and their ability to implement such a plan. To do so, children were given a limited number of marbles then required to spend time with a less desirable marble run, followed by a more desirable marble run. The primary objective was to determine whether the opportunity to create an explicit plan to save would increase saving behaviours, relative to children who were not given such an opportunity. To address this goal, half of the children were given the opportunity to explicitly create a savings plan prior to entering the testing situation. Additionally, the present study sought to examine the contribution of DoG and conflict IC to savings behaviours. Given the demands thought to be involved in the task, it was expected that these skills would be related to performance on the Savings paradigm.

Comparing Performance across the Conditions of the Savings Task

First, it was expected that more children in the Planning condition would be classified as Savers on Trial 1 of the Savings task, when compared to the Baseline condition. In spite of the small sample size, comparisons across conditions provided

support for this hypothesis. More children in the Planning condition were able to successfully save on Trial 1 of the Savings task. This finding is interpreted to mean that the Planning condition allowed children to consider how they would like to spend their marbles and allocate them between the two bowls, thereby creating an explicit plan. By bringing the bowls into the testing room, the children were reminded of their initial plan when they were faced with the temptation to use all of their marbles in the first room. That is, encouraging the participants to think about how to allocate their limited resources, and having a visual reminder of their plan available each time they reached for a resource, helped them to carefully consider their spending choices. One interpretation of this finding is that the bowls may have helped children overcome their desire for immediate gratification by reminding them of the reason they should save (delayed gratification). These results are interesting in that they indicate that the opportunity to create an explicit plan contributed to children's ability to save, even when evaluated using a limited sample size. This finding is in line with research on adult saving that has found that having savings plans facilitated the achievement of savings goals (Rha et al., 2006).

Secondly, there was support for the hypothesis that children in the Planning condition would save more marbles on Trial 1 (but not Trial 2) when compared to children in the Baseline. Children in the Baseline condition (but not the Planning condition) saved significantly more marbles on Trial 2, when compared to Trial 1. Given that previous research has found that children can learn to save across trials (Metcalf & Atance, 2011), the results for the Baseline condition were anticipated. This effect was not present in the Planning condition, suggesting that the creation of a plan provides an

additional support for these children making this strategy as effective in improving performance on the Savings task as learning across trials. If this holds up with a larger sample size (data is still being collected on this project), this has interesting implications for parents and/or educators. For example, when educating children regarding the benefits of saving and the ways they can begin to save, savings plans should be considered

Next, it was expected that all children, regardless of condition, would learn from the experience of Trial 1 to save on Trial 2. In other words, I had hypothesized that the opportunity to develop a plan (a 'budget') and experience would both have an effect on savings behaviour. However, an increase in the number of Savers across trials was found for the Baseline condition, but not in the Planning condition. This result is similar to that obtained above. The increase in the number of Savers on Trial 2 in the Baseline condition is in line with the findings of Metcalf and Atance (2011). Making an explicit decision regarding the allocation of resources facilitated the saving behaviour of children in the Planning condition, such that they were able to reflect on the ways in which they would like to spend their marbles. Children in the Baseline condition did not have the opportunity to create an explicit plan, and therefore the increase in the number of Savers and the number of marbles saved, on Trial 2 for this group appears to be due to prior experience of Trial 1 of the task. They were perhaps able to reflect upon their previous spending decisions in order to develop a more successful strategy prior to beginning Trial 2. The opportunity to experience what it would be like to be in the more-desired room, with limited (or no) resources made an impact on children in the Baseline condition, such that they were more likely to save when faced with that opportunity again. In other

words, children were able to demonstrate better savings behaviours for one of two different reasons (opportunity to plan, and experience from the first trial), but the two factors were not cumulative.

This result could also be interpreted to mean that children at this age reach their maximum savings at an average of 2 marbles (the average number of marbles saved by children in the current study). Based on the supports provided to them, the children in the Planning condition are able to reach this level on Trial 1. However, the children in the Baseline condition continue to improve across trials based on the experience of Trial 1. Again, the supports provided to children in the Planning condition appear to be functionally equivalent to learning from the experience of Trial 1 in the Baseline condition. However, more research is needed to determine what exactly it is that these children are learning from Trial 1. For example, are children in the Baseline condition learning, on the basis of a single trial, to create a plan to save, or are they simply learning to spend less marbles in the first room, without making an explicit decision to save? It is also possible that these children are creating, or modifying, a strategy to inhibit their impulse to spend all of their marbles in the first room.

Comparing Performance in the Planning Condition

It was expected that within the Planning condition, Planners would save more than non-Planners. There was no difference in the number of Planners and non-Planners that became Savers, or the number of marbles saved by each group for the second room. However, given the limited sample size of 10 Planners and 6 non-Planners these results cannot be interpreted very meaningfully. One possible explanation for this pattern of results is that the children in the Planning condition were required to think about how

they would like to spend their marbles prior to entering the first room. This opportunity may provide these children with enough of a plan to account for the difference between conditions, as well as the lack of difference between Planners and non-Planners in the Planning condition. This result is inconsistent with research with adults showing a positive relationship between creating a plan to save and successfully implementing that plan (Rabinovich & Webley, 2001; Rha et al., 2006). The current study would require a larger sample of Planners and non-Planners in order to clarify the relationship between planning and successfully saving in children. However, should a larger study support my original hypothesis (and the interpretation provided above), this would point a very valuable finding. If this proves to be the case, then children with lower 'automatic' planning skills can be provided with specific, explicit, planning experiences that may help them to demonstrate better planning behaviours. These planning behaviours could, in turn, lead to more saving behaviours.

Children in the Planning condition, who created a plan to save at least one marble for the second room ('Planners'), were also expected to show superior planning skills when compared to non-Planners (who did not allocate any marble for the second room). This hypothesis was not supported, as Planners and non-Planners performed equally well on a measure of planning ability. Performance on the Truck Loading task was bimodal with 39% of children reaching Level 1, and 39% performing at ceiling. Therefore, the lack of variability may not have allowed for a strong comparison of Planners and non-Planners. Additionally, the sample available for this analysis ($N = 14$) is likely too limited in size to yield significant results.

Contribution of Inhibitory Control

Finally, it was hypothesized that Savers in both conditions would demonstrate better DoG and conflict IC skills. It is important to recognize that this pattern of results was not found, as Savers and non-Savers performed equally well on these tasks. It is possible that these results point to a factor above and beyond DoG and conflict IC that may be contributing to children's ability to save. A replication of these results with a large sample size would likely suggest that saving requires skills other than DoG and conflict IC. These results would support the position of the current study, and of Metcalf and Atance (2011), that saving is indeed different from DoG. However, these results are in conflict with findings in the adult literature, including the BLCH, that link superior self-control to successful saving (Ottaviani & Vandone, 2011; Shefrin & Thaler, 1988). Future research is needed to determine which factors differentiate these abilities in young children.

