

The role of executive functioning and perspective-taking in facilitating children's socially competent behaviours

by

Vanessa Huyder

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Behaving in a socially competent manner (i.e., interacting with other social actors in an effective manner by adjusting one's goals and behaviours according to the demands of various social situations) is a complex process that requires various cognitive skills. The purpose of the current study was to determine the unique contributions of executive functions, theory of mind and verbal skills to socially competent behaviours in either a cooperative or a competitive context. The impact of manipulating children's perspective-taking (e.g., taking the perspective of another person) on their socially appropriate behaviours was also investigated. Pairs of children completed a cooperative and a competitive social task together and were assigned to either focus on their own or another's perspective. Children then completed measures of executive functioning, theory of mind, and verbal skills. Results revealed that executive functioning was related to more appropriate social behaviours in the cooperative task, even when controlling for theory of mind and verbal skills; however, this relation was not found in the competitive task. Furthermore, there was no significant effect of the manipulation of perspective-taking on children's behaviours. These findings indicate that executive functions make a unique contribution to children's socially competent behaviours in a cooperative social context.

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Dedication

This Master's Thesis is dedicated to my husband, Jeremy Huyder, whose encouragement, support and unwavering faith in me contributed to this accomplishment.

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Introduction

As children develop they become more aware of the interpersonal environment within which they live. In order to be able to function within this environment children must become socially competent. That is, they must develop the ability to interact with other social actors in an effective manner, in which they meet their own needs and goals while considering the requirements of the social context and the needs and goals of others. One aspect of social competence is that children are able to adjust their behaviours and goals according to the demands of the social situation at the same time that they regulate their emotional reactions to the situational context (Ciarano, Visu-Petra, & Settanni, 2007). For example, children must recognize that a classroom group project would require different types of social behaviours than would a competitive playground game, and subsequently modify their behaviours accordingly. Social competence has important implications for children's well-being. As such, it is important to ascertain how social competence develops and identify those factors that promote and support its development. The current study investigates young school-age children's abilities to modify their social behaviours according to context demands and examines the skills that enable them to behave in a socially competent manner.

Defining social competence

Clarifying the definition of social competence is important for determining common ground amongst research findings in this area and better informing social skills assessment and intervention (Rose-Krasnor, 1997). Much research literature conceptualizes social competence as adaptive functioning in the social environment and includes the central feature of "effectiveness" in social interactions (Ciarano et al., 2007; Green & Rechis, 2006; Rose-Krasnor). Thus, being socially competent means that one is able to take on the complex task of interacting

appropriately with others in varying contexts wherein one's own needs and goals are met and the needs of others are also considered (Green & Rechis; Rose-Krasnor).

Despite this overarching notion of what social competence is, there is currently no clear consensus on what constitutes the key elements of social competence. In order to provide some common ground in the field Rose-Krasnor (1997) proposed a theoretical framework for defining socially competent behaviours. In this framework, social competence is seen as an organizing construct that involves various characteristics. First, it may include *transactional* characteristics, meaning that it is a joint product of the individual, social environment, and other social actors. Second, there are *context-dependent* characteristics, in that effective behaviours need to be adjusted according to different contexts. Third, there are *performance-oriented* characteristics, which involve the ability to appropriately employ a skill in conditions that may not be ideal (e.g., stressful), and may require emotion regulation abilities. Finally, *goal-specific* characteristics involve the selection of effective strategies and performance of certain behaviours that will help one accomplish specific goals. In sum, social competence involves the ability to mobilize and coordinate one's own capacities in the face of environmental demands, balance one's own needs with the needs of others, all the while keeping in mind and updating information from the (social) environment (Rose-Krasnor; Rubin, Bukowski, & Parker 1998, as cited in Green & Rechis, 2006).

Children will encounter many different types of social contexts, such as cooperative versus competitive situations, in which they must assess the situation and adapt their behaviours according to the changing context. It is widely accepted by researchers that socially competent behaviour and thought varies from situation to situation (i.e., it is situation-specific), in that behaviours considered to be adaptive will vary as a function of the situation and other social

actors (Rose-Krasnor, 1997). For example, when children are in situations where their goal is convergent or shared with another individual, social competence means they would appreciate the shared goal and choose to follow a strategy that involves combining efforts to more effectively reach that goal (Epley et al., 2006). Thus, being able to cooperate with others reflects an important and fundamental component of social behaviour. However, behaving in a socially competent manner does not always involve cooperation with others. As previously mentioned, children will often encounter situations in which they must compete against others, such as in competitive situations in which there are limited resources that each party is trying to attain (i.e., each party has divergent self-interests or individual goals) (Green & Rechis, 2006; Epley et al.). Thus, if faced with such a scenario, a socially competent individual would recognize the change in context and adjust his/her behaviours and goals to follow a strategy that involves competing against another to attain his/her individual goal.

Development and implications of social competence

Children's ability to coordinate their behaviour in a collaborative fashion with other social actors develops throughout their preschool years. By the first year, children are able to demonstrate some of the social cognitive skills involved in working cooperatively with others (e.g., coordinating attention with another person and an object of shared interest, gesturing in order to communicate and share experiences with others; Tomasello, 2007; Tomasello & Carpenter, 2007). However, even by the middle of the second year children show minimal collaborative behaviours in that they have difficulty in joining their own efforts with another social actor, in a planful and intentional way, to reach some sort of common or shared goal (Brownell & Carriger, 1991; 1990). In the course of the second year, as children develop social cognitive skills (e.g., understanding and differentiating self versus others; being able to represent

specific causal relations between one's own actions and the independent actions of one's partner), cooperative interchanges and sharing appear to increase in frequency (Hay, 1979; Brownell & Carriger, 1991; 1990). By the end of the second year, children are able to coordinate their behaviour with a peer to achieve a goal collaboratively (Brownell & Carriger, 1991; Warneken, Chen, & Tomasello, 2006). For example, Brownell and Carriger found that children of this age coordinated their own behaviours with that of another child in order to manipulate an apparatus in such a way as to achieve a shared goal (e.g., getting a toy). By the preschool years, children engage in more prosocial behaviours, whereby they display direct helping or sharing behaviours with others (e.g., sharing or directing another to share a limited resource or a toy; Cook & Stingle, 1974; Olson & Spelke, 2008; Smiley, 2001). In fact, through the preschool to school age years (3-5 years-old) children display a developmental progression, of engaging in a more "well-adjusted, flexible, emotionally mature, and generally prosocial pattern of social adaptation" (LaFreniere & Dumas, 1996, p. 373).

The development of children's social competence has become a well-researched topic in the developmental literature due to its strong influences on later life adjustment (Ciairano et al., 2007; Bonino & Cattelino, 1999). Children's social competence is predictive of other interpersonal characteristics as well as future social outcomes. For example, social competence is important in how one gets along with peers and forms relationships (Ashiabi, 2007). In particular, social competence is important in children's socio-emotional development. Halberstadt and colleagues (2001) state that children's abilities to express and interpret their own emotions and the emotions of others will influence the success their strategies have in social interactions. Social-emotional development has been found to be important in children's development in many aspects, such as school readiness and academic performance (Ashiabi;

Wentzel & Asher, 1995). Furthermore, longitudinal evidence suggests a link between poor social adjustment in childhood and later life difficulties, such as early school drop-out, juvenile and adult criminality, later internalizing and externalizing problems, and adult psychopathology (Hymel, Rubin, Rowden, & LeMare, 1990; Parker & Asher, 1987).

Cognitive skills involved in social competence

Behaving in a socially competent manner requires the coordination of many skills; one must attend to and use cues within the environment, identify one's own goals and the goals of others, coordinate one's behaviour accordingly, and flexibly apply strategies to varying situational contexts. As such, social competence requires a complex set of cognitive skills, including the ability to think about the intentions of others and the ability to use this information to guide one's own behaviour.

