THE FUTURE IS NOW:
THE DEVELOPMENT OF FUTURE REASONING IN PRESCHOOL CHILDREN

by

Karen M. Lemmon

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy

at

Dalhousie University
Halifax, Nova Scotia
August 2003

Your file Votre référence
ISBN: 0-612-83725-4
Our file Notre référence
ISBN: 0-612-83725-4

DALHOUSIE UNIVERSITY

DEPARTMENT OF PSYCHOLOGY

The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "The Future is Now: The Development of Future Reasoning in Preschool Children" by Karen M. Lemmon in partial fulfillment for the degree of Doctor of Philosophy.

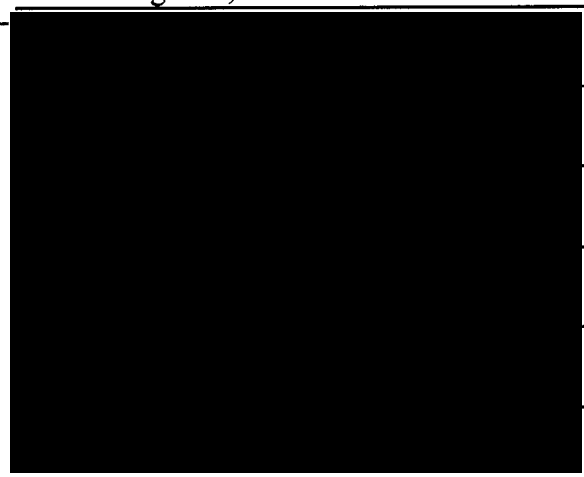
Dated: August 1, 2003

External Examiner:

Research Supervisor:

Examining Committee:

Departmental Representative:



DALHOUSIE UNIVERSITY

DATE: 19 August 2003

AUTHOR: Karen M. Lemmon

TITLE: The Future is Now: The Development of Future Reasoning in Preschool Children

DEPARTMENT OR SCHOOL: Psychology

DEGREE: PhD CONVOCATION: October YEAR: 2003

Permission is herewith granted to Dalhousie University to circulate and to have copied for non-commercial purposes, at its discretion, the above title upon the request of individuals or institutions.

[redacted]

Signature of Author

DEDICATION

For My Parents

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABSTRACT

Adults take for granted the understanding that a future goal can be used to guide present action. Moreover, the ability to weigh these present and future considerations is seen as a natural process in future-oriented decision-making. However, research on the development of future-oriented prudence has revealed that 3-year-olds, when faced with making a decision between a reward now and a more substantial reward later, seem to choose the lesser reward (Thompson, Barresi, & Moore, 1997). The purpose of this thesis was to investigate the development of preschool children's future self-interest in order to gauge their understanding that future concerns can guide present decisions. This was accomplished by examining how three- to five-year-olds' future self-interested behaviour relates to an understanding that past activities can influence a present state (Povinelli, Landau, & Perilloux, 1996), what role the episodic neurocognitive system may play (Wheeler, Stuss, & Tulving, 1997), and by exploring novel future-oriented decision-making measures. Results indicated that children's future self-interest strengthens substantially over the preschool period. Three-year-olds demonstrate minimal future self-interest, even in choices that maximize the difference between immediate and future rewards. Around four years of age, with improvements in the understanding that the past can influence the present and developments in the episodic neurocognitive system, children begin to show more consistent future self-interested behaviour. As children approach the age of five, they seem to begin functioning from a standpoint of temporal neutrality (Nagel, 1970) such that present and future considerations can be weighed together and neither holds more importance than the other.

List of Abbreviations and Symbols

ANOVA	Analysis of variance
F	Fisher's F ratio
M	mean
n	number in a subsample
N	number in a sample
p	probability
r	Pearson product-moment correlation coefficient
SD	standard deviation
t	computed value of a t-test

ACKNOWLEDGEMENTS

First, I would like to thank my supervisor Chris Moore for his guidance, support, and intellect. I would also like to extend my appreciation to committee members John Barresi and Phil Dunham for their input and to Doug Frye for his contribution as external examiner. Many students, research assistants, and volunteers helped in some way with these experiments including Amy Appelle, Angela Ellsworth, Melody Foerester, Lori MacDonald, Shannon Macgillivray, Teri Phillips, and Renee Susin. Thanks to all. I am also very grateful to the children who participated in these experiments and to their parents and preschool teachers. Thanks to my supporters at the Mount! Your advice and discussions were so helpful. And finally, the love and never-ending encouragement from my partner, family, and friends has made all the difference.

THE FUTURE IS NOW:

THE DEVELOPMENT OF FUTURE REASONING

IN PRESCHOOL CHILDREN

General Introduction

Adults know that actions we take now can influence the future. Thus, weighing present and future considerations when we make a decision seems to be a natural ability. For example, as you are preparing to walk to work, you hear a weather report for a chance of rain later in the day. It is currently sunny, but you carry an umbrella with you because you do not want to be drenched on the walk home. This type of future-oriented decision- making seems to involve the ability to connect present thoughts and actions with potential future events. Realization of this present-future connection entails not only that the present can influence outcomes for the future, but also that considerations about the future can affect present thoughts or actions. Thus, a woman who behaves with future self-interest is demonstrating her understanding that her present actions can be guided by desires for her future. Certainly, infants and young children do not demonstrate the same ability to consider the future which adults possess, so when and how does it emerge and develop?

In this thesis, recent ideas for investigations of the future self-awareness based on the semantic-episodic memory distinction will be examined. Given that it is difficult to present the concept of future self in isolation from those of present and past selves, several authors' perspectives on and investigations of the temporally extended self will be reviewed. Developmental literature related to future-oriented thinking in children will then

be evaluated. In particular, the choice to delay gratification will be presented as a useful tool to assess preschool children's understanding that a future perspective or goal can guide present actions or decisions.

In recent years, a few researchers have proposed a semantic-episodic distinction for the future similar to that which traditionally has been used to discuss memory systems (Atance & O'Neill, 2001a, 2001b; Klein, Loftus, & Kihlstrom, 2002; Wheeler, Stuss, & Tulving, 1997). In earlier work, Tulving (1985; 1989) described two amnesic patients who were not only unable to remember or re-experience personal events, but also seemed unable to imagine potential future experiences. Recently, Klein et al. (2002) provided empirical evidence from another amnesic patient whose semantic memory and ability to discuss possible future non-personal (semantic) events was intact, but whose episodic memory and ability to discuss possible personal future events was impaired. Tulving (1985) suggested that this memory condition could be attributed to a lack of autonoetic consciousness which "encompasses extended subjective time, an individual's ability to apprehend her personal past and future" (p. 5).

Building on Tulving (1985, 1989), Wheeler et al. (1997) argued that one must be autonoetically aware of the present self in order to remember the past and imagine the future. Autonoetic consciousness allows individuals "the possibility to apprehend their subjective experiences throughout time and to perceive the present moment as both a continuation of their past and as a prelude to their future" (p. 335). These authors further suggest that the emergence of autonoetic consciousness coincides with the development of the episodic neurocognitive system, which mediates our mental time traveling. They

proposed that although autonoetic consciousness may be present around three years of age, the level of awareness for episodic re-experiencing does not develop until around four years. It would follow that the ability to identify with future interests would also not develop until about four years of age.

Atance and O'Neill (2001a, 2001b) also extended the concept of episodic memory to propose a similar manner of discussing the personal future, which they entitle *episodic future thinking*. This notion of episodic future thinking relies heavily on the conception of the episodic neurocognitive system proposed by Wheeler et al. (1997) which is a system not limited to memory for previous subjective experiences, but includes the imagination of potential future experiences as well. Extending the *re-experience* condition of memory, Atance and O'Neill define their concept as the ability to *pre-experience* some potential future event. In this way episodic future thinking can be distinguished from semantic future thinking in which no mental time travelling is required. The ability to engage in episodic future thinking implies that the future person, the one who will be experiencing said events, is an extension of the present person, the one now thinking about the future person. This is commonly referred to as temporal self-continuity or the temporally extended self.

Understanding what it means to have a self continuous through time has a philosophical tradition dating back to John Locke (see Barresi, 2001). Further attempts to explain this human condition and its development continue. According to Nagel (1970), a temporally extended individual views the present as one moment in a life that continues from past through present to future: "to identify with one's past or future is simply to

regard the present as a stage in the life of a persisting individual" and that the important notion is "how one identifies the present with a point in the life of a temporally extended person" (p. 60). It is this representation of the present self as temporally extended that allows one to identify with a past or future self. That is, possessing a temporally extended self-concept at the time of some act or event enables you to remember that event later or to imagine a future consequence of that action because you recognize that earlier, you *were* that self, and that later, you *will be* that self. A sense of self as temporally extended then should allow a person to reason about the future based on a comparison of present and future concerns.

Nagel (1970) further argued that individuals who possess a temporally extended self function from a standpoint of *temporal neutrality*. This concept means that the past, present, and future are equally accessible and one single time is no more important than another. Present desires or reasons for action do not hold more importance than those of the past or future simply because they are being experienced now. Similarly, neither future nor past concerns automatically override present ones. As adults we are able to function from a temporally neutral stance because we know that tomorrow, our present will become our past and our future will become our present. This idea of temporal neutrality can be interpreted as suggesting, first, that different temporal selves can be considered together, and second, that these selves are considered equal (i.e., our future present will hold as much importance as our current present). This equality of different temporal selves then reflects the awareness that one remains the same person over time despite changing from past to future.

In his examination of self-knowledge, Neisser (1988) identified one component pertinent to this thesis, the *extended self* which "...is based primarily on our personal memories and anticipations: I am the person who had certain specific experiences, who regularly engages in certain specific and familiar routines" (p. 36). This notion of the extended self clearly encompasses both episodic and semantic components of the future. Neisser (1988) suggested that the development of the extended self begins early and is essentially inevitable given our social environment. He places greater emphasis on personal memory than the personal future for his explanation of an extended self. Importantly, he argued that to remember when a routine is not being followed exemplifies some awareness of the extended self, but that episodic memory more clearly denotes awareness of self in the past.

Numerous researchers have investigated some aspect of the self extended in time including studies on autobiographical and episodic memory, recognition of past self, as well as expectations of self in the future and episodic future thinking. The majority of research on self extended into the past has focused on how children begin to represent their personal histories in narratives (Fivush, 1991; 2001; Fivush & Hudson, 1990; Haden, Haine, & Fivush, 1997; Howe & Courage, 1993; 1997; Nelson, 1992; 1993; 2001; Reese, Haden, & Fivush, 1993). Studies of autobiographical memory have generally focused on how memory for personally experienced events is represented (e.g., Welch-Ross, 1995). Recently, interest in the emotional and social conditions under which children are able to build representations of the personal past has emerged (Reese, 2002; Welch-Ross, 1997; 2001). Studies on personal memory have shown that when recalling a personally

experienced event we rely on both the episodic and semantic systems. It is the episodic system in particular that is linked to the self (e.g., Wheeler et al., 1997) and thus, episodic memory is a more pure expression of a temporally extended self.

Episodic memory and episodic future thinking are thought to be enabled by the attainment of autonoetic consciousness accompanying developments in the episodic neurocognitive system. Although Wheeler et al. (1997) did not mention any future-oriented tasks that may tap the episodic neurocognitive system, they argued for certain types of memory tasks that do. Free recall tasks have been purported measures of episodic memory since Tulving's early work (1972). However, memory of an event is often factual and likely involves the semantic memory system as well, whereas memory about less central details of the event may rely more on the episodic system than the semantic. Instead of asking someone to report the facts about what happened, one may tap the episodic system by asking about the order in which parts of an event occurred (provided the sequence was not based on logic or general knowledge) (see also McCormack & Hoerl, 2001). Another method of tapping the episodic system may be to ask about the context of events, for example, who told you a certain fact or where you learned it.

In a developmental study, Perner and Ruffman (1995) investigated the link between autonoetic consciousness and episodic remembering in young children. Participants were shown 12 pictures and then asked to recall them after a delay of one hour and one week. The authors' results revealed that free recall of the pictures was related to the ability to succeed on tasks that measured experiential awareness, understanding the source of your knowledge. The authors argued that free recall of an

episode relies on having encoded the source of one's knowledge about that episode, and therefore, is accompanied by autonoetic consciousness. It would follow then that the ability to recall events depends on the adequate development of the episodic neurocognitive system.

Another researcher, Povinelli, proposed a developmental model of children's understanding of the self extended in time (1995, 2001). He argued that around four years of age, children's *proper self* emerges which "holds the self-concept together as an enduring entity through time with a past and a future" (Povinelli, 1995, p. 168) made possible by the ability to consider several representations of self (e.g., past and future). This proper self then can be viewed as the present self, which is a continuation of a past and anticipation of a future self, like Nagel's (1970) notion of the temporally extended self. In order to test the connection with the past self in Povinelli's theory of a proper self, Povinelli, Landau, and Perilloux (1996) developed the delayed self-recognition procedure measuring young children's ability to realize that the past can influence the present.

In this task, which is analogous to the mirror self-recognition test for infants (Amsterdam, 1972), a sticker was surreptitiously placed on the child's head during a game that was being photographed or videotaped. At the end of the game, children viewed their past activities and those who reached up to remove the sticker from their heads at this point were credited with delayed self-recognition. The compelling aspect of the results from Povinelli et al. was that children around four years of age reached up to remove the sticker whereas younger children did not. Moreover, younger children's difficulty with the task was limited to the delay component and not to the video or photo medium. These

results offer support for the part of Povinelli's (1995; 2001) theory of the proper self which deals with the past.

Since then, other authors have investigated the development of a connection with the past self using the delayed self-recognition procedure (see Povinelli, Landry, Theall, Clark, & Castille, 1999; Povinelli & Simon, 1998; Suddendorf, 1999; Zelazo, Sommerville, & Nichols, 1999). Povinelli and Simon (1998) found that 4- and 5-year-olds reached for the sticker on their head during presentations of briefly, but not extremely, delayed images whereas 3-year-olds did not differentiate between the two types of feedback. Thus, older children can relate their own past image to their present self and they understand the limits of the influence time may have on their present self. It has also been established in a series of experiments that younger children do not appreciate that past experiences in which they participated are causally linked to their present circumstances (Povinelli et al., 1999). Three-year-olds do not understand that the more recent of two events influences the present circumstance whereas 4- and 5-year-olds do understand. Povinelli (2001) suggested that younger children may have difficulty with not only delayed self-recognition, but also realizing that the more recent of two events is the critical influence on the present because they do not understand either the temporally extended self or *the causal arrow of time* in general. For example, Event A is followed by Event B which influences Mental State X. Adults and older preschoolers know that B holds the most influence for X because B was more recent than A. When given new information regarding Event C, which happened even more recently than B, adults can change their minds about X. Moreover, adults can also change their minds about X when

given information about another event which is scheduled to happen *later*. Thus now the impending Event D will influence Mental State X because it will be more recent than Event C.

Why then do 3-year-olds not understand the causal arrow of time? It is not that they misunderstand the sequencing or ordering of events because even toddlers are able to accomplish this in simple recall tasks (e.g., Bauer & Mandler, 1989, 1992). Instead it may be that for one event to influence a condition, it must be considered as occurring *separately* from other events and from the condition. Otherwise the event is simply *part of* the other events and the overall condition. Thus, it is possible that 3-year-olds do not distinguish between these past events and the current condition, making it impossible for them to realize the causal influence. In their minds, Event A does not remain separate from Condition X, it is a part of it. When Event B occurs, the merged Event AB then comprises Condition X. The ability to consider to a noncurrent event as *distinct* from other noncurrent events as well as the current state may be critical for understanding temporal causality.

With respect to delayed self-recognition then, 3-year-olds know that they played a game with some stickers (A) and that event merges with their current self state (X). When shown a video of A, with new information inserted into the middle of the game (event B – the experimenter putting a sticker on their heads), they do not treat event B as distinct from the earlier event A. Event A simply becomes a merge of AB which cannot influence X because there is no distinction between the events. Similarly, when shown videos of two events (Povinelli et al., 1999), 3-year-olds do not realize that the more recent event is

more influential because Event A was merged with Event B to become the event AB which became incorporated into the current self state.

Some research has replicated the result that 4-year-olds perform better on delayed self-recognition than 3-year-olds (Zelazo et al., 1999). One study found no age difference in the ability to recognize self on delayed video (Suddendorf, 1999), although this may be explained by the left-right reversal of objects on the video compared to reality (Povinelli, 2001). Taken together, available evidence indicates that 3-year-olds have not developed a sense of self extended into the past, and therefore, have little understanding that the past self is connected to the present self. Younger children do not appear to be aware that their past can influence their present.

Another developmental account of the extended self by Barresi (2001) proposes three stages in the development of an extended self, the first of which occurs approximately during the early 3s. Barresi argued that young 3-year-olds begin to inhibit immediate desires, giving them the ability to imagine mental states that conflict with a current mental state. Then older 3s become able to use this ability to form a sense of self that extends into the future. Once an abstract theory of self (and mind) is acquired after age 4, children can imagine the episodic future of another person.

Barresi's (2001) account was based largely on research examining children's future-oriented prudential and altruistic behaviour (Thompson, Barresi, & Moore, 1997; Moore, Barresi, & Thompson, 1998) based on a modified delay of gratification choice paradigm (Mischel & Metzner, 1962). In this type of task, children are asked to choose between a smaller reward now and a more substantial reward at some specified future time

point. Making the choice to delay can be thought of as a form of future-oriented prudential behaviour because in order to gain the more substantive future reward children must give up an immediate reward (Thompson et al., 1997). As Nagel (1970) argued, future-oriented prudential behaviour reflects awareness of the connection between future and present selves such that "failure to be susceptible to prudence entails radical dissociation from one's future, one's past, and from oneself as a whole, conceived as a temporally extended individual" (p. 58). Consider an adult who, rather than spending most of his weekly pay cheque as he prefers to do, puts aside 15% in a savings program. He is behaving with self-interest for a distant time rather than the present and can do so because he understands that his future is connected to his present. Thus, a child who is willing to sacrifice immediate gains for later profit seems to understand that she will become her future self. Such a child is able to apply a future perspective to present action.

This delay choice paradigm then is one method of established research that seems to measure the ability to represent the connection between future and present (i.e., a particular present action can result in a particular state in the future). A substantial amount of work has been conducted on the choice to delay gratification. Importantly, this choice paradigm differs from the delay of gratification maintenance paradigm in which the length of time children are able to wait for a reward is the measure of interest. In the choice task, children are shown the competing rewards until they make their choice. In the maintenance or waiting paradigm, rewards remain in front of children for the required length of time, which may be more an assessment of the ability to deal with frustration or impulse control than an assessment of understanding the present-future connection.

Mischel and Metzner (1962) first examined choice differences in 6- to 12-year-olds as a function of delay interval. They asked children to choose between a small candy now and a larger candy later: in 1 day, 5 days, 1 week, 2 weeks, and 4 weeks. The choice to delay rewards correlated with age such that older participants were choosing the future rewards and younger participants were choosing the immediate rewards. Interestingly, choices to delay decreased as the time interval increased, specifically for older children. Thus, this study showed that throughout middle childhood older children are more likely than younger children to make choices based on future self-interest, and older children also demonstrate awareness of temporal properties in their decision making.

In the future-oriented prudence and altruism task (Thompson et al., 1997; Moore et al., 1998) children made various choices involving self and another person. In several experiments, children were offered a series of choices between one sticker immediately and two stickers at the end of the game (future-oriented prudence). Other options included sharing with a female experimenter either now or in the future, with and without a cost to self (altruism and future-oriented altruism trials). Immediate rewards were placed into the child's sticker book whereas delayed rewards were saved in the child's envelope until the game ended. At that point, the child was able to put all the stickers in the sticker book.

Thompson et al. (1997) found that 4- and 5-year-olds (range 4;0-5;8) were more likely to choose two future stickers than were 3-year-olds (range 3;0-3;11) in the future-oriented prudence trial. Three-year-olds chose rewards with a current value instead of choosing rewards which would have been of greater benefit to them in the future. These

authors argue that children who fail to delay, who fail to engage in future-oriented prudence, cannot represent self in the future. Although the mean performance of the older children was at chance levels in the experiment, the authors argue against the possibility that children were choosing randomly given the above chance performance on trials that did not involve a delay (i.e., children understood the task). These results were interpreted within the framework proposed by Barresi and Moore (1996), namely that older children have the ability to imagine conflicting noncurrent mental states. Thompson et al. (1997) also suggested that the ability to inhibit a desire for the current reward may be involved in children's choices. This possibility was tested in another experiment.

Moore et al. (1998) offered choices involving the present and future of both self and other to younger and older 3-year-olds and young 4-year-olds and compared performance to the ability to inhibit pointing at a desired object (Experiment 2). Young 3s ranged in age from 3;0-3;5 (mean 3;3) and Older 3s ranged in age from 3;6-3;11 with a mean age of 3;8. Young 4s were between 4;0-4;6 with a mean age of 4;4. No age differences on the future-oriented prudence choice were found among the three age groups. For the young 3s, a marginal positive correlation was found between future-oriented prudence and the ability to inhibit pointing at the object. However, no such relationship was detected for the two older age groups. In another experiment with older 3s and young 4s (Experiment 1) Moore et al. reported a marginal finding that young 4s delayed more often than older 3s on choices involving delay of gratification and delayed sharing, although the direct age comparison for delay of gratification alone was not

reported. They also reported no significant relationship between future-oriented prudence choices and theory of mind at either age.

Several other researchers have investigated the choice to delay gratification in a preschool population (Logue & Chavarro, 1992; Montgomery, 1976; Nisan & Koriat, 1977; Schwarz, Schrager, & Lyons, 1983; Toner, Holstein, & Hetherington, 1977). Nisan and Koriat (1977) sought to examine 5- and 6-year-olds' idea of the prudent choice and compare it to actual performance. They asked children about their own choice and either what they thought 1) a "smart" child would choose or 2) a "stupid" child would choose. There were no significant differences in delay of gratification between boys and girls for any recipient. Differences between self and the other in the second condition were also not significant. However, more children preferred an immediate reward for self and a delayed reward for the smart child in the first condition. This study indicates that although children seem to realize that delaying the reward is more prudent than not, they do not apply that knowledge to their own situation.

In another study with kindergartners, Montgomery (1976) offered three choice types to 4- and 5-year-olds who had a mean age of 5;5 (years; months). The *Advantageous Delay* choice was the standard choice between small immediate rewards and large delayed rewards. In *Neutral Delay* choices, reward values were identical at both times, and in *Disadvantageous Delay* choices, immediate rewards were larger than delayed rewards. Kindergarten children delayed significantly less often on the Disadvantageous Delay choices than on the Advantageous Delay choices and the Neutral Delay choices. Surprisingly, children did not delay more often on Advantageous than on

Neutral trials. In addition, the mean of Disadvantageous Delay choices was significantly greater than zero, so children were still choosing to delay rewards at a cost. These findings seem to indicate that the choice to delay is a function of reward value as well as the positive association with the delay notion itself. In addition, no difference in delay of gratification behaviour was found between 4- and 5-year-olds or boys and girls in this experiment.

In addition to the work by Thompson et al. (1997) and Moore et al. (1998), a few studies examined delay behaviour in children as young as 3 years. Toner et al. (1977) offered children aged 3;2 to 5;4 two choices administered at different times: participants were asked to choose between a small chocolate bar now and a larger chocolate bar later as well as between one candy now and two candies later. These authors found a significant correlation between age and the choice to delay in their sample of males only, such that the younger the boy, the more frequently he chose immediate rewards. They also found a significant interaction between age (older 3s versus middle 4s) and sex, but reported that post-hoc tests were not significant. No means were reported so it is impossible to determine any trend for simple effects. Interestingly, these authors also investigated the relationship between choice to delay and other measures of self-control (e.g., maintenance delay of gratification) and found no significant correlation. Thus, according to this evidence, self-control does not appear to be involved in preschoolers' decision making for future self-interests.

Schwarz et al. (1983) investigated the effects of age group and length of delay on preschoolers' reward choices. Three-, 4-, and 5-year-olds in each delay condition (7 hours

or 24 hours) were offered four choices, immediate and delayed choice respectively: a Ritz cracker or a caramel, three pretzels or a bag of chips, a piece of coloured paper or a whistle, and a penny or a nickel. On average in the short-delay condition, 3-year-olds delayed on 58% of trials, 4-year-olds delayed on 53% of trials, and 5-year-olds delayed on 70% of trials. In contrast, in the long-delay condition, 3-year-olds delayed on 30% of trials, 4-year-olds delayed on 28% of trials, and 5-year-olds delayed on 40% of trials. These results indicated that children in the short-delay condition waited significantly more often than children in the long-delay condition. The authors interpreted this finding as evidence for children's comprehension of the concept of delay. However, in both experimental conditions, the authors found no main effect of sex or age group.