Additional analyses revealed a significant relationship between performance on the DCCS and Trial 2 of the Savings task when controlling only for age. It is possible that children were able to use the experience of Trial 1 to develop an appropriate strategy to inhibit the impulse to use all of their marbles with the first toy. Previous studies have alluded to a relationship between inhibitory control and saving (Sonuga-Barke & Webley, 1991). However, prior to the current study, this construct had not been directly measured. Results from the current study do not support the idea of a relationship between these factors. However, a larger sample is required to further investigate this result.

Limitations

There are a number of limitations of the current study that must be addressed. First, the sample size was quite limited and this resulted in a low number of participants per condition. While a great deal of effort was put into participant recruitment for this study, too few participants were recruited due to the challenges of recruiting for an on-campus study (see Appendix A).

While it is important to note that significant between groups differences were found with a small sample, this study should be expanded to see whether the results hold up with a greater number of participants. The lab is working on recruiting more participants for this study, and therefore will learn more about the differences between Planners and non-Planners, as well as the contribution of planning, DoG and conflict IC to saving behaviours.

Planning ability was not related to performance on the Savings task, perhaps in part due to the fact that performance on the Planning measure was bimodal. Therefore, a more sensitive measure of planning ability, in conjunction with a large sample size, would allow for a better analysis of the contribution of planning to successful saving outcomes. There do not appear to be any such tasks currently reported in the literature, so one may have to be developed for this purpose.

Another limitation is that a large number of children chose not to complete the PPVT (10/33). A few of these children indicated to the experimenter that they were tired, bored, or did not want to play anymore. While it does not appear that all of these children were struggling with the task, a higher completion rate in conjunction with the recruitment of more participants, would allow for a more representative sample. This

would allow for a clearer depiction of the contribution that general language abilities have on savings behaviours. Each testing session lasted approximately one hour, with the PPVT being administered last. Shortening the testing session, or administering the PPVT in two parts, may have decreased fatigue and resulted in fewer children quitting this measure. Given that the types of WM are not well differentiated in preschool children (Hale et al., 1997), only one of these measures may have been necessary. Lastly, the Savings task is likely the most interesting for preschool children. Moving this task to later in the session could prevent any loss of interest that may occur over the session.

Recall that there was no support for the contribution of DoG or conflict IC skills to performance on the Savings task when controlling for age and general receptive language abilities. The majority of children (71%) made no attempt to peek during the Gift Delay task. Interestingly, a number of these children seemed to be watching the camera during this task. It is possible that these children recognized that their parents were watching and this may have made them less likely to disregard the experimenters' instructions not to peek. Facing the children away from the camera during this task may result in more variability in performance. Similarly, 63% of participants performed at ceiling on the DCCS. Perhaps more sensitive measures of DoG and conflict IC are necessary in order to accurately assess the contribution of these factors to saving. Again, at least in the case of conflict IC, such measures do not yet seem to exist.

Future Research

The present study provides some insight into preschool children's ability to demonstrate savings behaviour when faced with limited resources. However, there are additional aspects of children's saving that warrant investigation. The current study is

limited in that it only investigated one type of savings plans. Given that children who were provided with the opportunity to allocate their marbles were more likely to successfully save for the second room it would be of interest examine the influence that different types of plans have on one's ability to adhere to a savings plan. One possible line of research that should be considered is the use of implementation intentions, or 'if-then plans' (Gollwitzer, 1999). These types of plan would provide children with a tool that can be used when they are faced with the temptation to spend the resources they had previously allocated for another use or a future point in time. For example, the children could be provided with a statement such as 'If I want to use the marbles I saved for the big toy, then I will sit and wait until time is up instead!" Given the strong association between implementation intentions and successfully adhering to a number of types of plans (e.g., savings goals, weight loss, academic achievement; for a review see Wieber, Suchodoletez, Heikamp, Trommsdorff & Gollwitzer, 2011) it would be of interest to examine whether these plans can aid children in the achievement of savings goals.

Given the superior performance of the children in the Planning condition on Trial 1, and the improvement of children in the Baseline condition across trials, it would be of interest to examine the differential effects of planning and learning from experience in slightly older children. While a marble run may not be appropriate for older children, the same general procedure could be administered using a more age-appropriate game to determine whether the opportunity to create a plan is functionally equivalent to learning from experience in this age group, lending support for the implementation of educational programs.

While it is evident that the children in Metcalf and Atance's (2011) study and the Baseline condition of the current study are learning something across trials, it is not yet clear what this learning effect is. Future research should incorporate probing questions prior to the administration of Trial 2 in order to determine how the children would have preferred to spend their marbles, or how they would choose to spend the marbles if they could do the task again.

Given the lack of correlation between measures of DoG and conflict IC with performance on the Savings task, it is possible that something beyond these skills is accounting for the variability in performance on the Savings task. Future research should incorporate other measures of 'hot' and 'cool' EF (Zelazo & Müller, 2002). Hot EF refers to tasks that involve an affective and motivational component, while cool EF tasks do not involve these aspects (Hongwanishkul et al., 2005). The DCCS has been classified as a measure of cool EF, while delay of gratification tasks are considered to measure hot EF. The current study assumes that the children are motivated to save their marbles for their preferred marble run. Future research could include a motivation question, to determine what impact the participants subjective rating of motivation has on performance on the Savings task. It would be of interest to examine whether measures of hot EF are more likely to be related to performance on the Savings paradigm when compared to measures of cool EF, while taking into account the level of personal motivation. An examination into the relationship between these types of tasks and saving behaviour may produce a pattern of results supporting, or differing, from the present study.

Conclusion

Overall, the present study represents a novel contribution to the research literature surrounding children's ability to save by examining the ability of preschool children to create, and adhere to, a plan to save a limited resource for future use. This study lends support for Metcalf and Atance's (2011) finding that children in the preschool years are able to demonstrate saving behaviours.

This study represents a novel attempt to address the question of whether children are able to create a plan to save, and adhere to that plan when faced with temptation. Children who were given the opportunity were more likely to successfully save, indicating that the creation of a plan facilitates saving behaviour. A relationship between saving and DoG, as well as with conflict IC, was hypothesized, but not found. While these results should be interpreted with caution, they point to something beyond DoG and conflict IC that may be accounting for performance on the Savings task.