There is general consensus in the literature that theory of mind, the ability to attribute and understand the mental states of others (e.g., desires, feelings, thoughts and beliefs), is essential to everyday social interactions (Hughes, Fujisawa, Ensor, Lecce, & Marfleet, 2006; Hughes & Leekam, 2004). Specifically, we use information about others' intentions, desires, thoughts, and beliefs to make sense of the social world, to interpret and predict the actions of others, and to guide our behaviours in these situations (Ashiabi, 2007; Bosacki & Astington, 1999). Accordingly, Bosacki and Astington found that the theory of mind skills of sixth grade children, measured using brief social vignettes and questions to assess social understanding, were positively related to peer and teacher ratings of their social competence.

Theory of mind plays an especially important role when considering children's ability to adapt their behaviour to specific types of social contexts, such as cooperative versus competitive contexts. To behave in a cooperative or competitive manner, one must attribute independent

mental states to others in order to anticipate the goals and behaviours of other social actors and explain and predict their behaviours, thus choosing a strategy that will lead to the successful accomplishment of one's own goals (Flavell, 1999, as cited in Decety, Jackson, Sommerville, Chaminade, & Meltzoff, 2004). For example, playing a competitive game that requires predicting an opponent's next move in order to formulate an effective strategy (i.e., a game of chess), would require being able to attribute independent mental states to that opponent. Moreover, by recognizing the goals of the other person and how they converge or diverge from one's own goals, one is able to identify the social context as being one of cooperation or competition and adjust their subsequent behaviours accordingly. In a recent study with adults, Epley and colleagues (2006) found that asking participants to focus on another person's perspective during a cooperative task significantly increased context-appropriate behaviours (i.e., participants demonstrated more sharing behaviour). However, when asked to focus on another's perspective in a competitive context, adults displayed more competitive (i.e., self-serving behaviours) than without such instructions. Presumably, focusing on the other party's perspective highlighted the divergent self-interests of the competing party and caused the adults to adjust their own strategies to be more self-serving (Epley et al.). These results suggest that in competitive contexts looking into the minds of others may highlight cynical and self-interested motivations that would have been otherwise overlooked if one had remained egocentrically focused on their own interests and concerns. Basically, understanding others' mental states informed individuals as to the convergent or divergent goals of the other party and influenced their subsequent strategic behaviours. Previous research has not yet addressed how manipulating the perspective children focus on (i.e., their own or others) will affect children's behaviours in a cooperative versus competitive social context.

In addition to appreciating the mental states of others, past research suggests that cognitive skills, in particular, executive functions, are important in guiding individuals' social interactions and in promoting social-emotional competence (Decety et al., 2004; Nigg, Quamma, Greenberg, & Kusche, 1999; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006). Executive functioning is generally referred to as higher-order, self-regulatory cognitive processes that facilitate goal-directed behaviour by enabling the maintenance of behaviour on a goal set and calibration of behaviour to a context (Carlson, 2005; Pennington & Ozonoff, 1996; Hughes, 1998). However, there is debate in the literature over whether executive functioning is a unitary construct or can be separated into component processes (Garon, Bryson, & Smith, 2008). When it has been separated, the components include skills such as inhibitory control, cognitive flexibility, and working memory (Blair, Zelazo, & Greenberg, 2005; Diamond, 2006; Garon, Bryson, & Smith). In fact, research shows that the most common executive functioning components are inhibition of prepotent responses, mental set shifting (or cognitive flexibility), and working memory (Lehto, Juujarvi, Kooistra, & Pulkkinen, 2003; Miyake et al., 2000). Inhibitory control involves the ability to suppress or withhold a prepotent thought or response (Ciairano et al., 2007). Cognitive flexibility involves the ability to categorise data and stimuli according to different properties and allows one to move from one category to another and to modify one's point of view (Bonino & Cattelino, 1999). There tends to be some overlap between tasks measuring inhibitory control and cognitive flexibility in the research literature (Blair, Zelazo, & Greenberg, 2005). Finally, working memory involves the ability to hold information in mind and to mentally manipulate that information (Davidson, Amso, Anderson, & Diamond, 2006). Research shows that these executive functioning skills can emerge as early as infancy and become more refined throughout the preschool and school years (Diamond, 2006).

Several studies have found relations between executive functions and social competence, in that children's executive function abilities relate to appropriate and effective behaviours and strategies within various social contexts. In a two year longitudinal study, Nigg and colleagues (1999) measured children's (aged 6-8 years old) neuropsychological functioning (i.e., verbal fluency, inhibitory mental control, and visual spatial ability) and assessed the relations with teacher ratings of children's social competence. They also measured more general cognitive abilities (i.e., IQ and reading ability) in order to control for these variables. Results demonstrated that measures of inhibitory control predicted later adjustment, while controlling for the other cognitive variables.

In addition, Bonino and Cattelino (1999) investigated the relation between cognitive flexibility and cooperative relations with peers. Seven-year-old boys and girls completed the Wisconsin Card Sorting Task, a task in which they were required to sort different cards according to changing criteria, in order to measure their cognitive flexibility. These children were then paired according to gender and similar level of flexibility in order to complete a cooperative "tied pencil's task" (p. 24). To be successful at this collaborative task, children had to negotiate with each other and cooperate in order to coordinate their two crayons, tied together by a short piece of string, to colour a picture. The results showed that child pairs with high levels of cognitive flexibility had significantly more cooperative interactions and turn-taking than child pairs with low levels of cognitive flexibility. Bonino and Cattelino suggest that flexibility in thinking allowed children to find "...a new cognitive representation of the task and of the mutual role of self and partner..." and be able "...to restructure the social situation and the task and find an effective way to complete the task not in competition, but in co-operation" (p. 32). An important strength of this study is the measurement of social competence within an ecological

setting and a problem-solving scenario, allowing the direct observation of children's social behaviours and comparison of such behaviours across the same situation (Green & Rechis, 2006).

A recent longitudinal study investigated the relation between inhibitory control and social competence, in particular cooperative behaviours (Ciairano et al., 2007). Children from three age groups (7, 9, and 11 years-old initially) first completed a Stroop task, in which they were required to name the colour in which words were printed as opposed to the word of a specific colour, to measure their inhibitory control. In a second session, children were paired together and told to play with a Jigsaw puzzle for a limited time period. One year later, the same children again completed the Stroop task and the puzzle task. The authors found that during the puzzle task dyads that performed better on the Stroop task (i.e., both individuals demonstrated higher inhibitory control) displayed significantly more cooperative behaviours (e.g., giving a puzzle piece to their partner to use) than dyads who demonstrated weaker inhibition skills. Furthermore, inhibitory control was found to be the most influential stable predictor of non-cooperative behaviours during the puzzle task.

While the previous studies looked at the relation between executive functions and social competence in neutral or cooperative social contexts, some research supports the idea that executive functioning may be involved in the modification and maintenance of effective strategies also within competitive social situations. For instance, investigators have looked at the commonalities in brain regions that are thought to underlie executive functioning processes and cooperative and competitive interchanges. A study by Decety and colleagues (2004) assessed cooperation and competition through an online computerized game where the objective was to build a target pattern either 1) alone, 2) in cooperation with a confederate, or 3) in competition

with a confederate. The functional imaging data showed that cooperative and competitive conditions, as compared with independent playing, were both associated with a common set of neural regions thought to underlie executive functions, indicating possible common executive function related neural underpinnings of these two processes of cooperation and competition (Decety et al.).

