

FUTURE PREFERENCES

**Preschoolers' Understanding of Future Preferences and its Relation to Theory of Mind and
Executive Function Abilities**

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All our dreams can come true, if we have the courage to pursue them – Walt Disney

DECLARATION OF ACADEMIC ACHIEVEMENT

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ABSTRACT

The aim of this dissertation was to explore whether preschoolers understand that preferences differ over time and between people. The first goal was to determine if 3-, 4-, and 5-year-olds could appreciate that their future or “grown-up” preferences may differ from their current ones (self-future condition). This understanding was compared to children’s understanding of the preferences of a grown-up (adult-now condition), or the grown-up preferences of a same-aged peer (peer-future condition). Results from 3 experiments ($N = 240$) suggest that these types of reasoning develop substantially over the preschool years, and that children are generally proficient by 5 years of age. Results also indicate that thinking about one’s own future preferences is more difficult than thinking about the (future) preferences of others. The second goal of this dissertation was to explore the relations between reasoning about preferences and theory of mind (ToM) and executive function (EF) abilities. Correlational analyses revealed that children’s reasoning about their future preferences and those of others was associated with EF skills, but not with ToM. These findings provide a timely contribution to the expanding research on children’s future-oriented cognition. Implications for theories about perspective-taking abilities, more broadly, and future research are also discussed.

CHAPTER 1

Preschoolers' Understanding of Future Preferences and its Relation to Theory of Mind and Executive Function Abilities

Whether it be taking something out of the freezer for dinner, bringing an umbrella along on a cloudy day in case it rains, or even reserving a room for a thesis defense, much of our daily lives involves thinking about, planning for, and anticipating the future. Indeed, the ability to think about the future is an important aspect of human cognition. It allows us to foresee the outcomes of situations, plan ahead, adjust our behaviour in the present to secure future needs, and avoid future negative consequences (Suddendorf & Corballis, 1997, 2007; Suddendorf & Moore, 2011). Although there has been research in adults and even young children on future thinking, broadly speaking, (e.g., Abraham, Schubotz & von Cramer, 2008; Addis, Wong & Schacter, 2007; Atance & O'Neill, 2001; Atance & Metcalf, 2013; Hudson, Shapiro & Sosa, 1995; Moore, Baressi & Thompson, 1998; Okuda et al., 2003; Spreng & Grady, 2010), only recently has the specific capacity to mentally project the *self* in the future (i.e., episodic foresight) become a topic of study among psychologists. The focus of this dissertation is children's ability to mentally project the self into the future and reason about their own future preferences.

Future Thinking vs. Episodic Foresight

“Future thinking” is a broad construct. Aspects of future thinking are likely involved in a number of cognitive abilities such as delay of gratification (e.g., Moore et al., 1998), planning (e.g., Hudson et al., 1995) and affective forecasting (e.g., Gilbert et al., 1998). In refining the aspects of future thinking involved in these and other abilities researchers have found it helpful to draw parallels to the research on memory. This is because memory is also a broad construct

which can be divided into its various aspects including sensory memory, working memory, short-term and long-term memory, and explicit and implicit memory, to name a few. Most notably, Tulving (1984, 2005) distinguishes between two types of declarative memory: semantic and episodic. He describes the semantic memory system as our “mental thesaurus” that includes facts, ideas, and concepts. Information that is retained in our semantic memory consists of more general knowledge and is often script-like. For example, in describing his typical bedtime routine of having a bath, getting into his pyjamas, brushing his teeth, reading a story and then kissing Mom or Dad goodnight, a young boy is likely tapping into his semantic memory. In contrast, the episodic memory system retains the temporal and spatial components specific to events as well as how we perceive them. A child describing that, during a recent sleep-over at Grandma’s, he took a bubble bath, put on his dinosaur pyjamas, forgot to brush his teeth, and then cuddled in the big bed while Grandma sang him lullabies is likely tapping into his episodic memory. Thus, the episodic memory system allows us to recollect personal experiences by mentally reliving past events.

The ability to mentally project the self back in time to relive events (i.e., episodic memory) is part of a broader cognitive ability known as *mental time travel* that also allows us to mentally project the self forward to pre-live future events (i.e., mental time travel into the future; Suddendorf & Corballis, 1997, 2007). Based on Tulving’s concept of episodic memory, Atance and O’Neill (2001) coined the term “episodic future thinking” to refer to the projection of the self into the future to pre-experience an event. Just as episodic memory differs from semantic memory, Atance and O’Neill argue that episodic future thinking differs from general knowledge about the future (i.e., semantic future thinking). For example, when setting a wake-up time on my alarm clock, I generally rely on my typical morning routine and commute. Because I have a

good idea of how long these activities will take, my decision is likely based on my script-like (i.e., semantic) knowledge of the amount of time needed to prepare, and when I need to leave the house to get to work on time. This decision does not generally involve envisioning myself showering, getting dressed, eating breakfast, packing my lunch, and driving through the rush-hour traffic. However, if I need to drop my car off at the garage tomorrow, I will most likely also consider the details associated with having to take the bus including such factors as waiting times, additional walking distances, and the amount of bus fare needed. In this case, I will mentally pre-experience the activities I will perform when taking the bus (i.e., engage in episodic future thinking).

In recent years, many other terms have been used to describe the specific capacity of mentally projecting the self into the future: “projection” (Okuda et al., 2003), “prospection” (Buckner & Carroll, 2007; Gilbert, 2006), “episodic simulation of future events” (Schacter, Addis, & Buckner, 2007), “simulation” (Schacter & Addis, 2007; Schacter, Addis, & Buckner, 2008) and, most recently, “episodic foresight” (Suddendorf & Moore, 2011). For clarity and consistency, the term “episodic foresight” (EpF) will be used in this dissertation (although this may not have been the term employed by the authors in their respective articles).

Despite differences in terminology the underlying abilities involved are consistently twofold: 1- imagining oneself in a future episode, and 2- acting in the present based on the imagined scenario. Thus, imagination, defined by Taylor (2013) as the ability to mentally transcend time, place, and/or circumstance, is an important prerequisite for episodic foresight. Indeed, both imagination and episodic foresight, as well as a number of other related skills that evolve in early childhood (e.g., perspective-taking, appearance-reality distinction, theory of mind, executive function, and pretense) involve the capacity for dual representations (i.e.,

thinking about a representation in two different ways at the same time) and secondary representations (i.e., representations that do not reflect the current reality) (Carlson & White, 2013; Moore & Barresi, 2013). With respect to imagining *oneself* in a future episode, Hudson et al. (2011) argue that “mentally simulating one’s thoughts and feelings is an essential component of the process” (p. 96). It is specifically this aspect of episodic foresight that is the focus of this dissertation. That is, in this dissertation, I examine children’s ability to mentally project the self into the future and reason about their own (simulated) future preferences.

Objectives

More specifically, the main goal of this dissertation is to explore children’s understanding that their future preferences may differ from their current preferences. For example, do children appreciate that while their favourite dinnertime meal might currently be macaroni and cheese, as an adult, they might prefer a surf and turf of steak and lobster tail with a side of asparagus? Although the importance of children knowing what they may someday prefer for dinner might not appear immediately relevant, an understanding that one’s preferences can change over time can have significant implications in the context of decision-making. Consider the following example. When asked what activity he wants to sign up for, a young boy states he wants to play hockey. After his parents register him to play, purchase all the necessary equipment, and bring him to two weeks of early-morning practices at the rink, the child decides he would prefer to play soccer instead and asks to quit the team. Although the child’s parents have likely been more affected in this scenario, it nonetheless illustrates how inaccurately predicting future preferences can lead to negative outcomes. During childhood, preferences for sports, activities, and interests change continuously and, thus, knowing when and how children come to appreciate these changes could help guide their decision-making.

Another main goal of this dissertation is to compare children's reasoning about their own future preferences with their capacity to consider other people's preferences. For example, do children also appreciate that while they enjoy watching cartoons such as Toopy and Binoo, their Mom or Dad might prefer to watch a live-action film? This comparison has important theoretical relevance in light of recent claims that envisioning the future and conceiving the viewpoint of others share similar cognitive resources (e.g., Buckner & Carroll, 2007) and thus, are similar forms of reasoning. Finally, a secondary goal of this dissertation is to explore whether there are relations between children's reasoning about future preferences and their theory of mind (ToM) and executive function (EF) skills (e.g., inhibitory control, cognitive flexibility, and working memory).

In the following sections, I review the research about young children's future thinking abilities. This review helps to further refine the particular aspect of children's future thinking that is the focus of this dissertation (i.e., episodic foresight). I also review the relevant literature on children's desire/preference reasoning, which has largely been investigated in the context of children's ToM, and explain how previous methodologies in this area inspired the development of the task I used to explore children's reasoning about future preferences. Finally, I discuss ToM and EF and their hypothesized relation to future thinking abilities.

In Chapter 2, I present a manuscript published in *Child Development*, which describes the three experiments I conducted to test my main hypotheses with respect to children's understanding of their own future preferences and the (future) preferences of others. In Chapter 3, I present additional information (e.g., details on methodology and analyses) that does not appear in the published manuscript and expand on the findings reported in Chapter 2 by examining the relation between children's understanding of future preferences, ToM, and EF.

Finally, I conclude with my General Discussion (Chapter 4), which further explores the main findings from my research, discusses its limitations, and suggests directions for future research.

Evidence of Future Thinking Abilities in Children

In the following section, I present the existing research examining future thinking abilities in young children. I begin with a brief overview of some of the early (and more recent) work that focused mainly on children's future-oriented language, delay of gratification, and planning abilities. I then review in more detail the relevant literature stemming from the research on children's general planning abilities and show how these studies have evolved to target children's ability to anticipate and address future needs and states. This review provides, in part, the rationale for my experiments and illustrates how they address an important gap in the literature.

Children's future-oriented language. Sometime during the second year of life, children begin to talk about the future with their parents, namely in the context of upcoming events and plans for the day (Sachs, 1983). By age 3, children are generally able to coordinate and talk about events in the past, present, and future (Weist, 1989). In fact, the majority of 3-year-olds commonly, and correctly, use broader temporal terms relating to the future such as "later" and "soon" (Busby Grant & Suddendorf, 2011). In addition, 3-year-olds begin to express uncertainty with respect to future events and intentions (e.g. "probably I will go to that big sand pile") (Atance & O'Neill, 2000). Although these references to the future are generally thought to be largely script-based, they reflect a general knowledge about the future and thus provide the first insight into children's future thinking abilities.

Children's ability to delay gratification. Benson (1994), however, argued that future talk does not provide the only evidence of the early development of future thinking. Thus, there

have been some attempts at studying abilities that are also believed to reflect children's emerging future thinking, such as forgoing an immediate small reward in the interest of receiving a larger reward in the future (i.e., delay of gratification). For example, several researchers have modified the now classic delay of gratification paradigm (see Mischel, Shoda, & Rodriguez, 1989, for a review of this early work) to investigate specific subsets of future-oriented skills. For example, Moore and his colleagues (Moore et al., 1998; Thompson, Baressi, & Moore, 1997) examined what they term future-oriented prudence (i.e., behaviours aimed at benefitting the future self), future-oriented altruism (i.e., behaviours aimed at benefitting others in the future) and future-oriented pro-social behaviour (in this case, behaviours aimed at benefitting both the self and a partner in the future) by asking children to choose between immediate and delayed sticker rewards for themselves and others. Similarly, Prencipe and Zelazo (2005) studied children's ability to delay gratification for themselves and others by having them choose between immediate and delayed rewards consisting of stickers, pennies, and candies. Results from these studies show improvements in the tendency to choose delayed rewards between the ages of 3 and 4 which suggests that children begin to mentally simulate and evaluate the outcomes of future situations (i.e., anticipate future situations) around this time.

Children's planning abilities. Similar age trends are reported by researchers interested in children's ability to prepare for a future goal (i.e., planning), which also involves anticipating future situations. For example, Hudson et al. (1995) asked 3-, 4-, and 5-year-old children to formulate a plan for going to the grocery store (or to the beach) that emphasized preparatory activities. After hearing a model plan for going on a picnic that involved the following: Getting up early; preparing sandwiches, a drink, and a snack; packing the picnic basket; preparing a blanket to sit on; putting on sunscreen; getting in the car and buckling your seatbelt; and finally,

going on the picnic, children were asked to report their plan. Once the children had reported their plan, the authors added a possible setback (e.g., forgetting to bring a shopping list to the store). They then asked the children both how they could prevent the setback (in the future) and how they could remedy it. While children at all ages were generally able to provide responses using their general knowledge (as evidenced by a control script condition where children were simply asked to report “what happens” at a grocery store), planning abilities as well as plausible prevention and remedy strategies improved dramatically with age.

More recently, Quon and Atance (2010) conducted a similar study in which they asked preschoolers about several specific future events and activities (e.g., What are you going to eat for breakfast tomorrow? What are you going to do the next time you go to the park? What are you going to do at bedtime tonight?). They then reviewed the children’s responses with their parents and asked the parents to rate the likelihood of each of the children’s statements. The majority of 3-, 4-, and 5-year-olds were able to generate specific personal plans (as opposed to more general, scripted answers such as “I will play”). Again, the number of responses reflecting plausible future events increased with age.

Results from these studies are consistent with those examining young children’s planning abilities using more traditional planning tasks. For example, Carlson, Moses, and Claxton (2004) found an increase in performance between 3 and 5 years on the Tower of Hanoi in which children were presented with an apparatus consisting of a series of disks placed on pegs in a particular starting configuration. Children were then asked to reconfigure the disks in the fewest possible moves while following certain rules (e.g., The daddy monkey, or large disk, can’t sit on the baby monkey’s, or small disk’s back). Similar age trends were reported by McColgan and McCormack (2008), on a Zoo task in which children chose a location along the path of a zoo to

leave a camera to later be able to take a picture of a specific animal. Of interest was whether children would plan ahead and place the camera in the appropriate location (i.e., in a locker located before the specified animal) given that they could only walk through the zoo once, and needed to visit the animals in a specified order along the zoo path.

Although the reported age trends are consistent between these more traditional planning tasks (e.g., Carlson et al. 2004; McColgan & McCormack, 2008), and Hudson et al. (1995) and Quon and Atance's (2010) studies, the former do not necessarily require children to project the self into the future to demonstrate their planning abilities. Both the Tower of Hanoi and the Zoo task consist of puzzles that can be solved logically. That is, rather than having to envisage themselves moving the pegs for the Tower of Hanoi, or walking along the path for the Zoo task, children need simply to consider the rules and make decisions accordingly. On the other hand, both Hudson et al.'s grocery/beach task and Quon and Atance's task more likely required children to mentally project the self into the future. Recall that once children reported their scripted plan of what happens at a grocery store, Hudson et al. introduced a set-back such as having forgotten a grocery list, creating a novel situation. Because of the novelty of this situation, it seems unlikely that children were able to rely on their general- or script-based knowledge and thus, were more likely to have envisioned themselves in that specific scenario. Children in Quon and Atance's study also more likely envisioned themselves in the specific scenario otherwise their parents would have rated their response as implausible. For example, it is more likely that a child who said that he would read "Good Night Moon" before going to bed actually envisioned himself at bedtime if his parent indeed confirmed that he had recently received that book (and thus had rated this particular response as "plausible"). Therefore, the

ability to plan for future situations, more specifically those involving the self, also develops over the preschool years.

Children's ability to anticipate future needs and states. While the planning tasks just described may require children to mentally simulate the general outcomes of situations involving the self, it is unclear whether children needed to anticipate the future needs or states of the self. However, several recent studies have specifically examined children's ability to anticipate a future need. For example, Suddendorf and Busby (2005) developed the *rooms task* in which children are required to perform a future-oriented action in a second room before returning to the room they were first introduced to. In a preliminary version of this task, 3-, 4-, and 5-year-olds spent two minutes in an "empty room" containing only a puzzle board without its pieces (in the experimental condition) or nothing at all (in the control condition) and then five minutes in an "active room" during which they played unrelated games with the experimenter. Children were then told they would be returning to the first room and asked to choose from a selection of four items, including the missing puzzle pieces, what they would like to take with them. Four- and 5-year-olds, but not 3-year-olds, were more likely to select the puzzle pieces in the experimental condition than in the control condition. The authors claim that children who succeeded on their task anticipated needing the puzzle pieces in the future so that they would have something to occupy themselves with in the first room. However, this method has been criticized. Most notably, it has been argued that children can succeed on the task by simply associating the puzzle pieces with the puzzle board without imagining themselves returning to the original room to play (e.g., Metcalf & Atance, 2011).

In a subsequent study, Suddendorf, Nielsen, and von Gehlen (2011) modified the rooms task to include elements that could not be as readily solvable by association. Specifically, the

authors presented 3- and 4-year-old children with a problem (e.g., a locked box that needed a special key to be opened) at a table in one room. Children were then either taken to the other end of the room and immediately asked to select an object to bring back to the table with the problem (instant condition) or to a different room to play games for 15 minutes and then asked to select an object to bring back to the original room (delay condition). Both age groups were able to solve the task in the instant condition whereas only 4-year-olds could secure the correct solution in the delay condition. The authors concluded that the 4-year-olds were able to remember the problem well enough to select the appropriate solution in anticipation of their return to the first room. However, once again, it is unclear whether any of the children were engaging in episodic foresight and not merely making semantic associations (e.g., triangle key “goes with” triangle key hole). In addition, much of the success on this task may have relied on children’s short-term memory abilities (e.g., remembering that the key hole was triangular shaped when presented with three keys of different shapes); a possibility also suggested by the authors, themselves. In fact, there is recent evidence suggesting that age-related improvements in children’s performance on similar rooms tasks were no longer significant after controlling for memory (e.g., Atance & Sommerville, 2014; Scarf et al., 2013)

Russell, Alexis, and Clayton (2010) used a different methodology to assess children’s anticipation of future needs. Preschoolers participated in a game of blow football with the experimenter that consisted of using a drinking straw to blow a ping-pong ball towards the opponent’s goal across the table, while also defending one’s own goal. The game table was set up on a dual-level platform so that the children could easily access it from one side but would need a box to stand on to reach the table when playing from the other side. Children always first played on the accessible side and were then asked to select the items needed to play from the

other side, either immediately or tomorrow. Results across four experiments showed an increase with age in preschoolers' ability to select appropriate items for future use (e.g., a box to stand on). While none of the 3-year-olds correctly answered the future questions and 5-year-olds generally succeeded on the task, the 4-year-olds' performance varied as a function of whether they were selecting the items for their own future use or the future use of a same-aged peer, with the former being more difficult. Possible explanations for these and other differences when reasoning about "self" and "other" will be addressed later in this dissertation. More importantly, children's performance across these studies suggests that while 3-year-olds generally have difficulty anticipating a future need, there is notable improvement in this respect over the preschool years.

Although the focus of these studies was on children's anticipation of a future need of theirs, children may also have anticipated a future state. More specifically, children may have mentally projected themselves into the future and imagined themselves not having anything to do in the original room (or not being able to reach the blow football table) and thus, being bored. By selecting an item or tool for future use in these cases, children may have been hoping to avoid a future state of boredom. However, whether or not young children can actually anticipate future states has only been explicitly examined in a few studies.

For example, Atance and Meltzoff (2005) developed a picture-book *trip task* that required children to anticipate specific future physiological states. They presented 3-, 4-, and 5-year-old children photographs of different scenes and asked them to imagine themselves doing a specific activity in that scene (e.g., walking across a rocky stream). They then presented the children with a set of three photographs depicting different items (e.g., Band-Aids, pillow, and toothpaste) and asked them to choose the item they would need on their trip. Of interest was

whether children would select the appropriate item and explain their choice by making reference to a future state (e.g., “I might get hurt”), suggesting that they had mentally simulated themselves doing the activity (i.e., had projected themselves into the future and thus engaged in episodic foresight). The authors found that even 3-year-olds were able to anticipate future states by selecting the appropriate item significantly more often than chance. However, their performance was poorer than that of 4- and 5-year-olds and they generated fewer verbal explanations referencing the future. Moreover, their performance was negatively affected by replacing one of the distracter items (e.g., toothpaste) with one that could be semantically associated with the scene (e.g., fish). Thus, although there is evidence that suggests that children as young as 3 years of age can anticipate and address a future state they are not currently experiencing, it appears these emerging skills are easily disrupted by a more salient response option.

In fact, Atance and Meltzoff (2006) discovered that children’s current state also influences their ability to predict a future state. The authors developed an experimental paradigm in which they manipulated preschoolers’ thirst levels by having them eat pretzels (intervention condition). Afterwards, children were asked which item, water or pretzels, they would like either “tomorrow” or “right now.” Children’s choices in the intervention conditions were compared to two baseline conditions in which children were not given pretzels and asked the same questions. Children’s choices from both baseline conditions indicated that 3-, 4-, and 5-year-olds preferred pretzels. However, the majority of the children in the two intervention conditions (i.e., “tomorrow” and “right now”) chose water. These results suggest that the preschoolers’ predictions about their future state were heavily influenced by their current state. More specifically, it appears children had difficulty appreciating that their future state may differ from their current state.

Summary of children's future thinking abilities. Research has shown that children talk about the future and demonstrate a number of abilities that require future thinking skills (e.g., delay of gratification, planning). They also appear to engage in episodic foresight as demonstrated by their ability to anticipate future situations involving the self, and their own future needs and states. Moreover, results from these studies converge to suggest that future thinking abilities emerge around 3 years of age with notable improvement over the preschool years. Nonetheless, episodic foresight has been investigated largely in the context of children's ability to anticipate future needs and physiological states of the self. Additionally, while I argued that the rooms and blow football paradigms may have also assessed children's ability to anticipate and address a future state of boredom, only future physiological states (e.g., thirst, hunger, cold) have been investigated, per se. As such, it is unclear whether young children can also mentally simulate future thoughts and feelings, and appreciate that these, too, change over time. I decided to address this issue by exploring episodic foresight in the context of preferences.

Preference/Desire Reasoning

One of the main objectives of this dissertation is to explore whether children appreciate that their future preferences may differ from their current preferences. Although this specific topic has not been addressed in the developmental research, there has been a considerable amount of research on children's understanding that others' preferences may differ from their own (e.g., Atance, Bélanger, & Meltzoff, 2010; Cassidy et al, 2005; Moore et al., 1995; Repacholi & Gopnik, 1997; Rokoczy, Warnecken, & Tomasello, 2007) and of children's understanding of the mental state of desire more broadly (see Flavell, 1999, for a review, and Wellman & Liu, 2004, for a meta-analysis of children's ToM, including desire understanding).

Despite a subtle difference in meaning, the terms “desires” and “preferences” have sometimes been used interchangeably in the literature on preschoolers’ desire understanding (i.e., Cassidy et al., 2005; Moore et al., 1995.). However, there appears to be a penchant for the term “desires” in the literature on children’s ToM. I use the term “preferences” to describe the concept my research explores as I specifically asked children what they “liked best” (i.e., preferred) and not what they “wanted” in my experiments. When referring to previous literature, I also use the term “preferences” where I consider the terms interchangeable. Otherwise, the author’s choice of terminology is respected.

Children’s proficiency at reasoning about others’ preferences. In an early article, Flavell et al. (1968) asked preschoolers to select gifts for their parents. Gift choices included items that were preferable to the children (e.g., doll, truck) and items that would be more preferable to their parents (e.g., silk stockings, necktie). Whereas the older children chose appropriate gifts for their parents, 3-year-olds chose items that they themselves would like (e.g., the toys). This provided the first evidence that younger preschoolers may have difficulty taking another perspective (in this case, their parents’) and thus appreciating that others’ preferences differed from their own. Several other studies have also shown that 3-year-olds have difficulty understanding that others’ preferences can conflict with their own (e.g., Cassidy et al., 2005; Moore et al., 1995; Zahn-Waxler, Radke-Yarrow, & Brady-Smith, 1977).

For example, Moore et al., (1995) asked preschoolers to choose a sticker for a character who had suffered an unpleasant experience with a cat. Sticker choices consisted of a highly desirable cat sticker or a less desirable flag sticker. Most often, 3-and 4-year-olds erroneously chose the sticker that they themselves preferred (i.e., the cat sticker). Cassidy et al., (2005) conducted a similar experiment and argued that that 3-year-olds’ difficulty with conflicting

desires stemmed from the combination of having to reason about a desire that directly *conflicted* with their own (e.g., they prefer cupcakes but another person might prefer apples as a snack), and also the need to *infer* the other person's desire based on this person's past experience (e.g., because the other person once got sick from eating too many cupcakes). When neither – or one – of these factors is involved, children's reasoning is significantly more accurate.

Thus, it appears that under certain conditions, children more easily identify others' preferences (e.g., Bartsch & Wellman, 1989; Cassidy et al., 2005; Wellman & Woolley, 1990; Atance et al., 2010). In fact, Atance et al. (2010) found that when children have their own desires fulfilled, they are better at considering the desires of others. They used a modified version of Flavell et al.'s (1968) gift-giving task that consisted of a self trial, in which participants were asked to pick a gift for themselves and a Mom trial, in which participants were asked to pick the item that would make a good gift for their Mom. Both trials featured a *Canadian Living* magazine, which was intended to be preferable to an adult, but not to a child, and a stuffed bear, which was intended to be preferable to a child, but not to an adult. When the Mom trial was presented first, the majority of 3-year-olds picked the bear (i.e., what they themselves desired) while 4- and 5-year-olds correctly adopted Mom's perspective and chose the magazine. However, when the Mom trial was presented second, after children had selected a bear for themselves on the self trial, 3-year-olds performed significantly better. Thus, it appears that children's understanding of others' preferences can be easily disrupted by a more salient response – for example, children's own preference. This is consistent with the evidence presented earlier that similar factors (i.e., a salient response) may impede children's emerging episodic foresight abilities. For example, recall that children's performance on Atance and Meltzoff's trip task (2005) was negatively impacted when one of the items they could choose to

bring on their trip (e.g., to a rocky stream) was semantically associated (e.g., fish) and thus more salient.