The current research provides preliminary support for the view that children in the preschool years are capable of creating a plan to save and demonstrating saving behaviours. Given the importance placed on the ability to save, this study provides support for the creation of programs aimed at educating parents and young children. For example, results of this study can be used to inform parents that children in this age group can benefit from being given a small allowance and the opportunity to create plans to save that allowance for future purposes. Giving children opportunities to explore plans to save their resources (i.e., money, treats, or toys) in a school or home environment may provide a foundation upon which future financial success can be built.

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Footnotes

[1]The current study utilized only the more-rewarding-present condition. However, children were asked to indicate their preferred marble structure and that room was the second room visited. This was done in order to ensure that the second room was indeed more rewarding to them. This condition was used as a baseline for comparison against a novel second condition.

Appendix A

Recruitment Efforts

- Parent database maintained by CRDL
- Advertisement placed in local parenting magazine
- Article submitted to local newspaper
- Advertisement placed in community newspaper
- Recruitment booth at local parenting event
- Flyers distributed at farmers market
- Posters distributed to public libraries
- Posters placed at local retailers
- Online advertisements placed on online forums
- Information sent to local daycares
- Information distributed to mommy groups and playgroups
- Information distributed to Carleton University parent group
- Information distributed to Paul Ellis center at Carleton University
- Advertisements placed on Kijiji and Craig's List
- Advertisements placed on parent groups on Facebook
- Contacted parent council of local schools
- Advertisements places at community centers

Appendix B

Consent Form: Parent/Guardian

Carleton UNIVERSITY

Dear parent(s) or guardian(s),

As part of a current project on children's cognitive development, we are talking to children to learn about their understanding of saving. The study has been approved by the Carleton University Psychology Research Ethics Board and it involves no physical or psychological risks for the children who take part in it. 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 both your own and your child's involvement.

Children will participate in a number of games. For example, in one game, children will be given a few marbles and have the opportunity to play with two different marble runs. Other games include remembering lists of items, sorting cards by shape and color, or pointing to pictures of things that the experimenter names (e.g., 'point to the dog'). Children usually enjoy these kinds of activities and will be given a small toy as thanks (even if they decide to stop playing part-way through). Our researchers all have current police record checks, and they will be sensitive to the children at all times. In addition, you will be asked to complete a short questionnaire related to demographic information and any savings behaviours that your child participates in or displays in the home.

We will meet with you and your child for approximately 1 hour, with a 10-minute break about half-way through. Participation in this experiment 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 sessions. The information collected in this study, including video recordings, is confidential and will be coded such that a child's name is not associated with their responses. If you prefer that your child's sessions are not recorded, you may indicate so on the consent and sessions will not be recorded. Any 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 and video recordings will be kept separate from the data in a secure environment and will be destroyed after 2 years.

Should you wish to participate in future research, any contact information provided along with the names and birth dates of your child and other children in the family, will be kept in a password protected database and will only be available to researchers in our lab. Once your children are older than twelve years, their information will be removed from

our database. Future participation is completely voluntary and you can ask to be removed from our database at any time.

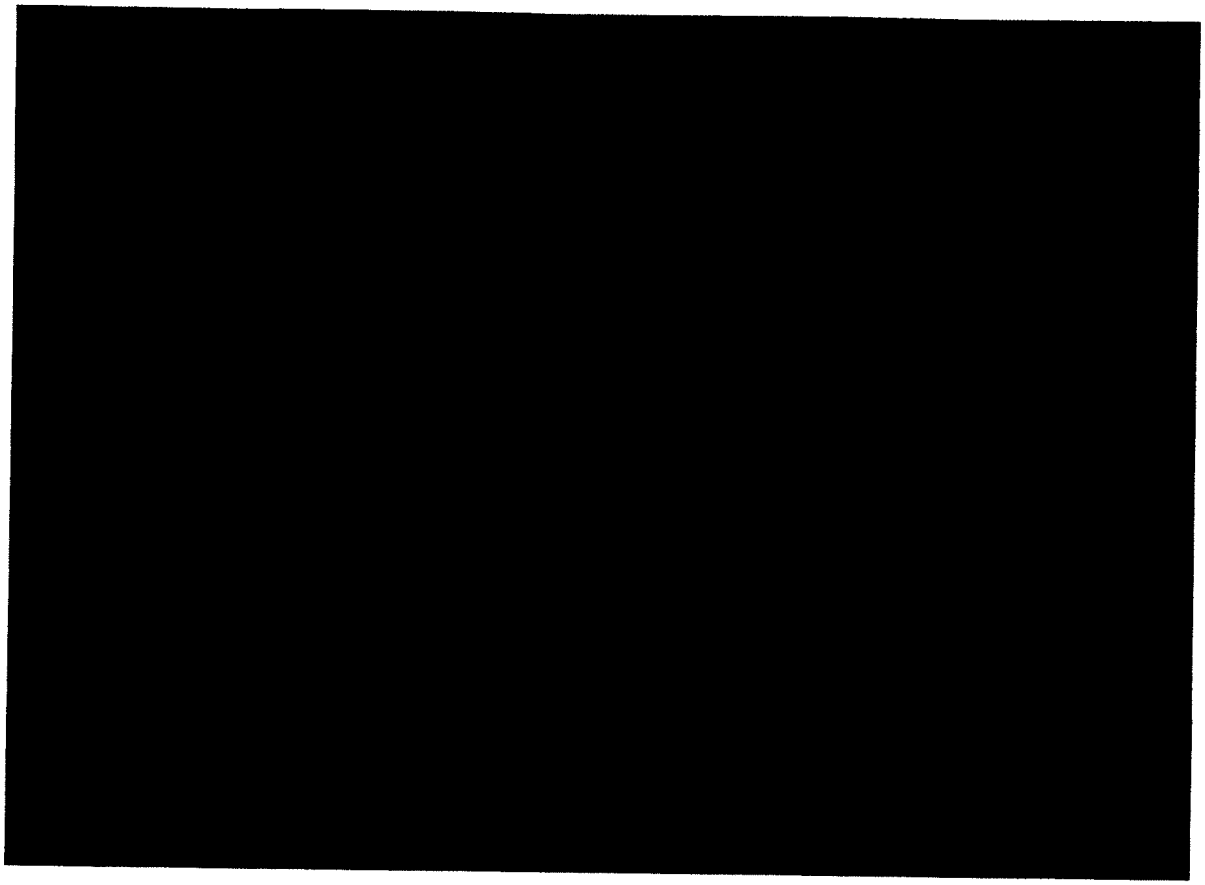
The research supervisor of this project is Dr. Deepthi Kamawar and she may be reached at 613-520-2600, ext. 7021 or deepthi_kamawar@carleton.ca. The primary researcher involved in this project is Kimberly Connolly, B.A. and she can be reached by email at kconnol1@connect.carleton.ca or by telephone at 613-520-2600 ext. 2885. If you have any ethical concerns about this study, please contact Dr. Monique Sénéchal (Chair, Carleton University Psychology Research Ethics Board, 613-520-2600 ext. 1155). The ethics protocol number for this study is 12-033. Should you have any other concerns about this study, please contact Dr. Anne Bowker (Chair, Dept. of Psychology, 613-520-2600 ext. 4173).