In sum, previous research reveals relations between children's theory of mind skills and executive function skills with socially competent behaviours (Bosacki and Astington, 1999; Bonino and Cattelino, 1999, Ciairano et al., 2007, Nigg et al., 1999). However, there are a number of factors in previous work that limit the conclusions that can be drawn. First, the use of peer and teacher ratings of social competence is not as valid as measuring children's behaviours in a standardized ecologically valid social task (i.e., one which children would often encounter in a school or play setting) as ratings of social competence may be confounded by general perceptions peers and teachers have of these children. Second, previous work has not looked at the relation between cognitive skills and socially competent behaviour in a competitive context. It is important to consider how executive functions may influence children's abilities to adjust their behaviours and strategies depending on different social situations (e.g., cooperative versus competitive). Third, the past studies on cooperative behaviour have tended to neglect the dyadic relationship between children during social interactions. As children's behaviours will affect each other in these social interactions, it is important to control for these dyadic relationships between social partners (i.e., how children affect their social partners' behaviours). Fourth, the measurement of executive functioning in past studies has some limitations. For instance, the Wisconsin Card Sorting task may not be a valid measurement of flexibility in children (Bonino and Cattelino, 1999). Specifically, the Wisconsin Card Sorting task was originally designed for

use with adults and is a complex task for young children (i.e., performance depends on participants' abilities to benefit from feedback) and it places substantial demands on working memory (i.e., it is not a pure measure of cognitive flexibility; Jacques & Zelazo, 2001). Furthermore, this study uses only one task to assess one component of executive functioning; however, because executive functioning has been found to be a multifaceted construct, it should be measured more comprehensively using other measures that assess the various components of executive functioning (e.g., inhibitory control) (Miyake et al., 2000). Finally, research suggests interrelations between executive functions and theory of mind skills. For example, studies show a relation between executive functions and theory of mind in which executive functioning may be a facilitator of theory of mind understanding (Carlson & Moses, 2001; Carlson, Moses, & Breton, 2002; Carlson, Moses, & Claxton, 2004; Hughes 1998; Hughes & Ensor, 2007; Carlson, Mandell & Williams, 2004; Nilsen & Graham, 2009). Consequently, it would be important to investigate the unique contributions made by both executive function and theory of mind skills in facilitating socially competent behaviour and whether executive functioning makes unique contributions to social competence over and above theory of mind. In other words, executive functioning may allow for the expression of theory of mind in a social context. As well, research indicates a relation between verbal ability, other cognitive skills, and social competence; thus it would be important to control for verbal ability when investigating the relationship between cognitive skills and social competence (Bosacki and Astington, 1999; Carlson & Moses; Jacques & Zelazo, 2005; Nigg et al., 1999).

Present investigation

The main goal of the current study was to determine whether children's executive function and theory of mind skills related to children's socially competent behaviours during

different situational contexts. A further research goal was to assess whether asking children to focus their attention on their own or another's perspective would change their social behaviour in the varied contexts and whether this manipulation would be more effective for children with better cognitive abilities.

In the past, children's social competence has been assessed using teacher ratings rather than comparing children across a standardized social context, thereby limiting the conclusions that can be drawn (e.g., Nigg et al., 1999). For this reason, as well as due to the advantages of assessing socially competent behaviours in an ecologically valid setting, a task that allows observation of children's behaviours in a standardized natural setting where they are interacting with other children was used.

In order to assess socially competent behaviours in different social contexts, in which children would be required to adjust their strategies/goals and behaviours according to the social situation, we measured children's social behaviours in both a cooperative and a competitive context. Specifically, in a cooperative context children were asked to complete a puzzle task as a team with another child, whereas in a competitive context children were told that they were competing with another child to see who could finish a puzzle task the fastest.

In order to study the relations between children's social competence and their executive function skills and theory of mind skills, children were administered tasks in those domains. Children's skills were assessed using two tasks that measure different factors of executive functioning, inhibitory control and cognitive flexibility. Children also completed a second-order false belief task, requiring them to assess the mental state of a character that holds a belief different from the children's or from reality. This is a commonly used measure for assessing children's theory of mind skills (Coull, Leekam, & Bennett, 2006). By measuring both executive

function and theory of mind in the same study, we begin to fill a gap in the literature by examining the unique contributions made by executive function and theory of mind skills to social competence. As well, because of the relations found between verbal ability and executive functions, theory of mind and social competence, children completed a measure of verbal skills.

It was hypothesized that executive functions would relate to increased appropriate behaviours in each context, while controlling for theory of mind and verbal skills. This was based on past findings that executive functions exert independent effects on social competence, while controlling for verbal skills. Furthermore, because past research suggests that executive functioning may be a facilitator of theory of mind understanding, but not the reverse, we hypothesized that executive functioning would make unique contributions to social competence over and above theory of mind. Essentially, it was predicted that executive function skills would allow children to make use of their knowledge of their partner's perspective in an interactive context.

We also investigated the impact of manipulating children's perspective-taking (i.e., by asking them to either focus on their own or another's perspective/goals/desires during the puzzle task) on their cooperative versus competitive behaviours. An effect of perspective-taking on cooperative versus competitive behaviours has been found with adults (Epley et al., 2006). The effect such a manipulation would have on children's behaviour, especially at a time when they are developing their executive function and theory of mind skills, has not yet been investigated. As per adult findings, we predicted that in general when children were asked to focus on another's perspective they would demonstrate more cooperative behaviours in the cooperative context and more competitive behaviours in the competitive context as the convergent or divergent goals of their partners would be highlighted. However, it was hypothesized that the

manipulation of taking another's perspective would be most effective for children with better cognitive abilities, specifically better executive function skills. For example, if children have less competence in these skills, they may not be able to inhibit their own perspective enough to focus on the needs and shared goals of others in a cooperative situation, consequently remaining egocentrically focussed and behaving less cooperatively.

Method

Participants

One-hundred and thirty-eight participants were recruited from Senior Kindergarten to Grade 2 classes within schools from the Waterloo Region Catholic District School Board. However, twenty-two participants were removed from all analyses or were not run through the study because they were unable to complete the tasks or did not complete the tasks appropriately (e.g., they incorrectly answered a question testing their understanding of the task instructions). Because we were looking at dyadic relationships, if the child met the above criteria, both that child and his/her partner were removed. One-hundred and fourteen participants remained (51 males; 63 females) and the ages ranged from 60.30 to 104.40 months of age ($M = 81.47$, $SD = 8.95$). Only children who had the written permission of their parents and verbal permission of their teacher participated in this study.

Materials

In order to measure children's social behaviours, a puzzle task was used. This consisted of two 16'' X 20'' puzzles (one puzzle of cupcakes and another puzzle of ice cream cones), a 16'' X 20'' picture model of each completed puzzle, and metal-wired holders on which the models sat upright (see Figure 1). Both puzzles were divided into two equal halves, with one half consisting of three distinct colours (e.g., blue, pink and yellow) from the other half (e.g., orange, purple, green). Each half of the puzzle was a distinct colour so that children could distinguish which pieces belonged on one half and which belonged on the other half. There were twelve pieces for each half of the puzzle and the twelve pieces for one half of the puzzle were cut in exactly the same shape as the twelve pieces for the other half of the puzzle so there were no clues as to which pieces went on which half when the pieces were faced down. There was an 18'' X 22'' wooden frame, with two equal halves held slightly apart by two hinges, on which the puzzle

was to be built. This ensured that the two halves were distinguished, but that the whole frame could not be separated into two separate pieces (i.e., this manipulation was to ensure that it was ambiguous whether the task was one that was meant to be completed cooperatively or separately allowing the same task to be used for both situational conditions). A stopwatch was used to time how long it took to put a puzzle together and a whiteboard was used on which to write this finishing time. Finally, there were two laminated sheets on which there were colours of each half of the puzzle. This was used to manipulate children's perspective-taking (i.e., focussing on one's own or another's perspective).

Procedure

To begin, children were assigned to pairs by randomly selecting their names from the class roster. Children participated in the study during the regular school day at a time designated by their teacher. They first completed the cooperative puzzle task with their partner. Children then individually completed tasks (i.e., in two separate rooms) measuring their inhibitory control skills, cognitive flexibility, theory of mind skills, and verbal skills. All tasks were always presented in this fixed order because we were interested in looking at individual differences amongst participants. A fixed order is standard practice when looking at individual differences because, "...it is critical that the individuals be exposed to identical stimulus contexts. That context includes not only the stimuli themselves but also the order in which they are presented" (Carlson & Moses, 2001, p. 1035).

One week later, the same pair was brought back to complete a competitive social task. Children completed this task against the other child who had previously been their partner. The first session took about 40 minutes whilst the second session took about 20 minutes.

Social Measures

The puzzle task used to measure children's social behaviours was designed so that it could be used in a cooperative or a competitive context, depending on specific instructions. This novel task allowed the observation of children's behaviours in two standardized social contexts and the measurement of children's abilities to adjust their goals and behaviours according to the changing social contexts.