Logue and Chavarro (1992) tested preschoolers aged 3;5-4;11 in a delay of gratification choice learning paradigm. In this experiment children received the delayed reward before the next choice was offered, whereas in typical studies, delayed rewards are made available after all choices have been made. Moreover, instead of hearing instructions on how to play the game, children learned how to obtain stickers from one of two drawers by pressing one of two buttons. After training, for delay of gratification proper, one sticker was available immediately or three stickers were available after a 30-second delay. Children tended to choose the immediate reward more often than the delayed reward. With their small number of participants ($n = 20$) the authors did not find any improvement with age. However, they did report that boys chose the immediate rewards more often than girls. By examining response patterns, the authors determined that girls alternated choices whereas boys more consistently chose immediate gratification.

Although the association between sex and delay behaviour in preschoolers remains unclear, the available evidence indicates that preschoolers find it difficult to act prudently until they near the age of 5.Thus, we have evidence that 3-year-olds are poorer than older children at tasks assessing the connection between past and present and the connection between future and present. Are those young children unable to connect their past and present the same children who are unable to connect their present and future? This question was examined by Lemmon and Moore (2001, Experiment 1) which appears to be the only study investigating the relationship between both past and future aspects of the temporally extended self. These authors administered the delayed self-recognition task to assess children's connection with the past, an order memory task to tap the episodic neurocognitive system, and a future-oriented prudence task to measure children's connection to future self. They found that performance on future-oriented prudence correlated positively with delayed self-recognition after controlling for age. Moreover, the order memory task also correlated significantly with future-oriented prudence and delayed self-recognition. Their findings indicate that children's ability to connect with past and future selves emerges simultaneously which coincides with episodic neurocognitive development. Thus, support for the theories by Nagel (1970) and Wheeler et al. (1997) were found in this experiment and an answer to Atance and O'Neill's (2001a) question of whether episodic future thinking and episodic memory emerge contemporaneously was also provided.

There are other studies investigating awareness of the future self which have relied on interview techniques, but few include children of a preschool age (e.g., Farnham-

Diggory, 1966; Guardo & Bohan, 1971; Hart, Maloney, & Damon, 1987; Klineberg, 1968; Mischel & Metzner, 1962). In one study which did include preschoolers, 4-year-olds were asked to describe themselves now and as they would be in five years time (Hart, Fegley, & Brengelman, 1993). Children explained their future selves with reference to social relations in comparison to their present selves who were described in terms of personal preferences, characteristics, and activities.

The area of future-oriented thinking and behaviour remains understudied, although the literature has been growing in recent years. Benson (1994) developed a parental questionnaire about future orientation in the daily routine of infants and toddlers up to the age of three. With a preschool population, Benson (1997) has shown that 4½-year-olds can sequence a series of events that might happen *tomorrow*, with improvements in this ability at 5½ and at 7½ years of age. In related work with language development, Hudson (2001) examined toddlers' and preschoolers' talk about the personal future with mothers. Unfortunately, how children talk about the future was not investigated with respect to the development of self, but this issue was recommended as an important avenue of future research. These methods of research, although important, do not assess a young child's awareness of the connection between the future and present selves that is key to measuring future self-interest.

One may think that planning could serve as an accurate measure of a child's interest in her future self. Indeed, preschool children's ability to plan for familiar events in which they are involved has also been investigated (Hudson & Fivush, 1991; Hudson, Shapiro, & Sosa, 1995). Hudson et al. (1995) examined preschool children's emerging

ability to provide verbal plans based on generalized event representations (GERs) for grocery shopping and going to the beach ("Can you tell me a plan for going grocery shopping?). Examples of grocery shopping plans are as follows:

> *3-year-old*: Get food. Get a carriage to put the food in. Pay for it. Go back home.
>
> *5-year-old*: You have to buy food. You gotta pay for it. If you gotta buy something it will cost a lot of money. Gotta get a cart. And put your food in your cart. Gotta remember to put it back once you're finished. Make sure you have a list and coupons for everything (p. 996).

Results indicated that 3-, 4-, and 5-year-olds comprehend what it is to plan (i.e., preparation for a future event) and that they do rely on GERs to plan for familiar events. However, only 5-year-olds have moved beyond the *single-goal event planning* ability (Hudson & Fivush, 1991) to consider several potential goals that may be appropriate.

Although this planning task involves self, it does not relate directly to states of self, and thus does not clearly require children to have a sense of self that is connected over time. The nature of the event, routine, means that children can and do rely on general (semantic) knowledge about such events. They can then report a plan based on their past or present experiences with grocery shopping, rather than thinking about their own specific future goals and preparing to satisfy those goals (i.e., to have particular food items over the next week for certain meals and then purchase those items). Thus, this type of planning research may be related to general awareness of future time. Clearly though, it does not involve future self-interest which requires an appreciation of the connection between a future event and a present action or decision.

More recently, Atance and O'Neill (2001b) examined younger and older 3-year-olds' ability to provide a verbal plan for one-step actions to achieve a goal under novel circumstances. These authors suggested that this type of planning task involving self may require episodic future thinking because the nature of the event is not routine and script-based, but rather is novel. In this task, a puppet asked the children to state their plan ("Can you tell me how you're gonna...?). After children replied with their plan, the puppet would ask them to show him how to perform the action. There were four planning categories each with two tasks. In the first category, *Body Action*, an experimenter showed the children how to a) ring a bell and b) put a ball in a bucket using her hands. Children were then asked how they could accomplish the same goal without using their hands. The next category was *Action With Tool.* The experimenter demonstrated, again with her hands, how to a) put a stuffed animal in a playhouse and b) push a toy frog into a bucket. Children were then asked to accomplish the same goal without using their hands at which point two tools were introduced. The options for a) were a stick and a string, and for b) were a ball and an elastic. One of each pair was obviously the better choice. In the third category, *Gaining Object*, children were asked to provide plans for retrieving a sticker from a box and a tube. In the final category, *Gaining Information*, children were asked to provide plans for determining whether water was warm or cold and whether a ball was hard or soft.

Verbal plans were scored separately from the success rate. Plans were scored as 1 if they included information about *how* the goal would be accomplished. Actions that were verbalized as the child was performing the action were not considered plans, but were

considered to be an on-line account of the child's behaviour. Children were also scored as successful or unsuccessful on each task. However, those results will not be discussed here because whether or not children succeeded seems irrelevant for the essence of planning. That is, unsuccessful children may simply have been physically uncoordinated in their actions. For planning then, all children found the *Action with Tool* category too difficult, so those scores were not included in the analyses. In all other tasks, older 3-year-olds (M_{age} = 3;10) provided significantly more plans than did the younger 3-year-olds (M_{age} = 3;5). Compared to younger children, the older children scored higher on a test of verbal ability which was positively correlated with performance on the *Gaining Object* and *Gaining Information* tasks.

Although these results showed that the ability to plan increased with age, the children may have been able to verbalize a plan without necessarily tapping into the episodic future. The authors examined the linguistic construction of children's plans for use of the word *gonna* because Gee (1985) suggested that children use this word to refer to future events for which they have a mental representation. The key term *gonna* occurred relatively infrequently, 13% of the time for older children and 20% of the time for younger children. Thus, based on this evidence, it is not clear that children needed to represent the link between the present and the future in order to verbalize plans in these tasks. Based on the above planning tasks then, we cannot conclude that 3-year-olds have a sense of future self that is connected to the present because these studies were not designed appropriately for assessing this ability.

In summary then, as adults we are able to connect future events to present thoughts and actions. We can therefore weigh present and future considerations when we make a decision and thus behave with future self-interest. Several authors argue that this is made possible by our temporally extended self, the part of our self-concept in which our future and our past are connected to our present (equivalent to having autonoetic awareness, awareness of one's own temporal self-continuity). As an adult I intuitively know that something I do or think now will become a part of my past, which may influence my thoughts and actions for a certain amount of time. Similarly, I also intuitively know that I can think about a possible future self state and take action now to influence my future outcome. Young children do not seem to have this awareness. They may be able to report certain details about events from an earlier time point, but they do not realize that their previous actions may still influence their present. They may be able to apply present knowledge to the future, but they do not appear to be able to apply a future perspective to guide their present actions.

Current Work

The purpose of this thesis was to document preschool children's understanding that a future goal or desire can guide present decisions by examining the development of future self-interest. In the first experiment, the developmental relationship between future self-interest and past self-awareness was investigated longitudinally. In the second experiment, the age at which children acquire a sense of self as temporally extended into the future and into the past was examined. The goal of the first part of the third experiment was to describe more completely the progression of future self-interest from

3½ to 5 years by determining whether 3-year-olds place greater importance on the present than the future and whether 4-year-olds function from a temporally neutral standpoint. The second part of the final experiment was designed to determine the age at which children are truly able to connect a future state with a present state by modifying the measure of future self-interest. The aims of the final part of Experiment 3 were to investigate preschoolers' ability to connect an impersonal future condition with a present course of action, and to determine whether this ability was related to the ability to demonstrate future-oriented self-interest.

In each experiment, variations of a sticker choice task were administered to measure children's future self-interest, adapted from Mischel and Metzner's (1962) delay of gratification choice paradigm. In the first two experiments, the connection between past and present was measured with delayed self-recognition, developed by Povinelli et al. (1996). In addition, development of the episodic neurocognitive system was assessed in the second experiment via two episodic memory tasks for order and context. In the final experiment, a novel task was designed to tap children's ability to imagine the impending future circumstance of a story character and choose an appropriate present course of action suitable for the impending future eventuality. This task did not require the child to imagine his or her own future as was required in the future-oriented prudence task, but rather served to function as a measure of the more cognitive ability to connect present decisions with future states.

CHAPTER 1: EXPERIMENT 1

Previous investigations of children's ability to show future-oriented prudence using the delay of gratification choice task indicate that younger preschoolers generally perform worse than older preschoolers. However, no one has investigated longitudinally the development of future-oriented prudence during the preschool period. Thus, one purpose of the current experiment was to examine changes and similarities in children's future self-interest over the middle 3 to the young 4 age period, thought to be a transitional period in development. A version of the future-oriented prudence choice task described by Thompson et al. (1997) was used to measure future self-interest. It is argued that the prudence choice task requires an understanding of the link between future and present (i.e., potential future outcome can affect current action). It was hypothesized that future-oriented prudence scores would correlate across age showing some stability in future self-interest over the 6-month period. An increase with age in future self-interest was also investigated although no predictions were made because some studies have reported differences around this age range (Thompson et al., 1997, Toner et al., 1977) whereas others have not (Moore et al., 1998; Schwarz et al., 1983).

An additional goal of this experiment was to examine the relation between children's understanding of the present-future connection and their understanding of the connection between past and present. The delayed self-recognition procedure (Povinelli et al., 1996) was utilized at 3½ years of age as a measure of understanding the past-present connection. One previous investigation (Lemmon & Moore, 2001, Experiment 1) found a positive age-partialed correlation between future-oriented prudence scores and delayed

self-recognition scores in a sample of 3½- to 4-year-old children. These authors suggested that a self extended into the past develops simultaneously with a self extended into the future during this time. Based on this finding, it was predicted that in the current experiment delayed recognizers would score higher on future-oriented prudence at age 3½ than would delayed non-recognizers. Compared to children who were unaware of the past-present connection and the present-future connection at the younger age, children who were aware of these relations were expected to be more aware of the present-future connection at 4 years of age as well. Although it is also possible that the processes involved in future-oriented prudence at 4 years of age differ from those involved at a younger age, it was theorized that the same processes were involved at both ages. Thus, delayed self-recognizers at 3½ were also expected to score higher than delayed non-recognizers on future self-interest at 4 years of age.

Method

Participants

Children who had participated in unrelated infancy studies were recruited for this longitudinal study. Forty-nine children completed the experiment at both times, age 3½ and age 4. However, potential problems with some future-oriented prudence trials necessitated the omission of data for 13 children (detailed under *Procedure*) leaving 36 participants (19 male; 17 female). Ages ranged from 40-43 months at Time 1 with a mean age of 41.0 months (SD = 0.9). Age in days beyond 3;3 was also calculated and ranged from 23-133 days (M_{days} = 60.2, SD = 25.3). At Time 2, ages ranged from 47-50 months

with a mean age of 48.3 months (SD = 0.8). Age in days beyond 3;11 ranged from 4-90 days (M_{days} = 41.4, SD = 21.8).

Procedure

At age 3½ children completed the future-oriented prudence task and the delayed self-recognition task. At age 4, children completed only the future-oriented prudence task. Delayed self-recognition was not completed again because it was thought that the covert marking procedure would have been contaminated by previous experience. As part of a larger study several other tasks were administered, at both ages plus at age 4½, but those data were not collected as part of this thesis.

The procedure for the delayed self-recognition task was modeled after Thompson et al. (1997) so at both ages, the Future-oriented Prudence question was included with two altruism trials. Because the altruism trials were collected for purposes other than those stated here, those data will not be reported. One of each trial type was included in a block of trials with a total of three blocks. Children were given a sticker book and a sticker envelope during the standardized instructions:

> Now we're going to play a game with stickers. I will ask you to choose which stickers you want. Sometimes you'll have stickers to put into your sticker book right now, but sometimes you'll have stickers to save in your envelope until the end of the game. And sometimes you'll have some stickers to share with [research assistant]. This is her sticker book and her sticker envelope so if you want to give her some stickers right now then she can put them in her sticker book, and if you want to give her some stickers to keep in her envelope to save until the end of the game, then she'll save them in here. Then you take your sticker book and sticker envelope home with you at the end of all our games today.

The research assistant was present for the child to share with on altruism trials. She sat at the opposite end of the table from the experimenter and did not interact with the

child during the game, but smiled when the child initiated contact. In the Future-oriented Prudence trial, children chose between having one sticker now and two stickers at the end of the game. Delayed reward choices were saved in the child's envelope until the end of the game and immediate rewards were placed into the child's sticker book after each trial.

Children received one point for choosing the larger reward (two) in each Future-oriented Prudence trial (total possible scores ranged from 0-3). When reviewing the session videotapes, it was noted that some children replied with "Two" and then appeared to be confused when the stickers were put in the envelope. One explanation for this reaction is that these children were not hearing the question constraints (i.e., time of reward delivery) and were simply voicing their current desire to have two stickers now. Thus, it was decided that each Future-oriented Prudence trial at both ages should be coded for validity of measurement. Children's responses were transcribed from videotape and then two trained assistants judged the validity of each trial (Valid or Invalid). Invalid codes were given to trials in which the question was not repeated when children replied "Two" and pointed to their sticker book or peeled the sticker for their sticker book. Each child was coded as 0 (one or more Invalid trials) or 1 (three Valid trials). At age 3½ there was one disagreement (48/49), Kappa = .94, $p < .001$, and after reviewing the videotape, that child was given a code of 0. In total, 12 children were omitted at age 3½ for having Invalid trials. At age 4 there were no disagreements (37/37), Kappa = 1.0, $p < .001$. One child was omitted for having an Invalid trial.

The procedure for the delayed self-recognition task was modeled after Povinelli et al. (1996). Before the hide-and-seek game started, the experimenter explained that the

video camera would make a tape so that afterwards they could watch themselves playing the game. The experimenter explained to the children that they were going to search for some stickers to put into a sticker book. Participants covered their eyes while the experimenter hid a series of 3 different stickers under one of three cups. When the child found the first hidden sticker, the experimenter patted the child on the head. On the second trial, the experimenter covertly placed a bright circular sticker (2 cm in diameter) on the child's head. This dot sticker was yellow for all children except those with blonde hair for whom a darker coloured dot was used for visibility. The dot remained on the child's head for the last trial during which time the experimenter did not touch the child's head. At the end of the game, the participants were told that it was now "time to watch what we just did on TV" and the videotape was rewound to 35 seconds before the dot appeared on the child's head. A delay of about five minutes occurred from the time of marking to that of viewing. No children reached for the dot between the time it was placed on their head and when it appeared on the television screen. The children's reactions to the playback were also recorded on video.

During the playback, the experimenter pointed to the image of the child on the television and asked the identity question ("Who is that?"). Children who did not answer this question correctly were not informed that the image was in fact them. If the children had not located the dot, the experimenter asked, "What is that?" while pointing to the image of the dot on the television. If children did not answer or responded incorrectly, then they were told "That's a [yellow] dot. That's a [yellow] sticker." This ensured that children knew it was a sticker located on the head of the person in the video image. The

final two questions were: "Where is that [yellow] dot really?" and "Can you touch the [yellow] dot?" Answers to these last two questions were not corrected. If children did not remove the dot following the last question, then they were shown a mirror and asked, "Who is that" and "Can you touch the [yellow] dot?"

Following Povinelli and Simon (1998), two trained assistants indicated whether or not each child appeared to reach for the dot on his or her head during the video playback. Coders agreed on 35/36 cases, Kappa = .94, $p < .001$, showing excellent inter-rater reliability. The one disagreement was reviewed by the coders and resolved.

Results

Analytic Strategy

Given the sex differences found in some previous work on delay of gratification (e.g., Logue & Chavarro, 1992; Toner et al., 1977), sex was used as a variable in all analyses. Age in days beyond 3;3 was used as a covariate for analyses at Time1 and Age in days beyond 3;11 was used as a covariate for analyses involving Time 2.

First, the effect of trial presentation order was tested at each age to determine whether children were more likely to save stickers at certain times during the game. The relationship between future self-interest and age was examined next. Mean Future-oriented Prudence scores were examined for an improvement with age, although this finding was not expected based on past research. Mean scores were then correlated across age with the expectation that performance would be positively related. Children's chance performance was also explored at both ages. Then, whether children who made inferences based on past experience also made future-oriented choices was examined by testing the

relationship between DSR performance at 3½ and Future-oriented Prudence scores at both 3½ and 4 years of age. Delayed recognizers were expected to score higher on future-oriented prudence at both 3½ and 4 years than were delayed non-recognizers.

Order Effects

Mean Future-oriented Prudence scores at age 3½ were submitted to a one-way ANOVA with repeated measures on Block (3: First, Second, Third) and Age in days at Time 1 as a covariate. Results revealed that Age was not a significant covariate, $F(1, 34) = 0.67$, $p = .42$. There was also no significant effect of Block, $F(2, 68) = 0.04$, $p = .97$. Similarly, mean Future-oriented Prudence scores at age 4 were submitted to a one-way ANOVA with repeated measures on Block (3) and Age in days at Time 2 as a covariate. Again, results revealed that Age was not a significant covariate, $F(1, 34) = 0.63$, $p = .43$, and Block was not a significant effect, $F(2, 68) = 0.02$, $p = .98$. Children's performance did not differ from the beginning to the end of the task. Therefore, Block was not used as a variable in further analyses.

Relation with Age

Mean scores on the Future-oriented Prudence choices at each age are presented in Table 1 for each sex. Scores on Future-oriented Prudence choices at 4 years of age were compared to scores at 3½ years of age. Means were tested in a two-way mixed analysis of variance (ANOVA) with Sex (2: Male or Female) as the between-groups variable, repeated measures on Age (2: 3½ and 4), and Age in Days at Time 1 and Time 2 as covariates. The covariates for Time 1, $F(1, 32) = 0.01$, $p = .93$, and for Time 2, $F(1, 32) = 1.92$, $p = .18$, were not statistically significant. There was no main effect of Sex, $F(1, 32)$

= .10, p = .76, and no main effect of Age, $F(1, 32) = 0.30$, p = .59. There was also no significant Sex x Age interaction, $F(1, 32) = 0.02$, p = .81. Children of both sexes performed no differently at age 3½ than they did at age 4.

Table 1

Mean Scores (SD) on Future-oriented Prudence at Ages 3½ and 4 as a Function of Sex

	Sex		
Age Group	Male (n = 19)	Female (n = 17)	Total
3½ Years	1.21 (0.9)	1.35 (1.0)	1.28 (1.0)
4 Years	1.26 (1.2)	1.29 (1.3)	1.39 (1.2)

It was expected that Future-oriented Prudence scores at age 3½ would be related to Future-oriented Prudence scores at age 4. However, the partial correlation, controlling for age in days at Time 1 and at Time 2, was not statistically significant, $r(32) = .226$, p = .20. The partial correlation was then examined for males and females separately, showing that for girls, performance was strongly correlated over time, $r(13) = .681$, p = .005, whereas for boys, performance over time was not related, $r(15) = -.277$, p = .28. Thus girls who showed future self-interest at age 3½ also showed future self-interest at age 4 and vice versa.

Chance Performance on the Future-oriented Prudence Task

When mean scores were compared to chance (1.5), results revealed that as a group, 3-year-olds were not significantly different from chance, $t(35) = -1.33, p = .19$, nor were 4-year-olds, $t(35) = -0.54, p = .59$. Although this analysis may suggest that children are performing randomly because they scored no different from chance, it may also be that children are not showing a preference for the delivery of rewards (i.e., they enjoy having some now and having some later as well). The number of children who performed significantly above and below chance was also examined. At age 3½, 22 children (14 males; 8 females) scored significantly below chance on Future-oriented Prudence, whereas 14 children (5 males; 9 females) scored significantly above chance. At age 4, 20 children (10 males; 10 females) scored significantly below chance and 16 children (9 males; 7 females) scored significantly above chance.

Relation between Present-Future and Past-Present Understanding

Whether an understanding of the relation between past and present was associated with future self-interested choices was also tested. At age 3½, there were 17 non-recognizers and 19 recognizers in the Delayed Self-Recognition Task (DSR). Mean Future-oriented Prudence scores are presented in Table 2 as a function of Sex and DSR. A 2 (Sex: Male or Female) x 2 (DSR: Pass or Fail) analysis of covariance (ANCOVA) was performed on mean Future-oriented Prudence scores at 3½ years of age. Age (Time 1) was not a significant covariate, $F(1, 35) = 0.3, p = .56$. Again here, there was no main effect for Sex, $F(1, 35) = 0.001, p = .97$. No main effect was detected for DSR, $F(1, 35) = 2.56, p = .12$, and the interaction also did not reach statistical significance, $F(1, 35) =$

2.54, $p = .12$. However, simple effects analyses revealed that female recognizers did score higher than female non-recognizers, $t(15) = 2.39$, $p = .03$. Girls who possessed an understanding of how the past influenced the present showed stronger future self-interest than did girls without this understanding of the past-present connection.

Table 2

Mean Scores (SD) on Future-oriented Prudence at Age 3½ as a Function of Sex and DSR

		DSR		
Sex	*n*	Fail	Pass	Total
Male	19	1.18 (0.9)	1.25 (1.0)	1.21 (0.9)
Female	17	0.67 (0.8)	1.73 (0.9)	1.35 (1.0)
Total	36	1.00 (0.9)	1.53 (1.0)	

A similar two-way (Sex x DSR) ANCOVA was performed on Future-oriented Prudence scores at age 4 with two covariates. Age at Time 1 was not a significant covariate, $F(1, 35) = 0.07$, $p = .79$ nor was Age at Time 2, $F(1, 35) = 0.04$, $p = .83$. There was no main effect of Sex, $F(1, 35) = 0.04$, $p = .83$, and no significant interaction, $F(1, 35) = 0.2$, $p = .66$. However, there was a main effect of DSR, $F(1, 35) = 5.86$, $p = .02$, such that compared to children who failed, children who passed DSR scored higher on

Future-oriented Prudence at age 4 (see Table 3). These results indicate that performance on delayed self-recognition at 3½ years predicted performance on the future-oriented prudence task at 4 years, after controlling for the variability in age. Children who understood the influence of the past on the present at 3½ years showed a stronger interest in their futures at age 4 than children who did not possess an understanding of how the past relates to the present.

Table 3

Mean Scores (SD) on Future-oriented Prudence at Age 4 as a Function of Sex and DSR

		DSR		
Sex	*n*	Fail	Pass	Total
Male	19	0.91 (1.2)	1.75 (1.0)	1.26 (1.2)
Female	17	0.50 (0.8)	1.73 (1.4)	1.29 (1.3)
Total	36	0.76 (1.1)	1.74 (1.2)	

Discussion

Results from this experiment indicated no improvement with age on future-oriented prudence, although this behaviour was consistent across age for girls. In addition, no sex differences in future self-interest were found at either age. Moreover, the ability to recognize delayed self-images was related to the ability to make future-oriented choices at 3½ years of age for girls, and at 4 years of age for all children.