Future Thinking vs. Other Forms of Perspective-Taking

In light of the research on preference/desire reasoning, I decided to compare children's ability to reason about their future preferences with their ability to reason about other people's preferences. In fact, I argue that both forms of reasoning are conceptually similar. First, both forms of reasoning involve adopting an alternate perspective: either the perspective of a *future self* when considering one's own future preferences, or the perspective of *another person* when considering what someone else prefers. In both instances, considering a perspective that is different from one's own requires a form of mental projection that Buckner and Carroll (2007) term "self-projection". In addition, both forms of reasoning involve shifting away from one's current perspective and, more specifically, inhibiting this perspective to accurately reason from the alternate perspective. In the following examples, I attempt to illustrate the similar shifts in perspective required when reasoning about the future self and reasoning about another person.

My ahead-of-season clothes shopping necessarily requires disregarding the numerous factors influencing my current state in order to consider what I will prefer to wear at a future date. Indeed, if I am shopping on a day when the outside temperature is -30°C , I might be influenced by the fact that I am cold and be drawn to the winter coats on the sale rack. However, if I can imagine myself in my future, alternate state such as waiting for the bus in spring's milder temperatures, I will likely realize that I will prefer something more lightweight and choose a raincoat. Along these lines, if I am unable to inhibit my now current perspective that a raincoat is sufficient for my needs, I may forget to pick up splash pants and warmer jackets for my children who prefer to spend much more time playing outdoors than I do, and are more likely to get cold

and wet skipping in puddles. Thus, reasoning about one's own future preferences and considering other people's preferences arguably both involve a shift in perspective from the self's current perspective to an alternate perspective.

Not only do these two forms of perspective-taking appear to be conceptually similar, there is neurophysiological evidence that suggests they are related. Several recent papers on perspective-taking in adults report similar findings suggesting that envisioning the future, remembering the past, and conceiving the viewpoints of others share similar cognitive resources and reflect the workings of the same core brain network. (e.g., Buckner & Carroll, 2007; Spreng & Grady, 2010; Viard et al., 2011). For example, Spreng and Grady (2010) showed adult participants photographs and associated cue words (e.g., people at the dinner table with the cue word "family") and then asked them to use the photograph and cue to either remember an event, imagine a future event, or imagine the thoughts and feelings of someone in the photograph. These three forms of reasoning all activated midline structures in the frontal and parietal lobes of the brain.

Experimental Task Developed for this Dissertation

Similar to the existing studies with adults (e.g., Spreng & Grady, 2010), for this thesis I developed a task in which I varied the perspective that children adopted. This allowed me to explore whether children appreciate that their future preferences may differ from their current preferences but also to compare children's reasoning about their own future preferences with their reasoning about other people's preferences. I adapted the gift-giving task that was originally designed by Atance et al. (2010). In this task, children were required to adopt the perspective of their Mom in order to select an appropriate gift for her but also adopted their own perspective when choosing a gift for themselves. Similarly, in an initial experiment (Chapter 2, Experiment

1), I asked children to reason from their own perspective, and either from the perspective of an adult, or from the perspective of their grown-up selves. Specifically, I presented children with pairs of “child”- (e.g., Kool-Aid) and “adult”- (e.g., coffee) preferable items and asked them to choose the items that an adult would like best (*adult-now* condition) or that they would like best when they were “all grown up” (*self-future* condition). I also asked children to choose which items they liked best right now. The children’s choices on these *self-now* trials were used as the baseline against which choices made with the alternate adult-now, or self-future perspective were compared.

Unlike the findings reported in the adult literature, my first experiment showed that children’s capacity to reason from their own future perspective (i.e., their ability to identify their own future preferences) *differed* from their ability to reason from another person’s perspective (i.e., their ability to identify that an adult’s preferences differed from their own). This then led me to ask why taking the perspective of one’s future self is harder for children than taking another person’s perspective. One possibility is that children’s difficulty centers on reasoning about the *future*. If so, then thinking about anyone’s future should be equally difficult for them. In contrast, it may be that children’s difficulty centers on reasoning about their *own* future and possibly acknowledging that what they will prefer in the future may differ from what they prefer now (i.e., in the present). To distinguish between these two possibilities (i.e., a more global deficit reasoning from a future perspective vs. difficulty reasoning from one’s own future perspective), in Experiments 2 and 3, I explored the extent to which children’s capacity to think about their own future preferences is similar or different from their capacity to think about the future preferences of *other* children. Accordingly, I introduced a third alternate perspective and asked children to choose the items that a same-aged peer would like when he/she was “all grown

up” (*peer-future* condition). The baseline perspective for the peer-future condition consisted of peer-now trials in which children chose the items a same-aged peer (i.e., “Billy/Sally”) liked best right now.

In summary, inspired by the future thinking and preference/desire reasoning research in the developmental literature, as well as the perspective-taking research in the adult-literature, I designed a single task that allowed me to explore children’s understanding of future preferences and compare this understanding to children’s reasoning about other people’s preferences.

A secondary goal of this dissertation was to explore whether there are relations between understanding future preferences and theory of mind (ToM), as well as between understanding future preferences and executive function (EF) (i.e., inhibitory control, cognitive flexibility, and working memory). Several researchers have proposed that these cognitive abilities, which also show marked improvement over the preschool years, are intimately linked to the development of future thinking skills (Atance & Jackson, 2009; Atance & Meltzoff, 2005; Atance & O’Neill, 2001; Buckner & Carroll, 2007; Moore et al., 1998; Spreng, Mar, & Kim, 2009; Suddendorf & Corballis, 1997, 2007). In the following sections, I present the theoretical arguments about why understanding future preferences might be related to these cognitive abilities, focusing on the conceptual similarities between my task (used to assess future thinking) and tasks used in developmental research to assess ToM and EF.

Theory of Mind

The term “theory of mind” (ToM) originally proposed by Premack & Woodruff (1978) refers to the ability to perceive oneself and others in terms of mental states, such as desires, beliefs, knowledge, emotions, and intentions, that influence human behaviour. The internal mental states and the resulting external behaviours are, in fact, separate entities such that mental

states can differ from what is observable (i.e., events, situations, behaviours) in the real-world (Wellman, Cross, & Watson, 2001). Many researchers have argued that an understanding that mental representations may differ from reality is central to ToM (e.g., Astington & Gopnik, 1988). As such, in the developmental literature, ToM research has been dominated by the investigation of false belief. For example, in the Change in Location task (Baron-Cohen, Leslie, & Frith's, 1985, derived from Wimmer & Perner, 1983), children witness a story in which the main character, Sally, places a ball in a box before leaving the room. During her absence, a second character, Anne, comes in, retrieves the ball, and moves it to a cupboard. Finally, Sally returns to retrieve the ball. Thus, Sally still thinks the ball is in the box while the children and Anne know that, in reality, the ball is in the cupboard. Children are then asked to identify where Sally will look for the ball. It is argued that if children respond that Sally will look in the box, they appreciate that Sally holds a belief that is different from their own and from reality, and by attributing Sally a false belief, children show evidence of possessing an important aspect of ToM (Perner, 1991; Wellman et al., 2001).

Despite the centrality of false belief reasoning in ToM research, it is nonetheless argued that understanding other mental states (e.g., knowledge, desires, etc.) is also essential to a mature ToM (Nguyen & Frye, 1999), and that an understanding of these different mental states is gradually acquired over the preschool years (see also Wellman, 2002 for a review). Accordingly, researchers have developed a number of different tasks to assess children's understanding of these mental states. For example, Wellman and Liu (2004) showed that children first (as early as 3 years of age in their particular study) understand that two people can hold different desires (i.e., diverse desires) before they understand that two people can hold different beliefs about the same object (i.e., diverse beliefs, at around 3 years 9 months). Next, children recognize (on

average around 4 years 6 months) that someone may not know things that they know (e.g., that there is a toy dog inside a drawer; demonstrating knowledge of another person's beliefs). This recognition is followed by false-belief understanding (around 4 years 11 months), and finally by a basic understanding of the distinction between real and apparent emotion (around 5 years 4 months).

Relation between theory of mind and future thinking. One could argue that different forms of perspective-taking involve ToM, as I have previously alluded to. In fact, some researchers have defined ToM as the ability to conceive the viewpoint of others (e.g., Buckner & Carroll, 2007). Although broad in its scope, this definition of ToM implies that to accurately reason from someone else's perspective, one must first appreciate that another person's mental states are distinct from our own and may also differ from reality. Similarly, in order to project the self forward in time and accurately reason from the self's future perspective (e.g., to identify one's own future preferences), one must first understand that one's own mental states can change over time and that future mental states may also differ from current states/reality. In addition to these conceptual similarities, there is evidence that these abilities emerge around the same time in development suggesting that they may be closely related. That is, both children's ToM (e.g., Wellman and Liu, 2004) and future thinking skills (e.g., Atance & Jackson, 2009) improve notably over the preschool years (i.e., between the ages of 3 and 5).

Although a number of researchers have advanced similar arguments to suggest that the ability to mentally project oneself into the future (EpF) is related to ToM (Atance & Jackson, 2009; Atance & Meltzoff, 2005; Atance & O'Neill, 2005; Buckner & Carroll, 2007; Moore et al., 1998; Spreng et al., 2009; Suddendorf & Corballis, 1997, 2007) few studies have explicitly examined the relation between future thinking abilities and ToM in children. In addition,

preliminary results are conflicting. Metcalf and Atance (2011) found an association between children's saving behaviour (argued to reflect the ability to engage in EpF) and their performance on a contents false belief task. Relatedly, Ford et al. (2012) found that false belief understanding accounted for part of the variance in children's performance on a prospective memory task (i.e., remembering to perform a planned action at some later point in time, also argued to involve EpF) even after controlling for age and language ability. However, results from a more recent study (Hanson, Atance & Paluck, 2014) did not show a significant relation between a battery of tasks believed to measure EpF and several standard ToM tasks. However, the authors attributed the lack of an association between EpF and ToM to the fact that their chosen tasks may have measured different components of EpF and ToM. More specifically, they reasoned that their EpF tasks may not have required the same kind of "perspective shift" as the ToM tasks. Whereas for the ToM tasks, children needed to explicitly contrast two mental states (e.g., the child desires one snack while a character is said to desire another, the child knows the ball is in the red box while the character believes the ball is in the blue box, etc.), for the EpF tasks, children did not need to explicitly contrast their present and future selves. That is, children's present state (e.g., sitting comfortably in the lab protected by the elements) in Atance and Meltzoff's (2005) picture book task (used in Hanson et al.), for example, may not be so salient that it interferes with children's ability to consider a possible future state (e.g., imagining getting wet and needing a raincoat when walking near a waterfall).

Because there is very limited research that has explored potential links between ToM and EpF, further investigation is warranted. Indeed, as evidenced by the theoretical arguments presented earlier, there appears to be conceptual similarities as well as neurophysiological evidence of a relation between these two forms of "self-projection". For this dissertation, I

explore the potential relation between EpF and ToM in two ways. First, similar to the tasks used in the adult literature, I directly compare thinking about one's own future preferences (i.e., future thinking) with thinking about the current preferences of an adult and the future preferences of a same-aged peer (i.e., conceiving the viewpoints of others, or "ToM" as it has been suggested in some cases). Recall that my task involves presenting children with pairs of child- (e.g., stickers) and adult- (e.g., magazines) preferable items and asking them to choose the items that an adult would like best (adult-now condition), that they would like best when they are all grown up (self-future condition), or that a same-aged peer would like best when he or she is all grown up (peer-future condition). Arguably, the surface demands between the condition that likely involves EpF (self-future condition) and the condition that likely involves ToM (adult-now condition) are well matched. Thus, comparing children's performance between these two conditions can speak to whether similar/different abilities are being drawn upon.

Second, consistent with the developmental literature, I also chose to administer "traditional" ToM tasks. Three ToM tasks (i.e., Diverse Desires, Diverse Beliefs, Contents False Belief) were selected from Wellman and Liu's (2004) scaling of ToM tasks discussed earlier. A meta-analysis of these tasks revealed good convergent and concurrent validity (Wellman et al., 2001). Additionally, the pattern of performance on these tasks is generally consistent across cultures even when slight task variations exist (Wellman et al., 2001). A fourth ToM task (i.e., Change in Location False Belief), not part of Wellman and Liu's scaling study, was also administered because of its prominence in ToM research. Thus, by determining whether children's performance on the perspective-taking task is related to their performance on the battery of traditional ToM tasks, I am able to further speak to possible links between future thinking and ToM.

Executive Function

Executive function (EF) is an umbrella term for the various cognitive processes involved in achieving a particular goal (Elliott, 2003). Although most definitions include a number of examples of these processes such as inhibition, set shifting, emotional control, initiation, working memory, planning, organization, and self-monitoring, there is no consensus in the literature on the specific processes that constitute EF, reflecting that EF is not a unitary construct (Elliott). In neuropsychology, EF has long been synonymous with frontal lobe activity; however, a recent review revealed that, while EF is primarily carried out in the frontal lobes, other brain networks are also essential to these functions (Alvarez & Emery, 2006), providing further evidence that EF reflects a broad array of cognitive functions. Not surprisingly, due to its numerous roles, EF is argued to be critical in cognitive and social development (Carlson, 2005).

Relation between executive function and future thinking. As with ToM, a number of researchers have argued for a link between EF abilities and the capacity to engage in future thinking (e.g., Atance & Jackson, 2009; Buckner & Carroll, 2007; Suddendorf & Corballis, 2007). Indeed, there appears to be a number of theoretical arguments that support a relation between these abilities, some of which I have previously highlighted in my discussion on the various forms of perspective-taking, as well as on the possible links between EpF and ToM. First, as mentioned, when thinking about the future, we must shift from our current perspective to a future perspective. The ability to make such a switch in thinking parallels one component of EF known as *cognitive flexibility* (i.e., mental flexibility, set shifting). In fact, cognitive flexibility is often broadly defined as the ability to adapt one's previous beliefs or thoughts to new situations and, more specifically, as the capacity to switch one's thinking or attention

between tasks in response to a specific change in rules or demands (e.g., Zelazo, Frye & Rapus, 1996).

Second, in order to envision the future and accurately reason from this perspective, one must be able to inhibit any influences from the current perspective. Thus, envisioning the future conceivably draws on one's ability to avoid first reactions and resist distractions before giving a more considered response. Again, this ability bears resemblance to the EF ability known as *inhibition* or *inhibitory control* (IC). More specifically, inhibitory control is defined as the capacity to voluntarily inhibit or regulate prepotent (i.e., strong or automatic) attentional or behavioral responses (Durstun et al., 2002). Third, when thinking about the future, and shifting our perspective accordingly, we must always keep track of the shifts we make. This requires that we hold and process significant amounts of information in our mind simultaneously which, by definition, relies on one's working memory (Baddeley & Hitch, 1974).

In addition to these theoretical arguments, findings from developmental studies show an increase in both children's EF (e.g., Carlson & Moses, 2001) and future thinking skills (e.g., Atance & Jackson, 2009) between the ages of 3 and 5 suggesting that the emergence of these abilities over the preschool years may be closely related. There is also neurophysiological evidence that suggests a link between future thinking and EF – more specifically, the frontal and medial temporal regions of the brain are involved in both skill sets (Addis et al., 2007; Okuda et al., 2003; Stuss & Alexander, 2000; Zelazo & Müller, 2010). However, once again, few studies have explicitly examined the relation between future thinking abilities and EF in children.

Similar to the findings with respect to a link between ToM and future thinking, preliminary results regarding a relation between future thinking skills and EF abilities are also conflicting. For example, Ford et al. (2012) found that, in addition to the link between false-

belief understanding and prospective memory reported earlier, IC (a component of EF) accounted for another part of the variance in children's performance on their prospective memory task. This relation remained significant even after controlling for the effects of age and language ability. In contrast, Hanson et al., (2014) found that children's average performance across a battery of EpF tasks and selected EF tasks (an IC task and two working memory tasks) did not remain significantly correlated after controlling for the effects of age and language. However, when the EpF tasks were considered individually, the Picture Book task was significantly correlated with an EF composite score of five inter-correlated EF tasks, offering some preliminary evidence that EpF is related to EF skills, as has been suggested by a number of researchers (Atance & Jackson, 2009; Buckner & Carroll, 2007; Suddendorf & Corballis, 2007).

In light of the arguments presented thus far, I decided to examine the relation between EF abilities and the ability to reason about future preferences. Although, as mentioned, EF comprises a number of elements including inhibition, working memory, planning, cognitive flexibility/set shifting, and generativity (Carlson, 2005), I decided to include only tasks that best matched the demands of the perspective-taking task. Thus, I opted for a measure of cognitive flexibility, the Standard Dimensional Change Card Sort task (DCCS; Zelazo, 2006), to parallel children having to shift from their current perspective to another's perspective, or their own future perspective. I also selected two measures of inhibitory control, the children's version (Hughes, 1998) of Luria's hand game (Luria et al., 1964) and the Sun/Moon task (Simpson & Riggs, 2005; derived from Gerstadt, Hong, & Diamond, 1994), to parallel children having to suppress their current preferences. Finally, because the perspective-taking task involved a fair amount of verbal instructions (i.e., an explanation of the different perspectives the children were required to adopt), and that children had to recall these instructions and the perspective when

selecting items, I also selected two measures of working memory: a Count and Label task (Gordon & Olson, 1998) and a Backwards Digit Span task (Davis & Pratt, 1995).

Hypotheses

The purpose of this dissertation was to examine whether young children understand that their future preferences may differ from their current preferences. It also aimed to compare children's reasoning about their own future preferences with their capacity to consider other people's preferences. The hypotheses outlined below were addressed over three experiments (Chapter 2) in which children were asked to identify which item (e.g., Play-Doh or a book of crossword puzzles) an adult would prefer (adult-now condition), their adult self would prefer (self-future condition), or that a peer would prefer as an adult (peer-future condition).

A secondary goal was to explore the relation between understanding future preferences and ToM, more broadly, as well as EF skills (i.e., inhibitory control, cognitive flexibility, and working memory) by comparing children's performance on the perspective-taking task and batteries of traditional ToM and EF tasks used in developmental research. Specific hypotheses relating to this secondary goal are outlined and examined in Chapter 3.

Effect of age. I hypothesized that 1) children's ability to identify "adult" items as preferable to an adult would increase with age, reflecting children's increasing capacity to conceive the viewpoint of others between 3 and 5 years as evidenced in the literature about ToM development (e.g., see Wellman et al., 2001 for a review). Similarly, I hypothesized that 2) children's ability to recognize that "adult" items would be preferable for their grown-up selves would increase with age, reflecting an improvement in future thinking skills between the ages of 3 and 5 (e.g., Atance & Meltzoff, 2005; Russell et al., 2010; Suddendorf et al., 2011). Finally, I hypothesized that 3) children's ability to identify "adult" items as preferable to a grown-up peer

would also increase with age, reflecting the aforementioned increases in both ToM and future thinking skills over the preschool years.

Effect of condition. Despite theoretical claims that ToM and future thinking abilities are related (e.g., Buckner & Carroll, 2007; Suddendorf & Corballis, 2007) and studies showing that both of these skill sets improve over the preschool years (e.g., Wellman et al., 2001 for ToM, and Atance & Meltzoff, 2005; Russell et al., 2010; Suddendorf et al., 2011 for future thinking), there is no evidence, to my knowledge, that supports a specific developmental hypothesis (i.e., that one skill set develops before the other). Thus, prior to conducting my first experiment, which included only the self-future and adult-now conditions, I did not have a specific hypothesis as to whether children would perform better in the adult-now condition (suggesting that conceiving the viewpoint of others emerges first) or in the self-future condition (suggesting that envisioning the future emerges first).

However, based on my findings from Experiment 1 in which children in the adult-now condition performed better (i.e., selected more “adult” items on the target trials) than children in the self-future condition, I predicted that in Experiments 2 and 3, which included the adult-now, self-future and peer-future conditions, 4) children in the adult-now condition would, again perform better than children in the self-future condition. This would replicate my findings from Experiment 1 and also suggest that considering other people’s preferences is easier than considering one’s own future preferences (and that, ultimately, future thinking may rely on ToM). As for the peer-future condition, several alternative hypotheses seemed plausible. On the one hand, 5) children may perform similarly in the self-future and peer-future conditions. This hypothesis is consistent with the theory-theory account of children’s theory of mind development stipulating that children use the same theoretical constructs to reason both about their own and

others' mental states (e.g., Gopnik & Wellman, 1992). Additionally, assuming that children perform better in the adult-now condition (hypothesis 4), a similar performance in the self-future and peer-future conditions further suggests that there is something particularly difficult about considering future preferences in general, whether they pertain to self or other. Because future thinking abilities begin to emerge around 3 years of age with notable improvement over the preschool years, it may be that this particular aspect of future thinking emerges later than others.

Another possibility was that 6) children would perform better in the self-future condition than in the peer-future condition, suggesting that considering both a future perspective as well as someone else's perspective (i.e., peer-future condition) is particularly difficult. It may be that, in line with simulation-theory, children use the self as a basis for predictions about others (e.g., Harris, 1992). Because the children's ability to consider their own future preferences is not yet consolidated, they have difficulty applying their limited knowledge about future preferences to others.

A final hypothesis is that 7) children would perform better in the peer-future condition than in the self-future condition suggesting that children's difficulty reasoning about their own future preferences does not lie in considering the future, per se, but rather something specific to one's *own* future preferences.

CHAPTER 2

What Will I Like Best When I'm all Grown up? Preschoolers' Understanding of Future Preferences

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Abstract

Three experiments investigated 3-, 4-, and 5-year-olds' ($N = 240$) understanding that their future or “grown-up” preferences may differ from their current ones (self-future condition). This understanding was compared to children’s understanding of the preferences of a grown-up (adult-now condition), or the grown-up preferences of a same-aged peer (peer-future condition). Children’s performance across all three conditions improved significantly with age. Moreover, children found it significantly more difficult to reason about their own future preferences than they did to reason either about an adult’s preferences or the future preferences of a peer. Our results have important implications for theories about future thinking and perspective-taking abilities, more broadly.

What Will I Like Best When I'm all Grown up? Preschoolers' Understanding of Future Preferences

An understanding of the future is an important aspect of young children's cognitive development and has recently become the focus of study by a number of researchers (for a review, see Suddendorf & Moore, 2011). Different methods have been used to assess future thinking including tracking children's future-oriented language (e.g., Busby & Suddendorf, 2005; Weist, 1989), delay of gratification (e.g., Moore, Barresi, & Thompson, 1998), and planning abilities (e.g., Hudson, Shapiro, & Sosa, 1995; Quon & Atance, 2010). Researchers have also assessed children's ability to select an item or tool in anticipation of future states and needs (e.g., Atance & Meltzoff, 2005; Russell, Alexis, & Clayton, 2010; Scarf, Gross, Colombo, & Hayne, 2013; Suddendorf, Nielsen, & von Gehlen, 2011). Results from these different studies suggest that the ability to think about the future begins to emerge around 3 years of age with notable improvement during the preschool years. Nonetheless, there are important aspects of children's future thinking that have not yet been fully explored. For example, the research that targets children's ability to anticipate future states and needs has mostly focused on physiological states or practical needs and less on states that could be described as more emotional or psychological in nature. Children's understanding that such states also change over time and, more specifically, that their future preferences may differ from their current preferences is the focus of the current study.

Understanding that one's own preferences can change over time is important to study because it can profoundly impact people's decision-making. Indeed, in adulthood, at least, there is an abundance of research showing that inaccurately predicting future preferences can lead to a host of negative outcomes (e.g., Loewenstein & Angner, 2003; Quoidbach, Gilbert, and Wilson,

2013). For example, getting a large tattoo, buying a flashy sports car, or accepting a job miles from home are decisions that may ultimately result in pain and disappointment when one must undergo expensive laser surgery, trade in the convertible for the family sedan, and feel trapped in a dead-end job far from family and friends. In fact, Quoidbach et al. (2013) recently coined the term “end of history illusion” to explain why adults often make decisions that their future selves regret. They argue that adults at every stage of life tend to underestimate the extent to which their personalities, values, and preferences will change in the future.

Although young children are not faced with the same kinds of decisions as adults, it is arguable that they, too, must make choices that require them to acknowledge that what they prefer right now may differ from what they will prefer in the future. For example, when asked how he would like to decorate his “big boy” room, a toddler may choose an Elmo theme claiming “he will always love Elmo” when, in reality, several years down the road, he will ask to redecorate when his new preference has shifted to Spiderman. In fact, early childhood is a period during which activity, food, and toy preferences change continuously and, thus, having an awareness of these changes is important in the life of a young child.