Cooperative Task. In order to investigate children's social skills in a cooperative context, pairs of children completed a puzzle as a team. Children were presented with either the cupcake or the ice cream cone puzzle (counterbalanced across participants) and instructed to finish the puzzle as fast as they could by working together as a team. The wooden puzzle frame, with each half held slightly apart by two hinges, was located immediately in front of the pair. The pieces to the puzzle were laid out face-down, randomly placed behind the puzzle frame and a model of the finished puzzle was placed behind these pieces. Children were instructed that it was their job to complete the half of the puzzle in front of them and were randomly assigned to sit in front of one of these halves (i.e., left or right side); however, children were told that they were allowed to help each other with each other's halves. Before beginning the task, each pair was asked to choose a team name in order to highlight the collaborative nature of the task. This was then written on a scoreboard where the team time to finish the whole puzzle would be written. Children were given one rule to follow, that if they picked up a piece they were to put the piece back face down, unless they or their partner was actively using that piece to complete the puzzle. This rule ensured that children had to make a decision with each piece of the puzzle that belonged to their partner; they could either turn it back over and not help their partner or assist their partner by providing the piece. Before beginning the puzzle, children were asked

specific questions to either have them focus on their own or the other child's perspective (e.g., which colour pieces their partner would need to complete his/her side). Children circled their answers on laminated sheets. The complete instructions for completing this task are presented in the Appendix A. During this task, children's behaviours were video recorded for later coding.

Competitive Task. In order to investigate children's social skills in a competitive social context, pairs of children were presented with either a cupcake or ice cream cone puzzle (i.e., the type of puzzle that they did not complete in the previous session) in the same manner as the cooperative puzzle task. The instructions and procedures were identical to the cooperative task except that children were told to complete their own half as fast as they could in order to beat the other person. As well, in order to highlight the competitive nature of the task, each child was asked to choose a name for him/herself, each of which was then written on the scoreboard where their individual times to finish their own half of the puzzle would be written. The complete instructions for completing this task are presented in Appendix B. Again, children's behaviours during this task were video-recorded for later coding.

Coding. Children's behaviour during the two social tasks were coded by a research assistant who was blind to the research hypotheses and the condition the children were in (i.e., cooperative or competitive and self or other perspective-taking). Children's behaviours were coded as cooperative if they demonstrated behaviours intended to help or collaborate with their partner. For example, cooperative behaviours included actions such as giving the other child a puzzle piece to put on his/her half of the puzzle or helping the other child find a piece he/she was looking for. Children's behaviours were coded as competitive if they demonstrated behaviours that did not aid the other child or directly hindered the other child's completion of his/her half of the puzzle. For example, competitive behaviours included picking up the other child's puzzle

piece and putting it back face-down further away from the other child (See Appendix D for coding criteria). Only behaviours that occurred during the joint activity when each child was still finishing his/her own half of the puzzle were included in the analyses (i.e., the period of time when the first child to finish his/her own half was still working on his/her puzzle half). This was to ensure that each child was experiencing the same conditions while these behaviours occurred (i.e., both children were actively working on the puzzle).

In order to analyze these behaviours, different variables were calculated for both cooperative and competitive behaviours in both social contexts: the proportions of behaviours and the proportion of time spent in cooperation with the partner. Because participants completed the puzzle task in different lengths of time, thus allowing different opportunities and lengths of time to display cooperative and competitive behaviours, proportions were calculated in order to control for these varying circumstances. The proportions of behaviours included the proportion of cooperative behaviours and the proportion of competitive behaviours. These proportions were calculated for each child by summing his/her total number of cooperative or competitive behaviours and dividing by the total number of behaviours (i.e., Cooperative + Competitive) that occurred during the joint activity (i.e., the period of time when both children were still finishing their halves of the puzzle). The proportion of the duration of time spent in cooperation with the partner was calculated by summing the total amount of time spent in cooperation with the partner and dividing by the total time for the joint activity. Table 1 describes these dependent variables in both the Cooperative and Competitive tasks.

Cognitive Measures

Inhibitory Control Task. The Simon Says game was used as a measure of inhibitory response control and has been found to be appropriate for elementary-aged children (Carlson,

2005; Strommen, 1973). In this task, the experimenter gave an action command that was either preceded by “Simon Says” or not and concurrently performed that action. Children were instructed to only imitate those actions that were preceded by the “Simon Says” command. This task measures children’s ability to refrain from performing certain actions/behavioural responses. For example, if the experimenter said “Touch your knee” without saying “Simon Says” the child should not imitate this action. Children’s total scores on this task were calculated using only the ten test trials where the behavioural command was not preceded with “Simon Says” and children must inhibit a response to imitate a commanded action. Children were given a score of 0-3 (0=full command movement, 1=partial command movement, 2=wrong movement, 3=no movement) on each of these trials; thus they could have a total score between 0-30.

Cognitive Flexibility Task. The Border Dimensional Change Card Sort was used as a measure of children’s cognitive flexibility (Hongwanishkul, Happaney, Lee, & Zelazo, 2005). This task has been found in past studies to be a valid measure of cognitive flexibility and to be age-appropriate for elementary-aged children (Garon, Bryson, & Smith, 2008; Hongwanishkul et al., 2005). In this game, target cards (a blue rabbit and a red boat) were affixed to two sorting boxes. Children were introduced to these two boxes and then shown two different types of cards (a red rabbit and a blue boat), which they were to sort into each box according to certain rules (i.e., shape rules or colour rules). Children first sorted cards according to the colour rule (i.e., they had to match the cards based on the colour). The researcher sorted two test cards into each box to illustrate what children were supposed to do. After these demonstration trials, children completed six pre-switch trials where the researcher stated the relevant rule, randomly selected a test card (with the constraint that the same type of card was not presented on more than two consecutive trials), labelled the card by the relevant dimension only (i.e., colour), and asked

children to place the card in one of the boxes. No feedback was provided; after children sorted each card the research simply stated, “Let’s do another one,” and then proceeded to the next trial.

When they had completed six trials, children were told to stop playing the first game and given new instructions to play a different game where they were to sort cards according to the shape rule. Children were then given six post-switch trials, which were identical to the pre-switch trials except that now they were sorting according to shape.

After completing these six post-switch trials, children were given a new, more difficult “border” version. Children were first introduced to a new test card that had a black border around it and were told that the black border indicated that they must play the colour game (i.e., match according to card colour). However, if the card did not have a black border, children were instructed to play the shape game (i.e., match according to shape). Children completed 12 trials where the researcher randomly presented cards of rabbits or boats with or without borders around them (with the constraint that the same type of test card – with or without a border – was not selected on more than 2 consecutive trials). On each trial, the researcher would label the card as having a border or not and ask the child to place it into one of the two boxes. The complete instructions for completing this task are presented in Appendix C.

As the main interest was children’s ability to flexibly switch between matching rules based on the stimuli, the measure used in the analyses was children’s total scores during the 12 Border test trials; thus their total score could range from 0-12.

Theory of Mind Task. The Second Order False Belief task was used to measure children’s ability to understand what another person believes or thinks by having them watch a video of two puppets interacting. The story depicted in the video was from Coull, Leekam, and Bennett (2006). In the video, one puppet (Sally) decided to play a trick on another puppet (Paul)

and took a toy robot from its original location and hid it in another location without realizing that the other puppet (Paul) was watching. After watching the video, children answered questions about what the puppets were thinking (e.g., “Where does Sally think Paul will look for the robot?”). To be successful, children would have to realize that Sally did not see Paul watching her hide the robot and would consequently think that Paul thinks the toy is still in its original location and would look for it there. Children received a score of 0 or 1 according to their answer to this question and this score was used in the data analyses.

Verbal Task. The Picture Vocabulary subtest from the Test of Language Development-Primary 3 (TOLD-P:3) was used to look at children’s verbal abilities (Newcomer & Hammill, 1997). In this task, children were shown pages with four pictures on each page and told to point to the picture that corresponded to the word said by the researcher. For example, if the researcher said “Show me baby” the child should point to the picture of the baby. There were a total of 30 items. All children started at the first item and continued with the task until, as per standardized protocol, they provided five consecutive incorrect responses. Children’s total score, out of 30, was used in the data analyses.

Results

Overview

The purpose of this study was to investigate the relation between executive functions and socially competent behaviours, while controlling for theory of mind and verbal skills.