Your consent is required for your child's participation in this project. Kindly sign the attached consent form indicating whether your child may participate in this research and return it to the experimenter. If you would like a summary of the research results once the study is completed, please contact Kimberly Connolly. However, please note that individual feedback regarding the children cannot be provided.

Thank you for your consideration.

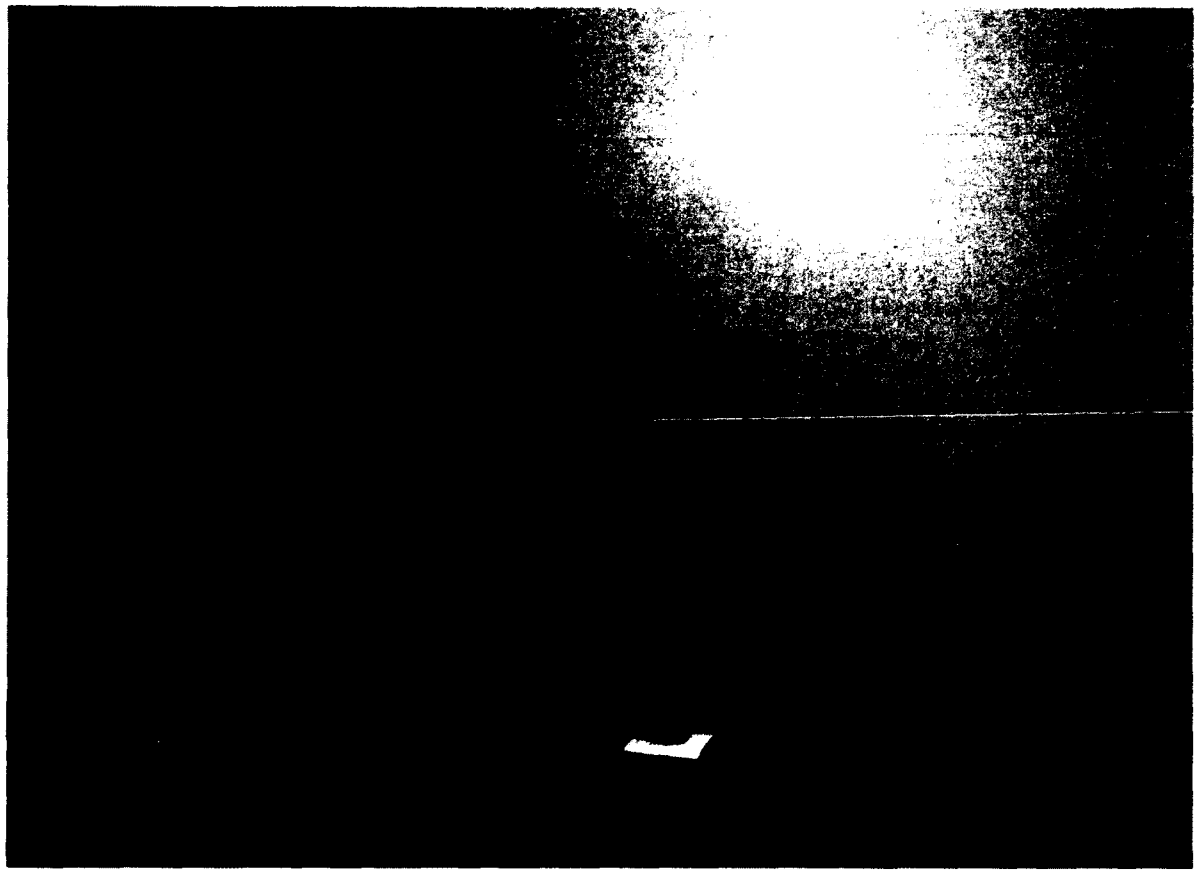
Sincerely,

Deepthi Kamawar, PhD Kimberly Connolly, B.A.



Appendix C

Photograph of the Complex and Simple Marble Runs



Appendix D

Savings Paradigm Protocol - Introduction

Introduction:

E guides child into hallway and introduces the two rooms: ***You are going to get to play in two rooms. Look at this door with the red sign*** (E points). ***This picture tells us that the red room has a little marble game. Let's look inside the red room.*** E enters red room with child. Child directed to try the marble run with one marble. ***Let's try the little marble game. Put your marble here*** (E points to top of marble run). ***See how the marble goes into this bowl at the end? Once you put a marble down the hole, the marble goes into this bowl and we can't use it again. Let's go see the other room.***

E guides child back out to hallway. ***Look at this door with the blue sign*** (E points). ***This picture means that this room has a big marble game. Let's look inside the blue room.*** E enters blue room with child. Child directed to try the marble run with one marble. ***Let's try the big marble game. Put your marble here*** (E points to top of marble run). ***Remember, once the marble goes into the bowl, we can't use it again.***

Ok, let's go back into the hall, I have a question for you. E guides child back into hallway, closing both testing room doors.

Preference check:
E presents child with a card that has photos of the **little (left) & big (right)** marble runs. E points to the photo on the left "***this is a picture of the little marble game.***" E points to photo on right, "***this is a picture of the big marble game.***"

E asks: ***Which marble game do you like best?***

(Take child to preferred room, based on preference check above, second).

If child indicates preference for complex marble run:

- **Red** room with little marble game is shown first.
- Photo of **little** run shown first (left) during marble allocation.