The extent to which children can acknowledge that what they prefer in the present may differ from what they prefer in the future is related to an important question in theory of mind (ToM) research, namely: Do young children understand that their preferences can differ from those of others? This understanding has been argued to be of central importance to both young children’s cognitive and social development (e.g., Atance, Bélanger, & Meltzoff, 2010; Cassidy et al., 2005; Repacholi & Gopnik, 1997). Some research in this area suggests that, by 18 months, children are able to infer diverse food preferences between themselves and others. In one study, they did so by judging the experimenter’s facial expression and offering her the snack she

preferred (i.e., broccoli), even when it differed from the one they preferred (i.e., goldfish crackers) (Repacholi & Gopnik). Relatedly, Wellman and colleagues (e.g., Wellman & Bartsch, 1988; Wellman & Woolley, 1990) asked children to choose an item they preferred, told them that a character preferred the other, and finally asked them which one the character would choose. A meta-analysis of these and other studies found that 95% of 3-year-olds accurately judged that two people (i.e., self and other) can have different desires about the same objects (Wellman & Liu, 2004).

In Wellman and colleagues' paradigm, as in Repacholi and Gopnik's (1997), children are given explicit information (emotional or verbal) about what the other person prefers. In contrast, when such information is not provided children's performance is poorer. For example, in their early work on conceptual perspective-taking, Flavell and colleagues (e.g., Flavell, Botkin, Wright, & Jarvis, 1968) asked preschoolers to select gifts for their parents. Gift choices included items that were preferable to the children (e.g., doll, truck) and items that would be preferable to their parents (e.g., silk stockings, necktie). Whereas the older children chose appropriate gifts for their parents (e.g., necktie), 3-year-olds chose the items that they, themselves, preferred (e.g., the toys) (see also, Atance et al., 2010).

These findings are particularly relevant to the experiments we report in this paper because just as children were not given explicit information about their parents' preferences, they are not likely to have explicit information about their own future preferences. Second, Flavell et al.'s (1968) findings suggest that children's understanding that preferences may differ across the lifespan (i.e., children and adults prefer different things) develops during the preschool years. More broadly, during the preschool years - and beyond - children gain a greater awareness that general knowledge may differ between children and adults (e.g., Taylor, Cartwright, & Bowden,

1991) and that infants, children, and adults may have different emotional reactions to the same situation (e.g., Sayfan & Lagattuta, 2008).

However, what none of these studies has addressed is children's understanding that changes in desires or preferences can occur *within* the same individual and, within one's own self, in particular. To our knowledge the only study that has explicitly assessed this issue is one by Gopnik and Slaughter (1991) that included a task aimed at assessing children's understanding of past to present changes in desire states. Most notably, children were given a task in which they were shown two equally appealing objects (e.g., two picture books or two boxes containing a hidden toy) and were asked to choose the one they desired. Once their desire was satiated (i.e., the book was read or the box was opened and the child was given the toy), children were asked to indicate their current desire. All children now chose the alternate item. However, when asked to recall their past desire, the 3-year-olds' performance was no better than chance suggesting that they had difficulty acknowledging that desires (past vs. present) can change over time.

Most of the evidence considered thus far suggests that 3-year-olds will have difficulty appreciating that their future or grown-up preferences will differ from their current preferences but that this ability will improve substantially between ages 3 and 5. However, this prediction has not yet been empirically tested and thus doing so was the primary goal of Experiment 1. Our secondary goal was to determine whether preschoolers have similar levels of difficulty/ease thinking about their own future preferences as they do thinking about the preferences of others. That children will perform similarly when asked to identify their future preferences and the preferences of others is supported by the fact that these two forms of perspective-taking both develop substantially between ages 3 and 5 (as outlined earlier in our Introduction). This hypothesis is also consistent with recent research on perspective-taking in adults and,

specifically, the claim that adopting one's future perspective and adopting the perspective of another person share similar cognitive resources and reflect the workings of the same core brain network (e.g., Buckner & Carroll, 2007; Spreng & Grady, 2010; Viard et al., 2011). In fact, this claim has led some researchers (e.g., Buckner & Carroll; Spreng & Grady, 2009) to argue that both forms of perspective-taking emerge together in human development (see also Moore et al., 1998).

To investigate children's understanding of their own and others' preferences, we designed a single task drawing both on the work of Flavell et al. (1968) and Atance et al. (2010). In Atance et al.'s "gift-giving" task, 3-, 4-, and 5-year-olds were presented with two items: one that was preferable to them (i.e., a small plush toy) and one that was preferable to their mothers (i.e., a cooking magazine). They were then asked to select which item would be a "good present" for their Moms as well as which item would be a "good present" for them. Whereas 3-year-olds failed to select the age-appropriate gift for Mom at above chance levels (in both Experiments 1 and 2), 4-year-olds (above chance performance in Experiment 2) and, to a greater extent, 5-year-olds (above chance performance in both experiments) did. Additionally, children whose desires had been fulfilled (i.e., had already selected a gift for themselves) chose an appropriate gift for their mothers significantly more often than children whose desires were unfulfilled (i.e., had to choose a gift for their mother first). We adapted Atance et al.'s (2010) gift-giving task by varying the perspective that children were asked about. In Experiment 1, one group of 3-, 4-, and 5-year-olds was asked to reason about the perspective of their future selves, whereas another group was asked to reason about the perspective of an adult.

Experiment 1

We presented children with pairs of “child-” (e.g., Kool-Aid) and “adult-” (e.g., coffee) preferable items and asked them to choose the items that they would like best when they were “all grown up” (*self-future condition*) or that an adult likes best (*adult-now condition*). We also asked all children to choose which items they like best right now. Children’s choices on these *self-now* trials were used as the baseline against which choices in the adult-now or self-future trials were compared.

Method

Participants. Participants were 120 English-speaking children: 43 3-year-olds (26 boys; $M_{\text{age}} = 41$ months, age range = 36 to 47 months), 43 4-year-olds (21 boys; $M_{\text{age}} = 53$ months, age range = 48 to 58 months), and 34 5-year-olds (18 boys; $M_{\text{age}} = 66$ months, age range = 60 to 71 months). Children were from predominantly White, middle-class backgrounds and were recruited from a medium-sized University city using posters, pamphlets, newspaper and on-line advertisements, and at children’s fairs.

Procedure. Children were tested individually in a laboratory setting by an experimenter while the parent or guardian watched through live video-feed on the computer screen in an adjoining room. All sessions were video-recorded. Children completed a perspective-taking task and several additional tasks that will not be discussed here.

Children were randomly assigned to one of two conditions of the perspective-taking task. Each condition required them to reason about their own preferences (self-now trials) and either the preferences of an adult (adult-now trials) or the preferences of their own future self (self-future trials). Thus, all children received 2 types of trials: self-now trials and adult-now trials in the adult-now condition; self-now trials and self-future trials in the self-future condition.

For each condition, children were presented with the same five trials for each trial type, in random order, each featuring two identical exemplars of a child-preferable item and two identical exemplars of an adult-preferable item, including: drinks (Kool-Aid and coffee); “reading” material (picture books and newspapers); games (Play-Doh and crossword puzzles); television shows (Dora the Explorer and cooking videos); and “leisure” activities (sticker books and magazines).

Specific verbal instructions varied as a function of trial type. For the adult-now trials children were shown a photograph of a sex-matched adult and told, “Here is a picture of Jane/John. She/He is a grown-up woman/man. She/He is as big as your Mommy/Daddy. I’m going to show you some things, and I want you to tell me the things that Jane/John likes best.” For the self-future trials, children were also shown the photograph of Jane/John and were told, “Right now, you’re 3/4/5 years old. But one day, you’re going to be all grown-up. You’re going to be as big as this woman/man. Her/His name is Jane/John, and she/he is as big as your Mommy/Daddy. I’m going to show you some things, and I want you to tell me the things you will like best when you’re all grown up.” For the adult-now trials children were then asked, for example, “Which one of these does Jane/John like best, one of these magazines or one of these sticker books?”, whereas for the self-future trials they were asked, “Which one of these will you like best when you’re all grown up, when you’re as big as Jane/John, one of these magazines or one of these sticker books?” The photograph of Jane/John remained on the table and visible during the adult-now and self-future trials.

As mentioned, all children were also given the same five trials just described, but worded as follows, “I want you to tell me the things you like best right now,” to establish a baseline measure of their current preferences. Children either received these self-now trials immediately

before the adult-now/self-future trials, or immediately after. The order of presentation and placement of the adult- and child-preferable items was randomized for each of the ten trials.

Scoring. Children's choice on any given adult-now/self-future trial was only included in the analysis if the child-preferable item was chosen on the corresponding self-now trial. Otherwise, it was impossible to determine whether children who held atypical preferences (e.g., preferred coffee to Kool-Aid) were indeed adopting the perspective of the adult/future self and not merely stating their own current preference. It is important to note that the majority of children (85%) chose either 4 or 5 of the child items on the self-now trials with only a minority (15%) choosing either 1, 2, or 3. Scores on the perspective-taking task were then calculated by dividing the number of adult items selected on the adult-now or self-future trials (possible range: 0-5) by the number of child items selected on the self-now trials (possible range: 0-5), with the resulting proportion score ranging from 0 to 1.

Results

Preliminary analyses. Age differences between conditions were not significant: 3-year-olds: $M = 40.62$, $SD = 3.25$ and $M = 42.23$, $SD = 2.79$, $t(41) = 1.74$, $p = .089$; 4-year-olds: $M = 52.59$, $SD = 3.49$ and $M = 53.95$, $SD = 3.38$, $t(41) = 1.30$, $p = .201$; 5 year-olds, $M = 66.19$, $SD = 4.23$ and $M = 65.06$, $SD = 4.12$, $t(32) = -.79$, $p = .436$, in the self-future and adult-now conditions, respectively. In addition, an ANOVA revealed no significant main effect of sex or significant interactions of sex with any other variable on perspective-taking scores and so the data were collapsed across this factor in all subsequent analyses. Although an ANOVA revealed significant differences between item-pair scores, $F(4, 424) = 4.21$, $p = .002$, these scores did not significantly interact with any other variable, suggesting that the pattern of performance that we report below was similar for all items.

Effects of order, age, and condition on task performance. Perspective-taking scores ($N = 120$) were analyzed using a $2 \times 3 \times 2$ ANOVA with order (self-now trials first; self-now trials second), age (3; 4; 5), and condition (adult-now; self-future) as between-subjects factors. This analysis revealed a significant main effect of order, $F(1, 108) = 4.95, p = .028, \eta_p^2 = .04$, such that children who received the self-now trials first ($M = .75, SD = .37, n = 54$) scored higher on the adult-now or self-future trials than children who received the self-now trials second ($M = .57, SD = .41, n = 66$). There was also a significant main effect of age, $F(2, 108) = 13.35, p < .001, \eta_p^2 = .20$. Polynomial trend analyses revealed a significant linear trend, $p < .001$, such that mean perspective-taking scores increased with age: $M = .48, SD = .41, n = 43$; $M = .62, SD = .41, n = 43$; and $M = .90, SD = .23, n = 34$ for the 3-, 4-, and 5-year-olds, respectively. Finally, there was a significant main effect of condition, $F(1, 108) = 9.77, p = .002, \eta_p^2 = .08$, such that children in the adult-now condition ($M = .75, SD = .35, n = 61$) scored higher than children in the self-future condition ($M = .54, SD = .43, n = 59$). None of the interactions were significant: Order \times Age, $F(2, 108) = 1.78, p = .174, \eta_p^2 = .03$, Order \times Condition, $F(1, 108) = 0.15, p = .698, \eta_p^2 = .001$, Age \times Condition, $F(2, 108) = 2.05, p = .134, \eta_p^2 = .04$, and Order \times Age \times Condition, $F(2, 108) = 1.12, p = .331, \eta_p^2 = .02$.

Chance analyses. Our main goals were to explore when children begin to understand that their future or grown-up preferences will differ from their current preferences, and to compare children's ability to think about future preferences with their ability to think about the preferences of others (i.e., the effects of age and condition). Because order did not interact with either age or condition, we collapsed the data across order for these analyses and compared children's perspective-taking scores to chance responding (i.e., a mean proportion score of 0.5)

using the t distribution. We used a pooled error term derived from all of the Experiment 1 data and a Bonferroni correction for multiple comparisons ($\alpha = .0083$).

These tests, conducted separately for each age group, showed that, in the self-future condition, 3-year-olds performed significantly below chance, $M = .28$, $SD = .35$, $t(20) = -6.14$, $p < .001$, 4-year-olds performed no different from chance (though trended in this direction), $M = .57$, $SD = .43$, $t(21) = 1.97$, $p = .063$, and 5-year-olds performed significantly above chance, $M = .84$, $SD = .28$, $t(15) = 9.39$, $p < .001$. In contrast, in the adult-now condition, all age groups performed significantly better than chance: $M = .68$, $SD = .37$, $t(21) = 4.86$, $p < .001$; $M = .67$, $SD = .38$, $t(20) = 4.75$, $p < .001$; and $M = .94$, $SD = .18$, $t(17) = 12.04$, $p < .001$, for the 3-, 4-, and 5-year-olds, respectively (see Figure 1).

Discussion

Our results show that children's capacity to consider their own future preferences as well as the preferences of an adult improve significantly between ages 3 and 5. In addition, children were significantly better at acknowledging that their own current preferences diverge from those of an adult than they were at acknowledging that their own current preferences will diverge from their adult ones. Furthermore, the results from our chance analyses suggest that only 5-year-olds consistently acknowledged a divergence in preferences between their "current" and "future" selves. That is, 5-year-olds appeared to recognize that although they currently preferred Kool-Aid to coffee, for example, this preference is subject to change once they are all grown up. In contrast, at age 3, children were consistently defaulting to their current preferences when asked what they will prefer as adults, as evidenced by their significantly below chance performance. At age 4, children were responding at chance which may signal a transitional stage of development

whereby they are no longer defaulting to their current preferences, but cannot yet acknowledge that these will differ from their future ones.

Because all age groups performed above chance in the adult-now condition (and significantly better than in the self-future condition), we can dismiss the possibility that children had difficulty reasoning about their own future preferences because they lacked the knowledge about what adults prefer. Otherwise, children should have performed similarly in the adult-now and self-future conditions. Why, then, is taking the perspective of one's grown-up self difficult for young children and also more difficult than taking the perspective of a grown-up?

One possibility centers on the type of "perspective shift" that children must make when thinking about the future self. More specifically, to acknowledge that one's current preferences may differ from one's future preferences, it is crucial to make what we might term an "intra-personal temporal" perspective shift. In contrast, in the adult-now condition, children need only make an "inter-personal" perspective shift, with no temporal quality attached to it. Although our data suggest that a temporal shift (i.e., recognizing that present and future preferences differ) is more difficult for children than a "person" shift (i.e., recognizing that self and other preferences differ), it may be that what children find particularly challenging is thinking about the *future self*. More specifically, children may have difficulty acknowledging that what they, themselves, prefer right now is subject to change in the future, rather than having a global difficulty thinking about the future (or future preferences), per se. If so, then children should perform better in a condition in which they are asked to reason about *another* child's future preferences as these do not directly pertain to the self. However, if thinking about the future, more generally, is difficult for young children then performance should not vary when thinking about their own, versus another

child's, future because both require acknowledging the fact that current and future preferences may differ. The goal of Experiment 2 was to distinguish between these two possibilities.

Experiment 2

As in Experiment 1, one group of children was asked to reason about the perspective of their future selves (self-future condition) and another group was asked to reason about the perspective of a grown-up (adult-now condition). We also asked a third group of children to reason about another child's future perspective and thus to identify what a same-aged peer would prefer when he or she is "all grown up" (*peer-future condition*). We only included 3- and 4-year-olds given that the performance of the 5-year-olds in Experiment 1 was nearly at ceiling.

Method

Participants. Ninety-six English-speaking children: 48 3-year-olds (23 boys; $M_{\text{age}} = 42$ months, age range = 36 to 47 months), and 48 4-year-olds (24 boys; $M_{\text{age}} = 53$ months, age range = 48 to 59 months) participated. Participant characteristics and recruitment methods were the same as in Experiment 1.

Procedure. Children were randomly assigned to either the adult-now condition, self-future condition, or peer-future condition. Children in the peer-future condition were asked to reason about the future preferences of a same-aged peer (peer-future trials) and the current preferences of this same-aged peer (peer-now trials). As in Experiment 1, the adult-now condition included adult-now trials and self-now trials, whereas the self-future condition included self-future trials and self-now trials.

Task instructions were similar to those in Experiment 1. One difference was that children were first shown an instant photograph of themselves during the introduction of the self-now trials (adult-now and self-future conditions) or a photograph of a same-aged, sex-matched peer

during the introduction of the peer-now trials (peer-future condition). For example, children were shown a photograph of Sally/Billy and were told “Here’s a picture of Sally/Billy. I’m going to show you some things and I want you to tell me what Sally/Billy likes best right now.”

Photographs (of self or peer) were then removed prior to the actual start of the self-now or peer-now trials.

As in Experiment 1, children were shown a photograph of a sex-matched adult (i.e., Jane/John) when introducing the adult-now trials, self-future trials, and peer-future trials. In addition, and unlike in Experiment 1, children were simultaneously shown a picture of themselves (self-future trials) or the same-aged, sex-matched peer (peer-future trials). Using the peer-future trials as an example, children were shown both photographs (i.e., same-aged peer and adult) and told, “Here is a picture of Jane/John. Jane/John is a grown-up woman/man. She/he is as big as your mommy/daddy. Here is a picture of Sally/Billy. One day, Sally/Billy is going to be all grown up. She/he’ll be as big as Jane/John. I’m going to show you some things and I want you to tell me what Sally/Billy will like best when she/he’s all grown up.” Children were then asked, “Which one of these will Sally/Billy like best when she/he is all grown-up?” Instructions for the self-future trials were identical, save that “you” was substituted for “Sally/Billy.” Unlike in Experiment 1, in which the photograph of the adult remained in view during the presentation of each trial, in Experiment 2, the photograph of the adult (as well as the child/peer) was taken away so as to prevent children from potentially matching “adult” items to the photograph of the adult, rather than actually reasoning about adult/grown-up preferences.

We used the same five trials as in Experiment 1 plus one additional trial in which children were asked to select between a school bag (child item) and a wallet (adult item). As in Experiment 1, children either received the baseline trials (i.e., six self-now trials in the adult-now

and self-future conditions, and six peer-now trials in the peer-future condition) before or after the six grown-up trials (12 trials total in each condition). The order of presentation and placement of the adult- and child-preferable items was randomized for each of the 12 trials.

Scoring. As in Experiment 1, children's choice on any given adult-now or self-future or peer-future trial was only included in the analysis if the child-preferable item was chosen on the corresponding self-now or peer-now trial. Once again, the majority of children (77% of 3-year-olds and 85% of 4-year-olds) chose 4, 5 or 6 of the child items on the self-now or peer-now trials with only a minority (23% and 15%, of 3- and 4-year-olds, respectively) choosing 0, 1, 2, or 3. There were five children who chose adult items for either themselves or their peer on each of the six trials and thus their data were necessarily excluded from all analyses. Scores on the perspective-taking task were calculated by dividing the number of adult items selected on the adult-now or self-future or peer-future trials (possible range: 0-6) by the number of child items selected on the self-now or peer-now trials (possible range: 0-6), with the resulting proportion score ranging from 0 to 1.

Results

Preliminary analyses. One-way ANOVAs revealed that age differences between conditions were not significant: 3-year-olds: $M = 42.63$, $SD = 4.46$; $M = 43.29$, $SD = 3.20$; and $M = 40.40$, $SD = 3.18$, $F(2, 45) = 2.68$, $p = .080$; 4-year-olds: $M = 53.71$, $SD = 3.33$; $M = 53.25$, $SD = 3.38$; and $M = 52.87$, $SD = 3.94$, $F(2, 45) = 0.23$, $p = .800$, for the adult-now, self-future, and peer-future conditions, respectively. In addition, an ANOVA revealed no significant main effect of sex or significant interactions of sex with any other variable on perspective-taking scores and so the data were collapsed across this factor in all subsequent analyses. Finally, an ANOVA

revealed that item-pair scores did not differ significantly, $F(5, 410) = 2.04, p = .072$, nor did they interact with any other variable of interest.

Effects of order, age, and condition on task performance. Perspective-taking scores ($N = 91$) were analyzed using a $2 \times 2 \times 3$ ANOVA with order (baseline trials first; baseline trials second), age (3, 4), and condition (adult-now; self-future; peer-future) as between-subjects factors. As in Experiment 1, this analysis revealed a significant main effect of order, $F(1, 79) = 6.53, p = .013, \eta_p^2 = .08$, such that children who received the baseline trials first ($M = .65, SD = .33, n = 48$) scored higher on the target trials than children who received the baseline trials second ($M = .47, SD = .41, n = 43$). There was also a significant main effect of age, $F(1, 79) = 5.30, p = .024, \eta_p^2 = .06$, such that 3-year-olds ($M = .49, SD = .37, n = 45$) scored lower than 4-year-olds ($M = .64, SD = .37, n = 46$), and a significant main effect of condition, $F(2, 79) = 3.50, p = .035, \eta_p^2 = .08$. Follow-up tukey comparisons revealed that children in the adult-now ($M = .63, SD = .36, n = 33$) and peer-future conditions ($M = .66, SD = .39, n = 25$) performed better than children in the self-future condition ($M = .43, SD = .37, n = 33$), $p = .050$ and $p = .037$, respectively. The difference in mean perspective-taking scores between the adult-now and peer-future conditions was not statistically significant. Finally, none of the interactions were significant: Order x Age, $F(1, 79) = 1.18, p = .280, \eta_p^2 = .02$, Order x Condition, $F(2, 79) = 0.23, p = .798, \eta_p^2 = .01$, Age x Condition, $F(2, 79) = 2.07, p = .133, \eta_p^2 = .05$, and Order x Age x Condition, $F(2, 79) = 1.88, p = .160, \eta_p^2 = .05$.

Chance analyses. As in Experiment 1, we collapsed across order to compare children's perspective-taking scores to chance responding (i.e., a mean proportion score of 0.5). We used the pooled error term derived from all Experiment 2 data and a Bonferroni correction for multiple comparisons ($\alpha = .0083$).

Using the t distribution we conducted separate tests for each age group within condition. As in Experiment 1, 3- and 4-year-olds performed significantly better than chance in the adult-now condition: $M = .63$, $SD = .35$, $t(15) = 3.34$, $p = .004$; $M = .64$, $SD = .37$, $t(16) = 3.39$, $p = .004$, for the 3-, and 4-year-olds, respectively. In the self-future condition, 3-year-olds performed significantly below chance, $M = .36$, $SD = .34$, $t(16) = -3.42$, $p = .004$, while 4-year-olds performed no different from chance, $M = .50$, $SD = .40$, $t(15) = -0.08$, $p = .939$, also replicating the results from Experiment 1. Finally, in the peer-future condition, 3-year-olds performed no different from chance, $M = .48$, $SD = .41$, $t(11) = -0.63$, $p = .543$, while 4-year-olds performed significantly above chance, $M = .83$, $SD = .28$, $t(12) = 8.39$, $p < .001$ (see Figure 2).

Discussion

The results of Experiment 2 suggest that children's understanding of an adult's preferences, their own future preferences, and the future preferences of a same-aged peer all improve significantly between ages 3 and 4. In addition, consistent with the results of Experiment 1, 3- and 4-year-olds were better at acknowledging that their current preferences diverge from those of an adult than they were at acknowledging that their current preferences diverge from those of their own future selves ($p = .050$). However, our results also indicated that children were significantly better at reasoning about a peer's future preferences than they were at reasoning about their own future preferences. This finding suggests that children's difficulty in reasoning about their own future preferences is not simply due to a global deficit thinking about the future but, rather, is partly due to the specific appreciation that *one's own* preferences will change in the future. We discuss this finding in more detail in the General Discussion.

Experiment 3

Although the results of Experiment 2 largely replicate those of Experiment 1, we ran one final experiment with 5-year-olds to conclusively pinpoint the age at which children succeed at identifying the preferences of a grown-up, their own grown-up selves, and the grown-up selves of another child.

Method

Participants. Twenty-four English-speaking 5-year-olds (12 boys; $M_{\text{age}} = 67$ months, age range = 60 to 71 months) participated. Participant characteristics and recruitment methods were the same as in Experiments 1 and 2.

Procedure. Procedure was identical to that used in Experiment 2.

Scoring. Scoring for this experiment was conducted in the same way as it was in Experiments 1 and 2. Once again, the majority of children (94%) chose 4, 5 or 6 of the child items on the self-now or peer-now trials with only one of the 5-year-olds having chosen 3.

Results

A preliminary ANOVA revealed no significant main effect of sex or significant interactions of sex with any other variable on perspective-taking scores and so the data were collapsed across this factor in all subsequent analyses. Although an ANOVA revealed significant differences between item-pair scores, $F(5, 90) = 2.35, p = .047$, these scores did not significantly interact with any other variable, suggesting that the pattern of performance that we report below was similar for all items.