Furthermore, we wanted to investigate whether asking children to focus their attention on their own or another's perspective would change their behaviours in the cooperative and competitive contexts and whether this manipulation would be more effective for children with better cognitive abilities.

Before addressing our main research questions, children's performance on the predictor variables (executive functioning skills, theory of mind skills, and verbal skills) and the relations between these variables was examined. Next, children's performances on the cooperative and competitive tasks were analyzed with respect to how children's behaviours changed across the different social contexts. As well, the relationship between each child's own behaviours and his/her partner's behaviours was analyzed.

Following these initial analyses, children's cognitive skills were examined in relation to their behaviour during a cooperative or competitive task. Because children were completing the social tasks with another child in a dyadic relationship where social partners could influence each other's thoughts, emotions, and behaviours, our main analyses were conducted using the Actor-Partner Interdependence Model. This model allows one to investigate both actor effects (i.e., when an individual's score on a predictor variable affects that same individual's score on an outcome variable) and partner effects (i.e., when an individual's score on a predictor variable affects his/her partner's score on an outcome variable). Thus, we were able to investigate the mutual influence between the members of each dyad when addressing our main hypotheses.

Initial Analyses

Cognitive Tasks. A MANOVA with gender as the grouping variable was conducted. There were no significant effects of gender on any of the cognitive measures, $F(4,108) = 1.10, p > .05$; thus gender was not included in further analyses. Children's performance on the cognitive tasks (i.e., Simon Says task, the Border DCCS task, the Second Order False Belief question, and the Test of Language Development: Picture Vocabulary (TOLD) task) are presented in Table 2. All measures show good variability, with no floor or ceiling effects, which suggests that the tasks used were age-appropriate for the sample.

The relations between the children's demographic and cognitive skills were examined (see Table 3). Specifically, the bivariate correlations between the children's performance on the Simon Says, the Border DCCS, SOFB question, TOLD, and their age were calculated. Similar to previous research, analyses revealed significant interrelations between the predictor variables and age (Carlson & Moses, 2001; Carlson, Moses, & Breton, 2002; Carlson, Moses, & Claxton, 2004; Hughes & Ensor, 2007). The Simon Says task was not significantly correlated with the SOFB question or age; however, it is not atypical to find this lack of relation. For example Sabbagh and colleagues (2006) found similar non-significant relations between inhibitory control measures and false belief understanding.

Recent research supports the idea that although the cognitive processes typically considered to be under the executive function umbrella can be differentiated, they also appear to tap a single underlying unitary construct (Miyake et al., 2000; Huang-Pollock, Mikami, Pfiffner, & McBurnett, 2009). Huang-Pollock and colleagues (2009) also outline two prominent benefits of summarizing executive function performance as a single factor: "...factor scores are more reliable than the scores on individually observed variables, and the decrease in the number of

variables under consideration leads to increased parsimony in interpretation” (p. 688). We were interested in the effects of executive functioning skills together; thus, consistent with previous research and because the Simon Says scores and Border DCCS scores were significantly correlated with each other, we created an Executive Functioning (EF) composite score (Carlson & Moses, 2001; Carlson, Mandell, & Williams, 2004; Hughes & Ensor, 2007; Huang-Pollock et al., 2009). This was done by transforming the scores on the Simon Says task and the Border DCCS task into z-scores and then adding them together. In order to inspect the strength of the correlations between the EF composite score and the SOFB score, when controlling for age and verbal skills, we conducted partial correlations. This revealed that, even when controlling for age, there were significant correlations between the EF composite and the SOFB question, $r(110) = .24, p = .01$, and the TOLD score, $r(110) = .51, p < .001$. When controlling for age and verbal skills, there were no longer significant correlations between the EF composite and the SOFB question, $r(110) = .14, p > .05$.

Cooperative / Competitive Tasks. Children’s cooperative and competitive behaviours were measured in both the cooperative and competitive context. Table 4 displays the mean and standard deviations for children’s overall number of behaviours during the time in the tasks where both children were engaged in the task. This measure however does not control for the amount of time pairs took to complete the puzzle tasks. As such, children’s performances on the task were calculated as described previously (i.e., proportion of cooperative/competitive behaviours and duration of time spent engaging in cooperative behaviour). Table 1 displays the mean and standard deviations for these variables. Because the variable for the proportion duration of cooperative behaviour was negatively skewed, this variable was transformed using a Logit transformation. The transformed data was included in all subsequent analyses.

A MANOVA with gender as the grouping variable was conducted. There were no significant effects of gender on any of the social behaviours, $F(5,108) = 0.36, p > .05$; thus gender was not included in further analyses. In general, results indicated that children displayed a greater proportion of competitive behaviours ($M = .61, SD = .40$) to cooperative behaviours ($M = .39, SD = .41$) in the competitive task, $t(113) = -2.88, p = .005$. However, there was no significant difference between the proportion of competitive behaviours ($M = .51, SD = .41$) to cooperative behaviours ($M = .48, SD = .41$) in the cooperative task, $t(113) = -.33, p > .05$.

To investigate whether children modified their behaviours based on the context as well as whether the manipulation of perspective affected children's behaviours (and to assess for an interaction between these two manipulations) a 2 (Task: Cooperative Task, Competitive Task) x 2 (Perspective: Other Perspective, Self Perspective) mixed model Analysis of Variance (ANOVA) for each of our dependent variables was conducted.

For the proportion of cooperative behaviours, there was a main effect of task, $F(1, 112) = 7.94, \eta_p^2 = .07, p = .006$, no main effect of condition ($p = .18$), with no significant interaction ($p = .32$). In general, children were showing a context appropriate decrease in their cooperative behaviours from the cooperative task ($M = .48, SD = .41$) to the competitive task ($M = .39, SD = .40$), $t(113) = 2.84, p = .005$. In other words, given the inverse relation between the cooperative and competitive proportions, this finding also indicated that children were showing a context appropriate increase in their competitive behaviours. However, focussing on another's perspective versus one's own did not lead to any significant changes in behaviours overall. For the proportion duration of cooperative behaviours, there was no main effect of task, ($p = .10$), no main effect of condition, ($p = .61$), and an interaction that was approaching significance, $F(1, 112) = 3.47, \eta_p^2 = .03, p = .07$. Thus, children were not showing a significant change in the

amount of time they spent in cooperation with the other child across the two tasks nor was there an effect of perspective-taking; however, there was a trend in that those in the “Other” condition were spending a greater duration of time in cooperation in the cooperative task ($M = -2.18$, $SD = 1.36$) than in the competitive task ($M = -2.64$, $SD = 1.35$), $t(57) = 2.57$, $p = .01$. In contrast, those in the “Self” condition were not showing this change from the cooperative ($M = -2.54$, $SD = 1.45$) to the competitive task ($M = -2.51$, $SD = 1.37$), $t(56) = -1.29$, $p = .90$.

The relations between children’s behaviour during the tasks and their partners’ behaviour were examined. The correlations of the dependent variables in both the cooperative and competitive tasks are displayed in Table 5. These analyses revealed significant correlations between the children’s behaviour and their partner’s behaviour. As is often the case in dyadic relationships, it is likely that children were influencing each other’s thoughts, emotions and behaviours. In order to account for this finding in our main analyses, the Actor Partner Interdependence Model was used to examine relations between children’s cognitive skills and their social behaviour (Kenny, Kashy, & Cook, 2006).

Relations between cognitive skills and social behaviours. Finally, before beginning our main analyses, we investigated the relation between children’s performance on the cognitive tasks and their behaviour during the social tasks (see Table 6). Analyses revealed that only the executive function composite was significantly correlated with the proportion of cooperative behaviour ($r = .22$, $p = .02$) in the cooperative task, but not the competitive task ($r = .08$, $p > .05$). Thus, children who demonstrated more proficient executive function skills were found to demonstrate more cooperative and less competitive behaviours during the cooperative task; however, no relation was found in the competitive task. This relation remained significant for the proportion of cooperative behaviours when partial correlations controlling for verbal skills and

age were conducted ($r = .19, p = .04$). However, this analysis did not account for the dyadic nature of the task (i.e., the behaviour of one partner on the other partner was not controlled for when examining the relations between executive functions and social behaviour), thereby limiting the conclusions that can be drawn by correlation measures. As such, our main analysis used dyadic models.