*Notes:
Modified for child who prefers simple marble run
Placement of photo counterbalanced

E: ***Let's see what you are going to do.***
E points to the sign on the door. ***First you are going to stay in the red room for 3 minutes. The red room has the little marble game. After, you are going to stay in the blue room for 3 minutes*** E points to the sign on the blue door. ***The blue room has the big marble game.***

Memory check: (a) ***Okay, so which room are you going to play in first?*** _____
(b) ***And which marble game is in the red room?*** _____
If incorrect, repeat instructions and memory check questions
(a) _____ (b) _____

Regardless of child's response 2nd time, E says: ***(Yeah...) We're going to go in the red room first. The red room has the little marble game. You only get 5 marbles today. You get to decide how many marbles you want to use in each room. Remember, once you put a marble down the hole, you can't take it out again.***

Appendix E

Savings Paradigm Protocol – Baseline Condition

Standardization Guidelines:
If child tries to take used marbles from bottom of run say, *"Remember, we can't play with those marbles anymore."*
If child attempts to interact with experimenter say, *"I'm doing my work right now."*

-Red Room-
E guides child into red room. ***"Okay, we're gonna stay in the red room for 3 minutes. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Other Observations (Verbal / Behavioural)
0:00-0:29						
0:30-0:59						
1:00-1:29						
1:30-1:59						
2:00-2:29						
2:30-3:00						

Total # marbles used: ___

Memory check: When timer goes off, E says: ***Okay, do you remember what we're going to do now?***

_____

If child does not spontaneously mention both the blue room *and* the big marble run, ask the following as necessary: ***So, which room are you going to play in now?***

_____

And which marble game is in the blue room?

_____

Regardless of child's answer(s) E says: ***(Yeah...) We're going to go in the blue room for 3 minutes. The blue room has the big marble game. Let's bring your marbles!***

-Blue Room-

E guides child into the blue room. ***"Okay, we're going to stay in the blue room for 3 minutes. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Other Observations (Verbal / Behavioural)
0:00-0:29						
0:30-0:59						
1:00-1:29						
1:30-1:59						
2:00-2:29						
2:30-3:00						

Total # marbles used: ___

Test Trial 2:

After completion of Test Trial 1, E guides child into the hallway. ***Guess what? I found 5 more marbles so you get to play again! The red door*** (E points) ***has a picture of the little marble game on it. Do you remember what's inside the red room?***

_____

If incorrect E states, ***The red room has the little marble game.***

The blue door (E points) ***has a picture of the big marble game on it. Do you remember what's inside the blue room?***

_____

If incorrect E states, ***The blue room has the big marble game.***

E points to the sign on the red door. ***First you are going to stay in the red room for 3 minutes. The red room has the little marble game. After, you are going to stay in the blue room for 3 minutes.*** E points to the sign on the blue door. ***The blue room has the big marble game.***

Memory check: **(a)** ***Okay, so which room are you going to play in first?***_____
(b) ***And which marble game is in the red room?*** _____

If incorrect, repeat instructions and memory check questions
(a) _____ (b) _____

Regardless of child's response 2nd time, E says: ***(Yeah...) We're going to go in the red room first. The red room has the little marble game. You only get 5 marbles today. You get to decide how many marbles you want to use in each room. Remember, once you put a marble down the marble game, you can't take it out again.***

Test Trial 2

-Red Room-
E guides child into red room. ***"Okay, we're gonna stay in the red room for 3 minutes.. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Other Observations (Verbal / Behavioural)
0:29-2:30						
0:30-0:59						
1:00-1:29						
1:30-1:59						
2:00-2:29						
2:30-3:00						

Total # marbles used: ___

Memory check: When timer goes off, E says: ***Okay, do you remember what we're going to do now?***

_____

If child does not spontaneously mention both the blue room *and* the big marble run, ask the following as necessary: ***So, which room are you going to play in now?***

_____

And which marble game is in the blue room?

_____

Regardless of child's answer(s) E says: ***(Yeah...) We're going to go in the blue room for 3 minutes. The blue room has the big marble game. Let's bring your marbles!***

-Blue Room-

E guides child into the blue room. ***"Okay, we're going to stay in the blue room for 3 minutes. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Other Observations (Verbal / Behavioural)
0:00-0:29						
0:30-0:59						
1:00-1:29						
1:30-1:59						
2:00-2:29						
2:30-3:00						

Total # marbles used: ___

Appendix F

Savings Paradigm Protocol –Planning Condition

Now I'm going to give you two bowls. This (E points to bowl) ***is for the marbles for the little marble game*** (E points to picture of little marble run). ***This*** (E points to bowl) ***is for the marbles for the big marble game*** (E points to picture of big marble run).

Memory Check: (a) ***Okay, so which game is this bowl for?*** _____
(b) ***And which game is this bowl for?*** _____

If incorrect, repeat descriptions and memory check questions:
(a) _____ (b)_____

Regardless of child's response 2nd time, E says: ***(Yeah...) This*** (E points to bowl) ***is for the marbles for the little marble game*** **(E points to picture of little marble run).** ***This*** (E points) ***is for the marbles for big marble game*** (E points to picture of big marble run).

E: Here you go! Put them in! (E gives child shallow box with 5 marbles inside)

Standardization Guidelines:
If child tries to take used marbles from bottom of run say, *"Remember, we can't play with those marbles anymore."*
If child asks to use marbles in the bowl for the blue room say, *"I'm doing my work right now."*

-Red Room-

E guides child into red room. ***"Okay, we're gonna stay in the red room for 3 minutes. Let's bring your bowls. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Takes marble(s) out of 'savings' bowl	Other Observations (Verbal / Behavioural)
0:00-0:29							
0:30-0:59							
1:00-1:29							
1:30-1:59							

2:00-2:29							
2:30-3:00							

Total # marbles used: ___ Total used - little bowl ___ Total used - small bowl ___

Memory check: When timer goes off, E says: ***Okay, do you remember what we're going to do now?***

_____

If child does not spontaneously mention both the blue room *and* the big marble run, ask the following as necessary: ***So, which room are you going to play in now?***

_____

And which marble game is in the blue room?

_____

Regardless of child's answer(s) E says: ***(Yeah...) We're going to go in the blue room for 3 minutes. The blue room has the big marble game. Let's bring your bowls!***

-Blue Room-

E guides child into the blue room. ***"Okay, we're going to stay in the blue room for 3 minutes. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Takes marble(s) out of 'savings' bowl	Other Observations (Verbal / Behavioural)
0:00-0:29							
0:30-0:59							
1:00-1:29							
1:30-1:59							
2:00-2:29							

2:30-3:00							

Total # marbles used: ___ Total used – red bowl ___ Total used - blue bowl ___

Test Trial 2:

After completion of Test Trial 1, E guides child into the hallway. ***Guess what? I found 5 more marbles so you get to play again! The red door*** (E points) ***has a picture of the little marble game on it. Do you remember what's inside the red room?***

_____

If incorrect E states, ***The red room has the little marble game.***

The blue door (E points) ***has a picture of the big marble game on it. Do you remember what's inside the blue room?***

_____

If incorrect E states, ***The blue room has the big marble game.***

E points to the sign on the red door. ***First you are going to stay in the red room for 3 minutes. The red room has the little marble game. After, you are going to stay in the blue room for 3 minutes.*** E points to the sign on the blue door. ***The blue room has the big marble game.***

Memory check: (a) ***Okay, so which room are you going to play in first?***_____
(b) ***And which marble game is in the red room?*** _____

If incorrect, repeat instructions and memory check questions
(b) _____

(c) _____

Regardless of child's response 2nd time, E says: ***(Yeah...) We're going to go in the red room first. The red room has the little marble game. You only get 5 marbles today. You get to decide how many marbles you want to use in each room. Remember, once you put a marble down the marble game, you can't take it out again.***

Okay, here are our bowls. (E points to bowl with picture of little marble run).
Do you remember which game this bowl is for? _____
If child does not mention the little marble game, E states: ***This*** (E points) ***is for the marbles you want to use in the red room with the little marble game*** (E points to picture of little marble run).