That no main effect of Age was revealed for Future-oriented Prudence trials in this study is not entirely surprising. Researchers investigating the relationship between age and delay of gratification have generally focused on a larger age range of children, beginning at age 4 or 5 and continuing up to early adolescence. An increase in delay behaviour corresponded to an increase in age in these studies (Inouye, Sato, & Sato, 1979; Mischel & Metzner, 1962; Rosek, Wessman, & Gorman, 1977). However, neither longitudinal nor cross-sectional studies have compared children's performance on future-oriented prudence at exactly 3½ and 4.0 years of age. The closest comparison occurred in Moore et al. (1998) who examined future-oriented prudence cross-sectionally in younger 3s, older 3s, and young 4s and found no differences among those age groups.

Only one previous study (Toner et al., 1977) reported different age improvements in Future-oriented Prudence for each sex; a correlation between age and delay behaviour in boys, such that younger boys chose the immediate reward more frequently. No such result was found in the current experiment. Indeed, no sex differences were found at either age. These results support several other studies that did not find sex differences in delay of gratification (Montgomery, 1976; Nisan & Koriat, 1977; Schwarz et al., 1983), but contrast with one study where boys chose the immediate reward more often than girls

(Logue & Chavarro, 1992). Considered together then, there is no strong evidence to suggest that girls choose more wisely than do boys in future-oriented decision making situations.

The consistency with which boys and girls make choices may be an issue however. It is interesting that despite the lack of a sex difference in mean performance, girls' behaviour remained stable over time whereas boys' behaviour did not. These results seem to indicate that boys' future self-interest is changing from 3½ to 4 years of age whereas the degree of future self-interest that girls possess at 3½ years of age essentially remains the same at age 4. Boys may be changing more radically than girls during this 6-month time period. It is possible that boys' behaviour will become consistent later on, over the fifth year of life rather than during the time period just preceding it.

In the current experiment, future self-interest was related to delayed self-recognition at the younger age for girls and at the older age for all children. These results indicate that future self-interest is developing along the same dimension as an understanding of past influence in 3½-year-old girls. Moreover, 3½-year-olds' understanding of how the past can influence the present can be used to predict their understanding that future desires can guide present decisions six months later. Unfortunately, delayed self-recognition was not measured at 4 years so we cannot determine whether an understanding of the present-future connection at a younger age can also predict an understanding of the past-present connection at an older age. Nonetheless, these findings offer support for Lemmon and Moore's (2001, Experiment 1) positive

correlation between 3½- to 4-year-olds' performance on the future-oriented prudence and delayed self-recognition tasks.

The positive correlation between future-oriented prudence and delayed self-recognition may indicate that these tasks share a common feature. One possibility is that both tasks require the representation of a current and noncurrent mental state, present and future for prudence, present and past for delayed self-recognition. Moreover, these mental states are conflicting. Children want both one sticker now and two stickers later in the future-oriented prudence task. In the self-recognition task, their current representation of self with no sticker conflicts with a past representation of self that has a sticker. Thus, the common element of the tasks may be children's ability to represent current and noncurrent conflicting mental states. Indeed, Barresi and Moore (1996) suggested that around four years of age children become able to consider two conflicting mental states simultaneously (one current and one noncurrent) which they described as *double imagination*. Povinelli (2001) also suggested that children's increasing ability to consider multiple representations of the same object allows children to think of self ("me") as having various temporal forms. This ability then may enable children to consider various forms of self (i.e., past, present, and future) which allows for the development of a sense of self extend into the future and into the past. The sense of self as temporally extended may enable children to appreciate that their past experience can influence their present and that their potential future desire can affect their present choice.

Results from this experiment seem to indicate that the six-month period before a child turns four years is not one of great change in future-oriented self-interest. With

Future-oriented Prudence means being nearly identical for both sexes at both ages in the current experiment, it would seem that the older 3 age period is not one over which interest in the future self strengthens. Additionally, that performance on the Future-oriented Prudence trials was not above chance at either age further suggests that prudential behaviour does not become more future-oriented until children move beyond their fourth birthdays.

Moreover, the analysis of chance performance on the sticker choice task also seems to indicate that children are choosing randomly. However, results point to the child's sex as being an important consideration when discussing the development of future-oriented self-interest over this age range. That is, girls demonstrated stability of future-oriented prudential behaviour from 3½ to 4 years whereas boys did not. In addition, awareness of the past-present connection at 3½ did not relate to future-oriented behaviour at that time in boys, but it did in girls. Thus, it is plausible to argue that 3½ -year-old boys may be choosing randomly on the future-oriented prudence task. However, the fact that 3½-year-old girls' performance is related over time indicates that their choices cannot be random. While still at chance then, girls at both ages may simply be showing no strict preference for having stickers either now or later (i.e., they would like some stickers both now and later). It is possible that 3½-year-old boys were not interested in the particular stickers used in this experiment and that is why they seem to perform randomly at this age. Stickers may be more rewarding to girls than to boys at 3½, but by the time a boy nears 4 years of age, stickers become more rewarding. Like girls, boys' awareness of the past-present connection at 3½ also predicted their ability to act with future-oriented prudence

at age 4. Thus, it is also possible that boys at 4 years may be showing no strong preference for one temporal state, preferring to have some now and some later. One remaining question from this study then is whether the recognition of past self relates to future-oriented self-interest in children over 4 years of age as well.

CHAPTER 2: EXPERIMENT 2

The previous experiment examined the development of future self-interest over the 3½ to 4 year age period and the relation between children's awareness that the future and the past can both affect the present. Results showed that future self-interest remained stable over time for girls, but changed during that time for boys. In addition, awareness of the past-present relation at 3½ years of age predicted awareness of the present-future relation for 3½ -year-old girls and for all 4-year-olds. The purpose of this experiment was to investigate the associations among future self-interest, the awareness that the past can influence the present, and the episodic neurocognitive system. This was carried out over a wider age range than in the previous study to provide a clearer developmental picture.

Children between the ages of 3;1 and 4;7 completed another version of the sticker choice task. As before, Future-oriented Prudence trials, one sticker now or two stickers at the end of the game, were included as a measure of future self-interest. Two new trial types were added as well: Simple Present and Simple Future. Simple Present trials, the choice between one or two stickers now, were included for two reasons: 1) to give the children some opportunities to put stickers in their books immediately; 2) as a control to ensure that children valued two stickers over one. Simple Future trials, one versus two stickers at the end of the game, were included as another measure of future self-interest. It was reasoned that younger children might be able to perform better on a trial that had them focus solely on the future rather than both the future and the present. The cognitive demands of a Simple Future trial, contrasting two values at one time point, seem lower

than those in the Future-oriented Prudence trial in which children must consider the contrast between two values at two different time points.

This reasoning was in line with some criticisms that failure on the future-oriented prudence task does not negate younger children's sense of the connection between the future and present. Atance and O'Neill (2001b) suggested that the standard delay choice design might obscure the interpretation of young children's present-future connection. That is, children may indeed be able to identify with future desires, but they are unable to wait to satisfy them in the standard delay design given the choice between present and future rewards. Younger children may have an interest in their future selves, but when given a choice *between* present and future, they will choose present because their ability to postpone gratification is immature or because receiving one sticker now is more desirable than waiting for two. The important question is *why* younger children are unable or unwilling to postpone gratification. Is it because they lack impulse control or because they cannot connect future concerns with present decisions? Thompson et al. (1997) argued that younger children are unable to delay gratification because they do not have a sense of future self. Without this link between future and present, children will not prefer delayed over immediate rewards. It was hoped that the new Simple Future choice with its focus on the future alone would address the issue of choosing between immediate and delayed rewards. Moreover, the Simple Future choice does not seem to involve impulse control or the ability to resist temptation (reaching for stickers immediately).

To measure awareness of the connection between past and present, children completed the delayed self-recognition task as in Experiment 1. Incorporated into the

delayed self-recognition task were three memory tasks, two of which theoretically tapped into children's episodic neurocognitive system (Wheeler et al., 1997). The order memory task described by Lemmon and Moore (2001, Experiment 1) was refined and two more tasks were added. In the first memory task, children were asked to recall the names of stickers they had found during the sticker hiding game. This Simple Recall task was used as a measure of general memory ability. In theory, children might perform well on this task without having to re-experience the finding event. One possibility is that children may rely on images held in memory rather than the phenomenal experience of the event.

In Lemmon and Moore's Order Memory task of the DSR sticker-finding event, children responded by pointing to a sticker in their sticker books. This procedure may have presented unwanted contextual cues, such as the sticker's position in the book, as to the order of recovery. Thus this task was adapted for the present study to improve and expand memory assessment. Children were shown a card displaying five stickers identical to the ones from the sticker finding game and were asked to point to the sticker they had found first through to last. As emphasized by Lemmon and Moore (2001), the to-be-remembered order of items was random (i.e., no necessary reason for any one particular item to follow another particular item). This was based on Tulving's (1972) argument that recalling a random order of events necessarily involves the episodic memory system because one's phenomenal experience of the events serves as the only guide to remembering. Conversely, with recall of events in logical order, general knowledge may be used to reconstruct the sequence without the need to remember. There is some evidence for a difference in recall ability for logically and randomly ordered events. Brown (1975)

found that preschoolers' memory for a logical sequence of three events surpassed their memory for those same events in random order. Moreover, in memory judgments for recency, 4-year-olds have been shown to rely on remembering, not knowledge, to distinguish item order (McCormack & Russell, 1997). Finally, it is important that these memory tasks were incidental. Children were not told beforehand that they would be required to recall anything about the stickers or the game. This approach was followed because incidental tasks exclude the use of deliberate memory strategies which tend to increase with age (Bjorklund, 1995), eliminating potential variability in the episodic memory tasks due to strategy implementation.

A second memory question about the context of the sticker-finding event accompanied each question about the order. In this task children were asked under which of three cups each sticker had been hidden. Although Wheeler et al. (1997) argued that memory for context was a measure of episodic memory because it relies on the experience of an event, use of the context measure in this experiment was exploratory. It was unclear to what extent this particular task would tap into children's re-experiencing of the sticker finding game versus knowing what happened in that game.

It was predicted that the Future-oriented Prudence scores would correlate positively with age because of the larger age range used in this experiment compared to the first study. It was also hypothesized that mean scores on Simple Future trials would be higher than those for Future-oriented Prudence. Older children were expected to perform better on Delayed Self-Recognition than were younger children given the results by Povinelli and his colleagues (1996, 1998) and Zelazo et al. (1999). Finally, based on the

findings described by Lemmon and Moore (2001, Experiment 1), it was also hypothesized that scores on Future-oriented Prudence would be positively correlated with scores on Delayed Self-Recognition and Order Memory. Context Memory scores were also expected to correlate with Future-oriented Prudence scores, but Simple Recall scores were not.

Method

Participants

Fifty-four children (26 female; 28 male) with a mean age of 45.6 months (5.0) participated in this study. Children ranged in age from 37-55 months. For the purposes of some analyses, a median split was performed on the sample resulting in two age groups, Middle 3-year-olds and Young 4-year-olds. There were 26 three-year-olds with a mean age of 41.1 months (2.2) and an age range of 37-45 months and 28 four-year-olds with a mean age of 49.9 months (2.6) and an age range of 46-55 months.

Procedure

Children were tested individually in a laboratory room. Approximately half of the participants completed the sticker choice task first while the other half completed the delayed self-recognition and memory tasks first.

Sticker Choice Task. Trials in this task involved making choices for self and other both now and in the future. Three of the trials pertained to self only and two pertained to both self and the research assistant. As in Experiment 1, the trials involving self alone were collected as part of this thesis and thus only those data will be reported. The standardized instructions from the first experiment were provided at the beginning of the game. Delayed

reward choices were saved in envelopes until the end of the game and immediate rewards were placed into sticker books at the end of each trial.

Following the instructions, each child was first given a practice trial in which he or she was asked to choose between one sticker now and two stickers now. Children who chose one sticker were told that in this game they could have two stickers for their sticker book, not just one. This initial trial was followed by three identical offers with counterbalanced choices. Importantly, feedback was not given on these three trials measuring Simple Present. As in Experiment 1, the other trial options were offered in three randomized blocks, with four trials (2 for self only and 2 for self and other) comprising each block. The two self-only trials were Future-oriented Prudence, one sticker now versus two stickers at the end of the game, and Simple Future, one versus two stickers at the end of the game. Children received one point for choosing the larger reward with possible scores ranging from 0-3 for each trial type.

Delayed Self-Recognition and Memory for Personally Experienced Events. The recognition procedure involved administering the memory tasks between the game and the video playback following the procedure described by Lemmon and Moore (2001, Experiment 1). Thus, children first played the hide-and-seek game as in the previous experiment, then completed the memory tasks, and finally, watched the video playback that tested for delayed self-recognition.

Before the hide-and-seek game started, the experimenter explained that the video camera would make a tape so that afterwards they could watch themselves on the television playing the game. The experimenter explained to the children that they were

going to search for some stickers to put into a sticker book. Participants covered their eyes while the experimenter hid a series of 5 different stickers under one of three cups. After each trial, the experimenter asked children to identify the sticker. This was to ensure that participants knew which sticker they had found on each trial. In addition, on the first and second trials of finding the sticker, the experimenter patted the child on the head in a congratulatory fashion. On the third trial, the experimenter covertly placed a bright 2-cm dot on the child's head. The dot remained on the child's head for the last two hiding trials during which time the experimenter praised the child by clapping her hands. At the end of the game, the children were told that it was now "time to watch what we just did on TV" and the videotape was rewound. An assistant rewound the videotape to approximately 35 seconds before the dot sticker appeared on the child's head.

Children completed the three memory tasks while the videotape was being rewound. First, the experimenter asked the child to name the stickers that had been found during the game as a control question (*Simple Recall*). Participants were then shown a card that contained five stickers identical to the ones they had found during the game (the order on the card did not match the order in which the child discovered the stickers during the game). Children were asked to point out which sticker was found on each trial (*Order Memory*) and under which cup each sticker was found (*Context Memory*). The experimenter asked, "Which sticker did you find first? And which cup was that sticker under? Which sticker did you find the second time? And which cup was that sticker under?" and so on for each of the five stickers. For all three memory tasks, participants

were given one point for each correct answer, with possible scores ranging from 0-5 on each task.

After completion of the memory tasks, the videotape was played back for the child and experimenter to view. The child and experimenter remained seated as the television was rolled directly in front of them. A delay of about seven minutes occurred from the time of marking to that of viewing. The children's reactions to the playback were also recorded on video.

During the playback, the experimenter pointed to the image of the child on the television and asked the identity question ("Who is that?"). All children were asked this question either immediately after they had removed the sticker or approximately 30 seconds after it was placed on their heads in the video. Children who did not answer this question correctly were not informed that the image was in fact them. If the children had not located the sticker, the experimenter asked, "What is that?" while pointing to the image of the sticker on the television. If children did not answer or responded incorrectly, then they were told, "That's a yellow dot. That's a yellow sticker." This ensured that children knew it was a sticker located on the head of the person in the video image. The final two questions were: "Where is that yellow dot really?" and "Can you touch the yellow dot?" Answers to these last two questions were not corrected. If children did not remove the dot following the last question, then they were shown a mirror and asked, "Who is that" and "Can you touch the yellow dot?"

As in Experiment 1, two trained coders recorded the point at which each participant first appeared to reach for the sticker during the video playback. However, in

this experiment scoring was not dichotomous because it was thought that children who reached for the sticker before the question prompts may be qualitatively different from children who reached up during the question period. In addition, with the larger age range tested in this experiment (3;1-4;7) compared to the first one (3;4-3;6) more variability in DSR performance was expected. Thus, children who reached up before the first question received 2 points whereas those who reached up during the prompting period received 1 point. Those children who did not reach up during the video presentation received a score of 0. Inter-rater reliability was excellent (Kappa = .94, $p < .001$) and the two disagreements were resolved by discussion.

Results

Analytic Strategy

First, the effect of game order and trial presentation order in the sticker choice task was tested at each age to determine whether children's performance was influenced by playing the sticker choice task first or whether children performed better on later trials compared to earlier trials. Performance at each age was tested against chance (1.5) on the two future-oriented trial types to determine whether children were able to consistently make future self-interested choices.

In order to provide a more stringent measure of future self-interest, scores for Simple Future and Future-oriented Prudence were adjusted for Simple Present scores. Children had been expected to score 3/3 on Simple Present trials; however, many children did not. For some reason, two stickers were not better than one to all children. One potential explanation for this behaviour is that some children did not want to appear

greedy and thus would not choose two stickers. Thus, a difference score was computed by subtracting children's total Simple Present scores from their total Simple Future and Future-oriented Prudence scores in order to control for the tendency to choose future stickers based on these reasons. With this type of adjustment, positive scores represent more future than present self-interest, scores closer to 0 represent equal future and present self-interest, whereas negative scores represent present over future self-interest.

The relationship between age and future self-interest was examined using the difference measures. Mean difference scores were then correlated with age in months with the expectation that Future-oriented Prudence scores may show an increase with age whereas Simple Future scores would not. Mean difference scores were then examined for sex, age, and trial type differences.

Next, age differences were tested on all measures of the past with the expectation that older children would score higher than younger children in Delayed Self-Recognition, Order and Context Memory. Then, the prediction that children who demonstrated recognition of past self and better episodic memory for the events would also score higher on Future-oriented Prudence trials was tested. It was expected that Delayed Self-Recognition scores would correlate positively with Future-oriented Prudence scores as well as Context and Order Memory scores. Moreover, it was expected that Future-oriented Prudence scores would correlate positively with Context and Order Memory scores.

Order Effects

First, the order in which children played the games (Sticker Choice Task first or last) was tested for influence on performance. Game order did not affect Simple Present choices, $t(52) = .36, p = .72$, Simple Future choices, $t(52) = .28, p = .78$, Future-oriented Prudence choices, $t(52) = .82, p = .42$, Simple Recall, $t(52) = 1.71, p = .09$, Order Memory, $t(52) = .51, p = .62$, Context Memory, $t(52) = -.66, p = .51$, or Delayed Self-Recognition, $t(52) = -.45, p = .65$. Game order was therefore omitted as a variable in further analyses. In addition, the Block (3: First, Second, Third) in which choices were offered during the sticker choice task influenced neither Simple Future scores, $F(2, 106) = 1.21, p = .30$, nor Future-oriented Prudence scores, $F(2, 106) = 0.70, p = .50$. Thus children's performance did not show that previous trial experience influenced later scores.

Chance Performance on the Sticker Choice Task

On the Simple Future trial, the Middle 3 boys did not perform significantly different from chance, $t(11) = 1.23, p = .24$, whereas the Middle 3 girls performed significantly above chance, $t(13) = 3.45, p = .004$. Both sexes of the Young 4s performed significantly above chance on the Simple Future trial, boys and girls respectively, $t(15) = 2.64, p = .02$, and $t(11) = 2.77, p = .02$. On the Future-oriented Prudence trial, the Middle 3s' performance was not significantly different from chance, boys and girls respectively, $t(11) = -0.29, p = .77$, and $t(13) = -0.49, p = .63$. The Young 4s' performance also was not significantly different from chance, boys and girls respectively, $t(15) = 0.21, p = .84$, and $t(11) = 1.45, p = .18$.

Sticker Choice Task

Pearson correlations were calculated between each difference score and Age in months because it was hypothesized that age would be a contributing factor to performance on Future-oriented Prudence choices but not on Simple Future choices. Indeed, there was no significant correlation between Age and Simple Future scores, $r(54) = .147$, $p = .29$. However, Age in months did correlate significantly with Future-oriented Prudence scores, $r(54) = .270$, $p = .05$. This finding indicates that as children increased in age they tended to show more future self-interest whereas as children decreased in age they tended to show more present self-interest. In addition, given the differential effects for boys and girls from Experiment 1, correlations were also performed separately for each sex. For boys, the correlations between Age and Simple Future scores and Age and Future-oriented Prudence scores were not significant, respectively, $r(28) = .284$, $p = .14$, and $r(28) = .166$, $p = .40$. For girls, the correlation between Age and Simple Future scores was not significant, $r(26) = -.076$, $p = .71$. However, Age did correlate significantly with Future-oriented Prudence scores, $r(26) = .421$, $p = .03$, indicating that as girls increased in age so too did their tendency to choose the larger delayed rewards.

Mean actual and difference scores on the sticker choice trials for each sex at each age are presented in Table 4. Children's performance was tested for sex, age, and trial type differences. Mean difference scores were submitted to a three-way mixed ANOVA with Sex (2: Male, Female) and Age (2: Middle 3s, Young 4s) as the between-groups variables and Trial Type (2: Simple Future, Future-oriented Prudence) as the within-groups variable. Results revealed no main effect of Sex, $F(1, 50) = 0.49$, $p = .83$, no main

effect of Age Group, $F(1, 50) = 1.63$, $p = .21$, and no significant Sex x Age Group interaction, $F(1, 50) = 0.59$, $p = .45$. A significant effect of Trial Type was found, $F(1, 50) = 12.77$, $p = .001$. However, none of the interaction terms with Trial Type was significant: Trial Type x Sex, $F(1, 50) = 0.30$, $p = .59$, Trial Type x Age Group, $F(1, 50) = 1.21$, $p = .28$, Trial Type x Sex x Age Group, $F(1, 50) = 1.89$, $p = .18$. Boys and girls at both ages performed equally well on Simple Future and Future-oriented Prudence choices. As a group, children scored higher on Simple Future choices than on Future-oriented Prudence choices.

Table 4

Mean Scores and Difference Scores (SD) on Sticker Choice Trials for Each Sex in Each Age Group

		Scores			Difference Scores	
Age Group	*n*	Simple Present	Simple Future	Future Prudence	Simple Future	Future Prudence
Middle 3s	26	2.62 (0.6)	2.08 (1.0)	1.38 (1.0)	-0.50 (1.2)	-1.23 (1.1)
Male	12	2.58 (0.7)	1.83 (0.9)	1.42 (1.0)	-0.75 (1.3)	-1.17 (1.1)
Female	14	2.64 (0.5)	2.36 (0.9)	1.36 (1.1)	-0.29 (1.1)	-1.29 (1.1)
Young 4s	28	2.36 (0.8)	2.11 (0.8)	1.71 (1.1)	-0.25 (1.2)	-0.64 (1.6)
Male	16	2.13 (1.0)	2.06 (0.9)	1.56 (1.2)	-0.01 (1.3)	-0.56 (1.8)
Female	12	2.67 (0.5)	2.17 (0.8)	1.92 (1.0)	-0.50 (0.9)	-0.75 (1.2)
Total	54	2.48 (0.7)	2.09 (0.9)	1.56 (1.1)	-0.37 (1.2)	-0.93 (1.4)

Pearson correlations between Simple Future and Future-oriented Prudence scores were also calculated although no strict predictions about the association were made. Overall, Simple Future scores correlated positively with Future-oriented Prudence scores after controlling for age in months, $r(51) = .618, p < .001$. This positive relationship held true for each sex as well. The age-partialed correlation between Simple Future and Future-oriented Prudence scores was significant for males, $r(25) = .638, p = .001$, and for females, $r(23) = .686, p = .001$. Thus, future-oriented prudential choices increased in one trial type as they did in the other trial type for all children.

Delayed Self-Recognition and Memory

Mean scores on delayed self-recognition and memory can be found in Table 5. A series of independent *t*-tests was performed to explore age differences in these tasks. Four-year-olds outperformed three-year-olds on Delayed Self-Recognition, $t(52) = 2.18, p = .03$. There was no age difference on Simple Recall, $t(52) = 0.52, p = .61$, or Context Memory, $t(52) = 1.12, p = .27$. However, 4-year-olds showed better memory for Order than did 3-year-olds, $t(52) = 2.43, p = .02$.

Table 5

Mean Scores (SD) on Delayed Self-Recognition and Memory Tasks for Each Age Group

Age Group	*n*	Delayed Self-Recognition	Simple Recall	Order Memory	Context Memory
Middle 3s	26	0.81 (0.9)	2.46 (1.2)	1.69 (1.5)	1.69 (1.2)
Young 4s	28	1.29 (0.8)	2.64 (1.4)	2.68 (1.4)	2.04 (1.1)
Total	54	1.06 (0.8)	2.56 (1.3)	2.20 (1.6)	1.87 (1.1)

Table 6 presents correlations among the past measures for each age group. In order to obtain a more stringent analysis, Simple Recall was partialed out in addition to age in months because that memory task was used as a measure of general memory ability which may show improvements with age.