Perspective-taking scores ($N = 24$) were analyzed using a 2 x 3 ANOVA with order (baseline trials first; baseline trials second), and condition (adult-now; self-future; peer-future) as between-subjects factors. This analysis revealed a significant main effect of order, $F(1, 18) = 4.48, p = .048, \eta_p^2 = .20$, such that children who received the baseline trials first ($M = .99, SD =$

.05, $n = 12$) scored higher on the grown-up trials than children who received the baseline trials second ($M = .83$, $SD = .22$, $n = 12$). Neither the main effect of condition, $F(2, 18) = 0.15$, $p = .863$, nor the Order x Condition interaction, $F(2, 18) = 0.15$, $p = .863$ were statistically significant.

As in both previous experiments, we compared children's perspective-taking scores to chance responding (i.e., a mean proportion score of 0.5) within each condition using the t distribution (pooled error term, Bonferroni correction: $\alpha = .0167$). These tests showed that 5-year-olds performed significantly above chance in each condition, $M = .90$, $SD = .23$, $t(7) = 10.95$, $p < .001$; $M = .90$, $SD = .18$, $t(7) = 10.95$, $p < .001$; and $M = .94$, $SD = .12$, $t(7) = 12.10$, $p < .001$ for the adult-now; self-future; and peer-future conditions, respectively.

Discussion

Our results show that, by age 5, children are competent at reasoning about the preferences of a grown-up, their own grown-up selves, and the grown-up selves of a same-aged peer.

General Discussion

In three experiments we explored preschoolers' understanding that their current preferences are subject to change and, specifically, may differ from those they will hold in the future. We also compared this understanding to children's understanding that others' preferences differ from their own, and that another child's future preferences may differ from that child's current preferences. Our results indicate that children's ability to think about these different perspectives significantly improves with age. In addition, children have significantly more difficulty accurately predicting their own future preferences (e.g., that, as adults, they will prefer coffee to Kool-Aid) than they do predicting either the current preferences of an adult (Experiments 1 and 2) or the future preferences of a peer (3- and 4-year-olds in Experiment 2).

Experiment 3 also showed that it is only by 5 years of age that children were significantly above chance in the adult-now, self-future, and peer-future conditions. In contrast, 3-year-olds' performance was only above chance in the adult-now condition, whereas the 4-year-olds' performance was above chance in both the adult-now and peer-future conditions.

Implications for research on future thinking

Although recent research has revealed marked development in children's ability to talk about the future (e.g., Atance & Meltzoff, 2005; Busby & Suddendorf, 2005) and choose an item or tool to solve a future problem (e.g., Suddendorf et al., 2011), our experiments are the first to explore preschoolers' understanding that their future or grown-up preferences may differ from their current ones. The fact that this ability also develops significantly between ages 3 and 5 further contributes to a unified picture of improvement across various domains of young children's future-oriented cognition. Yet our findings also extend upon this research by suggesting a possible developmental trajectory through which children progress when contemplating future preferences.

Specifically, the results of our chance analyses show that, at age 3, children have difficulty both thinking about their own personal future as well as the future of another child. As such, one could describe this age group as having a more global deficit in contemplating the future; a characterization that is consistent with previous research. However, at age 4, children are competent at appreciating that another child's grown-up preferences may differ from that child's current ones, but have difficulty applying this understanding to the self. A similar finding was reported by Russell, Alexis, and Clayton (2010) who found that 4-year-olds were better at selecting necessary items for a game of "blow football" the next day when asked to choose for another child than when asked to choose for themselves. This "self-other" difference signals a

potentially important phenomenon in the development of future thinking ability and, specifically, that in some instances it may be easier for children to think about another child's future than it is for them to think about their own. Why might this be the case?

Episodic vs. semantic distinction

One factor that may serve to explain the difference between the self-future and peer-future conditions is their potentially different reliance on mental time travel (MTT) and, specifically, the ability to mentally project the self into the future to pre-experience an event (Suddendorf & Corballis, 1997; 2007). It has been argued that this capacity differs from general knowledge about the past and future (i.e., semantic memory and semantic future thinking) (Atance & O'Neill, 2001; Tulving, 2005) and, in fact, emerges later in development than its semantic counterpart (e.g. Tulving, 2005). Thus, it may be that reasoning about one's own future preferences draws both on the episodic system – in this case, mentally traveling in time to think about one's future self (e.g., “when I'm all grown-up, I'll like coffee”) and the semantic system (e.g., the knowledge that adults like coffee), whereas reasoning about both an adult's preferences and the future preferences of another child draw mainly on the semantic system. If so, then the extra step involved in the reasoning process (i.e., envisioning the self in the future, or drawing on the episodic system) might account for why children's performance in Experiment 2 was significantly better in the peer-future condition than it was in the self-future condition.

More specifically, it is possible that when children are asked to take the perspective of another person they adopt a semantic or knowledge-based (i.e., what another person ought to do) reasoning mode that leads to a correct response. In contrast, when making decisions that pertain to the self, the reasoning mode is also episodic. In addition, it is arguable that when the “mental projection” into the future pertains to the self (as opposed to other), this projection is especially

difficult because it is contaminated by the self's current beliefs, desires, or preferences. As such, it is possible that improvements both in episodic thinking and inhibition interact to lead to task success. This could be tested in future experiments in which tasks in each of these domains are administered alongside our perspective-taking task.

Such an account may also help to explain the self-other difference reported by Russell et al. (2010). As noted, these authors found that 4-year-olds were better at selecting necessary items for a future game of blow football (at a spatial location where they had not yet played) when asked to choose for another child than when asked to choose for themselves. Russell et al interpret this difference as resulting from a growth error that involves over-applying newly-developed level 2 perspective-taking skills; that is, at age 4, children were so focused on the spatial perspective of playing the game of blow football that they failed to select the correct items needed to actually *play* the game. This account cannot explain our self-other difference given that our task does not involve a spatial element. However, we believe that our episodic vs. semantic account may also serve to explain Russell et al.'s findings. Specifically, when children needed to select items to play the game in the future, their current desire for the appealing (but not future-relevant) items hindered their capacity to think ahead. In contrast, when making a selection for the other child, the conflict between current and future desires was not as strong thus allowing them to think ahead about what items the other child would need for the next day.

The role of experience

Another explanation for why an intra-temporal perspective shift (i.e., self-future condition) is more difficult than either inter-personal (i.e., adult-now condition) or even inter-personal temporal (i.e., peer-future condition) shifts is that children have fewer opportunities to witness differences between their own changing perspectives over time (e.g., they preferred

rattles as babies but now prefer Play-Doh) than between their own and another person's perspective (e.g., they prefer Elmo but a friend or sibling prefers Big Bird; or, their baby brother used to like drinking from a bottle but now insists on using a cup). "Future-perspective" shifts, in particular, may be especially challenging for children because they require reasoning about a point in time that children have not yet experienced, and that may not often be discussed with parents. As such, it is possible that "past-perspective" shifts (e.g., acknowledging that, as a baby, one preferred a rattle to Play-Doh) are easier because children may, at the very least, be able to draw on parents' talk about the past (e.g., "when you were a baby you played with rattles"), or on their direct experiences with a younger sibling to make such judgments; a possibility that we are currently exploring.

Implications for theory of mind research

As we noted in the Introduction, theory of mind research (at least as it pertains to desire or preference understanding) has mostly focused on children's ability to acknowledge differences between their own desires and those of another person (e.g., Atance et al., 2010; Cassidy et al., 2005; Flavell et al., 1968) or, at least in one study (i.e., Gopnik & Slaughter, 1991), differences between one's own current and recent past desires. These situations can pose difficulties for young children and our results similarly show that children have difficulty acknowledging differences between their own current preferences and those that they may hold in the future.

In addition, one finding that was consistent in all three of our Experiments is that children's performance on our task was superior when they were given the opportunity to consider their own present perspective prior to considering an alternate one (e.g., that of an adult). Atance et al. (2010) report a very similar finding; namely that children were better able to

select an appropriate gift for their Moms when they had the opportunity to select a gift for themselves first. This result was interpreted as evidence that having one's own desire fulfilled freed up the necessary cognitive resources to consider the desire of another person. We would take this a step further to argue that merely *considering* one's own current perspective first may help the child to then acknowledge that someone else (or the self at a different point in time) may hold a contrasting perspective. This finding should be explored further and in different contexts because it has relevance for the kinds of manipulations that may improve children's perspective-taking ability.

Finally, and more broadly, our results are interesting in light of the different predictions that various accounts of theory-of-mind development (though mostly pertaining to an understanding of false belief) make about children's self-other reasoning. For example, by a theory-theory account (e.g., Gopnik & Wellman, 1992), children are argued to reason similarly about self and other because they uniformly apply their theory about how the mind works across both of these contexts. By contrast, other theories (e.g., simulation theory) are more in line with the possibility that children will understand mental states in self before other. Finally, in recent accounts stemming from brain imaging findings (e.g., Buckner & Carroll, 2007), the argument is that several different forms of perspective taking, including thinking about others and about one's own future self, rely on the same common brain network and thus these two capacities should emerge around the same time. Yet, in contrast to all of these accounts, our data show that, at least with respect to reasoning about future states or preferences, children may first need to understand that they can hold perspectives that differ from those of another person before they can understand that their own perspectives may differ over time.

Limitations

We chose to study the specific capacity to consider future or grown-up preferences. It may be that a different pattern of findings would have been obtained had we asked children to consider future knowledge or belief states – especially since these tend to be less affective. We also suspect that asking children about different future points in time (e.g., “next year,” “later in childhood,” etc.) would provide a broader picture of children’s reasoning about future preferences, as would varying the desirability of the items in question. For example, one challenge of understanding that our current and future preferences will differ may lie in children having to imagine a shift from liking “desirable” (e.g., Kool-Aid) to “undesirable” (e.g., coffee) things. If so, then manipulating the extent to which the child or adult item is considered desirable to children is predicted to impact performance on our perspective-taking task.

A related point is the subtle difference between children thinking that it is *possible* vs. *probable* that their grown-up preferences will differ from their current ones. Our paradigm tapped into the latter which is arguably more difficult than the former. One could adapt our method to tap into the former by presenting children with a rating scale consisting of unhappy, neutral, and happy faces and asking them to point to the face that best corresponds to how much they will like Kool-Aid and coffee when they are all grown up. This would allow for a more fine-grained or continuous (vs. categorical) analysis of children’s understanding of the changing nature of preferences.

Developing adequate continuous measures for children would be challenging but doing so would allow for a more direct comparison between our data and data from adults. That is, in studies testing adults’ predictions about future emotions or preferences (e.g., Quoidbach et al., 2013), researchers use continuous measures (e.g., rating scales) to assess the extent to which people predict that their preferences will change, rather than the dichotomous measure that we

used in the current study. Using such continuous measures allows for the detection of a significant bias in adults' future predictions but this does not mean that their predictions are fully inaccurate. Similarly, although the 5-year-olds' predictions about their future selves were practically at ceiling in our study (and hence, "accurate"), this does not mean that they would show less bias than adults on more continuous measures assessing future preference predictions.

Conclusions

Our results provide a timely contribution to an understudied aspect of young children's cognitive development: the ability to reason about one's future self and one's own future preferences, in particular. We have shown that this skill develops substantially between ages 3 and 5, and that it is more difficult than contemplating the future preferences of a peer. Although we suggested potential hypotheses to explain this finding, additional studies are needed to further identify how the mechanisms that underlie thinking about one's own future may differ from those that underlie thinking about the future of another person. In addition to this issue being of strong theoretical interest, we believe that its applied value is equally great. For example, were it to be found that children sometimes think more accurately about the future when they consider another person's perspective rather than their own, this could form the basis of interventions to improve the future-oriented decision-making of children and adults alike.

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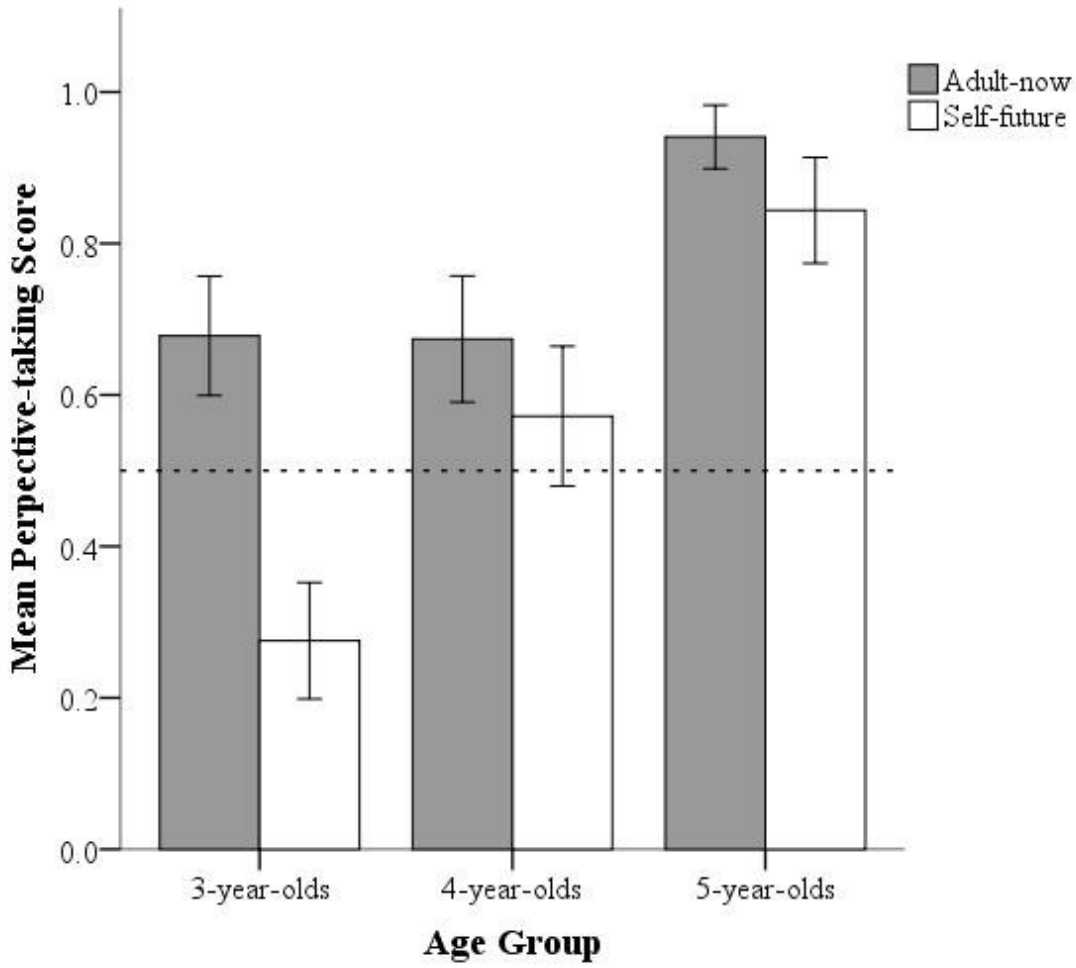


Figure 1. Children’s mean perspective-taking scores in Experiment 1 for each age group by condition. Error bars represent standard errors of the mean. Reference line corresponds to chance responding (i.e., mean perspective-taking score of 0.5).

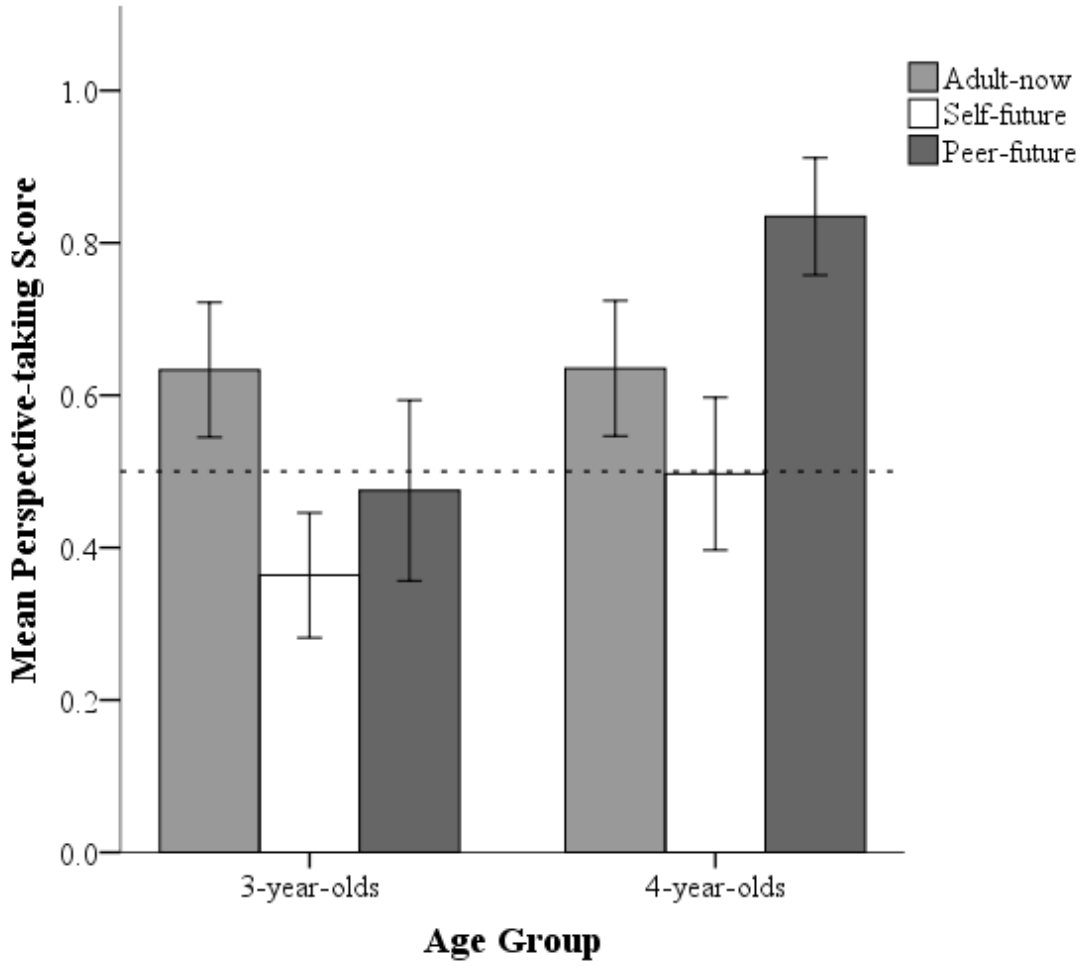


Figure 2. Children’s mean perspective-taking scores in Experiment 2 for each age group by condition. Error bars represent standard errors of the mean. Reference line corresponds to chance responding (i.e., mean perspective-taking score of 0.5).

CHAPTER 3

Is Reasoning About Future Preferences Related to Theory of Mind and/or Executive Function Abilities?

In the previous chapter, I addressed my main goal of exploring children's ability to accurately reason about their own future preferences. Combined findings from my three experiments suggest that, over the preschool years, children gradually come to appreciate that their future preferences may differ from their current preferences. That is, when asked what they will like when they're all grown up, 3-year-olds tended to default to their current preferences and selected child-preferable items for their future selves, whereas the majority of 5-year-olds chose adult-preferable items. Although children's ability to recognize others' (future) preferences also improved during the preschool years, my results suggest that children had comparatively more difficulty envisioning their own future preferences. Possible explanations (e.g., knowledge-based reasoning, experience) for this difference were also discussed. In the current chapter, I further discuss possible reasons for this difference. More specifically, I explore the cognitive processes of ToM (i.e., desire/preference, belief, and false-belief reasoning) and EF (i.e., working memory, inhibitory control, and set-shifting) and whether they may be differentially related to children's ability to contemplate their own versus another child's future preferences.

ToM. As mentioned earlier in this thesis, several researchers have argued that future thinking skills may be related to ToM (e.g., Hanson, Atance, & Paluck, 2014). One theoretical argument to support this relation is that both forms of reasoning involve a shift from one's current perspective to an alternate perspective: either the perspective of a *future self* or the perspective of *another person*. Implicit in this argument is that to adopt an alternate perspective, one must first appreciate that others (including the future self) may hold perspectives that are

different from one's own perspective; an ability that is central to ToM. Thus, not only do future thinking and ToM involve similar abilities but ultimately, future thinking may rely on ToM (e.g., Bucker & Carroll, 2007).

To investigate the proposed relation between ToM abilities and future thinking abilities, I correlated children's performance on my Perspective-Taking (PT) task to their performance on four ToM tasks: Diverse Desires (DD), Diverse Beliefs (DB), Contents False Belief (CFB), and Change in Location False Belief (CIL). As mentioned in the General Introduction, these tasks were selected due to their demonstrated convergent and concurrent validity as well as their prominence in the field of children's ToM research. More importantly, each of these tasks taps into an ability that may also be involved in future thinking. The DD task measures children's understanding that one's desires may differ from those of others while the DB task assesses children's knowledge that people can hold different beliefs. Similarly, and as previously argued, envisioning the self in the future and accurately reasoning from that future perspective requires that children understand that the future self's desires and beliefs (or perspective, more broadly) may differ from their current perspective.

The CFB and CIL tasks examine children's understanding that their mental representations of the world can differ both from reality and from those of others. To be successful on these tasks, children must engage in a higher-order level of thought, or "metarepresentation", in which they reflect on a representation of reality (e.g., their former belief in the CFB task and the character's belief on the CIL task) that may differ from reality. It is this form of metarepresentation that Suddendorf and Corballis (1997) argue is necessary to engage in future thinking. That is, children must be able to represent their future selves' thoughts and

representations to understand that their future selves may have mental states that differ from their current states.

Positive correlations between performances on the different ToM tasks and the PT task would indeed suggest that similar cognitive abilities are involved. For example, a positive correlation between children's scores on the PT task and scores on the DD task would suggest that both tasks may involve a basic understanding that one's preferences/desires may differ from those of others (i.e., an adult in the adult-now condition; the future self in the self-future condition; a peer in the future in the peer-future condition; and a character in the DD task).

EF. It has also been theorized that future thinking entails a number of abilities that parallel EF abilities (e.g., Suddendorf & Corballis, 2007). In my General Introduction, I highlighted that envisioning the future involves shifting one's mindset between present and future perspectives; an ability that may be related to *cognitive flexibility* (i.e., mental flexibility, set shifting) or, making "shifts" in our thinking. I also stated that future thinking requires that we minimize the influences of our current perspective; an ability that may be related to *inhibitory control* (IC) or, the capacity to overcome a prepotent response. Finally, I highlighted that engaging in future thinking involves keeping track of the elements that pertain to each perspective and the shifts that we make and thus may be related to *working memory* (WM) or, the EF ability that enables us to hold and manipulate such information in our mind.

To investigate the proposed relation between EF abilities and future thinking abilities, I correlated children's performance on my PT task to their performance on five EF tasks: Count/Label (CL) and Backward Digit Span (BWDS), two measures of WM; Sun/Moon (SM) and Hand Game (HG), two measures of IC; and the Dimensional Change Card Sort (DCCS), a measure of cognitive flexibility. Again, positive correlations between performances on the

different tasks would suggest that similar cognitive abilities are involved. For example, a positive correlation between children's scores on the PT task and scores on SM, or scores on HG, would suggest that both tasks involve inhibiting a prepotent response.

Hypotheses. Consistent with previous research, I expected the majority of ToM tasks to be significantly inter-correlated; however, because the selected ToM tasks form the basis of a developmental scale, I did not anticipate all inter-task correlations to be equally strong (e.g., CFB and CIL, both false belief tasks, would most likely show stronger correlations than CFB and DD, a diverse desires task). Also consistent with previous research, I expected the EF tasks to be positively inter-correlated. Relatedly, I expected that children's performance on all tasks would increase with age (i.e., that 4-year-olds would outperform 3-year-olds), consistent with findings from studies showing that ToM (e.g., Wellman et al., 2001) and EF (e.g., Carlson, 2005) abilities improve substantially over the preschool years. Finally, I expected that the ToM tasks (namely, FB tasks) would be positively correlated with the EF tasks, consistent with findings from studies suggesting that these abilities are related (e.g., Carlson, Moses, & Breton 2002).

Adult-now condition. I predicted a positive correlation between children's performance in the adult-now condition of the PT task and their performance on the ToM tasks, and more specifically, on DD. This is because the adult-now condition requires children to take the perspective of another person and report this person's mental state (in this case, his/her preferences), an ability that has been termed ToM in some of the adult literature (e.g., Buckner & Carroll, 2007). If the ToM tasks and the adult-now condition are, in fact, different measures of the broader construct of ToM, then the correlations between these tasks should be high. Additionally, because the demands of DD most closely parallel those of the adult-now condition

of the PT task (i.e., both require children to reason about another's current preferences) the correlation should be highest between these two tasks.

In addition, I predicted positive correlations between children's performance in the adult-now condition of the PT task and their performance on the five EF tasks. This is because the adult-now condition requires children to switch from their current perspective to the perspective of an adult (i.e., cognitive flexibility), and inhibit their current preference (i.e., inhibitory control) when selecting the item the adult would prefer. Children must also continuously manage the demands of the task and utilize their working memory to recall the perspective from which they are required to reason.

Self-future condition. I predicted a positive correlation between children's performance in the self-future condition of the PT task and their performance on the ToM tasks, and more specifically, on the FB tasks. As mentioned, when children pass a FB task, they demonstrate the knowledge that mental states such as beliefs can vary in two ways: they can differ from their own and they can differ from reality. Correctly identifying one's own future preferences also incorporates the understanding of both differences: differences between people (i.e., between the future self and current self), and differences with reality because the future self is an imagined state.