(E points to bowl with picture of big marble run).
Do you remember which game this bowl is for? _____

If child does not mention the big marble game, E states: ***This bowl*** (E points) ***is for the marbles you want to use in the blue room with the big marble game.*** (E points to picture of big marble game).

E: Here you go! Put them in! (E gives child shallow box with 5 marbles inside)

Test Trial 2

-Red Room-
E guides child into red room. ***"Okay, we're gonna stay in the red room for 3 minutes. Let's bring your bowls. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Takes marble(s) out of 'savings' bowl	Other Observations (Verbal / Behavioural)
0:29-2:30							
0:30-0:59							
1:00-1:29							
1:30-1:59							
2:00-2:29							
2:30-3:00							

Total # marbles used: ___ Total used - red bowl ___ Total used - blue bowl ___

Memory check: When timer goes off, E says: ***Okay, do you remember what we're going to do now?***

_____

If child does not spontaneously mention both the blue room *and* the big marble run, ask the following as necessary: ***So, which room are you going to play in now?***

_____

And which marble game is in the blue room?

_____

Regardless of child's answer(s) E says: ***(Yeah...) We're going to go in the blue room for 3 minutes. The blue room has the big marble game. Let's bring your bowls!***

-Blue Room-

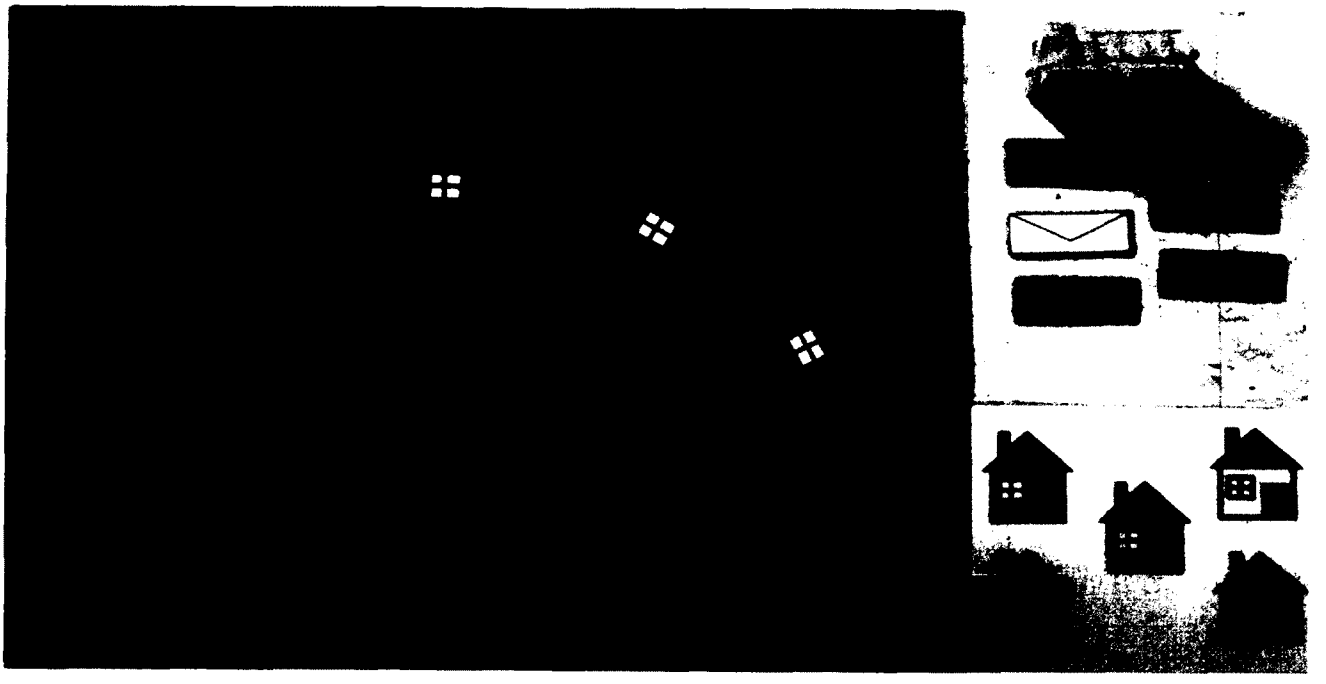
E guides child into the blue room. ***"Okay, we're going to stay in the blue room for 3 minutes. I'm going to do my work over here until time is up."*** E sets timer and places it on table, then sits at table to "work".

Time	# Marbles used	Plays with marble on floor	Plays with marble in hands	Attempts to retrieve used marble	Verbalizes intention to save	Takes marble(s) out of 'savings' bowl	Other Observations (Verbal / Behavioural)
0:00-0:29							
0:30-0:59							
1:00-1:29							
1:30-1:59							
2:00-2:29							
2:30-3:00							

Total # marbles used: ___ Total used - red bowl ___ Total used - blue bowl ___

Appendix G

Photograph of Truck Loading Task



Appendix H

Truck Loading Protocol

TRUCK LOADING TASK

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 like this** (*demo*). **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? (*demo*)

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 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)*

O.K., 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)

<u>LEVEL 2: 3 houses</u>

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 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)*

Here are the invitations. *(place down 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: _____

Appendix I

Gift Delay Protocol

Now, I have a gift for you, but I forgot to wrap it! Can you sit here while I wrap your gift? Okay, you sit here facing that way. Remember, no peeking!

Noisily wrap gift for 60 seconds. After 60 seconds child can open gift.

Scoring:

Peeking: _____

0- turned around to peek

1- Peeked over shoulder

2- No attempt to peek

Latency to peek over shoulder (sec) _____
Latency to turn around to peek (sec) _____
Number of peeking attempts _____

Appendix J

Modified Choice Delay Protocol

Introduction

In this game, you're going to get some stickers! Sometimes you might want to use your sticker right away by putting them on your sticker page and sometimes you might want to wait and save your stickers to take home. If you want to save your stickers, I will put them in this envelope (E points) with this sticker page (E points) and give them to you before you go home.