Table 6

Age- and Simple Recall-Partialed Correlations among Past Measures for Each Age Group

Age Group	Order Memory	Context Memory
Middle 3s ($n = 26$)		
Delayed Self-Recognition	-.074	.237
Order Memory		.065
Young 4s ($n = 28$)		
Delayed Self-Recognition	.643**	.452*
Order Memory		.031

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

Relations among all Experimental Tasks

To examine the relations among tasks measuring the future and past, age-partialed correlations were conducted separately for each age group (presented in Table 7). Neither future measure correlated with Delayed Self-Recognition for the younger children. For the older children Future-oriented Prudence correlated with Delayed Self-Recognition whereas Simple Future did not. Context Memory correlated with Future-oriented Prudence scores for both the younger and older children. In addition, for the older children, Context Memory correlated with Simple Future scores and Order Memory correlated marginally with Future-oriented Prudence scores. Simple Recall did not correlate with the future measures at either age.

Simple Recall was then partialed out in addition to age. In this analysis, the relationship between DSR and Future-oriented Prudence scores remained significant for the older children, $r(24) = .454$, $p = .02$, as did the relationship between Context Memory and Future-oriented Prudence, $r(24) = .430$, $p = .03$, and the relationship between Context Memory and Simple Future scores, $r(24) = .482$, $p = .013$. In addition, the correlation between Order Memory and Future-oriented Prudence scores remained marginal, $r(22) = .360$, $p = .071$. For the younger children, the correlation between Context Memory and Future-oriented Prudence scores remained similar, $r(22) = .401$, $p = .052$.

Table 7

Age-partialed Correlations among Difference Choice Scores, Delayed Self-Recognition and Memory for Each Age Group

Age Group	Simple Future	Future Prudence
Middle 3s ($n = 26$)		
Delayed Self-Recognition	-.074	.226
Simple Recall	.239	.070
Order Memory	-.144	-.018
Context Memory	-.036	.392 ^
Young 4s ($n = 28$)		
Delayed Self-Recognition	.281	.436 *
Simple Recall	-.155	-.002
Order Memory	.288	.389 †
Context Memory	.483 *	.429 *

Note. † = $p < .066$; ^ = $p < .053$; * = $p < .05$

Discussion

In this study, children's future self-interest increased with age, true for girls in particular. Children's ability to connect past and present states of self also increased with age as did their memory for the order of a particular event. Simple Future scores were related to Future-oriented Prudence scores at both ages. However, Simple Future scores were not related to Delayed Self-Recognition at either age, whereas Future-oriented Prudence scores were related to Delayed Self-Recognition for the older children. Although both Order and Context Memory correlated with Delayed Self-Recognition for the older children, Context Memory correlated significantly with Future-oriented Prudence whereas Order Memory correlated marginally. Context Memory was also related to Simple Future for the older children.

In contrast to other studies (Logue & Chavarro, 1992; Schwarz et al., 1983) the number of future-oriented choices correlated positively with age (3;1-4;7) in the current experiment. Logue and Chavarro (1992) found no significant correlation between age in months (3;5-4;11) and delay behaviour. Schwarz et al. (1983) also found no significant correlation between age (3;0-5;11) and delay behaviour. One plausible explanation for these discrepancies is procedural differences in the tasks. Logue and Chavarro (1992) used a learning paradigm in which delayed sticker rewards were delivered after 30 seconds and before the next choice. Schwarz et al. (1983) used food rewards that were delivered 7 hours after the task. In the current experiment, sticker rewards were delivered at the end of the game (about 10 minutes). Granted, children did not necessarily know how long "the

game" would last, but they did know that they were not staying "at school" for the entire day.

Findings from the current experiment extend those of Experiment 1 where no improvement with age was found from 3;6 to 4;0. It is true though that with preschool populations specifically, previous results regarding future self-interest are inconsistent. For example, Montgomery (1976) found no difference between 4- and 5-year-olds' delay of gratification behaviour and age differences were not detected among 3s, 4s, and 5s in Schwarz et al. (1983), nor among younger 3s, older 3s, and young 4s in Moore et al. (1998). Moore et al. (1998, Experiment 1) did report a marginal finding that young 4s delayed more often than older 3s on choices involving delay of gratification and delayed sharing, although the direct age comparison for delay of gratification alone was not reported.

Two studies have reported age effects with preschoolers. Thompson et al. (1997) observed that 3-year-olds delayed less often than children over 4 years of age (specifically 4;0-5;8). In their sample of 3- to 5-year-olds, Toner et al. (1977) found that the choice to delay with candy was positively correlated with age in boys, but not girls, which is opposite to the finding in the current experiment that delay behaviour increased significantly with age for girls. Most studies do not report significant differences in delay of gratification between boys and girls (Montgomery, 1976; Nisan & Koriat, 1977; Schwarz et al., 1983) although one study reported that boys delay less often than do girls (Logue & Chavarro, 1992). Thus based on the current findings, the association between sex and delay behaviour in a preschool population remains unclear. However, some

support was found for an increase in future self-interest from age 3 to age 4, particularly for girls.

As a test of younger children's future-thinking ability, the future-oriented prudence choice was compared to another future-oriented choice that did not conflict with a present offer (Simple Future). A strong correlation between the two trials for both sexes may indicate a common element, thought to be episodic future thinking, and thus the ability to connect the future with the present. However, Simple Future trials were less difficult than Future-oriented Prudence trials. Both younger girls and older children performed above chance on Simple Future trials. All children performed at chance on Future-oriented Prudence trials. These findings for Simple Future trials would seem to indicate that 3-year-old girls do indeed have an understanding that future interests can be influenced by present choices. Given that Simple Future trials do not involve an impulse control aspect, as the Future-oriented Prudence trials are hypothesized to involve, some support is given to Atance and O'Neill's (2001b) suggestion that some 3-year-olds may have a sense of the future, but are unable to demonstrate that understanding in a standard Future-oriented Prudence choice.

However, it is not clear that these results based on Simple Future performance do indicate a young child's ability to engage in episodic future thinking. It is possible that Simple Future choices can be based, for example, on a child's knowledge that two is better than one, be it now or in the future. Without the conflict between future and present, as in the Future-oriented Prudence choices, one cannot be certain that Simple Future is indeed measuring a child's understanding of the connection between the future

and the present. Rather, the present may simply be applied to all choices. Thus, it would seem that in order to be certain that a task measures future-oriented thinking, the potential future state must explicitly be made distinct from the present state.

Although Future-oriented Prudence scores correlated with age in months, particularly for girls, children did not perform above chance on that trial. It may be that children do not show a significant increase in the recognition that future desires can guide present decisions until their late 4s or early 5s. Another possibility is that the limited room for variability in the sticker choice task hinders the finding of significant age effects. If you consider children's Simple Present scores to be their individual maximums for choosing two stickers (which are not always as high as 3) coupled with a baseline of chance performance (1.5), then range for variability is limited. A task that increases the range of variability would show clearer and more consistent age effects. There are at least a couple of ways this could be accomplished without modifying the scoring system for the task. First, it may be useful to incorporate Simple Present trials into the choice task proper instead of administering them all at the beginning as was done in this experiment. If children are offered now-only choices that satisfy their current desires along side other offers, then they may be more willing to choose the future option in the Future-oriented Prudence trials. This idea was incorporated into the method of Experiment 3A. An increase in variability to show age effects may also be accomplished by increasing older children's willingness to delay. One way of doing that may be to make more obvious the benefit of the future option compared to the present option. Such an attempt was made in

Experiment 3B by comparing children's choices on trials with lower future reward values to those with higher future reward values.

In support of previous findings with delayed self-recognition, younger 4-year-olds performed better than middle 3-year-olds (Povinelli et al., 1996; Zelazo et al., 1999). In addition, the relationship between delayed self-recognition and future-oriented prudence replicates the finding by Lemmon and Moore (2001, Experiment 1) indicating that children who understand the present-future connection also understand the past-present connection. However, in contrast to the findings of Lemmon and Moore, the ability to recollect the order of the sticker-finding event was not significantly related to future self-interest. This discrepancy may be due to the differing measures of future self-interest used in each experiment. By factoring in children's tendency to choose two instead of one in current situations, a more stringent measure of the connection between future and present was used in the current experiment. The discrepant results may also be accounted for by differing procedures in the order memory task. In Lemmon and Moore's study, children referred to their sticker books while answering which may have increased their ability to recall correctly the order in which stickers were found. With no such aid in the current experiment, children's reliance on their memory of the events was enforced. The current procedure may have made more evident, as suggested by Wheeler et al. (1997), the involvement of executive functioning abilities in remembering the order of events.

Memory for context then may be purer measure of episodic memory than order memory. Interestingly, it was this context measure of episodic memory that correlated with not only delayed self-recognition, but also simple future and future-oriented prudence

for the older children. It also correlated with future-oriented prudence for the younger children. The context memory task was explored as another measure of the episodic neurocognitive system and autonoetic consciousness (Wheeler et al., 1997). These results then indicate that the episodic system does play a role in children's understanding that the past can influence the present and that future desires can guide present decisions.

The context memory task required the child to represent two distinct noncurrent events. To remember the context of finding a sticker, the child must consider both the sticker and the cup. Thus, it is plausible to argue that this task requires the child to be able to reflect simultaneously on two or more representations and to consider the connection between them. These requirements can also be proposed for the delayed self-recognition and sticker choice task. In order to pass the delayed self-recognition task, the child must be able to think about the connection of the prior self (the self with the sticker in the video image) with the current self so the inference can be made that there must still be a sticker on his or her head now. To choose the future option in the Simple Future trial, the child must be able to consider two different future options, having one later or having two later. To succeed in the Future-oriented Prudence trial, the child must be able to consider a current desire (have one now) as well as a future desire (have two later) in order to maximize benefit for self.

Older children may have acquired the ability to represent and reflect upon mental states that conflict, one of which is current and one of which is noncurrent. The delayed self-recognition task requires the child to represent two conflicting states: the prior self with the sticker in the video image and the current self thought to have no sticker. The

Future-oriented Prudence trial also requires the child to represent two conflicting states: the present desire for one sticker and the future desire for two stickers. The Simple Future trial seems to involve children's ability to imagine two different representations (one or two) both of which are noncurrent. In a similar way, context memory seems to involve the representation of two different events (a sticker and a cup) both of which are noncurrent. The extent to which these two latter tasks require "conflicting" representations is debatable, and thus it may be that the conflict is not the most important ability, but rather the temporal dimensions (i.e., noncurrent). Trials that compared two reward values at one single time point were not difficult for the children. It is unclear though whether a trial that requires the representation of conflicting temporal states alone would also prove unchallenging to the children. Such a trial would have a temporal conflict without having a reward value conflict (i.e., there is no benefit to delaying in a choice that offers one sticker either now or later), opposite to the Simple Future trial in which there was a reward value conflict, but no temporal conflict.

It has been argued that events represented as *personally experienced* can be remembered at a later time (Perner, 2001; Perner & Ruffman, 1995; Povinelli, 1995, 2001; Povinelli et al., 1996, 1998) It is therefore reasonable to suggest that events represented as *to-be-personally-experienced* can be acted upon in the present. Children are able to identify with the increased future reward for self in the prudence task because they are temporally self-aware when making the decision in the present. Children who are not temporally self-aware will focus on the present self and thus choose 1 sticker now over 2 stickers later. Thus, a choice to delay in the prudence trials may indicate the child's ability

to identify with a future self, as argued by Thompson et al. (1997). Moreover, individuals who have a sense of self extended into the future recognize that the present can influence the future and that eventually they will experience that future. Thus children who are able to make the most future-oriented prudential decision recognize that a present decision will affect a future outcome and that the choice that benefits their own future will eventually benefit their own present.

The ability to connect these representations may rely on a sense of self that is temporally extended because the temporally extended self functions as the thread that links these different events through time. Without considering the present self as temporally extended, one cannot connect these different temporal selves. This interpretation seems to fit with one aspect of Nagel's (1970) idea of temporal neutrality, that different temporal selves can be considered together. Another aspect of temporal neutrality is that no more importance be placed on any one time than any other time. A person who possesses a temporally extended sense of self would be able to consider all temporal aspects of self (past, present, and future) and not place emphasis on one over the other (e.g., present is more important than future). Although it seems intuitive to suggest that younger children place more importance on present interests than on future ones, this issue has not yet been addressed in the current work. The extent to which 4-year-olds can function from a temporally neutral standpoint also has not been previously investigated. Thus, in the next experiment (3A), children completed an expanded version of the future-oriented prudence choice task aimed at examining these issues.

CHAPTER 3: EXPERIMENT 3A

This final experiment is presented in three parts, each with its own purposes and hypotheses. The same children were visited at their preschools on two occasions. Experiments 3B and 3C were conducted on the first visit whereas Experiment 3A took place one to four weeks after the first visit. Several children were unavailable on this second visit so the number of children who participated in Experiment 3A was lower than those who participated in 3B and 3C.

One purpose of Experiment 3A was to examine whether children's responses to Simple Future trials (one or two stickers at the end of the game) are motivated by a connection to a present state rather than a connection to a future state. Thus, trials with a choice between present rewards only (Simple Present) as well as trials with a choice between competing present and future values (Future-oriented Prudence) were needed as comparison measures. If children are basing Simple Future choices on present knowledge or interests, then one might expect to see no significant difference between Simple Future and Simple Present choices, but a significant difference between Simple Future and Future-oriented Prudence choices. On the other hand, if children are basing Simple Future choices on an understanding of the present-future connection, then one might expect to see no significant difference between Simple Future and Future-oriented Prudence choices, as well as a significant difference between Simple Future and Simple Present choices.

Another purpose of this experiment was to determine whether 4-year-olds operate from a standpoint of temporal neutrality and whether 3-year-olds place greater emphasis on present interests than on future interests. By answering these questions the progression

of future self-interest from 3½ to 5 years can be described more completely (i.e., what changes in children's reasoning occur as they proceed from virtually no understanding of the connection between future and present to a standpoint of temporal neutrality). If children do have a temporally neutral self, then they will choose the most prudent alternative whether it is now or in the future. Moreover, they will realize that choosing the future reward is not always the best alternative. In certain situations, delaying a reward can in fact be costly. Two new trial types were added in this experiment, No Future Benefit (one sticker either now or at the end of the game) and Future Cost (two stickers now or one sticker at the end of the game). These trials were included to distinguish between children who chose future rewards for prudential reasons versus those children who opted for future rewards for other reasons. That is, some children may simply think that waiting for something is better than having it now. Those children may have been taught that "good things come to those who wait" or they may have been told by their parents to save the stickers when I came in to see them.

Three of the choices in the current experiment are similar to those offered by Montgomery (1976) to 4-and 5-year-old kindergarteners: *Advantageous Delay*, choices between small immediate rewards and large delayed rewards (Future-oriented Prudence); *Neutral Delay*, where reward values were identical at both times (No Future Benefit); and *Disadvantageous Delay*, where immediate rewards were larger than delayed rewards (Future Cost). Children delayed significantly less often on the Disadvantageous Delay choices than on the Advantageous Delay choices and the Neutral Delay choices. However, the mean of Disadvantageous choices was significantly greater than zero, so children were

still choosing to delay rewards at a cost. These findings seem to indicate that although "waiting to suffer" was clearly not a prudent option compared to the other two offers, the children still chose to suffer from time to time. Surprisingly, children did not delay more often on Advantageous than on Neutral trials as had been expected. Montgomery (1976) reasoned that children would choose the present reward as often as the delayed reward in Neutral trials, but that children would choose the delayed reward more often than the present reward in Advantageous Delay trials. However, it seems that children chose the delayed reward in Neutral trials as often as they chose the delayed reward in Advantageous Delay trials. Based on this study then, it would appear that kindergarten children do not express a temporally neutral standpoint in their choice behaviour. One might expect a person functioning from a temporally neutral standpoint to choose the future reward less often in Disadvantageous choices than in Advantageous choices. Moreover, if the self were temporally neutral, then it would not matter whether a reward was received either now or later, making the Neutral choice performance around chance levels. Thus, choosing the future reward in Neutral choices should occur significantly less often than in Advantageous choices and significantly more often than in Disadvantageous choices.

The Sticker Choice Task developed for the current experiment involves future choices with a reward value conflict only (Simple Future), a temporal conflict only (No Future Benefit), and combined temporal and reward value conflicts, one choice in which the present reward is more valuable (Future Cost) and another choice in which the future

option is more valuable (Future-oriented Prudence). Table 8 details the trial types and their current and future reward values.

Table 8

Trial Type Reward Values in the Sticker Choice Task

	Reward Value	
Trial Type	Current	Future
Simple Present	1 or 2	0
Simple Future	0	1 or 2
Future-oriented Prudence	1	2
Future Cost	2	1
No Future Benefit	1	1

Children in the three oldest age groups were expected to demonstrate at least a fledgling understanding of the present-future connection by performing above chance in the Simple Future choices. Only the Older 4s were expected to perform above chance in the Future-oriented Prudence trial, highlighting their future self-interest and hence their understanding that the future is connected to the present.

Additionally, as proposed in the discussion of Experiment 2, Simple Present trials were incorporated into each block of trials with the hope that giving children some immediate rewards during the task proper would at least release them from an overwhelming desire for immediate rewards, if not encourage them to choose the future option in Future-oriented Prudence trials. Children in all age groups were expected to perform equally well on Simple Present trials. With respect to other predicted age differences, Older 4s were expected to score higher than Middle and Older 3s on Future-oriented Prudence trials.

If 3-year-olds place greater emphasis on present interests than on future interests, one might expect them to choose the present option in the three trials with temporal conflicts (scored as 0) and the largest option in Simple Present trials (scored as 1). In Simple Future trials, they might choose randomly, or base their choices on the knowledge that two is better than one. Simple Present scores would not be expected to be higher than Simple Future scores. However, one could expect that Simple Present and Simple Future scores would be higher than Future-oriented Prudence, No Future Benefit, and Future Cost scores, whereas the number of future choices on the latter three trials would likely not differ.

A pattern of performance in which Future-oriented Prudence scores are significantly higher than No Future Benefit and Future Cost scores, would indicate that children are aware that a future outcome can guide present action. One could suggest that children who choose the future option on all future-oriented choices, with no difference among the three temporal conflict choices, have an understanding of the future as being an

important consideration (whether they have been taught that is a different matter). However, they have not achieved a level of temporal neutrality, the understanding that future considerations are not the *most* important, but that both present and future outcomes must be considered and weighed against each other.

It was reasoned that a level of temporal neutrality could be identified by the following response pattern: no differences among Simple Present, Simple Future, and Future-oriented Prudence as well as Future-oriented Prudence being significantly higher than Future Cost. This pattern of performance would only be expected among older children, possibly among the Older 4s in this experiment. However, it is quite possible that Older 4s are not yet functioning at a level of temporal neutrality. If this is the case, then one might expect Simple Present and Simple Future scores to remain higher than Future-oriented Prudence scores and Future-oriented Prudence scores to remain no different than No Future Benefit and Future Cost scores.

Method

Participants

Forty-eight children who had participated in related experiments (3B and 3C) were visited at their Halifax preschools on another occasion. Eleven (5 male, 6 female) Middle 3-year-olds who ranged in age from 41 to 43 months (M_{age} = 42.4 months, SD = 0.7) and 13 (6 male, 7 female) Older 3-year-olds who ranged in age from 45 to 47 months (M_{age} = 46.6 months, SD = 0.6) completed the prudence task. Twelve (7 male, 5 female) Young 4-year-olds who ranged in age from 48 to 52 months (M_{age} = 49.1 months, SD = 1.4) and 12

(9 male, 3 female) Older 4-year-olds who ranged in age from 55 to 62 months (M_{age} = 59.0 months, SD = 2.1) also participated in this experiment.

Procedure

Children were tested in a quiet area of the centre away from the other children. Standardized instructions introducing the game were given first:

> Now we're going to play a game with stickers. I will ask you to choose which stickers you want. Sometimes you'll have stickers to put into your sticker book right now, but sometimes you'll have stickers to save in your envelope until the end of the game. Then you take your sticker book and sticker envelope home with you at the end of the day.

For the task proper, children were asked to complete three blocks of the following five trial types in randomized order: 1) Simple Present - one sticker now or two stickers now; 2) Simple Future - one sticker or two stickers at the end of the game; 3) No Future Benefit - one sticker now or one sticker at the end of the game; 4) Future Cost - two stickers now or one sticker at the end of the game; 5) Future-oriented Prudence - one sticker now or two stickers at the end of the game. As in previous studies, immediate rewards were placed in sticker books whereas future rewards were saved inside envelopes until the game was over.

Scoring. Children received one point for choosing the future option in the No Future Benefit, Future Cost, and Future-oriented Prudence trials and one point for choosing the larger reward in the Simple Present and Simple Future trials. Possible scores ranged from 0-3 for each trial type.

3A Results

Analytic Strategy

First, the possibility that children may have performed differently at certain times during the game than others was tested. Next, in order to compare with the previous experiments, correlations between age in months and Future-oriented Prudence scores were conducted for each sex. Mean scores on Simple Present, Simple Future, and Future-oriented Prudence were tested for trial type and age differences. Then mean scores on No Future Benefit, Future Cost, and Future-oriented Prudence were tested for trial type and age differences in order to compare with Montgomery (1976). Finally, children's performance on each trial type was compared to chance to further explain on patterns of performance.

Order Effects

Children's performance on each trial was examined for an order effect. Mean scores were submitted to a one-way ANOVA with repeated measures on Block (3: First, Second, Third). Results revealed no significant effect for both the Simple Present trial, $F(2, 94) = 2.23$, $p = .11$, and the Simple Future trial, $F(2, 94) = 0.40$, $p = .67$. There was also no significant effect of Block on the No Future Benefit trial, $F(2, 94) = 0.86$, $p = .43$, the Future Cost trial, $F(2, 94) = 1.65$, $p = .20$, or the Future-oriented Prudence trial, $F(2, 94) = 0.56$, $p = .57$. Thus, children did not perform differently on earlier trials than on middle trials than on later trials.

Sticker Choice Task

Pearson correlations between age in months and Future-oriented Prudence scores were calculated separately for each sex. Age in months correlated positively with Future-oriented Prudence scores for boys, $r(27) = .576$, $p = .003$, and for girls, $r(21) = .576$, $p = .006$. However, as a comparison with the first two experiments having children up to the age of 4;6, Future-oriented Prudence scores did not correlate significantly with age for boys, $r(18) = .086$, $p = .74$, or for girls, $r(18) = .322$, $p = .19$.

Table 9 displays the mean scores (*SD*) on each trial type for each sex in each age group. It is worthwhile to reiterate here that choice of the larger option was scored as 1 in the two Simple trials and that choice of the future option was scored as 1 in the other trials. Thus, in No Future Benefit and Future Cost trials, lower scores represent choice of the present option.

Sex differences were tested on choices involving the future for children up to age 4;6 (18 male; 18 female). Children in the oldest age group were omitted because the number of females (3) was considerably smaller than the number of males (9). There was no difference in performance between boys and girls on Simple Future, $t(34) = -0.18$, $p = .86$, or Future-oriented Prudence, $t(34) = 1.55$, $p = .13$. Similarly, boys did not perform any better than girls on No Future Benefit trials, $t(34) = -0.79$, $p = .44$, or Future Cost trials, $t(34) = -0.89$, $p = .38$. Sex was therefore not included as a variable in remaining analyses.