Dyadic Models

Social behaviours predicted by cognitive skills. In order to investigate the relation between executive functions and cooperative and competitive behaviours in both the cooperative and competitive tasks, while controlling for theory of mind and verbal skills, we used structural equation modeling (SEM). This allowed us to explicitly model the actor and partner effects that each child had on their own behaviours and their partner's behaviours, while simultaneously controlling for each predictor variable (i.e., executive functioning composite, SOFB, and TOLD scores).

Figure 2 shows the structural model for the cooperative social task using the dependent variable of the proportion of cooperative behaviours as an example. Each variable for a dyad is labelled as either A or B for each partner in the dyad. In this model, we tested the hypothesis that the actor effect of the EF composite, represented by Path *a*, would account for a significantly greater proportion of cooperative behaviours in the cooperative task, while controlling for the partner effect of the EF composite (Path *b*) and the actor and partner effects of SOFB and TOLD scores represented by Paths *c*, *d*, *e*, and *f*. Significance was determined by an alpha value of less than .05 and the significance of the chi-square values were referenced from the chi-square table in Howell (2004).

The results for this model are shown in Figure 3. Because our dyads are interchangeable (i.e., indistinguishable dyad members), the fit of this model has been adjusted using I-SAT (i.e., a saturated model where everything is modeled as related to everything else in a completely unconstrained way) and I-NUL models (i.e., where all variables are modeled as completely unrelated). This model fit extremely well, $\chi^2(6, N = 57) = 2.20, ns$, CFI = 1.00, RMSEA = 0.00. Results for the actor effect of EF composite on the proportion of cooperative behaviours in the cooperative task was significant, while controlling for actor and partner effects of theory of mind and verbal skills, ($B = .23, p = .04$), indicating that children with better executive functioning skills were displaying a greater proportion of cooperative behaviours and a smaller proportion of competitive behaviours in the cooperative task than children with poorer executive functioning skills.

A similar model was run for the duration of cooperative behaviour in the cooperative task proportionate to length of task duration. This model fit extremely well, $\chi^2(6, N = 57) = 2.20, ns$, CFI = 1.00, RMSEA = 0.00; however, there were no significant actor or partner effects of the predictor variables on the duration of cooperative behaviours. Thus, when controlling for theory of mind and verbal skills, children's executive functioning skills did not appear to affect the length of time with which they engaged in cooperative behaviours.

Similarly, there were no significant actor or partner effects of the predictor variables on any of the dependent variables in the competitive task. These models fit extremely well, $\chi^2(6, N = 57) = 2.20, ns$, CFI = 1.00, RMSEA = 0.00. Thus, when controlling for theory of mind and verbal skills, children's executive functioning skills do not appear to influence the behaviours they display in a competitive context.

Adjustment of behaviours predicted by cognitive skills. It was hypothesized that

children with better executive functioning skills would show a more appropriate change in their behaviours from the cooperative task to the competitive task, such that there would be fewer cooperative behaviours and more competitive behaviours in the competitive task than in the cooperative task.

In order to address this research question, we calculated two dependent variables representing the change in the proportion of cooperative behaviours and the proportion duration of cooperative behaviours from the cooperative task to the competitive task. This was done by running a linear regression analysis, where behaviour in the cooperative task was the independent variable and the same behaviour in the competitive task was the dependent variable, and saving the unstandardized residuals. These unstandardized residuals, representing the change in behaviour from the cooperative to the competitive tasks, then became the dependent variables in the two SEM models.

The model with the change in the proportion of cooperative behaviour as the dependent variable fit extremely well, $\chi^2(6, N = 57) = 2.20, ns, CFI = 1.00, RMSEA = 0.00$; however, there were no significant actor or partner effects of the predictor variables on the dependent variable. The same results were found for the model with the change in the proportion duration of cooperative behaviour as the dependent variable. Thus, when controlling for actor and partner effects of the other predictor variables, it does not appear that children with better executive functioning skills show a change in their behaviours from the cooperative task to the competitive task.

Interaction of manipulation of perspective-taking and cognitive skills. To investigate whether the manipulation of taking another's perspective during a social task would be more effective for children with better cognitive skills (i.e., eliciting more appropriate behaviours), we

applied a multisample SEM in which a model for each dependent variable was applied simultaneously to the two groups (i.e., Self and Other condition). The model for the Self condition is identical to that for the Other condition, with corresponding parameters of a' , b' , c' , d' , and so on. This allowed us to test the interaction of whether the manipulation of perspective-taking (i.e., the Other condition) would be more effective for children with better cognitive skills (i.e., they would display more appropriate behaviours).

When looking at the dependent variable of the proportion duration of cooperative behaviour in the cooperative task, we found that this two-sample model fit extremely well, $\chi^2(8, N = 28) = 4.25, ns, CFI = 1.00, RMSEA = 0.00$. To test the hypothesis that the slopes of the predictor variables (both actor and partner effects) were different across the two conditions, we compared the fit of models where each path in the Self condition was set equal to each relevant path in the Other condition. For example, in one model the path for the actor effect of verbal skills (TOLD) was set equal for both the Self and Other conditions. There were no significant interactions between condition (Self and Other) and any of the predictor variables, indicated by the fact that each constrained model fit just as well as the original model. However, the difference between the slopes for the original model and a constrained model, where the path of the actor effect for verbal skills (TOLD) was set equal across the two groups, was marginally significant, $\Delta\chi^2(1) = 2.74, p = .10$. This indicates that the slope in the Other condition was approaching being significantly different from the slope in the Self condition for those with better verbal skills. This suggests that the manipulation of perspective in the Other condition was more effective for those with better verbal abilities, even when controlling for actor and partner effects of the other predictor variables, in that those in the Other condition with better verbal skills were displaying a longer duration of cooperative behaviours.

There were no significant interactions between cognitive skills and manipulation of perspective when looking at the other dependent variables in the cooperative and competitive tasks, as well as changes in behaviours across the two tasks (*ns*). Thus, when controlling for actor and partner effects of the predictor variables, focussing on another's perspective was not more effective in changing behaviour for those with better cognitive skills in either task.

Discussion

The first aim of this study was to determine whether children's executive function skills were related to context appropriate social behaviours during two types of standardized social tasks, while controlling for theory of mind and verbal skills. Furthermore, the relation of children's executive functioning skills and abilities to adjust their behaviours appropriately from a cooperative to a competitive social context was investigated. The second aim was to assess whether asking children to focus their attention on another's perspective versus their own perspective would increase more appropriate social behaviour in two different contexts and whether this manipulation would be more effective for children with better cognitive abilities. In order to address these research aims, a task that allowed observation of children's behaviours while interacting with another child in two standardized social settings was used. Social competence was assessed by measuring children's social behaviours in both a cooperative and a competitive social context. Before completing these tasks, children were assigned to a condition where they were asked to focus on either the perspective of the other child or their own perspective. Finally, children were administered tasks intended to assess their executive functioning, theory of mind, and verbal skills. Several research questions were addressed in the analyses.

First, results indicated that the measures assessing executive functioning, theory of mind, and verbal skills were significantly correlated. This finding is consistent with previous work in this area. Many researchers have found a relations between children's ability to understand other's mental states and their executive functioning skills, as well as verbal skills (Carlson & Moses, 2001; Carlson, Moses, & Breton, 2002; Carlson, Moses, & Claxton, 2004; Hughes & Ensor, 2007). Research that has adopted a longitudinal or microgenetic approach provides strong support for the view that executive functioning facilitates children's performance on theory of

mind tasks, but weak support for the view that theory of mind is a prerequisite for executive functions (Flynn, 2007; Flynn, O'Malley, & Wood, 2004; Hughes & Ensor, 2007). Research also indicates that executive functioning plays a continued role in supporting the use of mental state information in various social contexts (e.g., Nilsen & Graham, 2009; Brown-Schmidt, 2010). Furthermore, results also indicated that the relation between executive functioning and theory of mind remained when controlling for age, but not verbal ability.