In addition, considering the future involves a metarepresentation (i.e., thinking about one's future thoughts) and more specifically, the capacity to metarepresent that the future self may hold representations – or thoughts about preferences – contradicting the current self's representations which is argued to be similar to the metarepresentations involved in accurately identifying that another may hold a false belief (Suddendorf & Corballis, 2007). Thus, the correlation should be higher between the self-future condition of the PT task and FB than the

self-future condition and the other ToM tasks. Although the demands of the DD task resemble those of the self-future condition of the PT task in that both require children to identify their own preference/desire and a different preference/desire for their future selves, it does not require the same level of metarepresentation.

I also predicted positive correlations between children's performance in the self-future condition of the PT tasks and their performance on the five EF tasks for the same reasons listed for the adult-now condition. However, I predicted a higher correlation between the self-future condition and the IC tasks, specifically, suggesting that shifting from one's present perspective to one's future perspective draws more heavily on inhibitory control skills. Indeed, inhibitory control skills might partially explain why children performed better in the adult-now condition than the self-future condition because the self's current preferences are more salient in the latter. This is because when identifying another's preferences one asks, for example: What does John like? In contrast, to identify the self's future preferences one asks: What will *I* like in the future? Because there is reference to the self in the question, the self is inherently more salient.

Peer-future condition. I predicted a positive correlation between children's performance in the peer-future condition of the PT task and their performance on the ToM tasks, and more specifically, on FB tasks. Similar to my reasoning for correlations between ToM and the self-future condition, both the peer-future condition of the PT task and FB tasks involve a metarepresentation that someone else's belief or preference can be different from one's own and from reality.

Finally, I predicted positive correlations between children's performance in the peer-future condition of the PT tasks and their performance on the five EF tasks, for the same reasons as for both other conditions. However, I predicted a lower correlation between the peer-future

condition and the IC tasks specifically because the self's current preferences are the least salient in the peer-future condition. That is, the cognitive distance appears greater because children are both choosing for someone else, and for this person at a future time.

Method

Participants. Participants who completed ToM and EF tasks in addition to the perspective-taking task described in Chapter 2 were the 96 typically-developing preschoolers from Experiment 2: 48 3-year-olds (23 boys; $M_{\text{age}} = 42$ months, age range = 36 to 47 months), and 48 4-year-olds (24 boys; $M_{\text{age}} = 53$ months, age range = 48 to 59 months). As mentioned, all children were fluent in English. Additional children were recruited, but were not included in the study due to fussiness (i.e., not wanting to complete the majority of tasks, $n = 5$). Children were recruited by telephoning or e-mailing parents who responded to the print and online advertisements previously described. Again, the sample was predominantly Caucasian (88%), while other ethnic groups were represented to a lesser degree (3% Asian, 4% Black, 1% Hispanic, 3% Middle Eastern, 1% other). Participants were also from primarily middle-class (10%) or upper middle-class income brackets (75%) and had highly-educated parents (20% college diploma, 44% university degree, 27% graduate degree). All children were given a small gift to thank them for their participation and parents of participating children were provided with free parking during the visit.

Procedure. All participants were administered the perspective-taking task (described in Chapter 2), four ToM tasks, and five EF tasks in a single session, lasting approximately 45 minutes. Table 1 provides a brief description of the four ToM tasks, and five EF tasks. Complete task descriptions can be found in Appendix A. All participants were also administered a language measure during this same session. More specifically, children's combined performance

on the Receptive Vocabulary (RV) and Picture Naming (PN; a measure of expressive vocabulary) subtests of the Wechsler Preschool and Primary Scale of Intelligence, Third Edition (WPPSI-III; Wechsler, 2002), was used as the estimate of children's linguistic development.

Because the desired number of participants did not allow for total randomization across all tasks, task order was determined in the following manner. A Latin square design was used to counterbalance blocks of similar tasks: the self-now/peer-now trials of the perspective-taking task (PT1) (block 1), the adult-now/self-future/peer-future trials of the perspective-taking task (PT2) (block 2), the four ToM tasks (block 3), and the five EF tasks (block 4). The two language subtests, language being a control measure, were always administered as the fifth block. (RV always preceded PN as is standard in WPPSI-III administration.) This resulted in four block orders (see Table 2).

Recall that the perspective-taking task consisted of three conditions: adult-now (A), self-future (B), and peer-future (C). Each of the four block orders (1, 2, 3, and 4) was allotted to each of the three different conditions. The result was twelve unique protocols (A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, and C4). For each protocol, the PT1 and the PT2 trials, as well as the four ToM and the five EF tasks were assigned a random order within their predetermined blocks. Additional counterbalancing information is provided with each task description. Finally, each protocol was administered eight times. That is, two 3-year-old girls and two 3-year-old boys completed protocol A1, as did two 4-year-old girls and two 4-year-old boys; and so on.

I completed the sessions for 30% of the participants, while two research assistants complete the sessions for 40% and 30% of the participants, respectively. A third research assistant, who was blind to the study's hypotheses, completed reliability coding on 50% of the

sessions. Measures of reliability accompany each task description (see Appendix A), and all disagreements were resolved by a third coder.

Results

Preliminary analyses. Missing data analyses revealed that 16 participants (16.7% of the sample) did not contribute a Hang Game (HG) score. Two of these scores were missing due to administration errors whereby the experimenter discontinued the task prematurely. The remainder of the missing HG scores resulted from a combination of participants who did not attempt the task altogether, or chose not to continue at some point. In all instances, a total score could not be calculated because of the incomplete trials. None of the other tasks had a comparable amount of missing scores (i.e., missing scores represented less than 10% of the sample in all other instances) suggesting that there may have been a characteristic of the HG task that appealed less to children (e.g., length of instructions/practice trials, number of actual trials, “fun factor”). As such, it was judged that children’s performance on this task may not reflect their true inhibitory control abilities and thus, the HG data were dropped from subsequent analyses.

Although there is no agreed upon cut-off in the literature as to an acceptable percentage of missing data, less than 5% missing data is believed to be inconsequential (Schafer, 1999). Nonetheless, missing data mechanisms and missing data patterns are also said to impact on research results (Tabachnick & Fidell, 2012). With respect to the other tasks, there was no particular pattern to the missing scores which represented only 1.84% of task scores (20 of 1056 total scores). Because of the manner in which data were entered (i.e., as total scores per task rather than as individual data points for each trial), percentage of overall missing data points (e.g., a given trial on the Sun-Moon task) could not be calculated. However, a very conservative

estimate, in which missing task scores are attributed to missing data for all trials on the task in question (which was rarely the case), suggested a maximum of 4.43% missing data (544 of 12 288 individual data points). Of the cases (i.e., participants) with missing tasks scores, a single one of them was missing more than three scores (i.e., DD, CFB-self, CFB-other, and BWDS scores, in addition to the HG score). Inspection of this participant's performance on other tasks revealed that the participant obtained scores of 0 and/or scores that were lower than most participants on the majority of tasks including both language tasks suggesting that there were comprehension difficulties. As such, this case was eliminated from subsequent analyses.

Remaining cases with two or less missing task scores had the missing values replaced with the variable mean using the Expected Maximization (EM) method with Age and Condition as predictor variables. The EM method (see Schafer, 1997; Schafer & Olsen, 1998) involves first estimating the means, variances, and covariances for each task score from subjects whose data is complete and within the parameters of the predictor variables. Thus, in this case, means, variances, and covariances for each task score were estimated for each of the six Age x Condition combinations. Second, a maximum likelihood procedure estimates a regression equation that relates each task score to each of the other task scores (e.g., $SM = 0.12PT + 0.134CL - 0.214DD + \dots + 0.0013DB$). These equations are then used to estimate the missing values. To ensure the estimates are more realistic, some error is introduced to the variances and covariances. Using these new data, the means, variances, and covariances are then estimated again. The regression equations are also calculated again (still using maximum likelihood procedures) and finally, new estimates are produced. This sequence: 1- the calculation of means, variances, and covariances, 2- the formulation of regression equations, and 3- the estimate of missing values, is repeated until the estimates change only negligibly. Values generated by this

EM method were then rounded off to the nearest plausible values (e.g., 0 or 1 for a DD score; an integer between 0 and 21 for the SM score, etc.).

Univariate outliers (i.e., values more than 2 standard deviations from the mean) were identified by saving standardized values as variables for all tasks. There were only such outliers on the two language subtests (i.e., RV and PN). More specifically, five participants obtained a score of 11 or below on RV and three participants obtained a score of 6 or below on the PN. These outliers were transformed by making them the next lowest possible scores of 12 and 8 for RV and PN, respectively.

Kurtosis and skewness statistics for all variables of interest were examined for absolute values greater than 3.3 which would be considered indicative of violating the assumption of normality (Tabachnick & Fidell, 2012). The greatest values were 1.13 (BWDS) and -2.02 (CFB-other) for skewness and kurtosis, respectively, suggesting that all variables approximate a normal distribution. Finally, bivariate correlations between all variables of interest were performed. The highest correlation was .68 (between RV and PN) and thus, there was no indication of multicollinearity between variables.

Descriptive and developmental analyses. Separate one-way analyses of variance (ANOVAs) on continuous variables and Chi square analyses on categorical variables examined the effects of participants' sex, and task counterbalancing. Children's performance on the variables of interest did not vary significantly as a function of sex nor task order and so I collapsed across these variables for all subsequent analyses.

One-way ANOVAs¹ on continuous variables (i.e., language measures and EF tasks) and Chi square analyses on categorical variables (i.e., ToM tasks) were conducted to test for age effects (see Table 3). Four-year-olds performed significantly better than 3-year-olds on all EF

tasks. Despite the mean scores of 4-year-olds being higher than that of 3-year-olds on the DD and the DB tasks, the differences were not statistically significant. However, age effects were significant on the three other ToM task scores (CFB-self, CFB-other, and CIL). Age effects were also significant on the RV and the PN raw scores as well as on a composite language score (LComp). Although a General Language Composite (GLC) score that is made up of the combined performance on RV and PN can be obtained on the WPPSI-III, it is a standardized score that controls for age. Thus, the alternate language composite (LComp) score was created by averaging both scores, after first standardizing individual scores into z -scores so they fell on the same scale. This allowed for a single measure of language ability independent of age.

Relations within ToM tasks and within EF tasks. Pearson product-moment correlation coefficients (two-tailed) were calculated for both the ToM tasks and the EF tasks to determine whether the tasks of the same type were related to one another as well as to age and language. Partial correlations were also computed to determine whether the relationships remained significant after controlling for chronological age (in months) and language ability. These partial correlations (as well as all subsequent ones) were first conducted using the raw scores on RV and PN, then using the LComp score, and finally using the GLC (omitting the age variable already accounted for in this case). Results were similar in all instances and thus, for simplicity, only the LComp is reported.

ToM. Three of the five ToM scores (CFB-self, CFB-other, and CIL) were significantly inter-correlated both before and after controlling for age and language while the two other scores (DD and DB) became significantly inter-correlated only after controlling for age and language (see Table 4). I calculated the Cronbach's alpha level on a scale made up of the three false belief

scores (i.e., CFB-self, CFB-other, CIL), and the resulting alpha was good, $\alpha = .76$, leading me to create a composite false-belief score (an average of the three scores).

EF. All four of the EF tasks (Count/Label, Backward Digit Span, Sun/Moon, and Dimensional Change Card Sort) were significantly inter-correlated both before and after controlling for age and language (see Table 5). As a result, I created an EF composite score by averaging the scores from all four EF tasks, after first standardizing individual scores into *z*-scores so they fell on the same scale. The Cronbach's alpha for this composite score was good, $\alpha = .70$. However, I also created a WM composite score by averaging the scores from the two WM tasks again, using the standardized individual scores. The Cronbach's alpha for this composite score was also good, $\alpha = .73$. My reasoning for creating these two separate composite scores was to allow me to correlate children's performance on the PT task with their performance on the EF tasks at varying levels of specificity (e.g., PT scores with EF composite, PT scores with working memory composite, and PT scores with individual EF tasks).

Relations between ToM abilities and EF abilities. As mentioned, there is evidence to suggest that ToM and EF are closely related (e.g., Carslon & Moses, 2001). Thus, Pearson product-moment correlation coefficients (two-tailed) were calculated to determine whether my data also suggest a link between the different ToM and EF-related abilities. Partial correlations were also computed to determine whether any relationships remained significant after controlling for chronological age (in months) and language ability. DD scores initially correlated with the WM composite and the SM scores but not the DCCS scores; however, the correlations did not remain significant after controlling for age and language ability. DB scores did not significantly correlate with any of the EF-related scores. Finally, the FB composite correlated with all three EF-related scores, both before and after controlling for age and language (see Table 6).

Finally, although I previously reported developmental analyses where I examined the effects of age on all task scores, I also examined whether ToM and EF scores (individual and composite) were similar across the three conditions of the perspective-taking task. Recall that in Chapter 2, performance on the perspective-taking task differed by condition. As such, I wanted to ensure that the groups of children in each condition did not, for some unknown reason, also differ on their ToM and EF scores (despite the ToM and EF tasks being identical across conditions except for the order in which they were presented). However, recall that preliminary analyses revealed no effect of task order on any of the ToM or EF variables. One-way ANOVAs on continuous variables (i.e., EF tasks and composite scores) and Chi square analyses on categorical variables (i.e., DD and DB) were conducted to test for condition effects. In all instances, mean differences across conditions were not statistically significant. Thus, children performed similarly on ToM tasks and EF tasks independent of which condition of the perspective-taking task to which they were assigned.

Relation between reasoning about (future) preferences, ToM, and EF. To determine the extent to which reasoning about an adult's current preferences, one's own future preferences, and the future preferences of a peer are related to ToM and EF abilities, I conducted separate Pearson product-moment correlation coefficients (two-tailed) by condition. Partial correlations were also computed to determine whether the relationships remained significant after controlling for chronological age and language ability (see Table 7).

PT scores significantly correlated with the EF Comp scores across conditions before controlling for age and language. These correlations remained significant after controlling for age and language in the self-future and peer-future conditions only. There were also several other differences with respect to the various EF abilities that likely contributed to the correlations

between the PT scores and the EF Comp scores. In the adult-now condition, PT scores were only significantly correlated with the DCCS scores before controlling for age and language (though the partial correlation approached significance). In the self-future condition, PT scores were initially significantly correlated with WM Comp scores, SM scores, and DCCS scores. After controlling for age and language, the correlation between PT scores and DCCS scores remained significant while the correlations between WM Comp scores and SM scores approached significance. Finally, in the peer-future condition, PT scores were significantly correlated with the WM Comp scores and DCCS scores before controlling for age and language and approached significance afterwards. In addition, PT scores in the peer-future condition were the only scores found to be correlated to any measure of ToM and, more specifically, the FB Comp scores. This correlation also approached significance after controlling for age and language.

Discussion

The goal of this chapter was to examine the relation between children's ability to envision their future preferences and their ToM and EF abilities. However, before I interpret the associations I found between reasoning about one's own and others' (future) preferences and ToM/EF, it is important to note that I largely replicated a number of findings with respect to the development of ToM and EF abilities themselves. Consistent with the age-related increases in performance reported in numerous studies (e.g., Carlson & Moses, 2001; and Wellman et al., 2001), I also found that 4-year-olds outperformed 3-year-olds on all ToM and EF tasks. Within the ToM tasks, children in my study demonstrated the developmental sequence of understanding proposed by Wellman and Liu (2004) by which they first understand diverse desires (i.e., highest mean performance), followed by diverse beliefs (i.e., lower mean performance than DD), and finally false-belief understanding (i.e., lowest mean performances). In addition, a number of the

ToM tasks (i.e., FB-related tasks) were inter-correlated with one another, as were all of the EF tasks. The FB composite score and EF scores (i.e., the WM composite, the SM score and the DCCS score) also remained correlated after controlling for age and language, which is consistent with previous research that suggests that ToM (namely, FB understanding) and EF skills are closely related (e.g., Benson et al., 2013; McAlister & Peterson, 2013; Müller et al., 2012). That I was able to replicate findings from previous research suggests that I can be confident that my other findings (i.e., those based on children's performance on the PT task and its relation to their performance on the ToM and EF tasks) were not due to sampling biases or the testing environment.

Another important consideration in the interpretation of my results is the fact that children performed similarly on ToM and EF tasks across conditions. This finding provides further evidence that children's performance on the PT task was independent of their performance on all other tasks and that any differences in performance on the PT task can, in fact, be attributed to the perspective that children were required to adopt.

Relation between preference reasoning and ToM. Contrary to my predictions, I only found one significant correlation involving ToM: children's performance in the peer-future condition was significantly correlated with their false-belief understanding. Because none of the other correlations were significant, it appears that my results do not support a relation between reasoning about one's own future preferences and ToM. Similarly, Hanson et al. (2014) failed to find an association between children's performance on a battery of tasks measuring episodic foresight (EpF) and the same traditional ToM tasks used in the current study. Both Hanson et al.'s and my findings fail to support recent theories emphasizing similarities between the ability to take the perspective of a future self and the ability to take the perspective of another person

(i.e., ToM) (e.g., Buckner & Carroll, 2007; Suddendorf & Corballis, 1997, 2007). Recall from the General Introduction that Hanson et al. argued the EpF tasks administered for their study may not have required the same kind of “perspective shift” as the ToM tasks. However, just as the ToM tasks required children to explicitly contrast two mental states (e.g., the child knows the ball is in the red box while the character believes the ball is in the blue box), children also had to explicitly contrast their present and future selves in the self-future condition of the PT task (e.g., the child likes stickers right now while he may prefer magazines in the future). In addition, results from the PT task, specifically that children performed better in the adult-now and peer-future conditions than in the self-future condition, further suggest that envisioning the self in the future differs from taking the perspective of another person.

Relation between preference reasoning and EF. Consistent with my predictions, children’s performance in all conditions of the PT task was significantly correlated with their performance on the DCCS, a measure of cognitive flexibility. This suggests that one of the key elements in being able to accurately reason about one’s own future preferences or the preferences of others is the ability to make a cognitive switch in one’s thinking and adopt the other perspective. I argued that working memory was also likely essential for children to recall the perspective from which they were required to reason. However, working memory composite scores were only significantly correlated with children’s performance on the PT task in the self-future and peer-future conditions. It may simply be that the working memory demands in these conditions are greater than in the adult-now condition. That is, in the adult-now condition, children must recall that they are selecting items for an adult (i.e., “who?”) whereas in the self-future and peer-future conditions, children must recall both that they are selecting for either the self or a peer in the future (i.e., “who?” and “when?”). Finally, results supported my hypothesis

that the inhibitory demands would be greatest in the self-future condition as children's performance on the measure of inhibitory control, the SM task, was significantly correlated with their performance on the PT task in the self-future condition only suggesting that the self's current preferences are more salient in the self-future condition. Again, it may be that reference to the self in any context, including the future (i.e., Which of these will *you* like best when *you* are all grown-up?), draws one's attention primarily to the self in its current state such that overcoming its influences is particularly challenging (e.g., Right now I like Dora the Explorer but what will I like when I'm all grown up?).

Taken together, my findings offer some preliminary evidence that reasoning about one's future preferences is related to cognitive flexibility, working memory, and inhibitory control, as has been suggested by a number of researchers (Atance & Jackson, 2009; Buckner & Carroll, 2007; Suddendorf & Corballis, 2007), though this finding will need to be replicated and extended in future studies. In addition, by identifying how the mechanisms that underlie thinking about one's own future preferences differ from those that underlie thinking about the (future) preferences of another person, my results may serve to further explain the self-other differences in children's reasoning reported in the literature (e.g., Russell, Alexis & Clayton, 2011).

In sum, despite theoretical arguments supporting a relation between future thinking, ToM, and EF, very few studies have explicitly examined the possible links in young children. Although preliminary findings were mixed, there was little empirical evidence supporting the relation between future thinking and ToM. Results from the current study, in the context of reasoning about future preferences, also failed to support such an association. However, there is increasing evidence that future thinking may involve EF abilities including cognitive flexibility, working memory, and inhibitory control, as was the case in the current study.

Table 1

Task Descriptions

Task	Description
<i>ToM Tasks</i>	
Diverse Desires (Wellman & Liu, 2004)	Child chooses a “snack” for someone whose preference is stated to be opposite of that of the child’s.
Diverse Beliefs (Wellman & Liu, 2004)	Child indicates where a character will search for his bunny, after finding out that the character’s belief is the opposite of the child’s own belief.
Contents False Belief (Wellman & Liu, 2004)	The true contents of a Raisins box (marbles) are revealed to the child, who is then asked what s/he (i.e., the self) originally believed was in the box as well as what a naïve character (i.e., other) will think is in the box.
Change in Location (Carlson & Moses, 2001)	A classic “Sally-Anne” task, where the child must assess a character’s false belief.
<i>EF Tasks</i>	
Sun/Moon (Simpson & Riggs, 2005)	Child is instructed to say “sun” when presented with a card depicting a moon, and “moon” when presented with a card depicting a sun.
Hand Game (Hughes et al., 1998)	Child learns to mimic the hand gestures of the examiner (i.e., make a fist or point a finger), and then is asked to make the opposite gesture.
DCCS (Zelazo, 2006)	Child learns to sort cards by color, and then is told to sort by a new dimension, shape or vice versa.
Backward Digit Span (Carlson, 2005)	Child is asked to repeat a series of numerical digits, in reverse order, beginning with sequences of 2 digits.
Count/Label (Carlson, 2005)	Child is instructed to first label (e.g. cloud, duck, plane), then count (e.g. 1, 2, 3), and finally count and label objects at the same time (e.g. 1 is a cloud...)

Note. DCCS = Dimensional Change Card Sort

Table 2

Task block orders

Task Blocks					
Order	First	Second	Third	Fourth	Fifth
1	PT1	PT2	ToM	EF	Language
2	PT2	EF	PT1	ToM	Language
3	ToM	PT1	EF	PT2	Language
4	EF	ToM	PT2	PT1	Language

Note. PT1 = self-now/peer-now trials of the perspective-taking task, PT2 = adult-now/self-future/peer-future trials of perspective-taking task, ToM = ToM tasks, EF = EF tasks, Language = language subtests of the WPSI-III.

Table 3

Mean Scores on all Tasks as a Function of Age

Task	3-year-olds	4-year-olds	Age effects
<i>Perspective-taking task</i>	.49(.36)	.66(.36)	$F(1, 93) = 5.16^{**}$
<i>Language measure (WPPSI-III)</i>			
RV (raw scores out of 38)	21.35(5.40)	25.00(4.63)	$F(1, 93) = 12.47^{**}$
PN (raw scores out of 30)	17.13(4.80)	21.00(3.72)	$F(1, 93) = 19.29^{**}$
Language Composite (z-scores)	-.37(.92)	.38(.75)	$F(1, 93) = 19.17^{**}$
<i>ToM tasks</i>			
DD (range = 0-1)	.77(.43)	.85(.36)	$\chi^2(1, n = 95) = 1.00$
DB (range = 0-1)	.69(.47)	.79(.41)	$\chi^2(1, n = 95) = 1.22$
CFB-self (range = 0-1)	.31(.47)	.62(.49)	$\chi^2(1, n = 95) = 8.86^{**}$
CFB-other (range = 0-1)	.21(.41)	.51(.74)	$\chi^2(1, n = 95) = 9.44^{**}$
CIL (range = 0-1)	.19(.39)	.57(.50)	$\chi^2(1, n = 95) = 15.11^{**}$
<i>EF tasks</i>			
Count/Label (range = 0-2)	.50(.83)	1.60(.80)	$F(1, 93) = 43.24^{**}$
BWDS (range = 0-5)	.25(.76)	1.57(1.47)	$F(1, 93) = 30.63^{**}$
Sun/Moon (range = 0-21)	10.79(7.34)	15.85(6.35)	$F(1, 93) = 12.89^{**}$
DCCS (range = 0-5)	2.33(2.24)	4.06(1.82)	$F(1, 93) = 16.98^{**}$

Note. Standard Deviations are in parentheses. DD = Diverse Desires, DB = Diverse Beliefs, CFB =

Contents False Belief, CIL = Change in Location, BWDS = Backward Digit Span, DCCS = Dimensional

Change Card Sort. * $p < .05$, ** $p < .01$.

Table 4

Correlations between Theory of Mind (ToM) Tasks

Task	2	3	4	5	6	7
1. Age	.47**	.13	.09	.38**	.36**	.36**
2. LComp	-	.26*	.05	.53**	.39**	.31**
3. DD			.20(.21*)	.18(.10)	.08(.03)	.16(.13)
4. DB			-	.12(.14)	.05(.05)	.02(.03)
5. CFB-self				-	.58**(.55**)	.49**(.48**)
6. CFB-other					-	.46**(.44**)
7. CIL						-

Note. Partial correlations controlling for age and language are shown in parentheses. * $p < .05$,

** $p < .01$. RV = Receptive Vocabulary, PN = Picture Naming, LComp = Language Composite,

DD = Diverse Desires, DB = Diverse Beliefs, CFB = Contents False Belief, CIL = Change in

Location.