Table 9

Mean Scores (SD) on the Sticker Choice Trials for Each Sex in Each Age Group

Age Group	*n*	Simple Present	Simple Future	No Future Benefit	Future Cost	Future Prudence
Middle 3s	11	2.09 (0.9)	2.45 (0.5)	0.36 (0.7)	0.64 (1.0)	0.73 (0.9)
Male	5	1.80 (1.1)	2.40 (0.6)	0.00 (0.0)	0.20 (0.5)	1.00 (1.0)
Female	6	2.33 (0.8)	2.50 (0.6)	0.67 (0.8)	1.00 (1.3)	0.50 (0.8)
Older 3s	13	1.85 (1.1)	1.69 (1.1)	0.62 (0.9)	0.85 (1.0)	0.62 (1.0)
Male	6	2.17 (1.0)	1.67 (1.2)	0.83 (1.0)	1.00 (1.3)	1.00 (1.3)
Female	7	1.57 (1.1)	1.71 (1.1)	0.43 (0.8)	0.71 (0.8)	0.29 (0.5)
Young 4s	12	2.75 (0.5)	2.00 (1.0)	0.67 (1.0)	0.75 (0.9)	1.25 (1.1)
Male	7	2.71 (0.5)	2.00 (1.0)	0.43 (0.8)	0.57 (0.8)	1.29 (1.0)
Female	5	2.80 (0.5)	2.00 (1.0)	1.00 (1.2)	1.00 (1.0)	1.20 (1.3)
Older 4s	12	2.92 (0.3)	2.75 (0.6)	0.75 (1.1)	0.33 (0.5)	2.25 (0.8)
Male	9	3.00 (0.0)	2.67 (0.7)	0.56 (1.0)	0.22 (0.4)	2.33 (0.7)
Female	3	2.67 (0.6)	3.00 (0.0)	1.33 (1.5)	0.67 (0.6)	2.00 (1.0)
Total	48	2.40 (0.9)	2.21 (0.9)	0.60 (0.9)	0.65 (0.9)	1.21 (1.1)

Children's performance was examined for age group and trial type differences. Two separate repeated measures ANOVAs were conducted to test specific hypotheses. The first involved comparing Simple Present, Simple Future, and Future-oriented Prudence, and the second involved comparing Future-oriented Prudence, No Future Benefit, and Future Cost.

First, differences among Simple Present, Simple Future, and Future-oriented Prudence were tested with Age Group (4: Middle 3s, Older 3s, Young 4s, Older 4s) as the between-groups factor. The RMANOVA revealed a main effect of Age Group, $F(3, 44) = 9.64$, $p < .001$, and a main effect of Trial Type, $F(2, 88) = 35.92$, $p < .001$. A significant interaction qualified these main effects, $F(6, 88) = 2.18$, $p = .05$ (see Figure 1).

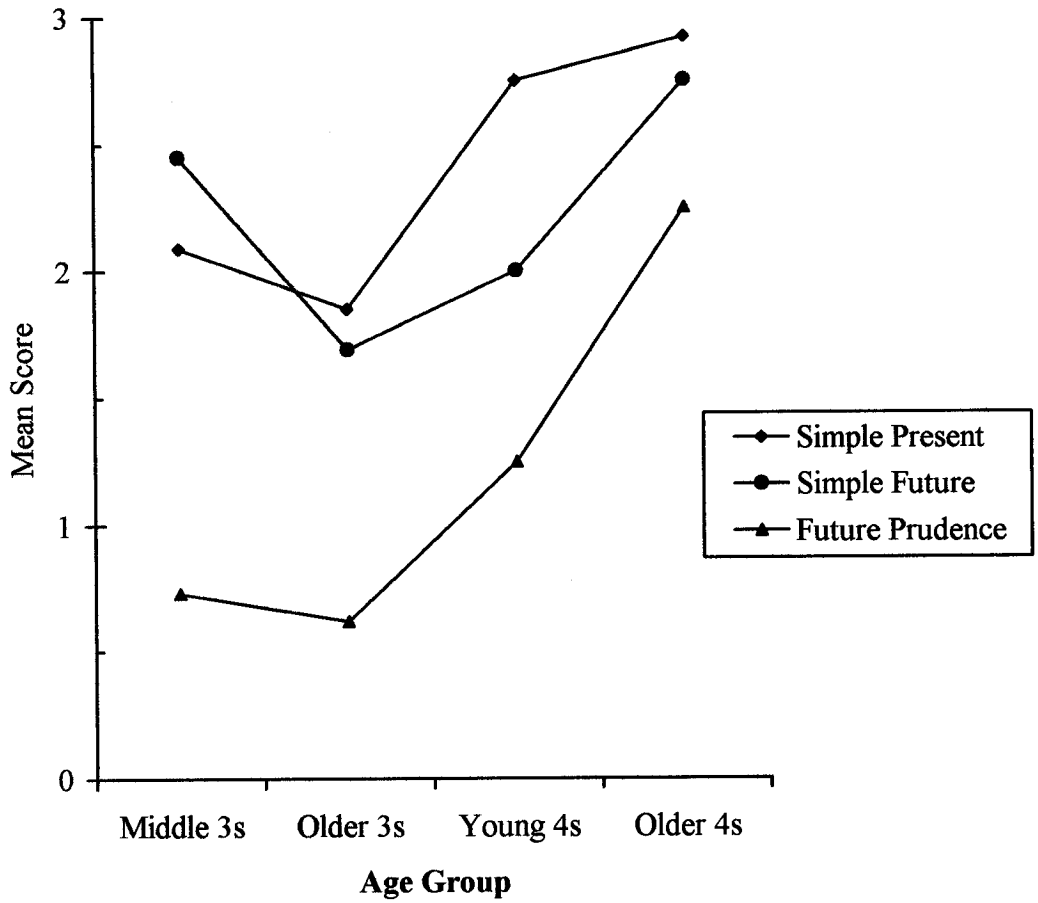


Figure 1. Mean scores as a function of Age Group and Trial Type.

To investigate simple effects, a series of one-way ANOVAs (Age Group) was performed on the mean scores for each trial type with Tukey HSD post-hoc tests (alpha level = .05). For the Simple Present trial, Older 4s and Young 4s chose the larger reward significantly more often than did Older 3s, $F(3, 44) = 5.53, p = .003$. For the Simple Future trial, Older 4s chose the larger reward significantly more often than did Older 3s, $F(3, 44) = 3.78, p = .02$. On the Future-oriented Prudence trial, Older 4s chose the future reward significantly more often than did both the Middle 3s and Older 3s, $F(3, 44) = 7.83$, $p < .001$.

Trial type comparisons for each age group (paired *t*-tests with an alpha level of .01) were also conducted to examine simple effects of the interaction between Age Group and Trial Type. For the Middle 3s, the difference between Simple Present and Simple Future was not statistically significant, $t(10) = -1.49, p = .17$. Middle 3s did however score marginally lower on Future-oriented Prudence than they did on Simple Present, $t(10) = -3.01, p = .013$, and significantly lower on Future-oriented Prudence than on Simple Future, $t(10) = -6.33, p < .001$. A similar pattern emerged with the Older 3s. The difference between Simple Present and Simple Future was not statistically significant, $t(12) = 0.46, p = .66$, and scores on the Future-oriented Prudence choice were significantly lower than scores on Simple Present, $t(12) = -3.26, p = .007$, and Simple Future, $t(12) = -3.74, p = .003$.

As with the 3-year-olds, the Young 4s also scored significantly higher on Simple Present than on Future-oriented Prudence, $t(11) = 5.20, p < .001$. However, children at this age scored marginally higher on Simple Present than on Simple Future, $t(11) = 3.00, p$

= .012. Moreover, the difference between Simple Future and Future-oriented Prudence was not statistically significant, $t(11) = 2.02, p = .07$.

For the Older 4s, the difference between Simple Present and Simple Future was not statistically significant, $t(11) = 0.80, p = .44$. Future-oriented Prudence scores were not significantly different from Simple Future scores, $t(11) = -2.57, p = .03$. However, like the youngest children, Future-oriented Prudence scores were marginally lower than Simple Present scores, $t(11) = -2.97, p = .013$.

Pearson correlations between Simple Future scores and both Simple Present and Future-oriented Prudence scores were also calculated for each age group (Table 10) to investigate further any similarities in reasoning children may have used (with an alpha level $< .10$ due to small n's). For Middle 3s, Simple Future scores correlated positively with Simple Present scores indicating that children chose either the larger or smaller rewards in both trials, whereas Simple Future did not correlate with Future-oriented Prudence. In contrast, for Older 3s, Simple Future did not correlate with Simple Present. However, Simple Future scores correlated positively with Future-oriented Prudence scores, indicating a similarity in performance (again choosing either the larger or smaller rewards in both trials). The correlations were not significant for the Young 4s. Similar to the Older 3s pattern of performance, the Older 4s showed a positive correlation between Simple Future and Future-oriented Prudence scores, but no correlation between Simple Future and Simple Present.

Table 10

Pearson Correlations between Simple Future and Simple Present and Future-oriented Prudence for Each Age Group

Age Group	*n*	Simple Present	Future-oriented Prudence
Middle 3s	11		
Simple Future		.516 *	.289
Older 3s	13		
Simple Future		.379	.505 *
Young 4s	12		
Simple Future		.422	.181
Older 4s	12		
Simple Future		- .127	.534 *

* = $p < .10$

Another repeated measures ANOVA was conducted to test the differences among choices involving temporal conflicts (No Future Benefit, Future Cost, and Future-oriented Prudence) with Age Group (4: Middle 3s, Older 3s, Young 4s, Older 4s) as the between-groups factor. The RMANOVA revealed no main effect of Age Group, $F(3, 44) = 1.16, p = .34$, but a main effect of Trial Type, $F(2, 88) = 13.7, p < .001$. A significant interaction qualified these main effects, $F(6, 88) = 6.97, p < .001$ (see Figure 2).

To investigate simple effects, a series of one-way ANOVAs for Age Group were performed on the mean scores for each trial type with Tukey HSD post-hoc tests (alpha level = .05). There were no age differences for the No Future Benefit trial, $F(3, 44) = 0.34, p = .78$, or for the Future Cost trial, $F(3, 44) = 0.81, p = .50$. As in the previous comparison, the age differences on Future-oriented Prudence were significant such that Older 4s scored higher than both 3-year-old age groups.

Trial type comparisons for each age group were conducted also (paired *t*-tests with an alpha level of .01). For the Middle 3s, Older 3s, and Young 4s, no significant differences among trial types were detected. For the oldest age group, No Future Benefit was not significantly different from Future Cost, $t(11) = 1.45, p = .18$. However, children chose the future option significantly more often on Future-oriented Prudence trials than on both No Future Benefit trials, $t(11) = 3.45, p = .005$, and Future Cost trials, $t(11) = 6.13, p < .001$.

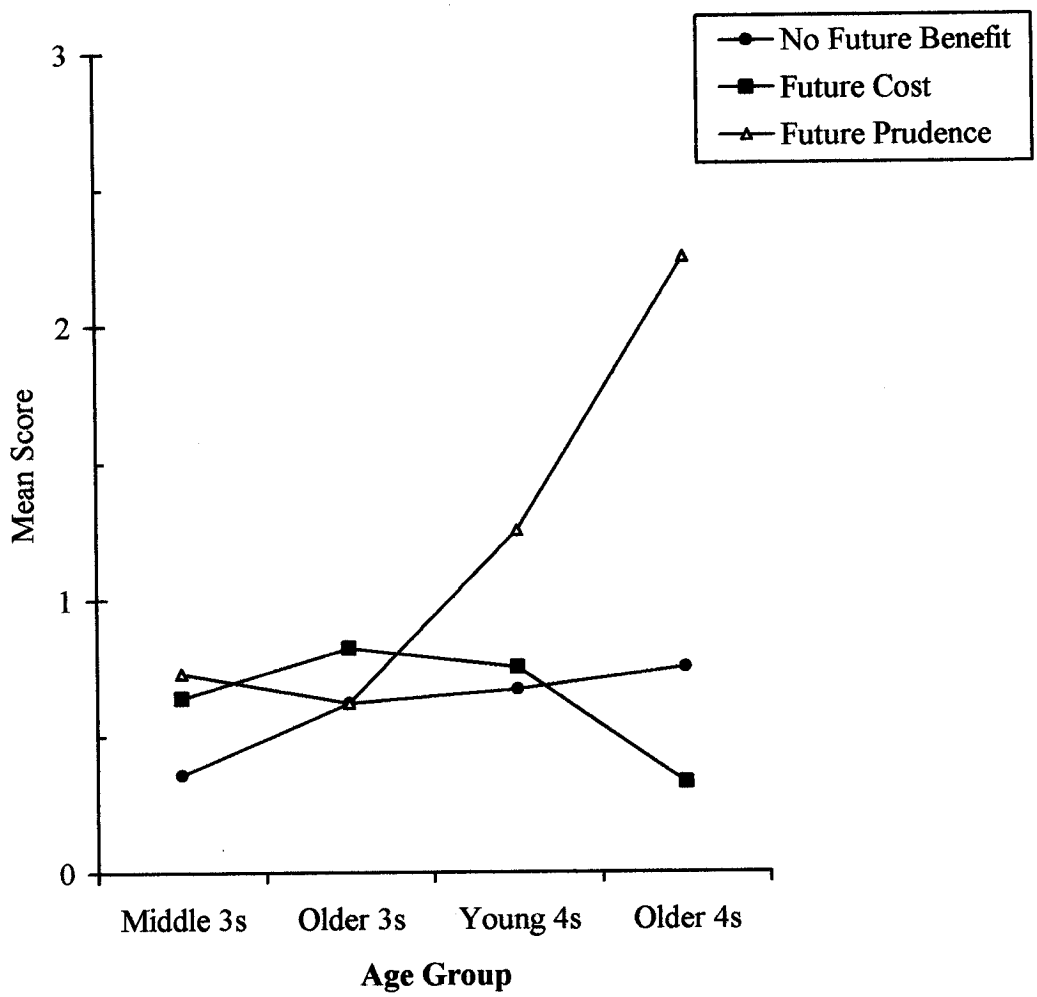


Figure 2. Mean scores on Trial Types with a temporal conflict as a function of Age Group.

Pearson correlations between Future-oriented Prudence scores and No Future Benefit and Future Cost scores were then calculated for each age group (see Table 11) to examine similarities in reasoning (with an alpha level < .10 due to small *n*'s).

Table 11

Pearson Correlations between Future-oriented Prudence and No Future Benefit and Future Cost for Each Age Group

Age Group	*n*	No Future Benefit	Future Cost
Middle 3s	11		
Future-oriented Prudence		.179	.313
Older 3s	13		
Future-oriented Prudence		.905 ***	.811 ***
Young 4s	12		
Future-oriented Prudence		.700 **	.671 *
Older 4s	12		
Future-oriented Prudence		- .238	- .490 †

† = $p < .11$, * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Correlations between Future-oriented Prudence and the two other temporal conflict trials were not significant for the Middle 3s. However, for both the Older 3s and the Young 4s, Future-oriented Prudence scores correlated positively with both No Future Benefit and Future Cost scores, indicating that children who chose the present reward on the prudence trial also chose the present option on the other two trials and vice versa. On the other hand, with Older 4s, no significant correlation was found between Future-oriented Prudence and No Future Benefit scores. A marginal negative correlation was found between Future-oriented Prudence and Future Cost scores, indicating that children who chose the future option on the prudence trial chose the present option on the cost trial and vice versa.

Chance Performance on the Sticker Choice Task

Mean scores on each trial type for each age group were presented earlier in Table 9 (p. 77). Not all age groups performed significantly above chance on the Simple Present trials, but rather just the two older age groups: Middle 3s, $t(10) = 2.08$, $p = .07$; Older 3s, $t(12) = 1.17$, $p = .26$; Young 4s, $t(11) = 9.57$, $p < .001$; and Older 4s, $t(11) = 17.0$, $p < .001$. Testing the difference from a score of 3, one sample *t*-tests showed that the two older age groups performed at ceiling in this task: Young 4s, $t(11) = -1.91$, $p = .082$, and Older 4s, $t(11) = -1.00$, $p = .34$. Thus, children of all ages consistently chose the larger reward in Simple Present trials, with the 4-year-olds being particularly competent at this choice.

On the Simple Future trials, the three older age groups were expected to perform above chance. However, the Middle 3s performed significantly above chance, $t(10) =$

6.06, $p < .001$, whereas performance of the Older 3s, $t(12) = 0.63$, $p = .54$, was not statistically different from chance. Young 4s' performance was only marginally above chance, $t(11) = 1.82$, $p = .097$. The Older 4s performed significantly above chance as hypothesized, $t(11) = 6.97$, $p < .001$, and also performed at ceiling in this choice, $t(11) = -1.39$, $p = .19$. The Middle 3s did not reach a ceiling level of performance however, $t(10) = -3.46$, $p = .006$. Again with Simple Future choices then, the oldest children were particularly competent.

On the No Future Benefit trials, the 3-year-olds performed significantly below chance: Middle 3s, $t(10) = -5.59$, $p < .001$; Older 3s, $t(12) = -3.67$, $p = .003$. The 4-year-olds also performed significantly below chance: Young 4s, $t(11) = -2.93$, $p = .014$; Older 4s, $t(11) = -2.28$, $p = .043$. Similarly, on the Future Cost trial, all groups performed significantly below chance: Middle 3s, $t(10) = -2.79$, $p = .02$; Older 3s, $t(12) = -2.39$, $p = .03$; Young 4s, $t(11) = -3.00$, $p = .012$; Older 4s, $t(11) = -8.21$, $p < .001$. Thus, children in all age groups were consistently choosing the present reward on No Future Benefit and Future Cost trials.

Finally, in the Future-oriented Prudence trial, the Older 4s performed significantly above chance as expected, $t(11) = 3.45$, $p = .005$. Although consistent in their choice of future rewards, their performance was not at ceiling, $t(11) = -3.45$, $p = .005$. The Young 4s' performance did not differ significantly from chance levels, $t(11) = -0.82$, $p = .43$. Children in the two younger age groups performed significantly below chance: Middle 3s, $t(10) = -2.83$, $p = .02$; Older 3s, $t(12) = -3.32$, $p = .006$. Their scores were still significantly greater than zero though: Middle 3s, $t(10) = 2.67$, $p = .02$; Older 3s, $t(12) =$

2.31, $p = .04$. Thus, children in the two younger age groups were consistently choosing the present reward, opting for the future reward from time to time.

3A Discussion

One aim of this experiment was to determine whether children base their Simple Future choices on a present state or a future state. Both groups of 3-year-olds scored no differently on the two simple trials, but significantly lower on Future-oriented Prudence than on Simple Future. This pattern of performance seems to indicate that 3-year-olds are basing Simple Future choices on a present state. However, Simple Future correlated with Simple Present for the Middle 3s whereas Simple Future correlated with Future-oriented Prudence for the Older 3s. Thus, Middle 3s may base Simple Future choices on present concerns whereas Older 3s may base those same choices on future concerns. The Young 4s scored higher on Simple Present than Simple Future, but no different on Simple Future than on Future-oriented Prudence. They also showed no correlation among trial types. This pattern of performance would seem to indicate that in their early 4s, children do not base their Simple Future choices on a present state, nor do they base them on an entirely future state. The oldest children however showed no significant difference between the two simple trials, or between Simple Future and Future-oriented Prudence. These findings seem to suggest that around their fifth birthdays children may be beginning to function from a temporally neutral standpoint. However, Simple Future scores correlated with Future-oriented Prudence scores, but not with Simple Present scores.

As a further test of the temporally neutral standpoint, the second purpose of this experiment, differences among temporal conflict trial types were investigated. Children

functioning from a temporally neutral standpoint were expected to choose the present option in Future Cost trials more often than in Future-oriented Prudence and No Future Benefit trials. They were also expected to choose the future option more often in the Future-oriented Prudence trials than on the No Future Benefit trials. Children in the three younger age groups performed equally on all trials, which may be explained by the low rate of choosing the future option on all trials. Based on this evidence then, it seems that 3-year-olds and young 4-year-olds place greater importance on present concerns than on future concerns.

The oldest children in this experiment chose the present option in Future Cost trials more often than in Future-oriented Prudence trials demonstrating their ability to weigh present and future concerns. They also chose the present option in No Future Benefit trials more often than in Future-oriented Prudence trials as one might expect of a temporally neutral view. However, no difference emerged between Future Cost and No Future Benefit trials. Thus, although Older 4s show some evidence of temporal neutrality, they still prefer to choose the immediate reward over the delayed reward in No Future Benefit choices. These findings are in contrast to those of Montgomery (1976). Kindergarteners in his experiment chose the immediate reward more often in Future Cost trials than in Future-oriented Prudence and No Future Benefit trials. However, there was no difference in performance between these latter two trials. This might be explained by the rather low rate of choosing the future option on all trials in Montgomery's study: 1.97/5 for Future-oriented Prudence, 1.74/5 for No Future Benefit, and 1.02/5 for Future

Cost. Taken together this evidence suggests that children could be expected to function from a standpoint of temporal neutrality sometime after their fifth birthdays.

Results from some previous studies on Future-oriented Prudence were supported here. Age correlated with performance on this trial type for both boys and girls. In Experiments 1 and 2 of this thesis, there was a positive correlation with age for girls, but not for boys. On the other hand, in their sample of 3- to 5-year-olds, Toner et al. (1977) found that the choice to delay was positively correlated with age in boys, but not in girls. Still others have investigated and found no relation between a child's sex and the choice to delay (Montgomery, 1976; Nisan & Koriat, 1977; Schwarz et al., 1983). With such discrepant findings, it is difficult to draw a conclusion. For that, studies specifically set out to examine sex differences in future-oriented prudential behaviour would be required.

It is possible that results here differ from those of Toner et al. (1977) because those authors used a candy reward with only one trial whereas in the current experiment stickers served as rewards with a total of 12 trials. One other study did not find a positive correlation between age and the choice to defer rewards over this age range (3;5-4;11) (Logue & Chavarro, 1992). This discrepancy with the current results may be accounted for by the differing methods used to measure future-oriented choice behaviour (i.e., Logue and Chavarro used a learning paradigm with each delayed reward choice delivered after 30 seconds and before the next choice began).

The procedures used in this thesis were modeled after Thompson et al. (1997) and so it would be important that the findings here agree with those. On the Future-oriented Prudence trial, Older 4s chose the future reward significantly more often than did both the

Middle 3s and Older 3s, agreeing with results reported by Thompson et al. (1997) who found that 4- and 5-year-olds delayed rewards more often than 3-year-olds. Nevertheless, both these findings contrast with Schwarz et al. (1983) who did not find any differences among 3-, 4-, and 5-year-olds. One plausible explanation for the discrepancies among these findings is that rewards in Schwarz et al. (1983) were delivered at the end of the entire day, a much longer time to wait than the end of the game.

In the first two experiments of this thesis, no age group differences (Middle 3s versus Young 4s) appeared for Future-oriented Prudence choices. In addition, Moore et al. (1998) also found no differences among younger 3s, older 3s, and young 4s. These findings were also replicated in the current experiment because no significant differences appeared among Middle 3s, Older 3s, and Young 4s. One can conclude then that substantial development in future-oriented thinking occurs over the Older 3 to Older 4 time period.

The Sticker Choice Task used in this experiment involved choices with a reward value conflict only (Simple Present and Simple Future), a temporal conflict only (No Future Benefit), and combined temporal and reward value conflicts – Future Cost in which the present reward was more valuable, and Future-oriented Prudence in which the future option was more valuable. As discussed in Experiment 2, the Future-oriented Prudence and Simple Future choices seem to require the ability to imagine two dissimilar representations, at least one of which is noncurrent. The relative importance of the conflict versus the temporal state was questioned. Perhaps the noncurrent versus current aspect is more critical in development than the conflicting state aspect. The No Future Benefit

choice served as a test of the ability to represent simultaneously current and noncurrent states that did not conflict. Simple Future choices fall under the conflicting state choice (one sticker or two stickers), both of which are in a single time. Children of all ages seem to accomplish both abilities readily. By the middle 3s, children seem to be able to reflect on two dissimilar states in the present and in the future. They can also think about the same state at two different times. Children of all ages also performed well in the Future Cost choice, which seems to require the ability to imagine two dissimilar states, one of which is current and the other which is noncurrent. Thus, what appears to develop around 4 years of age is not simply the ability to imagine two dissimilar current and noncurrent states (i.e., the concept of double imagination put forth by Barresi & Moore, 1996), but specifically, the ability to act in the interest of that noncurrent state which conflicts with the current state. There may be social factors involved in this distinction between the capacity for double imagination and the ability or willingness to use that capacity. For example, with the development of a temporally extended sense of self, that noncurrent state becomes increasingly important to the child compared to the current state.