Second, when looking at children's social behaviours in general, analyses revealed that children were displaying proportionally more competitive than cooperative behaviours in the competitive task. This suggested that children were realizing the nature of this competitive task and displaying context appropriate behaviours to compete with their social partner. However, in the cooperative task, children were not displaying more context appropriate cooperative behaviours than competitive behaviours. Thus, it may be that for children this young, working in an individualistic (i.e., non-cooperative) fashion is simply a more automatic way to think and respond in social contexts and that behaving in a cooperative fashion is a more cognitively demanding skill that needs to develop further. This may be because children have only recently developed the ability to collaborate with others and differentiate another's perspective from their own; thus, cooperating with others is still a developing skill (Brownell & Carriger, 1991; 1990; Cook & Stingle, 1974; Hay, 1979; LaFreniere, 1996). In fact, being egocentrically biased (i.e., being more focussed on one's own interests and concerns) is a natural tendency even for adults (Epley et al., 2006). However, it was found that relative to their total behaviours children were showing fewer cooperative behaviours and more competitive behaviours from the cooperative to the competitive tasks. Hence, children were able to recognize the changing demands of the cooperative versus competitive contexts and adjust their behaviours appropriately.

In order to assess how children's behaviours were affecting each other, the relation between partners' social behaviours was examined. This revealed that children's behaviours were significantly correlated with their partner's behaviours in both the cooperative and the competitive tasks, indicating that children were having an influence on each other's behaviours. In other words, children tended to modify their behaviour in an on-line fashion based on the behaviour of their partner, in essence developing a reciprocal pattern of behaviour. For example, if a child displayed a helping behaviour towards the other child during the puzzle task (e.g., giving the partner a puzzle piece he/she needed), the other child was more likely to recognize this helping behaviour and reciprocate (e.g., give the child a puzzle piece he/she needed). In contrast, if a child displayed a pattern of non-cooperative behaviours (e.g., not giving the partner a puzzle piece he/she needed), the other child was more likely to eventually cease his/her own helping behaviours. This observed pattern of children's reciprocity in actions has been found in previous work where children, as young as three years old, preferentially share resources with someone who has shared before over someone who has not directly shared before (reciprocity) (Harris, 1970; Olson & Spelke, 2008; Staub & Sherk, 1970). Furthermore, children have been found to respond to the fairness or unfairness of a givers' behaviour by retaliating for obvious selfishness; specifically if a giver shared less of a resource with another child, that child was less likely to share with the giver in the future (Staub & Sherk, 1970). Thus, children demonstrate an ability to detect the intentions of another social actor (i.e., to help/share or not to help/share) and to reciprocate in kind. Consequently, children are not acting in isolation, but in a dynamic reciprocal relationship where they can affect each other's thoughts, feelings, and actions. Consequently, it was important to examine actor and partner effects in the main analyses investigating the relations between children's cognitive skills and their social behaviour.

The main aim of this study was to examine the role that executive functions play in children's ability to behave in a socially competent manner given the situational context. The relation was examined when controlling for theory of mind and verbal skills within a dyadic model. Results revealed that children with better executive functioning skills were displaying a greater proportion of cooperative behaviours and a smaller proportion of competitive behaviours in the cooperative task. Thus, children with better executive functions were better able to behave in a way that was appropriate to the cooperative context and work towards a shared goal with their partner.

What role might executive function skills play in facilitating children's socially competent behaviour? It may be the case that executive functions aid in the process of collaborating with other social actors in order to achieve a shared goal because they enable one to maintain behaviour on a goal set and adjust behaviour to a context (Pennington & Ozonoff, 1996). In particular, inhibitory control allows one to deliberately suppress a salient, prepotent cognition or response in order to pursue higher order or longer-term goals. Thus, when children are in a cooperative context, executive functioning allows them to inhibit more salient responses to gratify their own immediate needs and goals in order to consider the needs and goals of others and choose a more cooperative response set that will lead to the accomplishment of a shared goal. As well, cognitive flexibility may allow children to adjust their representation of a task to find a more effective way to complete the task in cooperation with another (Bonino & Cattelino, 1999). Furthermore, executive functions allow one to determine the mental state of another, by suppressing one's own perspective in order to focus on another's; thus, identifying the needs and goals of another (Carlson & Moses, 2001). Being able to consider the needs and goals of other social actors and to choose more prosocial behaviours (i.e., helping behaviours) that would aid

another, would allow a child to maintain positive social relationships with others, which is an important aspect of children's social development (Berndt, 1985; Green & Recheis, 2006; Rose-Krasnor, 1997).

Given the role that executive functions play in children's social behaviour, it would be expected that children who have deficient executive functions may not be able to choose and follow a more cooperative response set and instead behave in a more aggressive, antisocial manner. In fact, not only has past research found that executive functions are related to typically developing children's cooperative prosocial behaviours (Bonino & Cattelino; Ciairano et al., 2007); research also suggests that clinical populations often identified as having social impairments (e.g., ADHD, autism spectrum disorders) also have deficient executive functioning skills, particularly in inhibiting prepotent responses, interference control, and cognitive flexibility (Ciairano et al.; Berlin & Bohlin, 2002; Happé, Booth, Charlton, & Hughes, 2006; Hughes, Russell, & Robbins, 1994; Ozonoff, Strayer, McMahon & Filloux, 1994). A recent study by Huang-Pollock and colleagues (2009) found that executive functioning mediated a significant proportion of the relationship between ADHD and deficient social behaviours during a computerized social task. Diamantopoulou and colleagues (2007) also found that high levels of executive function deficits were associated with low levels of prosocial behaviour and high levels of physical aggression.

In contrast to the significant relation between children's executive function skills and behaviour within a cooperative context, there were no significant actor or partner effects of the predictor variables on the cooperative or competitive behaviours within the competitive context. Previous research has not examined this relation directly, but it was hypothesized that children's executive function skills would be involved in facilitating competitive behaviour due to evidence

for a shared brain region (Decety et al., 2004). Why this lack of relation was found in the competitive task is not entirely clear. One explanation, as mentioned previously, is that if children's default is to behave in an individualistic (i.e., competitive) fashion, it may not matter whether children have better cognitive skills in order to behave in an appropriate fashion (i.e., less cooperatively and more competitively) in the competitive task. Essentially, having well-developed executive functions versus less well-developed executive functions would lead to the same competitive response set in the competitive context. In contrast, executive functioning skills may come into play when children must behave in a way that is not automatic for them, that is, in cooperative social contexts where children must inhibit a more natural inclination (i.e., to behave competitively) and keep in mind a collaborative goal in order to behave in a more cooperative fashion with another child.

It is also unclear why theory of mind was not significantly related to social behaviours in either social context. It may be that theory of mind skills were not required in order to perform appropriately in each context because of the relative transparency of the task. Specifically, children may not require theory of mind skills to manoeuvre this task because the instructions given to children made the goals of each task explicit. Thus, children did not have to infer the mental state (i.e., intentions and goals) of their partner in order to act appropriately in each context; they simply had to follow the instructions to either work as a team or individually. An interesting direction for future work would be to investigate whether children with better theory of mind skills perform more appropriately when the instructions of the task have been made less explicit. Another possibility for the lack of relation found between both theory of mind and social competence is because of the limited way in which this skill was measured. Specifically, only one theory of mind task (i.e., a second-order false belief task) was administered to assess

this skill. Although false belief tasks are an accepted way to measure theory of mind in the literature, a more comprehensive battery of theory of mind skills (e.g., assessing understanding of deception, false belief, and appearance-reality) would allow a more reliable and thorough assessment of children's theory of mind skills (Carlson et al., 2002; Carlson et al., 2004; Coull et al., 2006). It could be that no relation was found between theory of mind and social behaviours because of the limited way in which this cognitive skill was measured. Another possibility for this lack of relation is the method by which social competence was measured in the past. Specifically, Bosacki and Astington (1999) looked at social competence and its relation to theory of mind using teacher and peer reports of social competence, rather than an ecologically valid social task. Perhaps children's social competence as rated by teachers and peers is tapping something different than social competence observed in a standardized, natural social setting. For instance, observer ratings could be influenced by other factors, such as personal impressions and opportunities for observation.