Table 5

Correlations between Executive Functioning (EF) Tasks

Task	2	3	4	5	6
1. Age	.47**	.56**	.48**	.38**	.47**
2. LComp	-	.55**	.49**	.51**	.39**
3. CL		-	.57**(.53**)	.35**(.29**)	.36**(.33**)
4. BWDS			-	.40**(.34**)	.31**(.29**)
5. SM				-	.24*(.21*)
6. DCCS					-

Note. Partial correlations controlling for age and language are shown in parentheses. * $p < .05$,

** $p < .01$. LComp = Language Composite, CL = Count/Label, BWD = Backward Digit Span,

SM = Sun/Moon, DCCS = Dimensional Change Card Sort.

Table 6

Correlations between ToM and EF scores

ToM	EF		
	WM Comp	SM	DCCS
DD	.24*(.18)	.22*(.16)	.02(-.02)
DB	.16(.18)	.08(.09)	-.04(-.03)
FB Comp	.63**(.58**)	.42**(.36**)	.32**(.29**)

Note. DD = Diverse Desires, DB = Diverse Beliefs, FB Comp = False belief composite, WM Comp = Working Memory composite, SM = Sun/Moon, DCCS = Dimensional Change Card Sort. Partial correlations controlling for age and language appear in parentheses. * $p < .05$, ** $p < .01$.

Table 7

Correlations between Perspective-Taking Task Scores and ToM and EF Scores by Condition

	Adult-now	Self-future	Peer-future
<i>ToM</i>			
DD	.27(.18)	-.06(-.11)	.10(.04)
DB	-.17(-.26)	.23(.22)	-.17(.06)
FB Comp	.25(.12)	.21(.16)	.42*(.35 ⁺)
<i>EF</i>			
EF Comp	.39*(.25)	.48**(.45**)	.46*(.37*)
WM Comp	.27(.14)	.37*(.33 ⁺)	.41*(.35 ⁺)
SM	.28(.13)	.37*(.32 ⁺)	.23(.11)
DCCS	.43*(.34 ⁺)	.36*(.41*)	.38*(.30)

Note. DD = Diverse Desires, DB = Diverse Beliefs, FB Comp = False belief composite, EF Comp = Executive Function composite, WM Comp = Working Memory composite, SM = Sun/Moon, DCCS = Dimensional Change Card Sort. Partial correlations controlling for age and language appear in parentheses. * $p < .05$, ** $p < .01$, + $p < .10$.

Footnotes

¹Assumptions of normality for all ANOVAs were verified by visual inspection of Normal Q-Q plots, in addition to the skewness and kurtosis analyses discussed in the preliminary analyses section. Visual inspection of scatterplots of the X residuals and Levene's test for homogeneity of variances were used to verify for violations of the assumption of equality of variances. Independence of observations was assumed as each group had different participants (i.e., each participant could only be in one age group and each participant was randomly assigned to a single condition).

Although ANOVAs are considered robust to violations of the assumption of normality, as a precaution, any such violations resulted in conducting a non-parametric Kruskal-Wallis Test (for k samples, e.g., between conditions) or a non-parametric Mann-Whitney U Test (for 2 samples, e.g., between age groups), which do not require the assumption of normality. In addition, Welch ANOVAs were conducted in lieu of one-way ANOVAs when there were violations to homogeneity of variances. In all instances, parametric and non-parametric analyses revealed the same pattern of findings (see Appendix B). For clarity and consistency, I report only the results of the parametric analyses.

CHAPTER 4

General Discussion

This dissertation comprises an empirical study of children’s ability to reason about future preferences. It provides a timely contribution to the expanding research on young children’s future-oriented cognition and is the first study to examine children’s understanding of their own future mental states (i.e., preferences). In addition, by varying the perspective children were required to adopt, my perspective-taking task allowed for a direct comparison of children’s reasoning about their own future preferences with their capacity to consider other people’s current and future preferences. Finally, this dissertation explored the relations between understanding preferences and theory of mind (ToM) and executive function (EF) abilities. Below, I first address the hypotheses outlined in the General Introduction that pertain to the two main objectives of my research. I then address the two secondary objectives of my research. Next, I summarize the findings associated with each research question, and relate these findings to the existing literature. I then conclude by discussing my study’s limitations and how these might be addressed by proposing directions for future research.

Do Preschoolers Understand That Their Future Preferences May Differ From Their Current Ones?

The first main goal of this dissertation was to investigate 3-, 4-, and 5-year-old children’s understanding that the preferences of their “grown-up” (i.e., adult) selves may differ from those of their current (i.e., child) selves. To do so, I presented children with pairs of child- (e.g., picture books) and adult- (e.g., newspapers) preferable items and asked them to choose which ones they would like best “when they are all grown up” (self-future trials) and which ones they liked best “right now” (baseline trials). The results presented in Chapter 2 suggest that 3-year-olds have

difficulty envisioning themselves as preferring, for example, newspapers in the future because they currently prefer picture books. In fact, more often than chance, they selected “child” items such as the picture books as preferable to their future selves. However, by 5 years of age, children were generally competent at identifying that, as adults, they would likely prefer the newspaper to a picture book. More often than chance, they chose “adult” items such as the newspaper as preferable to their future selves (4-year-olds’ performance did not differ from chance). These findings support my hypothesis that children’s ability to recognize that adult items would be preferable for their grown-up selves would increase with age (Hypothesis 2). This increase in young children’s ability to recognize future preferences between the ages of 3 and 5 may reflect an improvement in their future thinking skills, more broadly. Indeed, similar age trends have been reported across various domains of young children’s future-oriented cognition (e.g., Atance & Meltzoff, 2005; Russell et al., 2010; Suddendorf et al., 2011). Thus, my findings further contribute to a unified picture of improvement in future thinking skills over the preschool years.

Although my study is the first to explore children’s understanding that current and future preferences can differ, there has been a considerable amount of research on children’s understanding that others’ preferences may differ from their own. Some of the findings from this research parallel mine because they also suggest that 3-year-olds have difficulty acknowledging differences in preferences, whereas 5-year-olds do not (e.g., Cassidy et al., 2005; Moore et al., 1995). However, other findings in this area show that, under certain conditions, 3-year-olds do understand differences in preferences (e.g., Wellman & Liu, 2004). To explain this disparity in results, Cassidy et al., (2005) suggested that 3-year-olds experienced difficulty in their study (as well as in similar studies) because the other’s preference *conflicted* (i.e., differed) with the

child's preference, and the child also needed to *infer* the other person's preference based on this person's past experience. Indeed, children reasoned more accurately when neither – or only one – of these factors was involved. For example, although Wellman and Liu's Diverse Desires task involves reasoning about a preference that differs from their own (one of the two factors), children are explicitly told that a character prefers another snack type before they are asked to choose a snack for the character. Cassidy et al., would thus argue that 3-year-olds' increased success at identifying that the character would choose a snack that differs from their preferred snack is because they do not have to infer the character's preference (i.e., only one factor is involved).

Applying Cassidy et al.'s (2005) argument to the current study, 3-year-olds' difficulty identifying their future preferences may have also been the result of two factors: 1- a future preference (e.g., coffee) that conflicted (i.e., differed) with their current preference (e.g. Kool-Aid), and 2- having to make an inference from experience because they were not explicitly told that, as a grown-up, they would prefer coffee to Kool-Aid. Indeed, while many children have observed adults enjoying a cup of coffee, most children have not yet experienced enjoying coffee themselves. Thus, if children were inferring the type of beverage they might enjoy from their own past experience, their choices were likely limited to water, milk, or juice (Kool-Aid). This would have led them to incorrectly select their current preference as also preferable for their future selves (e.g., So far, I've always liked juice so I'll like juice when I'm all grown-up). Arguably, 5-year-olds haven't yet enjoyed a cup of coffee either and would make similar inferences as the 3-year-olds. Thus, it appears that Cassidy's et al.'s argument is more of a description of *when* 3-year-olds are likely to have difficulty and not *why* they have difficulty in

comparison to older children. My other research questions address both when and why children might have difficulty understanding their future preferences.

How Does Preschoolers' Reasoning About Other People's Preferences Compare To Their Reasoning About Their Own Future Preferences?

The second main goal of this dissertation was to directly compare children's understanding of their own future preferences (self-future condition) to their understanding of an adult's current preferences (adult-now condition), and another child's future preferences (peer-future condition). Recall that I predicted age-related increases in performance in the self-future condition. Similarly, I hypothesized that children's ability to identify adult items as preferable to an adult would increase with age (adult-now condition; Hypothesis 1), as would their ability to identify adult items as preferable to a grown-up peer (peer-future condition; Hypothesis 3). The findings I report in Chapter 2 support both hypotheses. Children's performance in the adult-now condition is also consistent with the increase in children's ability to accurately identify the preferences of others between 3 and 5 years reported in the literature (e.g., Atance et al., 2010) as well as an increase in their capacity to conceive the viewpoint of others, more broadly, as evidenced in the children's ToM literature (e.g., see Wellman et al., 2001 for a review). Children's performance in the peer-future condition is also consistent with research on preferences and ToM, as well as with the improvement in children's future thinking skills over the preschool years.

Despite overall age-related improvements in performance, there were significant differences in children's performance between conditions. More specifically, my results indicate that children were better at predicting the current preferences of an adult and the future preferences of a same-aged peer than at predicting their own future preferences. Based on my

findings from Experiment 1, I had predicted that children in the adult-now condition would select more adult items on the target trials than children in the self-future condition (Hypothesis 4). These findings were replicated in Experiment 2 supporting my hypothesis, and suggesting that considering other people's preferences is easier than considering one's own future preferences. However, as discussed in the General Discussion section of Chapter 2, these findings are in contrast to Buckner and Carroll's (2007) review of the literature which suggests neural overlap (e.g., midline regions of the frontal lobe), at least in healthy adults, between different forms of perspective-taking including conceiving the viewpoints of others and envisioning the self in the future. By their account, because these different forms of perspective-taking rely on the same core brain network, these abilities should emerge around the same time. Yet, my findings suggest that the ability to conceive the viewpoint of others may emerge before the ability to imagine the self in the future and that, ultimately, future thinking may rely on ToM. Nonetheless, these findings would need to be replicated in studies with larger sample sizes using regression and factor analyses.

One explanation for the disparity between my results and those of Buckner and Carroll (2007) is that the brain network involved in both ToM and future thinking is also responsible for a number of other abilities (e.g., EF-related abilities are also associated with frontal lobe activity). Thus, while there may be overlap in the cognitive processes involved in both forms of reasoning, some (such as inhibitory control skills, discussed later) may be more specific to future thinking, or to specific aspects of future thinking. As such, at least with respect to the diverse nature of preferences, children appear more proficient at understanding differences in preferences between self and other, before they demonstrate this understanding for the self over time, despite similarities in the brain network involved.

Children's performance in the peer-future condition provides further evidence suggesting children's difficulty reasoning about their own future preferences does not stem from difficulties with future thinking, more broadly, but rather from processes specific to reasoning about one's *own* future preferences. This is because children were more accurate in identifying the future preferences of a same-aged peer than their own future preferences. Recall that I had put forth three alternative hypotheses with respect to the peer-future condition: that children would perform similarly in the self-future and peer-future conditions (Hypothesis 5); that children would perform better in the self-future condition than in the peer-future condition (Hypothesis 6); or, that children would perform better in the peer-future condition than in the self-future condition (Hypothesis 7). My findings support the latter. As discussed in Chapter 2, these results are in contrast to the theory-theory account of children's ToM development stipulating that children use the same theoretical constructs to reason both about the mental states of others as well as their own (e.g., Gopnik & Wellman, 1992), and thus should have performed similarly in both conditions. They are also inconsistent with simulation-theory that posits that children use the self as a basis for predictions about others (e.g., Harris, 1992). That is, by a simulation account, children should have been more proficient at reasoning about the future self than a "future" peer.

In Chapter 2, I discussed possible explanations as to why children find it more difficult to reason about their own future preferences than to reason about the (future) preferences of others. I first suggested that reasoning about one's own future preferences may involve both 1- the knowledge of what adults generally prefer (i.e., the semantic system) and 2- envisioning the self in the future and thinking about what I will likely prefer at the time (i.e., the episodic system, or mental time travel). However, reasoning about both an adult's preferences and the future

preferences of another child may simply involve the semantic system and consequently, may be an easier form of reasoning.

I also suggested that differences in experience may play a role in explaining why reasoning about one's own future preferences is more difficult than reasoning about others' preferences. More specifically, whereas children are regularly exposed to differences in preferences between people (e.g., they prefer Batman whereas their friend prefers Optimus Prime), they have few experiences witnessing their own preferences changing over time (e.g., they preferred the swings as toddlers but now prefer the monkey bars when playing at the park). In fact, identifying future preferences requires reasoning about a point in time that children have not yet experienced.

In Chapter 3, I explored possible mechanisms that underlie reasoning about preferences with the objective of providing additional insight into the self-other differences. More specifically, I explored ToM, as it pertains to the developmental literature, as well as executive function (EF) abilities.

Was Preschoolers' Reasoning About Future Preferences Associated With Their Performance on ToM Tasks?

Results from the additional analyses presented in Chapter 3 do not appear to support a link between reasoning about future preferences and ToM. Although children's performance on the perspective-taking task in the peer-now condition was significantly correlated with children's false-belief composite score (FB Comp), children's performance in the self-future condition did not correlate with any of the ToM scores (individual or composite). This latter finding contrasts with recent theories arguing that taking the perspective of others (i.e., ToM), and taking the perspective of a future self both involve "mentally projecting" the self into an alternate

perspective to be able to reason from the perspective of the other person or of the future self (e.g., Buckner & Carroll, 2007).

Hanson et al. (2014) also failed to find a relation between children's performance on a battery of episodic foresight (EpF) tasks and several of the same ToM tasks used in the current study. They argued, however, that the EpF tasks they administered may not have required the same kind of "perspective shift" as the ToM tasks. That is, whereas all the ToM tasks involved a contrast between the self's current perspective (e.g., a preference for cupcakes, the knowledge that the frog is in the green box) and an alternate perspective (e.g., a preference for apples, the belief that the frog is in the yellow box), the EpF tasks did not.

In contrast, the demands of the perspective-taking task used in my experiments appear, at least on the surface, to be similar to the ToM tasks in this respect. That is, in all three conditions (i.e., self-future, adult-now, peer-future), children had to shift from their current perspective to an alternate perspective (i.e., the future self, an adult, or the future of a same-aged peer) and acknowledge that the alternate perspective (i.e., a preference for "adult" items) conflicted with their own (i.e., a preference for "child" items). Similarly, the false belief tasks required children to shift from their current perspective to an alternate perspective (i.e., a character) and acknowledge that their current perspective (e.g., that the ball is in the green box) is different from the alternate perspective (e.g., the bear's belief that the ball is still in the yellow box). Thus, it may simply be that reasoning about the future, at least as it pertains to thinking about future preferences, is somewhat independent of ToM.

Was Preschoolers' Reasoning About Future Preferences Associated With Their Performance on EF Tasks?

Results of the additional analyses (presented in Chapter 3) do, however, support a link between reasoning about future preferences and various EF abilities. Children's performance on the perspective-taking task in all three conditions was significantly correlated with the EF Comp scores. Several other correlations with the various EF abilities were also significant – though to a lesser extent after controlling for the effects of age and language. Notably, all conditions were significantly correlated with the DCCS, a measure of cognitive flexibility, which lends further support to the idea that the perspective-taking task did indeed require some sort of shift in children's thinking.

In addition, the peer-future and self-future conditions were significantly correlated with the working memory composite (WM Comp). This finding supports my argument in the General Introduction that when thinking about the future, and shifting perspectives accordingly, children need to simultaneously hold and process significant amounts of information (e.g., the demands of the task, the perspective from which they are required to reason, etc.).

Finally, only the self-future condition was significantly correlated with the Sun-Moon task, a measure of inhibitory control. This finding suggests that when envisioning their future preferences, children had to draw on their ability to avoid their first reaction of selecting the item they currently preferred to give a more accurate response of an adult item as preferable for their future selves. This finding is also consistent with theories that inhibitory control is one aspect of EF likely to be involved in future thinking (Atance & Jackson, 2009; Suddendorf & Corballis, 2007). Taken together, these results provide preliminary evidence that reasoning about future preferences involves EF abilities including cognitive flexibility, working memory and, when considering one's own future preferences, in particular, inhibitory control. For reasons discussed below, these findings will need to be replicated and extended upon in future studies.

Limitations and Future Directions

I chose to study children's ability to reason about their future preferences. In doing so, I wanted to add to the growing body of research examining episodic foresight (EpF) in children and extend this research to children's understanding of future mental states – preferences, in particular. As mentioned in Chapter 2, it would also be important to address children's understanding of other mental states such as beliefs, knowledge, emotions and intentions in future research. Beyond simply extending the scope of the current research on future-oriented cognitions, comparisons between these different mental states may provide additional insight on the underlying mechanisms that influence future thinking abilities. For example, comparisons between future preferences and emotions - two more affective or “hot” mental states - and future knowledge and beliefs - two more cognitive or “cool” mental states - may show that inhibitory control skills have a more prominent role in the former, than the latter. Indeed, there is substantial research suggesting that inhibitory control skills may be most taxed when reasoning is about “hot” vs. “cool” states (e.g., Zelazo & Carlson, 2012).

Another limitation of my research is that while my perspective-taking task explored children's reasoning about future preferences and the future preferences of others, it is unclear whether it required children to engage in EpF. Hudson et al., (2011) argue that a task must meet specific requirements to ensure that children's EpF skills *specifically*, rather than their reasoning about the future in general, are tapped. These requirements include children envisioning a specific future episode in time, imagining themselves in that episode, and anticipating what they might be thinking and feeling at that time. As I mentioned in my General Introduction, having children identify what they will prefer when they are all grown-up likely required them to anticipate their future thoughts and feelings. It is debatable, however, whether asking children

about their adult preferences required them to mentally project into the future to imagine themselves enjoying coffee, or simply required that children make script-like associations that adults generally like coffee and so, as an adult, they will also like coffee.

However, the fact that there were condition differences on the perspective-taking task in my study (i.e., that children had more difficulty accurately identifying preferences for their future self than for an adult or a peer in the future) suggests that children were not simply making such script-like associations when responding. Otherwise, they should have also succeeded in the self-future condition. That is, as mentioned above, they could have simply reasoned that because grown-ups generally like coffee, when they are all grown up, they will also like coffee and chosen coffee as preferable to their future self. The fact that children were not simply stating what is preferable to adults, and even defaulting to their current preference as was the case for the majority of 3-year-olds, suggests that these children may have been attempting to engage in episodic foresight. That is, they may have tried to imagine themselves in the future, as an adult who prefers coffee to Kool-Aid. However, they may have had difficulty in doing so because, as discussed in Chapter 3, this reasoning requires that they simultaneously focus on the self while overriding the self's current state (e.g., Right now *I* like Kool-Aid, but what will *I* like when *I'm* all grown-up?)

The perspective-taking task we used could be modified to incorporate more of Hudson et al.'s (2011) elements and thus increase the likelihood of measuring EpF. For example, instead of simply asking children what they would like best when they are "all grown-up", children could be asked to envision that it is the morning of their 40th birthday which would correspond to Hudson et al.'s "specific future episode in time" criterion. To encourage children to imagine themselves specifically in that episode (2nd criterion), children could be asked to first "set the

stage” and describe in detail the scenario: Where are they? Who are they with? What are they wearing? For younger children, the answer to some of these could be forced-choice (e.g., Are you at home or at work?) or prompted (Which room of the house are you in?). Such questioning would also likely emphasize the novelty of the scenario as well as spatial and temporal components, which have been argued to be key components of engaging in episodic foresight (e.g., Atance & O’Neill, 2001, 2005; Suddendorf & Busby, 2003; Suddendorf & Corballis, 2007; Tulving, 1984, 2005). Finally, children could explicitly be asked how they are feeling (3rd criterion) by asking them to point to the appropriate face on a card depicting facial expressions linked to basic emotions (i.e., happy, sad, angry, surprised, disgusted, scared). Of interest would then be children’s responses when asked to plan how they would like their birthday to unfold: Would they prefer to drink coffee or Kool-Aid as they watch television?, Would Dora the Explorer or a cooking show be on the screen?, and so forth. The emphasis having been placed on the specific future episode, it might be found that even 3-year-olds are able to override their current state and accurately select the adult items for their future self.

A related point is whether the dichotomous nature of the item choices influenced children’s performance on the perspective-taking task. That is, on any given trial, children had to select between a child-preferable item and an adult-preferable item. When children selected a “child” item for their future selves, this was considered as incorrect. However, children may have considered that adults generally like coffee but believed that they, themselves, would still prefer Kool-Aid in the future. Similarly, on some trials, children chose “adult” items for both their current and future selves. These trials were dropped from the analyses because it was impossible to then determine whether children who had atypical preferences (e.g., preferred coffee to Kool-Aid) were indeed adopting the perspective of their future selves and not merely

stating their own current preference. Again, it may have been that children reasoned correctly and simply decided that that particular preference would remain stable over time (e.g., I prefer coffee to Kool-Aid now, and I will still prefer coffee to Kool-Aid as an adult).

Similar to the ideas put forth in Chapter 2, one way of circumventing these issues would be to present children with a wider array of choices that include both child- and adult-preferable items as well as more neutral items that are less associated to a specific age group. For example, children could be asked to choose between the following beverages: water, milk, chocolate milk, orange juice, apple juice, Kool-Aid, a soft drink, a sports drink, coffee, and wine. Next, children would be asked to place each drink along a ranking scale of 0-10 with unhappy (0), neutral (5), and happy (10) faces as anchors corresponding to how much they currently like each beverage, or how much they anticipate liking them when they are all grown up. Using this method, it might be found that even 3-year-olds understand that preferences may change. For example, a child could rank the Kool-Aid as a 10 and the coffee as a 0 (with the other beverages in between) for their current self (i.e., When asked: How much do like these drinks right now?) and then rank both the Kool-Aid and the coffee as a 10 for their future self (i.e., When asked: How much will you like these drinks when you are all grown up?). This would suggest that although children acknowledge that some of their preferences can change over time, their reasoning is, nonetheless, influenced by their current state.

Another advantage to this method would be that more of the data would be retained. Recall that the trials of children who indicated preferring an adult item for the current self were dropped from analyses because it was impossible to determine whether they were accurately reasoning from a future perspective or simply stating their current preference. For example, a child who chose magazines as preferable to both their current and future selves in the current

study would be able to rank the magazine as a 7 for their current self and a 9 for their future self with the proposed changes suggesting that the child did, in fact, consider what he would prefer in the future. As discussed in Chapter 2, there would be challenges associated with developing such continuous measures for children, but doing so would allow for a more detailed analysis of children's understanding of the diverse nature of preferences, and for a more direct comparison with data from adults that frequently use rating scales (e.g., Quoidbach et al., 2013).

Another limitation of my study is its generalizability. Although the overall sample size in each experiment ($n_1 = 120$, $n_2 = 96$) was sufficient to run the statistical analyses pertaining to the main research goals (i.e., ANOVAs, chance analyses), the sample sizes for the correlational analyses were smaller as a result of these being done separately by condition ($n = 33$; 33; and 29 for the adult-now, self-future and peer-future conditions, respectively). The minimum sample size required to run correlational analyses for large effect sizes of 0.50 with adequate power and alpha levels set at 0.80 and 0.05, respectively, is 26 participants. Ideally, a much larger sample size would have allowed for increased power and sensitivity (i.e., detecting smaller effect sizes). Nonetheless, many of the correlations I found were statistically significant. To be cautious, one could view the correlational analyses in this dissertation as exploratory and thus, in need of replication in studies using larger sample sizes.

Finally, the sample consisted predominantly of Caucasian children from households with highly-educated parents and incomes in upper middle-class brackets, which is consistent with the demographic composition of the region in which the data were collected (i.e., city of Ottawa and surrounding areas). This demographic is also typical of "university cities" where the majority of such research takes place. As such, it is often suggested that future research should include cross-cultural studies in order to have a more diverse sample of children because the findings may not

be representative of all ethnic and socio-economic groups. While there has yet to be cross-cultural research on children's future thinking abilities, there have been several studies examining the development of ToM across cultures. For example, Liu et al. (2008) found parallel developmental trajectories of false-belief understanding for children in China and North America. However, they found that the timing of the trajectory varied by as much as two years. In contrast, Shahaeian et al. (2011) found that there was a cross-cultural difference in the sequencing of ToM steps between Iranian and Australian samples but that the overall rates (i.e., age) of ToM mastery were similar. Thus, it appears that, at least with respect to ToM development, there is evidence to support a general trajectory that is influenced by specific experiential factors. Because desire/preference reasoning is considered an element of ToM, cross-cultural findings related to children's reasoning about future preferences may be similar (i.e., general developmental trajectory with specific variability resulting from different experiences).

Summary and Conclusion

This dissertation explored preschoolers' understanding that preferences may differ between people and over time. The results discussed in Chapter 2 suggest that children's ability to reason about their future preferences, an adult's current preferences, and the future preferences of a same-aged peer develop substantially over the preschool years, and that children are generally proficient at these types of reasoning by 5 years of age. Results also indicate that thinking about one's own future preferences is more difficult than thinking about the (future) preferences of others. Chapter 3 explored the relations between reasoning about preferences and ToM and EF abilities. Correlational analyses revealed that an understanding of differences in preferences between self and other as well as the self over time may be related to EF skills, but

not to ToM. These findings provide preliminary evidence of the mechanisms that may underlie reasoning about preferences and may also help to explain the observed self-other differences.