Given Middle 3s' relatively high score on Simple Future choices, it appears that children understand the present-future connection. Older 3s however scored significantly lower on this choice than did Older 4s. This could be interpreted as Middle 3s having a simple connection to the future that disappears a few months later. Another possibility is that when they are not faced with a distinction between present and future, as in the temporal conflict trials, Middle 3s rely on present desires as a guide to the future. Indeed, in a strictly reward value conflict choice focusing on the future, these young children used

a present standpoint (Simple Future and Simple Present were correlated). The opposite was true for Older 3s when Simple Future correlated with the prudence trial. At this age children seem to treat the two simple (reward value conflict) trials as different and the Simple Future and Future-oriented Prudence questions as similar. Older 3-year-olds then may try to think ahead to the future and base their choices on a future desire, which may seem less than clear. Interestingly, older 3-year-olds who opted for the future choice in Future-oriented Prudence also chose the future reward in No Future Benefit and Future Cost trials and vice versa. This is evidence for preference of either present-oriented or future-oriented behaviour, regardless of the consequences. For younger 3-year-old children, it seems that the present overrides any future consideration. They seemed to use the present standpoint on all trial types, although with no correlation between Future-oriented Prudence and the two other temporal conflict trial types, performance may also have been random on the prudence trial.

Similar to the older 3-year-olds, children in their early 4s who chose the future reward in Future-oriented Prudence also chose the future reward in No Future Benefit and Future Cost trials, evidence again at this age for preference of either present-oriented or future-oriented behaviour regardless of the consequences. Young 4s however showed no relation between Simple Future and Simple Present or Future-oriented Prudence. These children seemed confident about choosing in Simple Present trials and less confident about the prudent choice in Simple Future and Future-oriented Prudence trials. It is plausible to argue that around 4 years of age children are beginning to understand the connection between future and present. However, given their equal performance on the three

temporal conflict reward trials, one may conclude that younger 4-year-olds have not developed a firm understanding of the present-future connection.

Finally, based on evidence gathered in this experiment, it can be argued that older 4-year-olds are beginning to function from a standpoint of temporal neutrality (Nagel, 1970). First, they showed no difference between the two simple trials, or between Simple Future and Future-oriented Prudence. In contrast to younger children who likely base future desires on present desires, Older 4s will equate the two simple questions because interest in the future self is becoming equivalent to interest in the present self. Moreover, Older 4s were the only age group to show a difference between Future-oriented Prudence and Future Cost (with a marginally negative correlation as well) and Future-oriented Prudence and No Future Benefit. These findings point to a temporally neutral stance. Nevertheless, performance on the No Future Benefit trial was equal to Future Cost, which indicates that these children have not yet reached a temporally neutral standpoint in a strict sense where performance on No Future Benefit would be higher than Future Cost. Thus, it would seem that after 5 years of age, developments toward neutrality in the temporally extended self are still occurring.

CHAPTER 4: EXPERIMENT 3B

One observation about the Future-oriented Prudence choice in the first two experiments was that children were not performing differently from chance (all participants were under age 4;6). This may have been because the range of possible variability in the scoring system was so limited. In Experiment 3A, an attempt was made to increase variability by combining the Future-oriented Prudence trials with other immediate reward trials (Simple Present, No Future Benefit, and Future Cost). Results indicated that in this type of design, Middle and Older 3s performed below chance, Young 4s performed at chance, and Older 4s performed above chance.

Another possible explanation for children's poorer performance may be that children will not opt for the future reward because they are not sufficiently motivated by the difference between one and two in a temporally conflicting choice. If children can indeed act on their potential future desires, then evidence of the ability to connect future and present should appear when the value of the future desire is increased. Children should be more able to show their understanding that future desires can guide present decisions in a design that offers much larger rewards at the end of the game than in the standard Future-oriented Prudence choice.

In this experiment then, children in four age groups (Middle 3s, Older 3s, Young 4s, and Older 4s) were offered a series of choices involving varied future rewards. As in previous experiments the current reward was one sticker, but in this task the current reward was paired with future rewards of two, three, four, and five (named the Linear Increase Future-oriented Prudence Task). If children truly do not understand that future

desires can guide present decisions, then no amount of discrepancy between now and later should convince them to act on a desire that they will have in the future. On the other hand, if a child does indeed understand the present-future connection, but does not act on it in the one now versus two later choice, then perhaps she will be convinced to act when the future rewards are larger (i.e., in the one now versus five later choice). Thus, it was reasoned that increasing the value of the future rewards compared to the present rewards might increase Young 4s chance level of performance. In addition, to assist younger children with impulse control (reaching for stickers before hearing the question), children provided choices via an arrow game board indicating either now or the end of the game (see Carlson, Moses, & Hix, 1998).

It was hypothesized that the Middle 3s would not differentiate between lower and higher reward values whereas the Young and Older 4s would act on that distinction by choosing the future option more frequently on higher reward trials. Indeed, for the oldest children, it was predicted that scores would increase linearly as a function of the delayed reward value because these children understand the increasing future benefit compared to the present. Thus, although they may sometimes choose to accept one sticker now in the trial for one now versus two later in order to satisfy current desires, they would rarely accept one sticker now in the trial for one now versus five later.

Method

Participants

Sixty children were recruited from childcare centres in Halifax, Nova Scotia. Twelve children (5 male, 7 female) were Middle three-year-olds ranging in age from 41-43

months (M_{age} = 42.5, SD = 0.7). Fourteen children (7 male, 7 female) were Older three-year-olds ranging in age from 45-47 months (M_{age} = 46.6, SD = 0.6). Fourteen Young four-year-olds (7 male, 7 female) participated ranging in age from 48-52 months (M_{age} = 49.3, SD = 1.4). Fourteen Older four-year-olds (9 male, 5 female) also participated, ranging in age from 55-62 months (M_{age} = 59.3, SD = 1.9). Six children were omitted from the sample for being outside of allowable age ranges.

Procedure

Children were tested individually in a quiet area of the centre. First they were told about the game in general and then they were made aware of the available choices.

> Now we're going to play a game with stickers. I will ask you to choose which stickers you want. Sometimes you'll have stickers to put into your sticker book right now, but sometimes you'll have stickers to save in your envelope until the end of the game. Then you take your sticker book and sticker envelope home with you at the end of the day.
>
> First I'll tell you the different choices. You can have 1 sticker for your sticker book now (show Card 1) or 2 stickers to save in your envelope for the end of the game (show Card 2). In another choice I'll say you can have 1 sticker for your sticker book now (Card 1) or 3 stickers to save in your envelope for the end of the game (Card 3). Sometimes I'll even say you can have 1 sticker for your sticker book now (Card 1) or 4 stickers to save in your envelope for the end of the game (Card 4). And sometimes I'll say you can have 1 sticker for your sticker book now (Card 1) or 5 stickers to save in your envelope for the end of the game (Card 5).

Then they received a practice question dealing with the present as in the first experiment (1 sticker now or 2 stickers now). If the child chose one sticker now they were told that they could actually have two stickers now in this game. Then the experimenter showed children a black rectangular game board with a computer-generated replica of an envelope in one corner and a sticker book in the other. A large red arrow was fastened in the middle of the game board. Children were trained to point the arrow to the sticker book if they

wanted to put a sticker in their books immediately and to point the arrow to the envelope if they wanted to save stickers in their envelopes.

> I'm going to teach you how to play with this pointer. See this sticker book (symbol) is like your sticker book and this envelope (symbol) is like your envelope. If you want to put the stickers into your sticker book right away, then you point the arrow to this book (experimenter demonstrates). Can you try pointing the arrow to the book? Good. If you want to save the stickers in your envelope until the end of the game, then you point the arrow to this envelope (experimenter demonstrates). Now can you try pointing the arrow to the envelope? Good. So if you want stickers right away then you point to the sticker book, but if you want stickers at the end of the game then you point to the envelope. OK, show me where you would point the arrow if you wanted the stickers to put into your sticker book right away. Show me where you would point the arrow if you wanted to save the stickers in the envelope until the end of the game. [If correct, proceed with game; if incorrect, provide a reminder.]

For the task proper, children were asked four question types: 1 now or 2 at the end of the game; 1 now or 3 at the end of the game; 1 now or 4 at the end of the game; 1 now or 5 at the end of the game. Three blocks of trials were administered with one of each trial type in a block (randomized presentation order). Stickers were laid on the table above the appropriate symbol (i.e., one sticker was placed above the book whereas the number of future stickers was placed above the envelope). The present reward sticker was always contained within the set of future stickers. Each future reward sticker was different from the others, but remained within the same category (e.g., different fish). As in previous experiments, children placed present rewards into their sticker books and future rewards into their envelopes.

Scoring. The number of future choices that children made was recorded for each trial with the possible total scores ranging from 0-3 for each trial type. This is equivalent

to the scoring procedures for Future-oriented Prudence trials used in previous experiments reported here.

3B Results

Analytic Strategy

First, the possibility that children may have chosen the future reward more often earlier or later in the game was tested. Next, in order to compare with previous research, means were tested for sex differences and correlations between age in months and the number of future choices was conducted for each sex. Then, the difference in mean number of future choices among trial types was investigated as a function of age group in order to determine whether children made any distinction among varying reward values. In particular whether children distinguished between trials with higher versus lower reward values was tested. Children's performance on each trial type was then compared to chance, not strictly as a measure of random performance, but in order to shed light on preference and trial difficulty. Next, in an attempt to describe the choice strategy children may have used, the total number of stickers they chose for later was compared to the number chosen immediately. Finally, performance on the Sticker Choice Task from the previous experiment was compared to performance on the Linear Increase Future-oriented Prudence task in this experiment.

Order Effects

The mean number of future choices was submitted to a one-way ANOVA with repeated measures on Block (3: First, Second, Third). Results revealed no significant effect of Block, $F(2, 106) = 1.13, p = .33$. Children chose the future reward as often in the

first block as they did in the second block and as they did in the third block. Thus, order of presentation did not significantly influence children's choices during the game, so this variable was not included in further analyses.

Sex Differences

Mean scores (*SD*s) on each trial in the Linear Increase Future-oriented Prudence Task are presented in Table 12 for each sex in each age group. First, comparing the total number of future choices children made during the task tested differences between boys and girls. An independent t-test revealed that Sex was not a significant factor, $t(52) = 0.45$, $p = .66$. Boys chose the future option a total of 5.71 times ($SD = 4.3$) and girls chose the future option a total of 5.23 times ($SD = 3.5$). Thus, boys and girls made future-oriented choices equally often. In addition, the differential development of future-oriented prudence for boys and girls over this age period was also examined. Age in months correlated positively with the number of trials on which children chose the future reward for both boys, $r(28) = .37$, $p = .05$, and girls, $r(26) = .47$, $p = .02$ (the correlation for the total sample was $r(54) = .41$, $p = .002$).

Table 12

Mean Scores (SD) on the Linear Increase Future-oriented Prudence Task for Each Sex in Each Age Group

Age Group	*n*	Future Reward Choice: 2 Later	3 Later	4 Later	5 Later	Total
Middle 3s	12	0.50 (0.8)	0.67 (1.0)	0.83 (1.0)	0.75 (1.0)	2.75 (3.3)
Male	5	0.60 (0.9)	1.00 (1.2)	1.20 (1.1)	0.40 (0.6)	3.20 (3.4)
Female	7	0.43 (0.8)	0.43 (0.8)	0.57 (1.0)	1.00 (1.2)	2.43 (3.4)
Older 3s	14	1.14 (1.1)	1.21 (1.2)	1.21 (1.3)	1.29 (1.1)	4.86 (4.2)
Male	7	1.29 (1.3)	1.29 (1.4)	0.86 (1.2)	1.29 (1.3)	4.71 (4.8)
Female	7	1.00 (1.0)	1.14 (1.1)	1.57 (1.3)	1.29 (1.0)	5.00 (3.7)
Young 4s	14	1.36 (1.2)	1.36 (1.1)	1.64 (1.3)	1.71 (1.0)	6.07 (3.5)
Male	7	1.29 (1.4)	1.29 (1.0)	1.57 (1.5)	1.43 (1.3)	5.57 (4.5)
Female	7	1.43 (1.0)	1.43 (1.1)	1.71 (1.1)	2.00 (0.8)	6.57 (2.5)
Older 4s	14	1.79 (1.0)	1.71 (1.1)	2.00 (0.8)	2.36 (1.0)	7.86 (3.2)
Male	9	1.78 (1.1)	2.00 (1.1)	2.00 (1.0)	2.22 (1.1)	8.00 (3.7)
Female	5	1.80 (0.8)	1.20 (0.8)	2.00 (0.0)	2.60 (0.9)	7.60 (2.3)
Total	54	1.22 (1.1)	1.26 (1.1)	1.44 (1.2)	1.56 (1.2)	5.48 (3.9)

Age Group and Trial Type Differences

Mean scores from Table 12 were submitted to a two-way mixed ANOVA with Age Group (4: Middle 3s, Older 3s, Young 4s, Older 4s) as the between-groups variable and Trial Type (4: 2-Later, 3-Later, 4-Later, 5-Later) as the within-group variable. Results revealed a main effect of Age Group, $F(3, 50) = 4.70$, $p = .006$. Tukey post-hoc tests indicated that the Young 4s made marginally more future-oriented choices than the Middle 3s ($p = .096$) and that the Older 4s chose the future option significantly more often than did the Middle 3s ($p = .003$). The effect of Trial Type was also significant, $F(3, 150) = 2.99$, $p = .03$. Paired t-test comparisons ($p < .01$) revealed that children made significantly more future choices on the 5-Later trial than on the 2-Later trial, $t(53) = 2.82$, $p = .007$. Children also made marginally more future choices on the 5-Later trial than on the 3-Later trial, $t(53) = 2.31$, $p = .03$. However, the Age Group x Trial Type interaction was not significant, $F(9, 150) = 0.47$, $p = .89$ (Figure 3).

Trial Type means were also examined for a linear increase at each age with tests of within-subjects contrasts. The test for linearity was not statistically significant for the Middle 3s, $F(1, 11) = 1.52$, $p = .24$, for the Older 3s, $F(1, 13) = 1.43$, $p = .25$, and for the Young 4s, $F(1, 13) = 1.89$, $p = .19$. However, the test for linear increase was statistically significant for the Older 4s, $F(1, 13) = 5.52$, $p = .04$. Thus, only the oldest children showed a significant linear increase in their choice of the future option over reward trials.

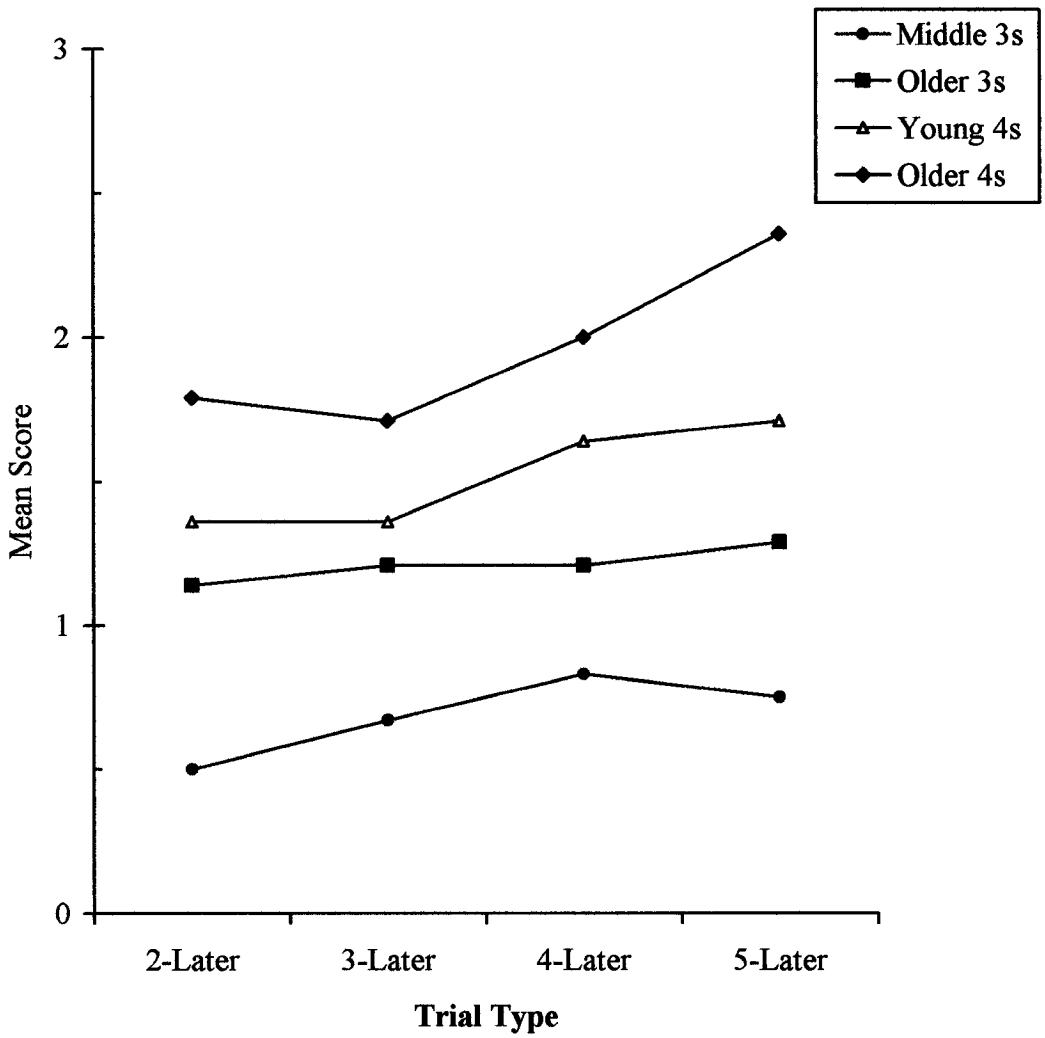


Figure 3. Performance across increasing reward trials for each Age Group.

Aggregate scores were then computed for the two lower (2-Later + 3-Later) and the two higher (4-Later + 5-Later) reward trials to test the prediction that 4-year-olds would show more future self-interest on higher reward trials than on lower reward trials, whereas 3-year-olds would make no distinction between varying reward values. Middle 3s scored a mean of 1.17 (1.7) on lower reward trials and 1.58 (1.8) on higher reward trials, a difference which is not statistically significant, $t(11) = -1.16$, $p = .27$. Older 3s scored a mean of 2.14 (2.0) on lower reward trials and 2.29 (1.8) on higher reward trials. This difference was not statistically significant, $t(13) = -0.52$, $p = .61$. Young 4s scored a mean of 2.71 (1.7) on lower reward trials and 3.36 (2.1) on higher reward trials. This difference was also not statistically significant, $t(13) = -1.61$, $p = .13$. Finally, Older 4s scored a mean of 3.50 (1.9) on lower reward trials and 4.36 (1.6) on higher reward trials. This difference was statistically significant, $t(13) = -2.48$, $p = .03$, indicating that Older 4s chose the future option more frequently on the higher reward trials than on the lower reward trials. This analysis confirms the test for linearity in that only the oldest children showed a significant increase in performance with increased reward values.

Chance Performance

For the total number of future choices where chance is 6 points, the Middle 3s performed significantly below chance, $t(11) = -3.46$, $p = .005$. Scores for the Older 3s and Young 4s were not statistically different from chance, $t(13) = -1.03$, $p = .32$, and $t(13) = -0.75$, $p = .94$, respectively. The Older 4s however scored significantly above chance, $t(13) = 2.18$, $p = .05$. To investigate further these differences, means on each of the four trial types (found in Table 8) were then tested against chance performance (1.5) for the Middle

3s and the Older 4s. On the 2-Later trial, the Middle 3s performed significantly below chance, $t(11) = -4.34$, $p = .001$, whereas the Older 4s did not perform at a level significantly different from chance, $t(13) = 1.10$, $p = .29$. For the 3-Later trial, again the Middle 3s performed significantly below chance, $t(11) = -2.93$, $p = .014$, whereas the Older 4s' performance was not significantly different from chance, $t(13) = 0.75$, $p = .47$. On the 4-Later trial, the Middle 3s performed significantly below chance, $t(11) = -2.24$, $p = .05$, whereas the Older 4s performed significantly above chance, $t(13) = 2.39$, $p = .033$. Similarly, on the 5-Later trial, the Middle 3s performed significantly below chance, $t(11) = -2.69$, $p = .021$, whereas the Older 4s performed significantly above chance, $t(13) = 3.18$, $p = .007$. In summary then, the youngest age group performed below chance on all trial types and the Older 3s and Young 4s performed at chance levels across trial types. Interestingly, the Older 4s performed at chance levels in the two lowest reward value trials, whereas they performed significantly above chance in the two higher reward value trials.

That the two middle age groups performed at chance levels does not necessarily indicate random performance. To understand better potential reasoning behind children's choices, the total number of stickers that children chose now and later was compared. A difference score, number of stickers chosen for Later - Now was calculated. The means for Now, Later, and Difference are presented in Table 13. The maximum number of immediate rewards was 12 and the maximum number of future rewards was 42; thus, the Difference scores ranged from -12 to 42.

Table 13

Means (SDs) for the Total Number of Stickers Chosen Now and Later in the Linear Increase Future-oriented Prudence Task at Each Age

		Number of Stickers Chosen		
Age Group	*n*	Now	Later	Difference
Middle 3s	12	9.3 (3.3)	10.1 (11.5)	0.8 (14.8)
Older 3s	14	7.1 (4.2)	17.2 (14.4)	10.1 (18.6)
Young 4s	14	5.9 (3.5)	21.9 (13.0)	16.0 (16.5)
Older 4s	14	4.1 (3.2)	28.5 (10.9)	24.4 (14.1)
Total	54	6.52 (3.9)	19.8 (13.9)	13.3 (17.8)

A mean difference score around 0 would indicate that children were trying to have approximately equal numbers of stickers in their books and envelopes. As children try to maximize future rewards, their mean difference scores would become increasingly positive. In contrast, as children try to maximize immediate rewards, their mean difference scores would become increasingly negative. Mean difference scores were tested for being

different from 0. Middle 3s performed no differently from zero, $t(11) = 0.20$, $p = .85$, whereas Older 3s performed marginally above zero, $t(13) = 2.03$, $p = .063$. Young 4s and Older 4s performed at a level greater than zero, $t(13) = 3.63$, $p = .003$, and $t(13) = 6.47$, $p < .001$, respectively. This analysis suggests that children in the two older age groups were consistently choosing with a strategy to maximize future rewards, whereas older 3-year-olds were just beginning to do so. Children in the youngest age group simply appear to be choosing some for now and some for later.

Future-oriented Prudence in Experiments 3A and 3B

To compare performance on the tasks from Experiments 3A and 3B, Pearson correlations between aggregate scores on the Linear Increase Future-oriented Prudence Task (3B) and means on the Future-oriented Prudence trials (3A) were calculated (see Table 14).

Table 14

Pearson Correlations between the Future-oriented Prudence Trials (3A) and the Linear Increase Future-oriented Prudence Choices (3B) at Each Age

		Experiment 3B Aggregate Variables		
Age Group (*n*)	Experiment 3A	2+3 Later	4+5 Later	Total
Middle 3s (11)				
	FoP	.75**	.41	.62*
Older 3s (13)				
	FoP	.56*	.57*	.56*
Young 4s (12)				
	FoP	.59*	.40	.51+
Older 4s (12)				
	FoP	-.03	-.18	.16

Note. $^{+} = p < .09$; $^{*} = p < .05$; $^{**} = p < .01$

None of the correlations was significant for the oldest age group. For all three younger age groups, the total number of future choices children made on the two lower reward trials correlated significantly with the number of future choices children made on the Future-oriented Prudence trials in Experiment 3A. Similar results appeared for the Older 3s on the aggregate of higher reward value trials. The total number of future choices in Experiment 3B correlated significantly with the total number of future choices in Experiment 3A for the two younger age groups, and this correlation was marginally significant for the Young 4s. Children who chose the future option more often in the Future-oriented Prudence trials in Experiment 3A also chose more future options in the Linear Increase Future-oriented Prudence task in Experiment 3B.

To further examine the relation between these two tasks, children were categorized according to their performance on the Simple Future and Future-oriented Prudence trials from Experiment 3A. Eighteen children scored above chance on both Future-oriented Prudence and Simple Future and were considered to have an advanced understanding of the present-future connection as measured by this task (labeled the *Advanced group*). Three children scored above chance on Future-oriented Prudence, but below chance on Simple Future, and were grouped as *Unclassified.* A further 18 children who scored below chance on Future-oriented Prudence and above chance on Simple Future were considered to have a simple understanding of the present-future connection and were categorized as the *Simple group.* Finally, nine children scored below chance on both future questions and were considered to have only a rudimentary grasp of how the future might influence the present as measured by the Sticker Choice Task. Children in this

group were categorized as *Basic*. Mean scores in Experiment 3B (lower reward aggregate, higher reward aggregate, and total number of future choices) are presented for each performance group in Table 15.