Each time we play this game, you get to choose one box! This box (E points) is the 'now' box. If you pick this box, you get to put these stickers on your page now! This box is the 'later' box. If you pick this box, we'll save your stickers for later when you go home and I'll put them over here in your envelope! Remember, you only get to pick one box every time we play the sticker game!

Ok, so if you want to use the stickers now, which box do you pick? _____
If incorrect: The 'now' box is for the stickers you want to use right away!

And if you want to save your stickers, which box do you pick? _____
If incorrect: The 'later' box is for the stickers you want to save for later when you go home.

Test Trials

5 later vs. 1 now
If you pick the later box (point), you get 5 stickers to take home for later. If you pick the now box (point), you get 1 sticker to use right away. Which box would you like to pick?
Now__ Later__

1 now vs. 4 later
If you pick the now box (point), you get 1 sticker to use right away. If you pick the later box (point), you get 5 stickers to take home for later. Which box would you like to pick?
Now__ Later__

1 now vs. 5 later
If you pick the now box (point), you get 1 sticker to use right away. If you pick the later box (point), you get 5 stickers to take home for later. Which box would you like to pick?
Now__ Later__

4 later vs. 1 now
If you pick the later box (point), you get 5 stickers to take home for later. If you pick the now box (point), you get 1 sticker to use right away. Which box would you like to pick?
Now__ Later__

4 later vs. 1 now
If you pick the later box (point), you get 4 stickers to take home for later. If you pick the now box (point), you get 1 sticker to use right away. Which box would you like to pick?
Now__ Later__

1 now vs. 5 later
If you pick the now box (point) you get 1 sticker to use right away. If you pick the later box (point), you get 5 stickers to take home for later. Which box would you like to pick?
Now__ Later__

Scoring
Each trial is given a score of '0' for a now choice and a '1' for a later choice.

Score 4-later (0-3): ___
Score 5-later (0-3): ___
Total Score (0-6): ___

Appendix K

Dimensional Change Card Sort (DCCS) Protocol

Present boxes. Show target cards (one at a time) while placing on boxes and saying:

Here is a blue boat and here is a red rabbit. This one is blue, and this one is red.

We're going to play a game. This is the colour game. The colour game is different from the shape game. All the blue ones go in this box *(pointing)*, **and all the red ones go in that box** *(pointing)*. **We don't put any blue ones in that box** *(pointing again)*. **No way. We put all the blue ones over here** *(pointing)* **and only the red ones go over there** *(pointing)*. **This is the colour game.**

Demo Sort: **Here is a blue one. This one goes here because it's blue.**
Child Sorts: **Here is a red one. Where does this one go?**

Feedback: **Very good** *or* **No, this one's red, so it goes over here.**

Okay, now I'm going to show you some blue ones and red ones.
Show preswitch cards, one at a time:

If it's a blue one, then it goes here. If it's a red one, then it goes there.

Show the card:	**It's a ____ ____ (blue/red one).**	Accuracy (√ or X)
Give child the card:	**Were does this go?**	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
No Feedback:	**Let's do another one!**	

Okay, now we're going to switch, so I'm going to put my switch cards in now *(put switch cards in)*. **We are not going to play the colour game anymore. We are going to play the shape game. All the bots go in this box** *(pointing)*, **and all the rabbits go in that box** *(pointing)*. **We don't put any boats in that box** *(pointing again)*. **No way. We put all the boats over here** *(point)* **and only rabbits go over there** *(pointing)*. **This is the shape game.**

Show 8 post-switch cards for each:

If it's a boat, then it goes here. If it's a rabbit, it goes there.

Show the card:	**It's a ____ ____ (boat/rabbit).**	Accuracy (√ or X)
Give child the card:	**Were does this go?**	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
No Feedback:	**Okay, let's do another one!**	

Children cannot re-sort once card is in box.

Appendix L

Black/White Stroop

Now we're going to play a different game!

Show black.

This card is black, right? When you see this card, I don't want you to 'black'. No, I want you to say 'white'.

Remove black; show white.

This card is white, right? When you see this card, I don't want you to say 'white'. No, I want you to say 'black'.

Training:

Show white. If hesitation – **What do you say for this one?**

[W] [B] (Good.)

[W] (Good.) [B]

number of training trials

If wrong or no response on either trial, repeat rules and training. Max of three training trials – always continue with test trials.

Testing – No feedback:

Circle or write in child's response, if not black/white:

1	W	B	_____
2	W	B	_____
3	W	B	_____
4	W	B	_____
5	W	B	_____
6	W	B	_____
7	W	B	_____

8	W	B	_____
9	W	B	_____
10	W	B	_____
11	W	B	_____
12	W	B	_____
13	W	B	_____
14	W	B	_____

15	W	B	_____
16	W	B	_____
17	W	B	_____
18	W	B	_____
19	W	B	_____
20	W	B	_____
21	W	B	_____

No self-correct: Record *first complete response*
e.g.,if child says 'Black – no white' code as 'black'. If child says 'Bl – white' code as 'white'.

Appendix M

Counting and Labeling

Now I'm going to show you some itty-bitty little things.

Set out Tree, Gift, and Cow.

I'm going to name these toys *(point to each toy as mentioned)*:
Tree – Gift – Cow.

Now I'm going to count them: One – Two – Three.

Now I'm going to count and name them at the same time:
One is a tree – Two is a gift – Three is a cow.

Clear away toys.

Now it's your turn!

Set out Cake, Frog and Teddy.

Can you name these toys? *(Correct if not reasonable name)*
Can you count them? *(Correct if needed)*
Now count and name them at the same time. *(Do not correct)* ☐ (√ or x)

Clear away toys.

It's your turn again!

Set out Cake, Frog and Teddy.

Can you name these toys? *(Correct if not reasonable name)*
Can you count them? *(Correct if needed)*
Now count and name them at the same time. *(Do not correct)* ☐ (√ or x)

Clear away toys.

Children are allowed to self-correct.
If child counts and names before <u>just</u> naming – have them <u>just</u> name, <u>just</u> count and <u>THEN</u> count & name.
If child names and counts (e.g., "Cake is one, Frog is 2") this is okay.