This study adds a unique contribution to the literature on young children's future-oriented cognition by being the first to examine children's understanding of a future mental state (i.e., preferences). It also extends upon existing future thinking research by suggesting a developmental trajectory for the ability to reason about future preferences and what mechanisms may be involved. Finally, its findings have "real-world" implications in the context of future-oriented decision-making. By knowing that a child is better at reasoning about a peer's future preferences, parents and caregivers can use a peer-oriented strategy. For example, parents could present a story to their preschooler about an older boy that gets to choose how to redecorate his bedroom. They could then ask the child what the boy would like and use the child's response to guide them when selecting that child's bedroom accessories so that a few years down the road, there is less chance of the child growing tired of what was chosen. Thus, understanding the factors that influence children's ability to accurately reason about their future preferences - and the future more broadly - might help circumvent negative consequences.

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Appendix A

Theory of Mind Tasks

Diverse Desires. (Wellman & Liu, 2004, derived from Wellman & Woolley, 1990, and Repacholi & Gopnik, 1997). Children were shown a toy figure of the muppet “Ernie”, a picture of an apple, and a picture of a cupcake and told: “Here’s Ernie. It’s snack time, so Ernie wants a snack to eat. Here are the two different snacks: an apple and a cupcake.” They were then asked to choose which snack they would prefer for snack time (own-desire question): “Which snack would you like best? Would you like an apple or a cupcake best?” Finally, they were told that Ernie likes the other snack, and asked the target question: “So, now it’s time to eat. Ernie can only choose one snack, just one. Which snack will Ernie choose? An apple or a cupcake?” The order in which the snacks were named was counterbalanced across participants. To receive a score of 1, children had to respond to the target question with the opposite snack from the own-desire question (Total Score: range = 0-1). Reliability coding resulted in a Cohen’s kappa = 1.0.

Diverse Beliefs. (Wellman & Liu, 2004, derived from Wellman & Bartsch, 1988, and Wellman, Hollander, & Schult, 1996). Children were shown a toy figure of the muppet “Telly”, a picture of a bed, and a picture of a basket and told: “Here’s Telly. Telly wants to find his bunny. His bunny might be hiding under the bed or it might be hiding in the basket.” They were then asked where they thought the bunny was hiding (own-belief question): “Where do you think the bunny is, in the basket or under the bed?” Finally, they were told that Telly thinks the bunny is in the other location, and asked the target question: “So where will Telly look for his bunny? In the basket or under the bed?” The order in which the locations were named was counterbalanced across participants. To receive a score of 1, children had to answer the target question with the

opposite response than that given to the own-belief question (Total Score: range = 0-1).

Reliability coding resulted in a Cohen's kappa = 1.0.

Contents False Belief. (Wellman & Liu, 2004, derived from Perner, Leekam, & Wimmer, 1987). Children were shown a clearly identifiable Raisins box, and asked what they thought was inside. The Raisins box was opened to reveal marbles. The Raisins box was then closed and children were asked the control question: "Okay, what is in the Raisins box?"; followed by the target self question: "When you first saw this box, before we opened it, what did you think was inside? Raisins or marbles?" Next, a toy figure of the muppet "Bert" was produced and children were told: "Now here comes Bert. Bert has never ever seen inside this Raisins box." Children were then asked the target other question: "So, what does Bert think is inside the box? Raisins or marbles?" Finally, they were asked a memory question: "Did Bert see inside this box?" Children received two scores for this task, a "self" score and an "other" score. To receive a self score of 1 children had to answer "Raisins" to the self target question (Total Score: range = 0-1) and to receive an other score of 1, children had to give correct responses to both the target other question ("Raisins") and the memory question ("no") (Total Score: range = 0-1). Reliability coding resulted in a Cohen's kappa = 1.0.

Change in Location False Belief. (Carlson & Moses, 2001, derived from Wimmer & Perner, 1983). Children were introduced to two colourful boxes, a green box and a yellow box, and two characters, a Champ Bear stuffed animal and a Cheer Bear stuffed animal. Champ Bear entered the scene and played with a toy frog. He then put the ball in one of the boxes (counterbalanced) and then left to "go play outside". Next, Cheer Bear entered, retrieved the toy frog, and played with it. She put it in the other box and left. Finally, Champ Bear returned and children were asked the false belief question: "Where does Champ Bear think the frog is?" and

two reality control questions: “Where did Champ Bear put the frog?” and “Where is the frog really?” To receive a score of 1, children had to answer both the false belief and reality control questions correctly (Total score: range = 0-1). Reliability coding resulted in a Cohen’s kappa = 1.0.

Executive Function Tasks

Dimensional Change Card Sort. (*DCCS; cognitive flexibility/set shifting; Zelazo, 2006*). Following the standard version of the DCCS, children were introduced to two boxes, one with a picture of a blue butterfly affixed to the front, and one with a picture of an orange arrow, and told that they were going to play a card game. The experimenter explained that the game was called the colour game, and that they had to sort the cards she presented. She then demonstrated by sorting a blue arrow card into the blue butterfly box. Children were asked to sort an orange butterfly card, and were either praised or corrected for their performance. Children then sorted up to eight test cards, placing them face down into the boxes and, regardless of their performance, the experimenter replied “Let’s do another one”. The experimenter then introduced the post-switch phase, by explaining that “Now, we are going to play a new game. We’re not going to play the colour game anymore, now we are going to play the shape game”. Children were then asked to sort 5 test cards according to the new criteria (according to shape), without any feedback, and their total score was the number of correct post-switch card placements they made (Total score: range = 0-5). Reliability coding resulted in an intraclass correlation coefficient = .960, $p < .001$.

Hand game. (*Cognitive flexibility, set shifting, inhibitory control; Hughes, 1998; derived from Luria et al., 1964*). While modeling a fist, the experimenter asked the child: “Can you show me how to make a fist with your hand?” Then, while modeling a pointing action, the

experimenter asked the child: “Good, now show me how you point your finger.” The child was then told how the hand game was going to be played: “Now we’re going to play the game a little differently. Here’s how we’ll play the game. First we both put our hands on our hips; now when I show you my hand I want you to make the same shape as me. So if I make a fist I want you to make a fist, and if I point a finger you point a finger too.” For the first 2 trials, the child received feedback but the following trials were given without feedback. The experimenter continued modeling actions until the child had correctly imitated 3 pointing gestures and 3 fists.

In the second phase, the experimenter explained the changes to the game: “That was very good. Now the game gets a bit harder. If I point a finger, then I want you to show a fist, and if I show a fist I want you to point a finger, so we’re not making the same shape anymore.” The experimenter modeled actions, with feedback about performance, until the child made 4 consecutive correct responses. Finally, the experimenter told the child: “OK, our practice is over now. Remember, in this game, if I point a finger, then I want you to show a fist, and if I show a fist I want you to point a finger, so we’re not making the same shape any more” and administered trials until the child got 6 correct in a row, with a maximum of 15 trials total. The measure of inhibitory control was the number of correct opposites out of 15. (Total score: range= 0-15). Reliability coding resulted in an intraclass correlation coefficient = .932, $p < .001$.

Sun/Moon task. (*Inhibitory control; Simpson & Riggs, 2005; derived from Gerstadt et al, 1994*). To begin this task, the experimenter showed the child a card depicting a sun and said “This card is sun, right? When you see this card, I don’t want you to say ‘sun’. No, I want you to say ‘moon’.” The same procedure was repeated with the moon card. Children were then given two practice trials, for which feedback was given, followed by 21 test cards, with no additional rule reminders. The cards were presented in a fixed, pseudorandom order. Accuracy (number

correct out of 21) was recorded (Total score: range = 0-21). Reliability coding resulted in an intraclass correlation coefficient = .972, $p < .001$.

Backward Digit Span. (*Working Memory; Carlson, 2005, derived from Davis & Pratt, 1995*). Children were introduced to a toy figurine of the muppet “Cookie Monster” and were told that Cookie says everything the experimenter says, but says it backwards. The experimenter then demonstrated, saying “5-8”, and making Cookie say “8-5”. Children were given two practice trials with feedback, followed by two test trials each with an increasing number of digits, beginning with two digits. The task ended when children erred on both trials of a given level. Children were awarded a score of 1 for each successful trial (Total score – range = 0-5). Reliability coding resulted in an intraclass correlation coefficient = 0.987, $p < .001$.

Count/Label. (*Working Memory; Carlson, 2005*). In this task, the experimenter showed children three small, 2D wooden objects (e.g., a boat, an apple, and a bird) and children watched while the experimenter labeled them (“cloud, duck, plane”). The experimenter then counted the objects out loud (“one, two, three”). Finally, she counted and labeled them each in turn (e.g., “one is a cloud, two is a duck, and three is a plane”). Children were then asked to complete all three steps in two test trials using different objects. Children’s ability to correctly count and label was awarded a score of 1 for each trial (Total score – range = 0-2). Reliability coding resulted in an intraclass correlation coefficient = 1.0.

Appendix B*Parametric and Non Parametric Analyses for the Effects of Order, Age, and Condition on Perspective-Taking Task Performance*

Comparison	Parametric Analyses		Non Parametric Analyses	
	Analyses	Results	Analyses	Results
<i>Experiment 1</i>				
Order (self-now trials first; self-now trials second)	2 x 3 x 2 ANOVA –	$F(1, 108) = 4.95,$	Mann Whitney U Test	$\chi^2(N = 120) = -2.66,$
	Main effect of order	$p = .028$		
Age Group (3; 4; 5)	2 x 3 x 2 ANOVA –	$F(2, 108) = 13.35,$	Kruskal-Wallis Test	$\chi^2(2, N = 120) = 21.17,$
	Main effect of age	$p < .001$		$p < .001$
	Follow-up polynomial	$p < .001$	Follow-up Dunn's Test	
	trend analysis		3 vs 4	$z = -11.62, p = .099$
			4 vs 5	$z = -34.23, p < .001$
			3 vs 5	$z = -22.67, p = .003$
Condition (adult-now; self-future)	2 x 3 x 2 ANOVA –	$F(1, 108) = 9.77,$	Mann Whitney U Test	$\chi^2(N = 120) = -2.92,$
	Main effect of condition	$p = .002$		

Comparison	Parametric Analyses		Non Parametric Analyses	
	Analyses	Results		Analyses
<i>Experiment 2</i>				
Order (baseline-now trials first; baseline-now trials second)	2 x 2 x 3 ANOVA –	$F(1,79) = 6.53,$	Mann Whitney U Test	$\chi^2 (N = 90) = -2.11,$
	Main effect of order	$p = .013$		$p = .035$
Age Group (3; 4)	2 x 2 x 3 ANOVA –	$F(1, 79) = 5.30,$	Mann Whitney U Test	$\chi^2 (N = 90), = 2.25$
	Main effect of age	$p = .024$		$p = .025$
Condition (adult-now; self-future; peer-future)	2 x 2 x 3 ANOVA –	$F(2, 79) = 3.50,$	Kruskal-Wallis Test	$\chi^2(2, N = 90) = 8.44,$
	Main effect of condition	$p = .035$		$p < .015$
	Follow-up Tukey –		Follow-up Dunn’s Test	
	AN vs SF	$p = .050$	AN vs SF	$z = 14.33, p = .024$
	SF vs PF	$p = .037$	SF vs PF	$z = -18.36, p = .008$
	AN vs PF	<i>ns</i>	AN vs PF	$z = -4.03, p = .560$

Comparison	Parametric Analyses		Non Parametric Analyses	
	Analyses	Results		Analyses
<i>Experiment 3</i>				
Order (baseline-now trials first; baseline-now trials second)	2 x 3 ANOVA – Main effect of order	$F(1, 18) = 4.48,$ $p = .048$	Mann Whitney U Test	$\chi^2 (N = 24), = 40.50$ $p = .023$
Condition (adult-now; self-future; peer-future)	2 x 3 ANOVA – Main effect of condition	$F(2, 18) = 0.15,$ $p = .863$	Kruskal-Wallis Test	$\chi^2(2, N = 24) = 0.30,$ $p = .863$

Parametric and Non Parametric Analyses for the Effects of Age on All Tasks

Task	3-year-olds	4-year-olds	Age effects	
			One-way ANOVA/ Chi square	Mann Whitney U Test
<i>Language measure (WPPSI-III)</i>				
RV (raw scores out of 38)	21.35(5.40)	25.00(4.63)	$F(1, 93) = 12.47^{**}$	$\chi^2(N = 95), = 3.24, p = .001$
PN (raw scores out of 30)	17.13(4.80)	21.00(3.72)	$F(1, 93) = 19.29^{**}$	$\chi^2(N = 95), = 3.99, p < .001$
Language Composite (z-scores)	-.37(.92)	.38(.75)	$F(1, 93) = 19.17^{**}$	$\chi^2(N = 95), = 4.17, p < .001$
<i>ToM tasks</i>				
DD (range = 0-1)	.77(.43)	.85(.36)	$\chi^2(1, n = 95) = 1.00$	$\chi^2(N = 95), = 0.99, p = .321$
DB (range = 0-1)	.69(.47)	.79(.41)	$\chi^2(1, n = 95) = 1.22$	$\chi^2(N = 95), = 1.10, p = .272$
CFB-self (range = 0-1)	.31(.47)	.62(.49)	$\chi^2(1, n = 95) = 8.86^{**}$	$\chi^2(N = 95), = 2.96, p = .003$
CFB-other (range = 0-1)	.21(.41)	.51(.74)	$\chi^2(1, n = 95) = 9.44^{**}$	$\chi^2(N = 95), = 3.06, p = .002$
CIL (range = 0-1)	.19(.39)	.57(.50)	$\chi^2(1, n = 95) = 15.11^{**}$	$\chi^2(N = 95), = 3.87, p < .001$
<i>EF tasks</i>				
Count/Label (range = 0-2)	.50(.83)	1.60(.80)	$F(1, 93) = 43.24^{**}$	$\chi^2(N = 95), = 5.47, p < .001$
BWDS (range = 0-5)	.25(.76)	1.57(1.47)	$F(1, 93) = 30.63^{**}$	$\chi^2(N = 95), = 4.95, p < .001$
Sun/Moon (range = 0-21)	10.79(7.34)	15.85(6.35)	$F(1, 93) = 12.89^{**}$	$\chi^2(N = 95), = 3.73, p < .001$
DCCS (range = 0-5)	2.33(2.24)	4.06(1.82)	$F(1, 93) = 16.98^{**}$	$\chi^2(N = 95), = 4.12, p < .001$

Note. Standard Deviations are in parentheses. DD = Diverse Desires, DB = Diverse Beliefs, CFB = Contents False Belief, CIL = Change in Location, BWDS = Backward Digit Span, DCCS = Dimensional Change Card Sort. * $p < .05$, ** $p < .01$.

Appendix C

Recruitment Pamphlet – Full length

Front



○ ○ ○ ○ ○ ○

Would you like to help us learn more about the development of thinking, planning, and language in children?



The University of Ottawa's Childhood Cognition and Learning Laboratory is conducting research on the development of thinking and planning skills in children ages 2 to 5.

Free parking is provided!



Childhood Cognition and Learning Laboratory
University of Ottawa
136 Jean-Jacques Lussier,
Vanier Building, 6th Floor,
Room 6006
Ottawa, ON K1N 6N5
(613) 562-5800 x 4475
e-mail: ccll@uottawa.ca

Please visit our website at:
www.socialsciences.uottawa.ca/ccll/



University of Ottawa's
Childhood Cognition & Learning Lab



○ ○ ○ ○ ○ ○

Are you looking for a fun and interesting activity to do with your child?

Back



OUR STUDIES

We are currently conducting a number of studies to help us learn more about the development of thinking, planning, and language in children.

Our studies consist of a series of fun and interesting games that your child will play with one of our experienced and friendly researchers. The games usually involve pictures, toys, puppets, and stickers.

The way in which your child responds during these games can help us learn a lot about cognitive development!

VISITING OUR LAB

Your visit to the CCLL will be arranged at your convenience. Visits take about an hour and you will always be with your child, either in the same room, or watching over a TV monitor in an adjoining room.

All children receive a small gift to thank them for their help and free parking is provided!

If you have a child between the ages of 2 and 5, we invite you to take part in a study at the University of Ottawa's Childhood Cognition and Learning Laboratory.



BENEFITS

Children tend to enjoy participating in our studies. In fact, it is not uncommon to hear children say that they would like to come back! In addition, parents enjoy discovering new aspects of their child's behaviour and thinking by watching our testing sessions. Through your help, we are also able to advance our scientific knowledge about the child's mind and its development.

CONTACT US

If you are interested in having your child participate in one of our studies, or would like more information, please call or email the Childhood Cognition and Learning Lab at:

(613) 562-5800 x4475
ccll@uottawa.ca

Appendix D

Recruitment Pamphlet – Abbreviated

Front

Are you looking for a
fun and interesting
activity to do with
your **child**?



Childhood
Cognition and
Learning Lab | 

- If you have a child **between ages 2 and 5**, we invite you to participate in an hour-long study at the **University of Ottawa**.
- We study children's **planning, memory, and problem-solving**.
- Our studies consist of a series of **fun activities** that help us discover how children think.
- **Parking is free**, and your child will receive a **thank-you gift** at the end of your visit!
- To participate, please fill out our online form: <http://bit.ly/uottawaccll>



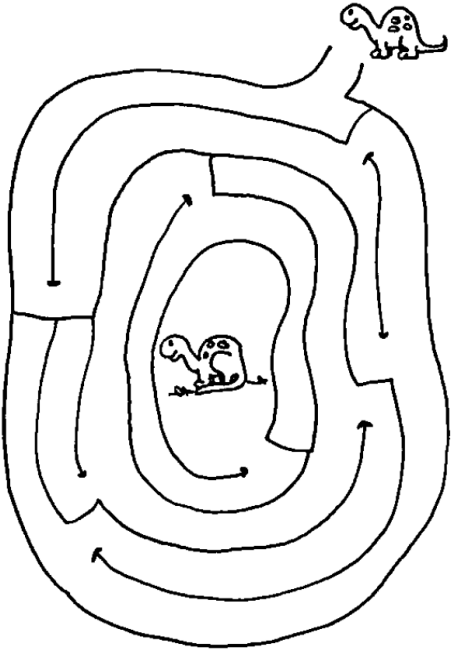
For more information, please contact us:
ccll@uOttawa.ca
613-562-5800 x 4475

University of Ottawa
Childhood Cognition and
Learning Laboratory
136 Jean-Jacques Lussier
Vanier Hall, Room 6006
Ottawa, Ontario K1N 6N5

www.socialsciences.uOttawa.ca/ccll 

Back

Can you help
the dinosaur
find its friend?



Appendix E

CCLL Facebook Pages

General information page

The screenshot shows the Facebook profile page for the Childhood Cognition and Learning Lab (University of Ottawa). The page header includes the Facebook logo and a search bar. The profile picture is a young child playing with blocks. The page name is "Childhood Cognition and Learning Lab (University of Ottawa)" with a location of "University · Ottawa, Ontario" and an "Edit Info" link. A "Basic Information" section lists: Founded (2003), Location (136 Jean-Jacques Lussier, Vanier Hall, Room 6006, Ottawa, ON K1N 6N5), About (The CCLL is a child psychology lab at the University of Ottawa.), and Description (The Childhood Cognition and Learning Laboratory began conducting research in the Fall of 2003 under the direction of Dr. Cristina Atance. We are a child psychology lab interested in learning more about how young children think. There are a variety of aspects of children's thinking that interest us. For example, when do young children start to plan for, and think about, the future? How do these abilities change and develop over the preschool and early school years? Also, how do young children make sense of mental phenomena such as beliefs and desires? Because these mental phenomena are not readily visible, how do children come to discover that they are crucial to explaining and predicting human behaviour? To explore these different aspects of children's thinking we conduct studies with children between the ages of 2 and 5.). Contact information includes Email (ccll@uOttawa.ca), Phone (613-562-5800 ext. 4475), and Website (http://www.socialsciences.uOttawa.ca/ccll). The left sidebar shows navigation options: Wall, Info, Photos, Visit the CCLL (with an Edit link), and About (with an Edit link). The About section text is "The CCLL is a child psychology lab at the University of Ottawa." and it shows "15 people like this".

Information page regarding a visit to the lab

The screenshot shows the same Facebook profile page but with a post from the Childhood Cognition and Learning Lab. The post title is "Childhood Cognition and Learning Lab (University of Ottawa) ▶ Visit the CCLL" with a location of "University · Ottawa, Ontario" and an "Edit Info" link. The post text says "We're interested in how your child thinks!" and "At the **University of Ottawa Childhood Cognition and Learning Lab**, we study children's planning, memory, and problem-solving." Below the text is a photograph of a woman and a young child sitting at a table, engaged in an activity with colorful blocks and a yellow puppet. The post text continues: "Our studies consist of a series of fun activities that help us discover how children think. If you have a child between **ages 3 and 5**, we invite you to participate in an hour-long study at the University of Ottawa. Parking is free, and your child will receive a thank you gift at the end of your visit!" At the bottom of the post, it says "For more information, please contact us: ccll@uOttawa.ca, 613-562-5800 ext. 4475, www.socialsciences.uOttawa.ca/ccll". The left sidebar is identical to the previous screenshot, but the "Visit the CCLL" option is highlighted in blue.

Appendix F

On-line Advertisements

Facebook

uOttawa Activity for Kids



Our research studies consist of fun games that help us discover how preschoolers think. Click to learn more.

Google

[Children's Thinking](#)
Participate in a fun study with your preschooler at UOttawa.
ccll.uottawa.ca

Appendix G

Demographic Questionnaire

**University of Ottawa
Childhood Cognition and Learning Laboratory**

The academic journals to which we submit our research findings often ask us to report about various aspects of our sample of children including their ethnicity, their parents' income, education, and profession, and the languages spoken in the home. However, these journals also recognize that it is not always possible to obtain this information from parents. Thus, although it would be helpful to us if you would be willing to fill out the information below, if you do not feel comfortable doing so, then you are in no way obligated to do so. Please know that the information that you provide will be kept separate from your consent form, making it impossible to link it to you in any way. Rather, the information that you provide will simply be pooled with other participant information so that we can provide overall percentages for reporting purposes (e.g., 80% of our sample was White, 10% was Black, 10% was Asian).

Project title: *Preschoolers' Understanding that Preferences Differ Across Time and Between People*

Child's ethnicity: _____

Languages spoken in the home:

First language: _____ Amount of exposure (hrs/day): _____ By whom? _____
 Language 2: _____ Amount of exposure (hrs/day): _____ By whom? _____
 Language 3: _____ Amount of exposure (hrs/day): _____ By whom? _____
 Language 4: _____ Amount of exposure (hrs/day): _____ By whom? _____

Annual household income: (Please circle one)

less than 20 000\$	20 000\$-40 000\$	40 000\$-60 000\$
60 000\$-80 000\$	80 000\$-100 000\$	more than 100 000\$

Education level and occupation of parents/guardians: Please check highest level of education attained, and indicate any professional designations (e.g., MD, CPA, etc.) and type of occupation for each parent/guardian:

Mother/Guardian:

Did not complete high school
 High school degree
 College degree
 University degree
 Graduate degree
 Professional Designation: _____
 Occupation: _____

Father/Guardian:

Did not complete high school
 High school degree
 College degree
 University degree
 Graduate degree
 Professional Designation: _____
 Occupation: _____

Appendix H

Consent Form

**University of Ottawa
Childhood Cognition and Learning Laboratory**

Researcher information:

Dr. Cristina Atance (Principal Investigator), University of Ottawa, Faculty of Social Sciences, School of Psychology; (613) 562-5800 x. 4476; atance@uottawa.ca;

Michèle Bélanger (Co-investigator), graduate student in Clinical Psychology, University of Ottawa

Project title: Preschoolers' Understanding that Preferences Differ Across Time and Between People

I, _____, agree to have my child _____ whose date of birth is _____ participate in the research conducted by Dr. Cristina Atance from the University of Ottawa, School of Psychology, Faculty of Social Sciences. The purpose of this research is to learn more about young children's understanding of preferences. There are two aspects of interest: (1) children's understanding that preferences can change over time, and (2) children's understanding that different people can have different preferences. The data from this study may later be used as part of Michèle Bélanger's doctoral dissertation.

My child's participation will consist of attending one **30-40** minute long session. During this session, my child will participate in the following types of tasks:

- 1) **Perspective-Taking Tasks:** My child will be given tasks that assess his/her understanding of the different aspects of preferences described above. For instance, my child will be presented with pairs of "child"- (e.g., Kool-Aid) and "adult"- (e.g., coffee) preferable items and asked to choose the items that he/she will like best when he/she is "all grown up" or that an adult would like best.
- 2) **Theory of Mind Tasks:** My child will be given tasks that require him/her to think and talk about desires and beliefs. For example, he/she will play a game where he/she will be asked to anticipate where a doll will look for her toy that another doll has moved to a new location.
- 3) **Executive Function Tasks:** My child will be given tasks that assess his/her ability to remember information for a short period of time, and to inhibit his/her tendency to say or do a certain thing. For example, he/she will play a game where he/she is asked to say "black" when shown a white card, and "white" when shown a black card.
- 4) **Vocabulary Task:** My child will also be given two verbal tasks from the *Wechsler Preschool and Primary Scale of Intelligence*. These tasks will help the researchers estimate the language ability of all the children who participate in this study and inform the researchers on how children's language may be related to children's performance on the tasks described above. Because this measure is being used for research, not clinical, purposes, I will not be given any specific feedback about my child's scores.