Table 15

Mean Aggregate Scores (SD) from Experiment 3B by Category of Performance in Experiment 3A

		Aggregate Variables from Experiment 3B		
Group	*n*	2+3 Later	4+5 Later	Total
Advanced	18	3.83 (1.8)	4.28 (1.6)	8.11 (3.1)
Unclassified	3	3.67 (1.5)	3.67 (1.5)	7.33 (2.3)
Simple	18	1.44 (1.6)	2.11 (2.2)	3.89 (4.1)
Basic	9	1.22 (1.3)	1.44 (1.6)	2.67 (2.8)
Total	45	2.36 (2.0)	2.84 (2.2)	5.33 (4.2)

The number of children in the *Unclassified* category was too small and thus this category was omitted from analyses. Mean scores on the variables from Table 15 were submitted to a one-way analysis of covariance with age in months as the covariate and Group (3) as the between-groups factor with Tukey HSD post-hoc comparisons (alpha level = .05). For the aggregate of lower reward trials (2+3 Later), age was not a significant covariate, $F(1, 41) = 0.44, p = .51$. There was a main effect of Group, $F(2, 41) = 5.16, p = .01$, with post-hoc comparisons revealing that children in the Advanced group chose the future option significantly more often than children in both the Simple and the Basic groups. For the aggregate of higher reward trials (4+5 Later), age was not a significant covariate, $F(1, 41) = 2.45, p = .13$. Again here, there was a main effect of Group, $F(2, 41) = 4.01, p = .03$, with post-hoc tests showing that the Advanced group chose the future option significantly more often than both the Basic and Simple groups. Similarly, for the mean total number of future choices, age was not a significant covariate, $F(1, 41) = 1.44, p = .24$. There was a main effect of Group, $F(2, 41) = 5.38, p = .008$, with post-hoc tests revealing that children in the Advanced group chose the future option significantly more often than children in both the Simple and the Basic groups.

3B Discussion

Results from this experiment indicate that the number of future choices children made increased with age, for both boys and girls. In particular, older 4-year-olds made significantly more future self-interested choices than did middle 3-year-olds. In addition, as a group children chose the future option more frequently in the 5-Later trial than in the 2-Later trial. However, only the oldest group of children showed a linear increase in

performance, and chose the future option more frequently on higher reward trials than on lower reward trials. When examining scoring-based chance performance, results revealed that the youngest children performed below chance on all trial types, that the two middle age groups performed at chance, whereas the oldest children performed at chance on the two lower reward value trials, but above chance on the two higher reward value trials. A reward number comparison indicated that the two younger age groups seemed to be choosing stickers for now and later equally, whereas the two older age groups seemed to be choosing significantly more stickers for later. Finally, a comparison of performance on the future choice tasks from Experiments 3A and 3B revealed no relation for the oldest children, but a positive correlation for the others. When categorized according to performance on the task from 3A, children with an advanced understanding that future desires can guide present decisions chose the future option more frequently than did children with simple and basic understandings of this present-future connection.

In the current experiment, as in the previous one, age in months correlated positively with the number of future choices children made for both boys and girls. In Experiments 1 and 2 of this thesis, there was a positive correlation with age for girls, but not for boys. One plausible explanation for the differing findings here is that the age range in earlier experiments was limited to 4½ years, whereas in the current experiment, children ranged up to the age of 5 years. When correlations between age and future choices were calculated for children in the three youngest age groups in the current experiment (ranging from 41-52 months of age), age in months did not correlate with delay behaviour in boys, $r(19) = .177$, $p = .47$, but did in the sample of girls, $r(21) = .455$, $p = .04$. In fact then, this

finding from Experiments 1 and 2 was replicated here in Experiment 3B. Thus, it would seem that between 3½ and 4½ years of age, a child's sex might be an important contributor to the development of future-oriented choice behaviour.

Because procedures used in this thesis were similar to those used by Thompson et al. (1997) and Moore et al. (1998) it is important that the findings here are line with those. Indeed, in the current experiment older 4-year-olds chose the future option more frequently than did middle 3-year-olds. This finding differs slightly from the results of Experiment 3A where Older 4s chose the future reward more often than both Middle and Older 3s. It also differs slightly from results reported by Thompson et al. (1997) who found that 4- and 5-year-olds delayed rewards more often than 3-year-olds. However, the findings in the current experiment generally support those previous findings. Moreover, the lack of age differences among Middle 3s, Older 3s, and Young 4s detected in this study also replicates the findings reported in the first three experiments and in Moore et al. (1998). No age group differences appeared for Future-oriented Prudence choices when performance for Middle 3s was compared to Young 4s in the first two experiments of this thesis. Moore et al. (1998) also found no differences among younger 3s, older 3s, and young 4s. These findings were replicated in the current experiment because no age significant differences appeared. From these results we can conclude that in a future-oriented decision-making task, even one that maximizes reward value differences, older 4-year-olds will outperform middle 3-year-olds, suggesting significant development over this time period.

As a group, children chose the future reward more often in the 5-Later choice than in the 2-Later choice. However, it was only the oldest children that showed not only a significant linear increase in task performance, but also significantly more future choices on higher reward trials than on lower reward trials. The hypothesis that both 4-year-old age groups would do so was partially supported, whereas the hypothesis that both 3-year-old age groups would not distinguish between varying reward value trials was fully supported. The patterns of chance performance reinforce these findings in some ways. First, the youngest children wanted their stickers now for the most part (below chance scoring-based performance), although from time to time they would choose future rewards. The oldest children on the other hand consistently chose the future rewards on the two higher reward trials. By also comparing the number of stickers children chose for both now and later, it was determined that all 4-year-olds behaved in a way to maximize future self-interests, whereas Older 3s were just beginning to choose in such a manner.

The scoring-based chance findings detected here are similar, although not exact, to those from Experiment 3A. In that experiment, on the Future-oriented Prudence trial offering one now versus two later, the Older 4s performed above chance, the Young 4s at chance, and both 3-year-old age groups performed below chance. The Future-oriented Prudence trial was administered together with four other trials, three of which offered children stickers immediately (Simple Present, No Future Benefit, and Future Cost). This setup may have encouraged the oldest children to choose the future option because their desire for immediate stickers was also satisfied periodically. With the younger children, the

three other immediate reward trials may have guided them into a "now" mindset wherein putting stickers in their books became the habitual action or choice.

Although the scoring-based chance performance of Young 4s did not improve in the current experiment over the previous one, one can conclude that Young 4s were choosing purposefully because the mean difference in the total number of stickers that they received later versus now was greater than zero. Maximizing future rewards with the arrow game board seems to have improved performance of Older 3s as well compared to the previous experiment in which their performance was below chance. Nevertheless, results from the current experiment also indicated that Young 4s, Older 3s, and Middle 3s performed similarly on the future choices in Experiments 3A and 3B. The oldest children however did not show a significant correlation between future-oriented prudence choices in these two experiments. One potential explanation for this finding is that the Older 4s may have been expecting more stickers in the future options in the Sticker Choice Task (Experiment 3A) because they remembered receiving several more stickers the first time an experimenter played a sticker game with them in the Linear Increase Future-oriented Prudence Task (Experiment 3B).

Another analysis showed that children who have a stronger understanding of the connection between future and present as measured in Experiment 3A outperformed children in other groups on their understanding of the present-future connection (linear increase) in Experiment 3B. In particular, it seems that children who performed above chance on the Future-oriented Prudence trials in 3A (the *Advanced group*), no matter their performance on Simple Future, chose the future option significantly more often in

Experiment 3B. These results provide evidence for task validity as well as reliability of future-oriented choices over a short time period (one to four weeks).

Results from this experiment shed light on developments at each age. As hypothesized, the Middle 3s did not make any significant distinction between trials with higher future rewards and those with lower future rewards. This age group also performed below chance on all trial types. Moreover, they scored significantly lower than Older 4s on this future-oriented prudence choice task. Even in a design that maximizes a future value then, 3½-year-olds will continue to favour present concerns. The arguments made in earlier experiments can also be applied to the interpretation of these findings. First, middle 3-year-olds do not have the ability to weigh future and present considerations because they have difficulty comparing and contrasting conflicting temporal states. Moreover, children at this age do not have an understanding that a future state can be used as a guide to present decisions because their sense of self as temporally extended, with corresponding developments in the episodic neurocognitive system, seem to be immature.

The Older 3s did not perform differently from chance in this experiment, nor did they show a significant linear increase in performance over reward trials, although they did show a trend toward maximizing future self-interest. The Older 3s went from below chance performance in Experiment 3A to better performance in the current experiment, which may suggest a shift in preference from immediate rewards to no strict preference for immediate rewards or a tendency toward preferring the larger future rewards. In fact, the number of future choices made by the Older 3s did not differ significantly from that of the

Older 4s. Together these results suggest that the understanding of the connection between future and present is still developing around the fourth birthday.

The Young 4s performed in a manner that suggests purposeful choosing to maximize benefits (they chose their stickers in such a way as to have more future rewards than immediate rewards). However, they did not show a significant linear increase in performance over reward trials. Young 4s made marginally more future choices than the Middle 3s and just as many future choices than the Older 4s. Together these results suggest that the understanding of the present-future connection is not at a level equivalent to Older 4s, and thus is still developing beyond the fourth birthday.

Finally, as hypothesized, Older 4s distinguished among varying levels of future rewards, showing a linear increase in performance. Moreover, they were the only age group to choose significantly more future choices in higher reward trials than in lower reward trials and score above chance on the 4-Later and 5-Later choices. Overall, they chose in a way to maximize benefits. This pattern of prudential behaviour is clear evidence for older 4-year-olds' future self-interest, and thus of their knowledge that future desires can guide present decisions.

In summary then, with this Linear Increase Future-oriented Prudence Task, Older 4s clearly demonstrated an understanding that future desires can guide present decisions. They chose the future option more frequently than Middle 3s; they were the only age group to show a linear increase in performance and to choose the future option more often on trials with higher reward values than on those with lower reward values. Young 4s showed some evidence of understanding the present-future connection with marginally

more future reward choices than the youngest children and purposeful choosing in the task to maximize future self-interest. Older 3s performed similarly to Young 4s, but did not show as much evidence of future self-interest as the Young 4s. The youngest children chose the immediate reward significantly more often than the Older 4s, did not show a linear increase in performance or differentiation of higher and lower reward values, and performed below chance on all trial types. Middle 3s then demonstrated little understanding that future desires can guide present decisions even with the larger discrepancies between present and future reward values apparent in this method.

CHAPTER 5: EXPERIMENT 3C

The purpose for the final section of this experiment was to develop a novel task designed to measure children's understanding of the connection between the present and the future. Previous research on future-oriented thinking has concentrated on children's ability to initiate a plan for some future event, either novel or familiar (e.g., Hudson et al., 1995; Atance & O'Neill, 2001b). However, these types of task do not explicitly require the child to have a representation of the relationship between present and future because children may have relied on general knowledge, previous experience, or chance to plan in those tasks. The future state or goal was presented to the children and they were asked how to achieve it. Because that future state did not seem to be part of a distinct future, clearly separate from the present, we cannot conclude that children would need to understand the present-future relation at all to plan in those tasks.

It was reasoned that in order to assess children's understanding of the present-future connection, a new task needed to be developed. A future thinking task was necessary that required children to take into account a future circumstance, different from the current state, and choose an appropriate present action to best suit the impending future state. Objects which undergo a process of growth or decay in a relatively short time span were thought to be appropriate for demonstrating a change of state from present to future. A small gel capsule containing a piece of sponge was chosen for this experiment because the sponge seemed to grow incredibly in less than a minute when immersed in warm water. As a control, an object that did not grow when immersed in water was also required. A small plastic toy character was chosen. Before exposure to water, the two

objects are approximately the same size, whereas after exposure to water, the sponge object becomes larger than the plastic object.

In the task designed for this study, the experimenter first demonstrated that when immersed in water, an object made of sponge expanded whereas an object made of plastic did not. Children were then told a story in which they were required to compare the present and future circumstances of two story characters (one made of sponge and one made of plastic). These two friends were planning for a day at the beach. First they would be going swimming and then they would be building some sandcastles and playing on the beach. Before leaving, each friend needs to choose a hat to wear and a towel to use on the beach after swimming. Children are given a choice between large and small hats and towels for each character. In order to answer correctly, the child must consider the future circumstance of the sponge friend (being larger than the plastic friend) not the current circumstance (being approximately the same size as the plastic friend) and recognize that choosing the larger hat and larger towel will be needed later. The future circumstance for the plastic friend will be the same as the present circumstance (being small) for which the small hat and small towel should be chosen.

Children who understand the connection between future and present states ideally should be able to answer all questions correctly, but in particular the question about the sponge friend's hat. This question was considered to be the critical test of children's ability to take the future into account because a large hat would be ineffective for a small character (blocking vision) and a small hat would be ineffective for a large character (no protection from the sun), whereas a large towel could be useful for a small character and a

small towel could potentially still be beneficial to a large character. Children who answer correctly about the plastic character only cannot necessarily represent the link between future and present states because the plastic character does not undergo any change. The present and future states are equivalent. Performance on this task was compared with performance on the Linear Increase Future-oriented Prudence Task from Experiment 3B. Compared to children who did not pass, children who passed the question about the sponge character's hat were expected to choose the future reward more frequently.

Method

Participants

The same children who participated in Experiment 3B also completed this task during the same visit. There were 12 Middle three-year-olds, 14 Older three-year-olds, 14 Young four-year-olds and 14 Older four-year-olds.

Procedure

Children were told that they would be hearing a story and were tested in a quiet area of the centre. First, the experimenter showed the child a piece of sponge (contained in a flexible capsule) and a plastic figurine that were approximately the same size. She then demonstrated that when immersed in water, something made of sponge expands whereas something made of plastic does not. Then children were told a story in which two friends (one made of sponge and one made of plastic) were going to the beach to swim and build sandcastles. First the friends would go swimming and then they would build some sandcastles. Children were told that before the characters left home, they needed to pack a hat and a towel to use on the beach after swimming. Children were shown a pair of hats

(one large and one small) and a pair of towels (one large and one small) that they chose for the sponge character. The test questions were "Which hat will [name of sponge character] bring to wear on the beach after swimming?" and "Which towel will [name of sponge character] bring to use after swimming?" Then they were shown another pair of hats and towels to choose for the plastic character. The test questions were "Which hat will [name of plastic character] bring to wear on the beach after swimming?" and "Which towel will [name of plastic character] bring to use after swimming?"

For the story order, questions about the sponge character could either come before or after questions about the plastic character. In addition, the order of item could have been Hat first (small/large or large/small) or Towel first (small/large or large/small). If the first item choice was small then the second item choice was large and vice versa.

Scoring. Children received one point each for choosing the large hat and large towel for the sponge character. One point each was awarded for choosing the smaller hat and towel for the plastic character. In addition, at the end of the story children were asked why they chose the particular sized hat for each character although results are not presented here due to a limited number of related responses.

3C Results

Performance on the Expanding Sponge Story Task is presented in Table 16. An experimenter error, in which the plastic figurine was substantially larger than the sponge capsule, occurred in almost half of the cases for the two 3-year-old age groups (five children in the Middle 3s and seven children in the Older 3s).

Table 16

Frequency of Correct Responses on Expanding Sponge Story Task (3C) for Each Age Group

		Story Question			
Age Group	*n*	Sponge Hat	Sponge Towel	Plastic Hat	Plastic Towel
Middle 3s	7	3	4	4	4
Older 3s	7	4	4	2	3
Young 4s	10	8	5	8	5
Older 4s	14	6	11	5	10
Total	38	21	24	19	22

Relation with Age

Children's performance on each question was correlated with age (in months). Spearman correlations revealed no positive associations with age for any of the questions: Sponge Hat, $r(38) = -.01$, $p = .95$; Sponge Towel, $r(38) = .23$, $p = .17$; Plastic Hat, $r(38) = -.048$, $p = .77$; Plastic Towel, $r(38) = .224$, $p = .18$. It is clear from Table 16 that the oldest children were able to answer the Towel questions quite easily (79% for sponge and 71% for plastic). The Young 4s on the other hand were able to answer the Hat questions quite easily (80% for both characters).

Given the experimenter error and the similarity in performance, 3-year-olds were grouped together ($n = 14$) in subsequent analyses. Thus, 7/14 (50%) three-year-olds passed the Sponge Hat question, 8/14 (57%) passed the Sponge Towel question, 6/14 (43%) passed the Plastic Hat question, and 7/14 (50%) passed the Plastic Towel question.

Chance Performance

Children's performance on each question in this task was compared to chance (0.5). As a group, the 3-year-olds did not perform significantly different from chance on all questions: Sponge Hat, $t(13) = 0.0$, $p = 1.0$; Sponge Towel, $t(13) = 0.52$, $p = .61$; Plastic Hat, $t(13) = -0.52$, $p = .61$; Plastic Towel, $t(13) = 0.0$, $p = 1.0$. The Young 4s performed significantly above chance on the two hat questions, but did not perform significantly different from chance on the two towel questions: Sponge Hat, $t(9) = 2.25$, $p = .05$; Sponge Towel, $t(9) = 0.52$, $p = .61$; Plastic Hat, $t(9) = 2.25$, $p = .05$; Plastic Towel, $t(9) = 0.0$, $p = 1.0$. The Older 4s did not perform significantly different from chance on the two hat questions as well as the plastic towel question: Sponge Hat, $t(13) = -0.52$, $p = .61$;

Plastic Hat, $t(13) = -1.08$, $p = .30$; Plastic Towel, $t(13) = 1.71$, $p = .11$. The Older 4s however did perform significantly greater than chance on the Sponge Towel question, $t(13) = 2.51$, $p = .03$.

Relation with the Linear Increase Future-oriented Prudence Task

First, Spearman correlations among choices on the Linear Increase Future-oriented Prudence Task and the Expanding Sponge Story Task were calculated and are presented in Table 17. Given the lack of variability in Young 4s performance (80% answered correctly and only 20% answered incorrectly), they were omitted from the analysis.

None of the correlations was significant for older 4-year-olds. However, for the 3-year-olds, the Sponge Hat response correlated significantly with the total number of future choices. Thus, children who answered correctly to the critical story question also chose more stickers for the future in the prudence task and children who were answering incorrectly chose more immediate rewards.

Table 17

Spearman Correlations among Expanding Sponge Story Questions and Linear Increase Future-oriented Prudence Task Aggregates (3B) for Each Age Group

	Aggregate Scores		
Story Questions	2+3 Later	4+5 Later	Total Later
All 3s (n = 14)			
Sponge Hat	.713**	.456	.606*
Sponge Towel	.370	.240	.278
Plastic Hat	.185	.055	.056
Plastic Towel	.274	.146	.165
Older 4s (n = 14)			
Sponge Hat	.291	.384	.381
Sponge Towel	-.066	.301	-.022
Plastic Hat	.169	.337	.244
Plastic Towel	-.199	.210	-.179

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

Performance on the Sponge Hat question was then used as a way of categorizing children because this question was the crucial test of children's ability to think into the future (i.e., a small hat would be useless for a large character and a large hat would be useless for a small character, whereas a small towel could still be of some use to a large character and a large towel could certainly be useful for a small character). A series of independent *t*-tests was run for 3-year-olds ($n = 14$) and older 4-year-olds ($n = 14$) on performance measures for the Linear Increase Future-oriented Prudence Task (means are presented in Table 18). Again here, Young 4s were not included in analyses because of unequal *n*'s, although their mean scores are reported.

For the 3-year-olds, children who answered the Sponge Hat question correctly chose the future option significantly more often than children who answered incorrectly in the lower reward trials, $t(12) = 3.33$, $p = .006$, and overall, $t(12) = 2.59$, $p = .02$. The comparison for the higher reward trials was marginal, $t(12) = 2.59$, $p = .09$, but in the same direction as the other findings. For oldest children on the other hand, those who answered the Sponge Hat question correctly chose the future option no more often than those who answered incorrectly on lower reward trials, $t(12) = 0.86$, $p = .41$, on higher reward trials, $t(22) = 0.29$, $p = .78$, or overall, $t(22) = 0.64$, $p = .54$.

Table 18

Mean Aggregate Scores (SD) on the Linear Increase Future-oriented Prudence Task (3B) by Sponge Hat Performance (3C) for Each Age Group

		Aggregate Scores		
Answer	*n*	2+3 Later	4+5 Later	Total Later
All 3s	14			
Correct	7	2.57 (1.6)	2.86 (1.8)	5.43 (3.3)
Incorrect	7	0.43 (0.5)	1.14 (1.7)	1.57 (2.2)
Young 4s	10			
Correct	8	2.88 (1.7)	3.50 (2.3)	6.38 (3.7)
Incorrect	2	3.00 (2.8)	2.50 (3.5)	5.50 (6.4)
Older 4s	14			
Correct	6	4.00 (2.3)	4.50 (2.3)	8.50 (4.5)
Incorrect	8	3.13 (1.6)	4.25 (0.9)	7.38 (2.0)

3C Discussion

The task used in this experiment was developed as a novel way of measuring children's ability to demonstrate their understanding that future desires can guide present decisions. However, age was not related to performance in this task as it has been in other tasks like those measuring future-oriented prudence and the episodic neurocognitive system. However, results revealed that 3-year-olds seem to use the same reasoning in the prudence task as in the story task, whereas older 4-year-olds do not.

It is somewhat surprising that no relation with age was found for the story task because the reasoning required for this task was thought to be similar to that required for making future self-interested choices, which was related to the episodic neurocognitive system in older children in Experiment 2. However, this lack of an age relation may be explained by the small number of participants available as well as the exploratory nature of this task (i.e., 3-year-olds performed at chance on all questions and 4-year-olds performed at chance on half the questions).

Correlation analyses indicated that the older children do not use the same type of reasoning on the Expanding Sponge Story task as they do on the Linear Increase Future-oriented Prudence task, whereas 3-year-olds appear to do so. In particular, 3-year-olds who answered the critical Sponge Hat question correctly made more future-oriented prudential choices than did children who answered incorrectly. It may be possible then that for younger children, the story task is tapping into temporal awareness of self and other, or more likely, that the future-oriented prudence task is tapping a cognitive ability involved in the expression of future self-interest: the ability to imagine conflicting current

and noncurrent mental states (Barresi & Moore, 1986; Thompson et al., 1997) or the ability to pre-experience an event (Atance & O'Neill, 2001a, 2001b) characteristic of a temporally extended self. This result fits with Barresi's (2001) developmental account of an extended future self in that young 3s have acquired the ability to imagine mental states that conflict with a current mental state and older 3s can use this ability to form a sense of self that extends into the future.

However, if one argues that the story task is measuring the ability to empathize with another person's future, then it is surprising that 4-year-olds' performance on the two tasks was not correlated. This would seem to go against Barresi's (2001) idea that once an abstract theory of self (and mind) is acquired at around age 4, children can imagine the future of another person. Of course, it is entirely possible that older children did not think of the story characters as other *persons* and that is why the two tasks were not related. Another possibility is that for the 4-year-olds, other personality and social characteristics come into play when they make choices in future-oriented prudence tasks whereas these characteristics are not involved in reasoning on an impersonal task such as the expanding sponge story.

One potential problem with the story task is highlighted by children's chance performance. It appears that 3-year-olds may have been performing randomly on all questions. However, given that children who answered the Sponge Hat question correctly performed better in the prudence task than children who answered incorrectly, evidence against this interpretation is provided. Performance on the questions about the plastic character may have been random though. In addition, the Young 4s seemed to be

performing randomly on the two towel questions and the Older 4s seemed to be performing randomly on the two hat questions. It may be then that this story task was too complicated for children of a preschool age. That is, the older children could keep two conflicting ideas in mind (e.g., hats for each character), but experience difficulty with keeping four relations in mind. Another possibility is that the story task required children to inhibit responding with the known current state (both characters are small). Children who could not inhibit would perform better on the plastic questions than the sponge questions. That did not seem to be the case at any age though when one examines the frequency of correct responses at each age.

Additionally, it may have been better to ask children the question whether the story characters changed in size after the swimming activity (before the test questions) to ensure that they understood that the sponge character was larger in size compared to earlier, while the plastic character remained the same size as before. As this represents the first attempt to measure children's future thinking with this kind of measure, conducting more research in this area with larger age ranges would prove informative.