Appendix N

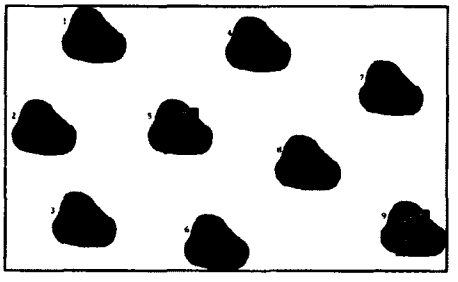
Corsi Span

Place page with "lily pads" on table in front of child.
Point to one lily pad per second. Stop when child makes an error on both strings of the same length (e.g.,when both items 5 and 6 are incorrect).Provide no feedback after 2 training trials.

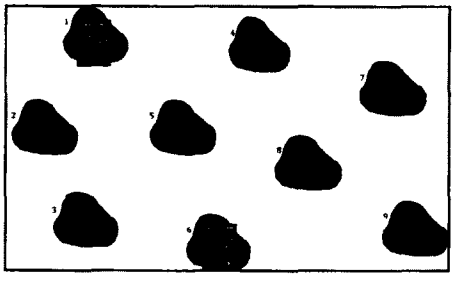
See these lily pads? We are going to pretend that our fingers are frogs jumping from lily pad to lily pad. After my frog jumps on the lily pads, you make your frog jump on the same ones in the same order. So watch which ones I jump on, and when I'm done, it will be your turn to jump on the lily pads the same way. Do you understand? Ok, let's try one! Watch carefully.

Score below (√ or x).
Feedback for Trial 1 and 2 only. That's right! *Or* Good try! But I pointed to these ones.

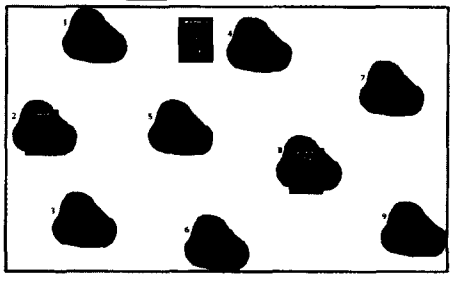
Trial 1 _____



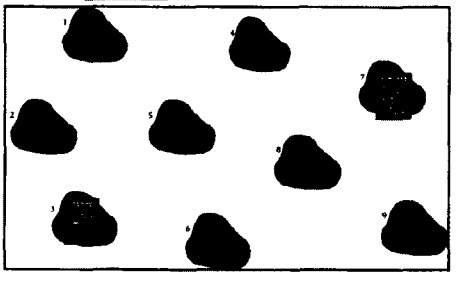
Trial 2 _____



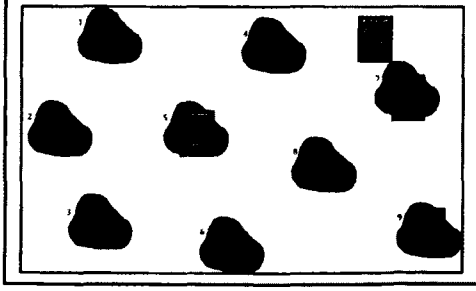
Trial 3 _____



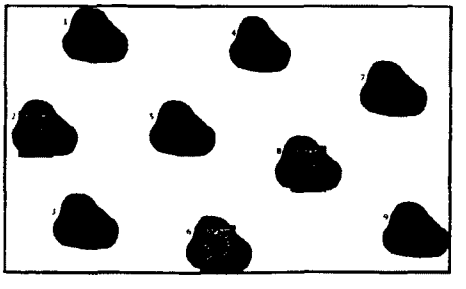
Trial 4 _____



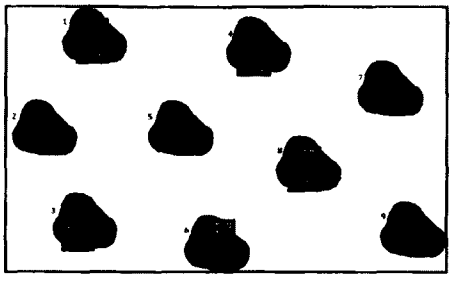
Trial 5 _____



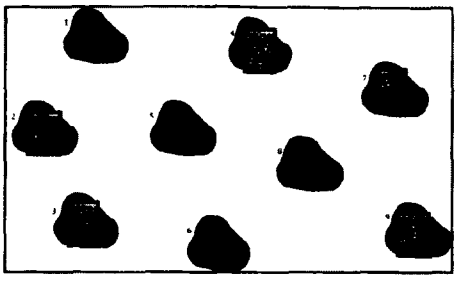
Trial 6 _____



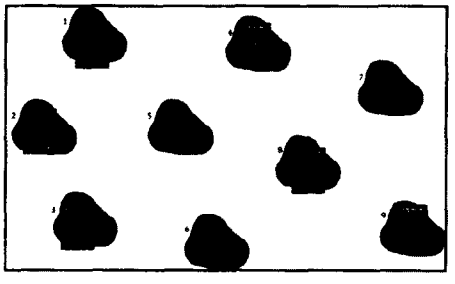
Trial 7 _____



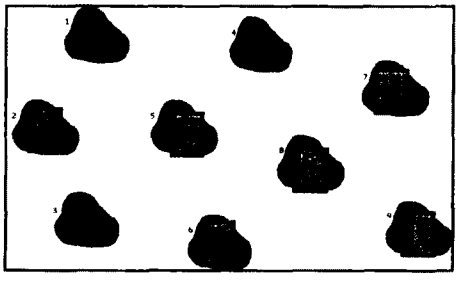
Trial 8 _____



Trial 9 _____



Trial 10 _____



Appendix O

Table O1.

Tasks Significantly Correlated with Age and General Language Ability

		Measure	*N*	Age	PPVT
Saving	1	Saving on Trial 2	33	---	.508*
DoG	2	Modified Choice Delay	32	.545**	---
conflict	3	DCCS	32	.412*	.565**
IC					
Memory	4	Count and Label	32	.583**	.661**
	5	Corsi	30	.499**	---
Planning	6	Truck Loading	31	.661**	.661**
Language	7	PPVT	22	.780**	---

Note. $*p < .05$. $** p < .01$.

Table O2

Partial Correlations between Savings task Performance and measures of DoG and Conflict IC Controlling for Age (in months)

		Measure	1	2	3	4	5	6	7
Saving	1	Trial 1	---	.189	.257	-.006	-.096	.191	.007
	2	Trial 2		---	.149	.073	.405*	.125	.443*
DoG	3	Modified Choice Delay			---	-.136	-.005	-.027	-.032
	4	Gift Delay				---	.078	.027	.337
Conflict IC	5	DCCS					---	.137	.428*
	6	Black/White Stroop						---	.245
	7	PPVT							---

Note. $*p < .05$. With the exception of the PPVT ($N = 20$) sample sizes range between $N = 28$ and $N = 30$.