My child's session will be video recorded. I understand that only the study team will have access to the DVDs. I have received assurance from the researcher that the information that my child will share, as well as the information that I complete on the "Demographic Questionnaire", will remain strictly confidential.

Anonymity will be assured in the following manner. The researchers will code all of the study records. The link between the codes and the study information will be kept in a separate, secured location. With my permission, the researchers will keep the DVDs for 10 years. These DVDs will be stored in a secured location at the CCLL. The researchers will keep my name, as well as my child's name linked to the study information for 10 years. If they publish the results of this study, they will not use my name or my child's name. I will also be asked whether I wish to have the researchers contact me about the opportunity to participate in future research studies in their laboratory, and whether I agree to having the researchers use segments of my child's videotapes for educational (e.g., classroom instruction) and academic (e.g., conference presentations) purposes. I understand that they would not reveal my child's name in these presentations.

Participation in this study is strictly voluntary. Moreover, only if my child, himself/herself, agrees to participate, will he/she take part in the study. There are no known risks for my child in these procedures. Children typically have fun engaging in these types of "games" with the researcher. The researcher will stop the session if my child does not wish to continue playing, or becomes tired or frustrated. My child and I are free to withdraw from the project at any time, before or during the session, refuse to participate, and refuse to answer questions.

I will have free parking while at the University of Ottawa. My child will also receive a small toy after the session, regardless of whether he/she completes the session.

Any information about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland Street, Room 154, (613) 562-5387, or ethics@uottawa.ca

By signing this form I agree to have my child participate in this research. There are two copies of this consent form, one of which I may keep. If I have any questions about the conduct of the research project, I may contact the researcher.

I give the researchers permission to re-contact me about future research. YES ___ NO ___

I give the researchers permission to use segments from the DVDs for educational or research presentations. YES ___ NO ___

Researcher's signature: _____ Date: _____

Parent's signature: _____ Date: _____

Appendix I**Assent Script****University of Ottawa
Childhood Cognition and Learning Laboratory (CCLL)****Researcher information:**

Dr. Cristina Atance (Principal Investigator), University of Ottawa, Faculty of Social Sciences, School of Psychology; (613) 562-5800 x. 4476; atance@uottawa.ca;

Michèle Bélanger (Co-investigator), graduate student in Clinical Psychology, University of Ottawa.

Project title: Preschoolers' Understanding that Preferences Differ Across Time and Between People

What will happen:

Hi my name is (experimenter's name inserted here). I have some toys I want to show you and some games to play in the room right next door. I will also be video recording us playing together. Your Mom/Dad will be watching us the whole time on this television monitor (*show child monitor*). She/he will be able to see everything that you do. If you would like to stop playing with me at any time, you just let me know okay? Are you ready to go see my toys? Do you have any questions?

_____ assent obtained

Appendix J

Protocol

PERSPECTIVE-TAKING TASK (Self-now)

“Here is a picture of you.” (*Experimenter shows child her/his photo and places it facing the child, centered, at the back edge of table.*)

“I’m going to show you some things and I want you to tell me what *you* like best, *right now*.”

“Which one of these do you like best, right now, one of these **NEWSPAPERS** or one of these **BOOKS**?”

“How come you chose the X?” _____

“Which one of these do you like best, right now, one of these **MAGAZINES** or one of these **STICKER BOOKS**?”

“How come you chose the X?” _____

“Which one of these do you like best, right now, one of these **KOOL-AID DRINKS** or one of these **CUPS OF COFFEE**?”

“How come you chose the X?” _____

“Which one of these do you like best, right now, one of these **SCHOOL BAGS** or one of these **WALLETS**?”

“How come you chose the X?” _____

“Which one of these do you like best, right now, one of these **JARS OF PLAY-DOH** or one of these **CROSSWORD PUZZLES**?”

“How come you chose the X?” _____

“Which one of these do you like best, right now, one of these **COOKING SHOW VIDEOS** or one of these **DORA THE EXPLORER VIDEOS**?”

“How come you chose the X?” _____



PERSPECTIVE-TAKING TASK (Peer-now)

“Here is a picture of Sally/Billy.” (*Experimenter shows child a photo of a sex-matched same-aged peer and places it facing the child, centered, at the back edge of table.*)

“I’m going to show you some things and I want you to tell me what **Sally/Billy** likes best, **right now**.”

“Which one of these does Sally/Billy like best, right now, one of these **CUPS OF COFFEE** or one of these **KOOL-AID DRINKS**?”

“How come you chose the X?” _____

“Which one of these does Sally/Billy like best, right now, one of these **STICKER BOOKS** or one of these **MAGAZINES**?”

“How come you chose the X?” _____

“Which one of these does Sally/Billy like best, right now, one of these **BOOKS** or one of these **NEWSPAPERS**?”

“How come you chose the X?” _____

“Which one of these does Sally/Billy like best, right now, one of these **COOKING SHOW VIDEOS** or one of these **DORA THE EXPLORA VIDEOS**?”

“How come you chose the X?” _____

“Which one of these does Sally/Billy like best, right now, one of these **JARS OF PLAY-DOH** or one of these **CROSSWORD PUZZLES**?”

“How come you chose the X?” _____

“Which one of these does Sally/Billy like best, right now, one of these **SCHOOL BAGS** or one of these **WALLETS**?”

“How come you chose the X?” _____



PERSPECTIVE-TAKING TASK (Adult-now)

“Here is a picture of Jane/John. Jane/John is a grown-up woman/man. She/he is as big as your mommy/daddy.” (*Experimenter shows child a photo of a sex-matched adult and places it facing the child, centered, at the back edge of table.*)

“I’m going to show you some things *again* and I want you to tell me what *Jane/John* likes best, *right now.*”

“Which one of these does Jane/John like best, right now, one of these **WALLETS** or one of these **SCHOOL BAGS?**” (*Experimenter places items as they are named, first item named on child’s LEFT.*)

“How come you chose the X?” _____

“Which one of these does Jane/John like best, right now, one of these **COOKING SHOW VIDEOS** or one of these **DORA THE EXPLORER VIDEOS?**”

“How come you chose the X?” _____

“Which one of these does Jane/John like best, right now, one of these **BOOKS** or one of these **NEWSPAPERS?**”

“How come you chose the X?” _____

“Which one of these does Jane/John like best, right now, one of these **MAGAZINES** or one of these **STICKER BOOKS?**”

“How come you chose the X?” _____

“Which one of these does Jane/John like best, right now, one of these **JARS OF PLAY-DOH** or one of these **CROSSWORD PUZZLES?**”

“How come you chose the X?” _____

“Which one of these does Jane/John like best, right now, one of these **KOOL-AID DRINKS** or one of these **CUPS OF COFFEE?**”

“How come you chose the X?” _____

.....

PERSPECTIVE-TAKING TASK (Self-future)

“Here is a picture of Jane/John. Jane/John is a grown-up woman/man. She/he is as big as your mommy/daddy.” (*Experimenter shows child a photo of a sex-matched adult and places it facing the child, centered, at the back edge of table.*)

“Here is a picture of you. One day, you’re going to be all grown up. You’ll be as big as Jane/John.” (*Experimenter shows child her/his photo and places it next to the photo of Jane/John, and then removes the picture of Jane/John.*)

“I’m going to show you some things *again* and I want you to tell me what *you* will like best when *you’re all grown up*.”

“Which one of these will you like best, when you’re all grown up, one of these **WALLETS** or one of these **SCHOOL BAGS**?” (*Experimenter places items as they are named, first item named on child’s LEFT.*)

“How come you chose the X?” _____

“Which one of these will you like best, when you’re all grown up, one of these **COOKING SHOW VIDEOS** or one of these **DORA THE EXPLORER VIDEOS**?”

“How come you chose the X?” _____

“Which one of these will you like best, when you’re all grown up, one of these **BOOKS** or one of these **NEWSPAPERS**?”

“How come you chose the X?” _____

“Which one of these will you like best, when you’re all grown up, one of these **MAGAZINES** or one of these **STICKER BOOKS**?”

“How come you chose the X?” _____

“Which one of these will you like best, when you’re all grown up, one of these **JARS OF PLAY-DOH** or one of these **CROSSWORD PUZZLES**?”

“How come you chose the X?” _____

“Which one of these will you like best, when you’re all grown up, one of these **KOOL-AID DRINKS** or one of these **CUPS OF COFFEE**?”

“How come you chose the X?” _____

.....

PERSPECTIVE-TAKING TASK (Peer-future)

“Here is a picture of Jane/John. Jane/John is a grown-up woman/man. She/he is as big as your mommy/daddy.” (*Experimenter shows child the photo of a sex-matched adult and places it facing the child, centered, at the back edge of table.*)

“Here is a picture of Sally/Billy. One day, sally/Billy is going to be all grown up. She/he’ll be as big as Jane/John.” (*Experimenter shows child the photo Sally/Billy and places it next to the photo of Jane/John, and then removes the photo of Jane/John.*)

“I’m going to show you some things *again* and I want you to tell me what **Sally/Billy** will like best *when she/he’s all grown up.*”

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **JARS OF PLAY-DOH** or one of these **CROSSWORD PUZZLES?**” (*Experimenter places items as they are named, first item named on child’s LEFT.*)

“How come you chose the X?” _____

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **BOOKS** or one of these **NEWSPAPERS?**”

“How come you chose the X?” _____

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **DORA THE EXPLORER VIDEOS** or one of these **COOKING SHOW VIDEOS?**”

“How come you chose the X?” _____

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **CUPS OF COFFEE** or one of these **KOOL-AID DRINKS?**”

“How come you chose the X?” _____

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **MAGAZINES** or one of these **STICKER BOOKS?**”

“How come you chose the X?” _____

“Which one of these will Sally/Billy like best, when she/he’s all grown up, one of these **WALLETS** or one of these **SCHOOL BAGS?**”

“How come you chose the X?” _____

.....

THEORY OF MIND TASKS

CHANGE IN LOCATION

Experimenter places both stuffed bears, both boxes, and the frog on the table before giving instructions.

“Here’s Cheer Bear and here’s Champ Bear. And, here’s a green box and here’s a yellow box. Cheer is playing with this toy frog. Then, Cheer puts the frog in this green box and leaves to go outside.” *Cheer is shown leaving and is then placed out of sight.*

“Now, Champ wants to play with the frog, so he goes over to the green box, gets out the frog, and starts to play with it. And when he's done playing with the frog, he goes over to the yellow box, puts the frog in there, and he goes outside.” *Champ is shown leaving and then is placed out of sight.*

“Look, Cheer is back and wants to play with the frog.”

Target question:

“Where does Cheer think the frog is?” _____ *If no response:* “Where does Cheer think the frog is? Does she think it’s in the green box or does she think that it’s in the yellow box?” _____ **(In the green box)**

Control question 1:

“Where did Cheer put the frog?” _____ **(In the green box)**

Control question 2:

“Where is the frog really?” _____ **(In the yellow box)**

CONTENTS FALSE BELIEF

Child sees a closed Raisins box with marbles inside. “Here’s a Raisins box. What do you think is inside the Raisins box?” _____ **(raisins)**

Open box: “Let’s see... it’s really marbles inside!” *Close box.*

Control question:

“Ok, what is in the Raisins box?” _____ **(marbles)**

Target self question:

“When you first saw this box, before we opened it, what did you think was inside?” _____
If no response: “raisins or marbles?” _____ **(raisins)**

A toy figure of a Bert is produced: “Now here comes Bert. Bert has never ever seen inside this Raisins box.”

Target other question:

“So, what does Bert think is inside the box?” _____ *If no response: “raisins or marbles?”* _____ (raisins)

Memory question:

“Did Bert see inside this box?” _____ (no)

DIVERSE BELIEFS

Children see a toy figure of Telly Monster, a picture of a bed, and a picture of a basket.

Own-belief questions:

“Here’s Telly. Telly wants to find his bunny. His bunny might be hiding under the bed or it might be hiding in the basket. Where do you think the bunny is, under the bed or in the basket?”

If the child chooses the bed: “Well that’s a good idea, but Telly thinks his bunny is in the basket. He thinks his bunny is in the basket.”

If the child chooses the basket: “Well that’s a good idea, but Telly thinks his bunny is under the bed. He thinks his bunny is under the bed.”

Target Question:

“So, where will Telly look for his bunny, under the bed or in the basket?” _____

To be correct, the child must answer the target question opposite from his or her answer to the own-belief question.

DIVERSE DESIRES

Children see a toy figure of Ernie, a picture of a cupcake, and a picture of an apple.

Own-desire question:

“Here’s Ernie. It’s snack time, so Ernie wants a snack to eat. Here are the two different snacks: a cupcake and an apple. Which snack would you like best? Would you like a cupcake or an apple best?” _____

If the child chooses the apple: “Well, that’s a good choice, but Ernie really likes cupcakes. He doesn’t like apples. What he likes best are cupcakes.”

If the child chooses the cupcake: “Well that’s a good choice, but Ernie really likes apples. He doesn’t like cupcakes. What he likes best are apples.”

Target question:

“So, now it’s time to eat. Ernie can only choose one snack, just one. Which snack will Ernie choose: a cupcake or an apple?” _____

To be scored as correct the child must answer the target question opposite from his or her answer to the own-desire question.



EXECUTIVE FUNCTION TASKS

COUNT & LABEL

Demonstration

“Now I’m going to show you some things.” (*Set out Cloud, Duck, and Plane.*)

“I’m going to name these toys: Cloud, Duck, Plane.” (*Point to each toy as it’s mentioned and counted.*)

“Now I’m going to count them: One, Two, Three.”

“Now I’m going to count and name them at the same time: One is a Cloud, Two is a Duck, Three is a Plane.”

Trial 1 (*Set out Lion, Car, and Tree.*)

“It’s your turn now. Can you name these toys?” (correct if needed)

“Can you count them?” (correct if needed)

“Now count and name them at the same time.” (**do not correct**)

Response: _____ correct _____ incorrect _____

Trial 2 (*Set out Train, Flower, and Turtle.*)

“It’s your turn again. Can you name these toys?” (correct if needed)

“Now count them.” (correct if needed)

“Now count and name these toys at the same time.” (**do not correct**)

Response: _____ correct _____ incorrect _____



HAND GAME

Consistent Warm-up

“Let’s play a new game. This game is called the **HAND GAME**.”

(*E models a fist action.*) “Can you show me how to make a fist with your hand?” (*E assists C in making fist if needed, then continue on to pointing.*)

C make fist? **Yes(1)** No(0) # of tries _____

“Good, (*E models a pointing action.*) now show me how you point your finger.” (*E assists C in pointing finger if needed.*)

C point finger? **Yes(1)** No(0) # of tries _____

Consistent Trials

“Now we’re going to play the game. Here’s how we’ll play. First we both put our hands on our hips. Now when I show you my hand I want you to make the same shape as me. So if I make a fist I want you to make a fist, and if I point a finger you point a finger too.” (*E models each action until C has correctly imitated 3 pointing gestures and 3 fists. E adds additional trials if necessary.*)

1. Point **C points(1)** C makes fist(0)
If right, E says: “That’s right! Good job!”

2. Fist C points(0) **C makes fist(1)**
If right, E says: “That’s right! Good job!”

3. Fist C points(0) **C makes fist(1)**

4. Point **C points(1)** C makes fist(0)

5. Point **C points(1)** C makes fist(0)

6. Fist C points(0) **C makes fist(1)**

Stop after 3
correct of each
action

OK! Great job!

Inconsistent Warm-up

“That was very good. Now the game gets a bit harder. If I point a finger, then I want you to show a fist, and if I show a fist I want you to point a finger, so we’re not making the same shape anymore.”

“What do you do if I show a fist?”

C says/indicates: **Point a finger(1)** Make a fist(0)

Stop after 4
consecutive
correct

“And if I point a finger?”

C says/indicates: Point a finger(0) **Make a fist(1)**

“And if I show a fist?”

C says/indicates: **Point a finger(1)** Make a fist(0)

“And if I point a finger?”

C says/indicates: Point a finger(0) **Make a fist(1)**

(E repeats these instructions, with feedback about performance, until C makes 4 consecutive correct responses.)

Total # of warm-up trials: _____

Inconsistent Tests

“OK, our practice is over now. Remember, in this game, if I point a finger, then I want you to show a fist, and if I show a fist I want you to point a finger, so we’re not making the same shape anymore.” *(E administers trials until C gets 6 right in a row, with a maximum of 15 trials total.)*

- | | | | |
|-----------|--------------------|------------------------|-------|
| 1. Fist | C points(1) | C makes fist(0) | _____ |
| 2. Point | C points(0) | C makes fist(1) | _____ |
| 3. Fist | C points(1) | C makes fist(0) | _____ |
| 4. Fist | C points(1) | C makes fist(0) | _____ |
| 5. Point | C points(0) | C makes fist(1) | _____ |
| 6. Point | C points(0) | C makes fist(1) | _____ |
| 7. Fist | C points(1) | C makes fist(0) | _____ |
| 8. Point | C points(0) | C makes fist(1) | _____ |
| 9. Fist | C points(1) | C makes fist(0) | _____ |
| 10. Fist | C points(1) | C makes fist(0) | _____ |
| 11. Point | C points(0) | C makes fist(1) | _____ |
| 12. Point | C points(0) | C makes fist(1) | _____ |
| 13. Fist | C points(1) | C makes fist(0) | _____ |

<p>Stop after 6 consecutive correct</p>
--

14. Point C points(0) **C makes fist(1)** _____

15. Fist **C points(1)** C makes fist(0) _____

Criterion reached (6 in a row)? Yes No

Total # correct: _____

Total # attempted: _____

.....

SUN/MOON STROOP

“Now we’re going to play a different game!” (*Show card with SUN.*) “This is a sun, right? When you see this card, I don’t want you to say **sun**. No, I want you to say **moon**.”

(*Remove the SUN, show the MOON.*) “This is a moon, right? When you see this card, I don’t want you to say **moon**. No, I want you to say **sun**.”

Training:

(*Show SUN. If hesitation, say: “What do you say for this one?”*) Sun **Moon** (Good.)

(*Show MOON. If hesitation, say: “What do you say for this one?”*) **Sun** (Good.) Moon

IF WRONG OR NO RESPONSE ON EITHER TRIAL, REPEAT RULES AND TRAINING. MAX. OF 3 TRAINING SESSIONS. ALWAYS CONTINUE WITH TEST TRIALS.

Testing (No feedback)

Trial	Response	Trial	Response	Trial	Response
1 Moon	Sun Moon	8 Sun	Sun Moon	15 Moon	Sun Moon
2 Sun	Sun Moon	9 Sun	Sun Moon	16 Sun	Sun Moon
3 Sun	Sun Moon	10 Moon	Sun Moon	17 Moon	Sun Moon
4 Moon	Sun Moon	11 Sun	Sun Moon	18 Moon	Sun Moon
5 Sun	Sun Moon	12 Moon	Sun Moon	19 Sun	Sun Moon
6 Moon	Sun Moon	13 Moon	Sun Moon	20 Sun	Sun Moon
7 Moon	Sun Moon	14 Sun	Sun Moon	21 Moon	Sun Moon

Total number correct (bold): _____

.....

STANDARD DCCS

*Experimenter places two file boxes on the table: the **blue butterfly** tray to the child's left and the **orange arrow** tray to the child's right.*

“Here's a **blue butterfly** and here's an **orange arrow**. We are going to play a game. This is the **SHAPE** game. The **SHAPE** game is different from the **colour** game. All the butterflies go in this box [*pointing to the tray on the left*], and all arrows go in that box [*pointing to the tray on the right*]. We don't put any butterflies in that box. No way. We put all the butterflies over here and only arrows go over there. If it's a butterfly, then it goes here. If it's an arrow, then it goes there. This is the **SHAPE** game.”

*Sort one test card, by shape, saying: “See here's an orange butterfly. So it goes here” [*place it face down in the correct tray*].*

“If it's a butterfly, then it goes here. If it's an arrow, then it goes there.”

Show children the other type of test card. “Now here's a blue arrow. Where does this one go?”

___ *If they sort correctly, say: “Very good. You know how to play the shape game.”*

___ *If they point correctly, say: “Very good. You know how to play the shape game. Can you help me put this blue arrow down?”*

___ *If child sorts incorrectly, say: “No, this one's a blue arrow, so it has to go over here in the shape game. Can you help me put this blue arrow down?”*

Ensure card is placed face down in the appropriate tray, turning it over if necessary.

Pre-switch phase (5 correct trials)

“Now it's your turn. So remember, if it's a butterfly, then it goes here. If it's an arrow, then it goes there. Here's an orange butterfly/a blue arrow. Where does this go?”

*Give child feedback by saying: “Yes, that's right” or “No, that's not correct – remember the rules” and proceed to the next trial. On each pre-switch trial, repeat the pre-switch rules, select a test card, label it by **both** dimensions and ask the child where it goes. Then provide child with appropriate feedback.*

“Remember, if it's a butterfly, then it goes here. If it's an arrow, then it goes there. Here's an orange butterfly/blue arrow. Where does this go?” *If the child only points, you may sort the card for them.*

Present cards in random order, make sure no more than 2 of same card in a row

Trial	Card		Child's sort		☒ or ☑
1	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
2	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
3	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
4	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
5	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
6	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
7	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
8	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	

Total number of shape trials: _____

Number of shape errors: _____

Post-switch phase (5 Trials – 4 out of all 5 trials or 3 out of last 3 trials = a pass)

“Now we are going to switch. We are not going to play the shape game anymore. We’re going to play the **COULOUR** game. When it’s blue, you have to put it in this box [*pointing to the tray on the left*], but whenever it’s orange, then it goes in that box [*pointing to the tray on the right*]. We don’t put blue things in that box. No way. We put blue things over here and only orange things go over there. If it’s blue, then it goes here. If it’s orange, then it goes there. This is the **colour** game.”

(Do not remove the target cards or the cards that were sorted during pre-switch)

“Here’s an orange butterfly/a blue arrow. Where does this go?” *Whether or not the child sorts correctly, simply say:* “Okay, let’s do another one.”

*On each post-switch trial, repeat the post-switch rules, select a test card, label it by **both** dimensions and ask the child where it goes. DO NOT provide child with feedback.*

“Remember, if it’s blue, then it goes here. If it’s orange, then it goes there. Here’s an orange butterfly/a blue arrow. Where does this go?” *If the child only points, you may sort the card for them.*

Trial	Card		Child's sort		☒ or ☑
1	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
2	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
3	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
4	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	
5	Orange butterfly	Blue arrow	Orange arrow	Blue butterfly	

Number of colour errors: _____



BACKWARD DIGIT SPAN

Instructions: Say one digit per second, reading digits forward. Record child’s response verbatim. Stop when child makes an error on both strings of the same length (e.g., when both items 5 and 6 are incorrect). Provide no feedback after 2 training trials.

“This is Cookie Monster. Whenever I say numbers, Cookie Monster says them backwards. Listen: **5 – 8**. (*Cookie Monster says:*) **8 – 5**. Now I want you to do the same as Cookie Monster and say my numbers backwards. Do you understand? Let’s try one. Ready? Listen carefully. Remember to say the numbers backwards. **2 – 4**.” (*score below, correct if needed*)

- *Correct:* “That’s right!”
- *Incorrect:* “That’s not quite right. I said 2 – 4, so to say it backward, you should say 4 – 2. Let’s try again: 2 – 4.”
 - *Correct:* “That’s right!”
 - *Incorrect:* “That’s not quite right. I said 2 – 4, so to say it backward, you should say 4 – 2.”

“Let’s try another one. Remember to say the numbers backwards. **7 – 1**.” (*score below, correct if needed*)

- *Correct:* “That’s right!”
- *Incorrect:* “That’s not quite right. I said 7 – 1, so to say it backward, you should say 1 – 7. Let’s try again: 7 – 1.”
 - *Correct:* “That’s right!”
 - *Incorrect:* “That’s not quite right. I said 7 – 1, so to say it backward, you should say 1 – 7.”

Training trials

i. **2 – 4** (“That’s right!” or correct the mistake) _____ – _____ ; _____ – _____

ii. **7 – 1** (“That’s right!” or correct the mistake) _____ – _____ ; _____ – _____

Test trials

1.	6 – 3	_____ – _____
2.	4 – 9	_____ – _____
3.	2 – 9 – 5	_____ – _____ – _____
4.	8 – 1 – 6	_____ – _____ – _____
5.	8 – 5 – 2 – 6	_____ – _____ – _____ – _____
6.	4 – 9 – 3 – 7	_____ – _____ – _____ – _____

7. 8-1-3-7-9 _ _ _ _ _

8. 4-2-5-8-1 _ _ _ _ _

9. 9-3-5-1-8-4 _ _ _ _ _

10. 6-5-8-4-2-7 _ _ _ _ _

LANGUAGE

*** Proceed with Picture Naming and Receptive Vocabulary subtests of the WPPSI ***

- Receptive Vocabulary: Stimulus Book 1 (first tab)
 - 3-year-olds: start at number 1
 - 4-year-olds: start at number 6

- Picture Naming: Stimulus Book 2 (last tab)
 - 3-year-olds: start at number 1
 - 4-year-olds: start at number 7