GENERAL DISCUSSION

The goal of this thesis was to examine the development of preschool children's future self-interest as a way of gauging their understanding that present decisions may be influenced by future concerns. This was accomplished by examining how future self-interest relates to an understanding that the past can also influence the present and by exploring novel methods of measuring both future self-interest and reasoning about the connection between future and present. Findings from the first experiment revealed no significant increase in the expression of future self-interest from 3½ to 4 years of age, although both future self-interest and past self-awareness at 3½ predicted children's future self-interest at age 4. In Experiment 2, future-oriented prudence increased with age over the young 3 to mid 4 age period. Future self-interest was related to measures of the personal past in the early 4 age range. In both Experiments 3A and 3B, the frequency with which children chose the future reward increased with age.

Although no mean performance differences appeared between boys and girls, patterns of development seemed to differ for each sex. Future-oriented prudential behaviour remained consistent over time for girls in the first experiment, and the relation between prudence and past self-recognition at 3½ was restricted to females. In the second experiment, future self-interest increased with age for the entire sample, but this was true for girls in particular. This same result appeared in 3B, but no differential development was detected in 3A.

Several new choices to compare with the standard future-oriented prudence trial were introduced in Experiments 2 and 3. In the second experiment, a less complex choice

about only the future was less difficult for the middle 3-year-olds and younger 4-year-olds than was the regular prudence trial. This same choice about only the future was less difficult for the 3-year-olds than was the regular prudence trial in Experiment 3A. However, this difference was not detected for the 4-year-olds who performed equally well on these two trials. Finally, compared to the standard prudence trial, children of all ages chose the future option less frequently on trials in which the future reward was of equal or lesser value than the present reward. In Experiment 3B, children of all ages chose the future reward more frequently on the largest reward trial than on the smallest reward trial. In particular, the older 4-year-olds showed a linear increase in their future choices over the reward trials from lowest to highest. Finally, 3-year-olds' better performance on the future reasoning task (3C) was related to the choice of more future rewards in the Linear Increase Future-oriented Prudence task from Experiment 3B.

Age, Sex, and Future-oriented Prudence

Previous research about changes in future self-interest is inconsistent. Many authors have found no age differences during the preschool period (Montgomery, 1976; Moore et al., 1998; Schwarz et al., 1983), whereas two studies have reported age effects (Thompson et al., 1997; Toner et al., 1977). Moreover, dissimilar future self-interested behaviour has been observed in boys and girls, such that future choice was positively correlated with age in boys, but not girls (Toner et al., 1977). Although one study reported that boys delay less often than girls (Logue & Chavarro, 1992), many authors who tested for sex differences did not report dissimilarities in delay choice (Montgomery, 1976; Nisan & Koriat, 1977; Schwarz et al., 1983).

Consistent with most previous work in the area then, sex differences were not detected for children's mean performance scores on future-oriented prudence in the experiments reported here. However, different patterns of development with age did appear for boys and girls. First, as discovered in Experiment 1, the consistency with which children make future-oriented choices may be different for each sex. From 3 ½ to 4 years of age, girls' behaviour remained stable whereas boys' behaviour did not. These results seem to indicate that the degree of future self-interest girls possess at 3½ years of age remains the same at age 4 whereas boys' future self-interest is changing from 3½ to 4 years of age. For boys then, this six-month period may be a time of radical development, and their future self-interested behaviour may become more stable after their fourth birthdays. In Experiment 2 with children aged 3;1-4;7, a positive association between future-oriented prudence and age was detected for girls, but not for boys, opposite to Toner et al. (1977). However, this association was true of both boys and girls in Experiments 3A and 3B, likely due to the increased age range. To fully answer questions about the differential development of future-oriented prudence in boys and girls though, studies explicitly designed to examine patterns for each sex should be undertaken.

Certain age differences were found in the third experiment as well, consistent with Thompson et al. (1997). Older 4s chose the future option more frequently than both the Older 3s and the Middle 3s in Experiment 3A. In Experiment 3B though, Older 4s chose the future option more frequently than only the Middle 3s. Despite this discrepancy, it seems apparent that in a multiple trial future-oriented choice task, children near the age of five will outperform 3-year-olds. In general, correlational evidence points to an increase in

future self-interest over the 3- to 5-year age range. Younger 3-year-olds' future self-interest, and hence their understanding that future concerns can dictate certain current actions, is not well developed. In addition, with no increase in future choices over the 6-month period from 3½ to 4, it appears that prudential behaviour does not become more future-oriented until after children celebrate their fourth birthdays. Indeed, during the Older 4 age period a significant increase in future self-interested behaviour seems to occur. Their pattern of prudential behaviour indicates a strong connection with a future self.

Future-oriented Prudence, the Episodic Neurocognitive System, and the Temporally Extended Self

Evidence from the first two experiments in this thesis suggests that children's understanding of the connection between the present and both the past and the future develops simultaneously around 4 years of age. This ability to represent current and noncurrent states and consider the connection between them is thought to be related to autonoetic consciousness (as part of the episodic neurocognitive system) which enables children to re-experience previous events and to pre-experience future events. Children also become able to experience both current and noncurrent self states from a subjective standpoint. Current self states must also be represented from an objective standpoint at the same time so that the current state can be recognized as merely one state in a continuing series of self states. Only when both current and noncurrent states of self can be represented in the same way will the child be able to achieve Nagel's (1970) idea of temporal neutrality, a primary characteristic of persons possessing a temporally extended sense of self.

Children's degree of temporal neutrality was investigated in Experiment 3A, that is, whether children place greater emphasis on present than on future concerns or whether present concerns hold no more importance in decision-making than do future concerns. Three-year-olds appeared to understand the present-future connection given their relatively high scores on Simple Future choices. However, children at this age also demonstrated that present concerns superseded any future considerations in choices with a temporal conflict. Moreover, in a strictly reward value conflict focusing on the future, it is probable that these young children used a present standpoint. It seems probable that the notion of "future" does not hold a strong enough place within the present self to be considered worthwhile and thus the present self remains the most important at this age.

Young 4-year-olds were expected to have a fledgling awareness of the connection between future and present, but still not be able to function from a standpoint of temporal neutrality. Children did not perform similarly on Simple Future, Simple Present and Future-oriented Prudence choices, although they performed equally well on Simple Future and Future-oriented Prudence. This provides evidence for their understanding that the future is an important consideration in decision-making. Children at this age seem to differentiate present and future concerns. Furthermore, the difference between Future-oriented Prudence and No Future Benefit choices (one reward either now or later) was not significant. This result is interesting because it indicates that children were willing to have a sticker later, rather than having one now, as often as they were willing to have two stickers later in the Future-oriented Prudence trial. Thus, despite the fact there is no future benefit in delaying the reward the Young 4s will still delay. It appears that children in this

age group treat either option as equal, which may suggest that Young 4s have come to equate the present and future. However, these children also performed equally on Future Cost trials as Future-oriented Prudence and No Future Benefit choices. Children were thus choosing a future reward at a cost to their present self-interest. Young 4-year-olds then appear to recognize that decisions based on future concerns can be as important as decisions based on present concerns. However, given the lack of delaying in the Future-oriented Prudence trials, it is not likely that Young 4s possess a firm sense of the self as temporally extended, and thus cannot be operating from a temporally neutral stance.

Older 4s are demonstrating clear evidence of understanding the present-future connection given the more frequent delaying on Future-oriented Prudence than Future Cost choices and the negative correlation between the two choices. At this age, children can simultaneously weigh present and future interests. However, one may conclude that Older 4s do not yet truly function from a temporally neutral standpoint (similar to 5½-year-olds in Montgomery, 1976) because they did not choose the future reward significantly more often on No Future Benefit trials than on Future Cost trials. With an indifference to temporal aspects of self, one would have expected children to choose the future reward more often on Future-oriented Prudence trials than the other two trials, and more often on No Future Benefit trials than on Future Cost trials. It may be then that temporal neutrality emerges sometime after 5½ years of age. It is also possible that the idea of temporal neutrality is not a pragmatic one in that as an adult, if I were given the opportunity to have something I valued either now or later, I would also choose to take that something now.

Preschoolers' ability to understand that a future goal or condition may guide current decisions may be related to general cognitive improvements that occur between 3 and 5 years of age. For example, the ability to engage in causal reasoning develops between 3 and 4 years (Das Gupta & Bryant, 1989). In particular, older 3-year-olds are able to generalize from training in causal reasoning whereas younger 3s are not (Brooks, Hanauer, & Frye, 2000). These studies would seem to suggest that causal reasoning is relatively sophisticated by the time a child reaches 4 years of age (cf. Mitchell & Riggs, 2000). In the future-oriented prudence task then preschoolers who are able to reason, "If I take one now then I do not get two later" or "If I want two later then I cannot have one now" are able to compare the present and future rewards and thus make the prudent decision. On the other hand, younger preschoolers, without a well-developed causal reasoning ability, would be unable to compare present and future rewards and thus would opt for the now rewards.

In addition, children's understanding of the causal arrow of time (Povinelli, 2001) has been suggested as an explanation for younger 3-year-olds' difficulty with delayed self-recognition and realizing that the more recent of two events is the critical influence on the present. Another investigation of children's understanding of time (Friedman, 2003), shows that by 4 to 4.5 years of age children are able to distinguish between possible and impossible temporal sequences or events (e.g., liquid flowing from a cup back into a jug is impossible whereas wooden blocks dropping onto a surface is possible). Indeed, the advancements that children show in future self-interest over the 3½ to 5 year age period

may be related to children's causal spatial-temporal reasoning, an ability which Welch-Ross (2001) proposed was important to the development of an autobiographical self.

Measuring Future-oriented Behaviour

With the discrepant age findings in the literature on delay of gratification, more tasks that properly assess preschoolers' future self-interest need to be explored. Results from the Linear Increase task can be seen as suggesting that increasing the motivational value of the future reward can improve children's performance, particularly those in the transitional age range from 3½ to 4½. By comparing performance on the Future-oriented Prudence trial in 3A to the 5-Later trial in 3B, we see that the youngest and oldest children performed similarly, whereas the Older 3s and Young 4s seem to show an increase in future-oriented prudence (from means of 0.62 to 1.29 and 1.25 to 1.71, for A and B respectively). Results from this task indicate that younger children's difficulty with delay of gratification choice types is not due to impulse control problems. Rather, taking into account the motivational strength of the future reward seems to be a more important consideration.

An important direction for research in this area involves reducing the direct conflict in the future-oriented prudence task to test whether older and younger 3-year-olds can show any understanding of the present-future connection. That is, perhaps younger children would be able to demonstrate future-oriented self-interest in a design that does not require them to relinquish a current reward in its entirety for the sake of future benefits. This could be tested in a double-reward design in which children would choose between two options of immediate stickers that also results in a certain number of future

stickers. Each choice would therefore involve receiving stickers both now and at the end of the game. In this design, researchers should be able to determine whether children focus on present desires or on future desires when making a decision that directly affects self. Perhaps knowing that they will receive something now will give them an opportunity to demonstrate that they can behave with future self-interest.

The Future-oriented Prudence choice would be 2 stickers now and 1 sticker later versus 1 sticker now and 3 stickers later. If children identify with future desires, then they should choose 3 stickers for later, but if children identify with present desires, then they should choose 2 stickers now. The important component of this question is that children still receive at least one sticker now no matter what they choose. Moreover, the Simple Future question used in this thesis did not clearly measure the connection between future and present because the conflict between present and future was removed. Thus, children may have based their responses on a present desire rather than a future desire. By using the double-reward design, the interpretation of the Simple Future choice may be clarified. A child would be offered 1 sticker now and 2 stickers later or 1 sticker now and 1 sticker later. Children who understand the present-future connection will perform above chance on this trial whereas children who act on only present desires will perform at chance.
It may also be possible to develop a planning type of task to assess future self-interest that focuses on the representation of the connection between future and present, but does not impose a direct conflict between present and future as in the future-oriented prudence trial. As was evident from the No Future Benefit trial in Experiment 3B, when current and future desires are equal, the current desire is usually fulfilled. However, in the case where

no current action is as desirable as a future outcome, then behaviour may also be classified as future-oriented. In other words, some action must be taken now that would not otherwise be taken, if there were not some future desire or goal reigning behaviour. This is different from the Simple Future trial used in Experiments 2 and 3A which was designed to eliminate the present-future conflicting desires.

What is being suggesting here then is that the current action is not something that would be expected or desired. Indeed it may be something to avoid. For example, I normally would not dust the house, preferring to do laundry. However, friends of the family may be dropping by tomorrow, so I do the dusting instead of the laundry. A similar situation may exist in which there are two current courses of action that could be taken that do not conflict directly with a future desire, goal, or probable circumstance. However, only one course of action can be pursued and only one action will benefit you in the future. For example, both dishes and laundry need to be done by someone who is expecting company for dinner later that day. That person has at least *some* clean clothing, but almost no clean cutlery and plates. Here, the prudent course of action would be to wash the dishes.

Future research should also involve more longitudinal work and include not only experimental evidence, but also information from child interviews and parental questionnaires about their child's future self-interest, or the understanding that future perspectives can guide present decisions. There are of course many other directions one can pursue, such as the cognitive underpinnings and social influences on children's developing ability to show interest in their future that makes it a fruitful area of research.

Experiments in this thesis have contributed to our understanding of preschool children's appreciation that future perspectives can affect present decisions. There appears to be no great increase in future self-interest until about 4 years of age when children become aware that the future is connected to the present. This understanding that a future state can dictate a present course of action strengthens substantially over the preschool period so that near the end of the fifth year of life, children begin to show a more adult-like appreciation of the connection between the future and the present.

REFERENCES

Amsterdam, B. (1972). Mirror self-image reactions before age two. *Developmental Psychobiology, 5*, 297-305.

Atance, C. M., & O'Neill, D. K. (2001a). Episodic future thinking. *Trends in Cognitve Sciences, 5*, 533-539.

Atance, C. M., & O'Neill, D. K. (2001b). Planning in 3-year-olds: A reflection of the future self? In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 121-140). Mahwah, NJ: Lawrence Erlbaum Associates.

Barresi, J. (2001). Extending self-consciousness into the future. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 141-161). Mahwah, NJ: Lawrence Erlbaum Associates.

Barresi, J., & Moore, C. (1996). Intentional relations and social understanding. *Behavioral and Brain Sciences, 19*, 107-122.

Bauer, P. J., & Mandler J. M. (1989). One thing follows another: Effects of temporal structure on 1- to 2-year-olds' recall of events. *Developmental Psychology, 25,* 197-206.

Bauer, P. J., & Mandler J. M. (1992). Putting the horse before the cart: The use of temporal order in recall of events by one-year-old children. *Developmental Psychology, 28,* 441-452.

Benson, J. B. (1994). The origins of future-orientation in the everyday lives of 9- to 36-month-old infants. In M. M. Haith, J. B. Benson, R. R. Roberts, & B. F. Pennington (Eds.), *The development of future-oriented processes* (pp. 375-407). Chicago: University of Chicago Press.

Benson, J. B. (1997). The development of planning: It's about time. In S. L. Friedman & E. Kofsky Scholnick (Eds.), *The developmental psychology of planning: Why, how, and when do we plan?* (pp. 43-75). Mahwah, NJ: Lawrence Erlbaum Associates.

Bjorklund, D. F. (1995). *Children's thinking: Developmental function and individual differences*. New York, NY: Brooks/Cole.

Brooks, P. J., Hanauer, J. B., & Frye, D. (2001). Training 3-year-olds in rule-based causal reasoning. *British Journal of Developmental Psychology, 19*, 573-595.

Brown, A. L. (1975). Progressive elaboration and memory for order in children. *Journal of Experimental Child Psychology, 19*, 382-400.

Carlson, S. M., Moses, L. J., & Hix, H. R. (1998). The role of inhibitory processes in young children's difficulties with deception and false belief. *Child Development, 69*, 672-691.

Das Gupta, P., & Bryant, P. E. (1989). Young children's causal inferences. *Child Development, 60*, 1138-1146.

Farnham-Diggory, S. (1966). Self, future, and time. *Monographs of the Society for Research in Child Development, 31* (1, Serial No. 103).

Fivush, R. (1991). The social construction of personal narratives. *Merrill-Palmer Quarterly, 37*, 59-82.

Fivush, R. (2001). Owning experience: Developing subjective perspective in autobiographical narratives. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 35-52). Mahwah, NJ: Lawrence Erlbaum Associates.

Fivush, R., & Hudson, J. A. (1990). *Knowing and remembering in young children*. New York, NY: Cambridge University Press.

Friedman, W. J. (2003). Arrows of time in early childhood. *Child Development, 74*, 155-167.

Gee, J. (1985). An interpretive approach to the study of modality: What child language can tell the linguist. *Studies in Language, 9*, 197-229.

Guardo, C. J., & Bohan, J. B. (1971). Development of a sense of self-identity in children. *Child Development, 62*, 98-110.

Haden, C., Haine, R., & Fivush, R. (1997). Developing narrative structure in parent-child conversations about the past. *Developmental Psychology, 33*, 295-307.

Hart, D., Fegley, S., & Brengelman, D. (1993). Perceptions of past, present and future selves among children and adolescents. *British Journal of Developmental Psychology, 11*, 265-282.

Hart, D., Maloney, J., & Damon, W. (1987). The meaning and development of identity. In T. Honess & K. Yardley (Eds.), *Self and identity: Perspectives across the lifespan* (pp. 121-133). Boston: Routledge & Kegan Paul.

Howe, M. L., & Courage, M. L. (1993). On resolving the enigma of infantile amnesia. *Psychological Bulletin, 113*, 305-326.

Howe, M. L., & Courage, M. L. (1997). The emergence and early development of autobiographical memory. *Psychological Review, 104*, 499-523.

Hudson, J. (2001). The anticipated self: Mother-child talk about future events. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 53-74). Mahwah, NJ: Lawrence Erlbaum Associates.

Hudson, J., & Fivush, R. (1991). Planning in the preschool years: The emergence of plans from general event knowledge. *Cognitive Development, 6*, 393-415.

Hudson, J., Shapiro, L., & Sosa, B. (1995). Planning in the real world: Preschool children's scripts and plans for familiar events. *Child Development, 66*, 984-998.

Inouye, A., Sato, S., & Sato, Y. (1979). Developmental study in delayed preference behavior. *The Japanese Journal of Psychology, 50*, 82-88.

Klein, S B., Loftus, J., & Kihlstrom. (2002). Memory and temporal experience: The effects of episodic memory loss on an amnesic patient's ability to remember the past and imagine the future. *Social Cognition, 20*, 353-379.

Klineberg, S. L. (1968). Future time perspective and the preference for delayed reward. *Journal of Personality and Social Psychology, 8*, 253-257.

Lemmon, K., & Moore, C. (2001). Binding the self in time. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 163-179). Mahwah, NJ: Lawrence Erlbaum Associates.

Logue, A. W., & Chavarro, A. (1992). Self-control and impulsiveness in preschool children. *The Psychological Record, 42*, 189-204.

McCormack, T., & Hoerl, C. (2001). The child in time: Temporal concepts and self-consciousness in the development of autobiographical memory. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 203-227). Mahwah, NJ: Lawrence Erlbaum Associates.

McCormack, T., & Russell, J. (1997). The development of recency and frequency memory: Is there a developmental shift from reliance on trace-strength to episodic recall? *Journal of Experimental Child Psychology, 66*, 376-392.

Mischel, W., & Metzner, R. (1962). Preference for delayed reward as a function of age, intelligence, and length of delay interval. *Journal of Abnormal and Social Psychology, 64*, 425-431.

Mitchell, P., & Riggs, K. J. (Eds.). (2000). *Children's reasoning and the mind.* Hove: Psychology Press.

Montgomery, G. T. (1976). Delay of gratification in children: A function of magnitude of reward and the delay cue. *Journal of Experimental Child Psychology, 21*, 549-555.

Moore, C., Barresi, J., & Thompson, C. (1998). The cognitive basis of future-oriented prosocial behavior. *Social Development, 7*, 198-218.

Moore, C., & Lemmon, K. (Eds.). (2001). *The self in time: Developmental perspectives*. Mahwah, NJ: Lawrence Erlbaum Associates.

Nagel, T. (1970). *The possibility of altruism*. Oxford, UK: Claredon Press.

Neisser, U. (1988). Five kinds of self-knowledge. *Philosophical Psychology, 1*, 35-59.

Nelson, K. (1992). Emergence of autobiographical memory at age 4. *Human Development, 35*, 172-177.

Nelson, K. (1993). The psychological and social origins of autobiographical memory. *Psychological Science, 4*, 1-8.

Nelson, K. (2001). Language and the self: From the *Experiencing I* to the *Continuing Me*. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 15-33). Mahwah, NJ: Lawrence Erlbaum Associates.

Nisan, M., & Koriat, A. (1977). Children's actual choices and their conception of the wise choice in a delay-of-gratification situation. *Child Development, 48*, 488-494.

Perner, J. (2001). Episodic memory: Essential distinctions and developmental implications. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 181-202). Mahwah, NJ: Lawrence Erlbaum Associates.

Perner, J., & Ruffman, T. (1995). Episodic memory and autonoetic consciousness: Developmental evidence and a theory of childhood amnesia. *Journal of Experimental Child Psychology, 59*, 516-548.

Povinelli, D. J. (1995). The unduplicated self. In P. Rochat (Ed.), *Self in infancy: Theory and research* (pp. 161-192). Amsterdam: Elsevier.

Povinelli, D. J. (2001). The self: Elevated in consciousness and extended in time. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 75-95). Mahwah, NJ: Lawrence Erlbaum Associates.

Povinelli, D. J., Landau, K. R., & Perilloux, H. K. (1996). Self-recognition in young children using delayed versus live feedback: Evidence of a developmental asynchrony. *Child Development, 67*, 1540-1554.

Povinelli, D. J., Landry, A.M., & Theall, L.A., & Clark, B. R., & Castille, C. M. (1999). Development of young children's understanding that the recent past is causally bound to the present. *Developmental Psychology, 35*, 1426-1439.

Povinelli, D. J., & Simon, B. (1998). Young children's understanding of briefly versus extremely delayed images of self: Emergence of an autobiographical stance. *Developmental Psychology, 34*, 188-194.

Reese, E. (2002). Social factors in the development of autobiographical memory: The state of the art. *Social Development, 11*, 124-142.

Reese, E., Haden, C., & Fivush, R. (1993). Mother-child conversations about the past: Relationships of style and memory over time. *Cognitive Development, 8*, 403-430.

Rozek, F., Wessman, A. E., & Gorman, B. S. (1977). Temporal span and delay of gratification as a function of age and cognitive development. *The Journal of Genetic Psychology, 131*, 37-40.

Schwarz, J. C., Schrager, J. B., & Lyons, A. E. (1983). Delay of gratification by preschoolers: Evidence for the validity of the choice paradigm. *Child Development, 54*, 620-625.

Suddendorf, T. (1999). Children's understanding of the relation between delayed video representation and current reality: A test for self-awareness? *Journal of Experimental Child Psychology, 72*, 157-176.

Thompson, C., Barresi, J., & Moore, C. (1997). The development of future-oriented prudence and altruism in preschoolers. *Cognitive Development, 12*, 199-212.

Toner, I. J., Holstein, R. B., & Hetherington, E. M. (1977). Reflection-impulsivity and self-control in preschool children. *Child Development, 48*, 239-245.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381-403). NY: Academic Press.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology, 26*, 1-12.

Tulving, E. (1989). Remembering and knowing the past. *American Scientist, 77*, 361-367.

Welch-Ross, M. (1995). An integrative model of the development of autobiographical memory. *Developmental Review, 15*, 338-365.

Welch-Ross, M. (1997). Mother-child participation in conversations about the past: Relations to preschoolers' theory of mind. *Developmental Psychology, 33*, 618-629.

Welch-Ross, M. (2001). Personalizing the temporally extended self: Evaluative self-awareness and the development of autobiographical memory. In C. Moore & K. Lemmon (Eds.), *The self in time: Developmental perspectives* (pp. 97-120). Mahwah, NJ: Lawrence Erlbaum Associates.

Wheeler, M., Stuss, D., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin, 121*, 331-354.

Zelazo, P. D., Sommerville, J. A., & Nichols, S. (1999). Age-related changes in children's use of external representations. *Developmental Psychology, 35*, 1059-1071.