Verbal skills were also found to be unrelated to socially appropriate behaviours in both social contexts. It was expected that better verbal skills would lead to more socially appropriate behaviours because it would provide children with a wider repertoire of response options during social interactions (e.g., negotiating and communicating with the other child). Furthermore, past research has found a relation between verbal skills and social competence; however, as mentioned previously, past research measured social competence using only teacher reports rather than an ecologically valid social task (Nigg et al., 1999). As well, the current study used only one verbal task (i.e., a receptive vocabulary task) to assess verbal skills, which may have limited the relation that could be found with social competence. Although tasks of receptive language have been used in the past to look at relations between cognitive skills and social skills,

verbal skills could be measured using more than one task of verbal ability (e.g., both receptive and expressive verbal skills) (Hughes & Ensor, 2007; Nigg et al., 1999).

Although it was hypothesized that children with better executive functioning skills would show a more appropriate change in their behaviours from the cooperative to the competitive task, such that there would be fewer cooperative and more competitive behaviours in the competitive task, no significant results were found. As outlined above, this may be due to a more automatic pattern of responding where executive functioning is not related to an increase in competitive behaviour because this is simply a default setting for children. Future studies could test this hypothesis by conducting the competitive task before the cooperative task and assess whether cognitive ability is then related to an appropriate adjustment of behaviour from the competitive to the cooperative task. If the hypothesis is true that behaving in a competitive fashion is a more natural tendency and that adjusting behaviour to be more cooperative requires more refined cognitive skills (e.g., the ability to inhibit a more natural inclination to behave competitively and to keep in mind a collaborative goal in order to behave in a more cooperative fashion with another child), then a relation between executive functioning and the adjustment of behaviour to a cooperative context should be found. Another possibility regarding these non-significant results may be the way in which executive functioning skills were measured. Specifically, executive functioning was measured using only two types of executive functioning skills (i.e., inhibitory control and cognitive flexibility). Although these skills were chosen based on past research looking at the relation between executive functioning skills and social competence, it may be that other executive functions (e.g., working memory, planning) are more relevant to the adjustment of social behaviours to changing contexts (Bonino and Cattelino, 1999; Huang-Pollock et al., 2009; Nigg et al., 1999). It may also be that the relation between executive functions and social

skills is fairly specific. For example, a specific component of executive functioning may be more predictive of the adjustment of social behaviours according to changing social contexts than of the demonstration of appropriate behaviour in one type of context (i.e., cooperative) (Huang-Pollock et al.). Thus, perhaps the tasks used to measure executive functioning did not fully capture the skills required to find a relation between executive functions and the adjustment of social behaviour according to changing social contexts. Future studies that include larger sample sizes could be conducted in which a wider range of executive function tasks could be assessed. Also, by including more tasks that tap different components of executive functions (e.g., inhibitory control, cognitive flexibility, working memory and planning) and creating composites of each, the relation between these specific components of executive functions and social competence could be investigated (Huang-Pollock et al.; Miyake et al., 2000).

In regards to the second aim of this study, the manipulation of perspective-taking did not have a significant effect on behaviours as expected from past research with adults (Epley et al., 2006). However, there was a trend in that those in the “Other” condition (i.e., focussing on the other child’s perspective) were spending a greater duration of time in cooperation in the cooperative task than the competitive task. In contrast, those in the “Self” condition (i.e., focussing on their own perspective) were not showing this change in behaviour from the cooperative to the competitive task. Thus, it seems that even though there was not a significant interaction between perspective-taking and task-type, there was a trend in the direction hypothesized in that focussing on another child’s perspective produced context appropriate changes in the duration of time that children spent in cooperation with their partner. Specifically, children were spending more time in cooperation with their partner during the cooperative task and less time in cooperation with their partner in the competitive task. However, it should be

emphasized that these findings were not significant, which may be due in part to children's developing cognitive skills (i.e., executive functions, theory of mind, and verbal ability). Specifically, taking another's cognitive perspective involves being able to infer another's thoughts, feelings, attitudes, interests, or concerns in a particular situation and to hold this information in mind to guide behaviours during a social task (Epley et al., 2006). This is a complex process that would require competent executive functioning, theory of mind, and verbal skills; however, children of this age range are still developing their skills in these cognitive domains (e.g., Davidson et al., 2006; Diamond, 2006; Birch & Bloom, 2004). Thus, the manipulation of perspective-taking may not be as effective as it would be with adults who have better-developed cognitive abilities. It is also possible that this manipulation did not have the expected results because of the method used for manipulating children's perspective-taking. Perhaps the instructions were not detailed enough to elicit a genuine focussing of perspective or were not worded in a manner that helped children to focus on one perspective or the other. As well, the context in which adults' perspectives were manipulated occurred in a limited resource type of context; thus it may be the case that in a similar type of situation children would show similar patterns to adults. Future research should investigate these questions by conducting this task with older children who have more refined cognitive skills, by adjusting the manipulation instructions to more explicitly ask the participant to focus on the other's needs and goals, and by studying children's behaviours in a limited resource situation.

There were also no significant findings for the interaction of the manipulation of perspective-taking and cognitive skills; however, there was a finding approaching significance indicating that the manipulation of perspective in the "Other" condition was more effective for children with better verbal skills, even when controlling for actor and partner effects of the other

predictor variables. Specifically, those in the “Other” condition with better verbal skills were displaying a longer duration of cooperative behaviour in the cooperative task. Perhaps better verbal ability allowed children to better understand the instructions and the manipulation and thus use this information to formulate a collaborative goal that would involve working together with their partner to finish the team puzzle. In regards to there being no significant interaction between executive functioning or theory of mind skills and the manipulation, as mentioned previously, this may be due in part to children’s limited cognitive skills and consequent lack of ability to make use of this manipulation of perspective. Future studies could look at this in a broader age range where there would be a greater variability in cognitive skill level (i.e., more advanced abilities). This would also require the use of different cognitive measures that would be appropriate for a broader age range.

In conclusion, this study was the first to date to use a dyadic model to control for partner and actor effects when examining the role that children’s cognitive skills play in facilitating socially appropriate behaviours. Results from this study support the hypothesis that executive functioning is related to children’s socially competent behaviours in a cooperative social context, even when controlling for theory of mind and verbal skills. This research adds to the current literature by providing a clearer picture of the cognitive skills that are related to socially competent behaviours in an ecologically valid social setting. However, future studies should be conducted to replicate these findings using a more comprehensive battery of executive functioning, theory of mind and verbal skills. Results also provide insight into the role cognitive skills play in children’s abilities to behave appropriately in cooperative versus competitive contexts. Although results indicated that children in general were able to adjust their social behaviours from a cooperative to a competitive context, further work is needed in order to clarify

whether cognitive skills play a more significant role in guiding the adjustment of children's social behaviours when they are required to change their behaviours from a more natural response set (i.e., competitive) to a less well-developed response set (i.e., cooperative). In this way, future work may elucidate whether children indeed show a more automatic response to behave competitively; thereby, clarifying the lack of relation between executive functions and socially appropriate behaviours in competitive contexts and identifying the circumstances in which cognitive abilities play a role in guiding children's socially competent behaviours.

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Table 1

Means (Standard deviations) of cooperative and competitive behaviours in the cooperative and competitive tasks

		<i>Cooperative Task</i>	<i>Competitive Task</i>
<i>Label</i>	<i>Description</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
<i>Proportion Cooperative Behaviour</i>	Total cooperative behaviours/total behaviours during joint activity	.48 (.41)	.39 (.41)
<i>Proportion Competitive Behaviour</i>	Total competitive behaviours/total behaviours during joint activity	.51 (.41)	.61 (.40)
<i>Proportion Duration of Cooperative Behaviour</i>	Total duration of cooperative behaviours/total time for joint activity	.05 (.06)	.04 (.06)

Note. *N*s = 114.

Table 2

Means (Standard deviations) of the Simon Says, Border DCCS, SOFB question, and verbal skills

<i>Cognitive Task</i>	<i>Mean (SD)</i>
<i>SimonSays30 (N = 113)</i>	23.77 (7.34)
<i>Border DCCS (N = 114)</i>	7.94 (2.48)
<i>SOFBquestion (N = 114)</i>	0.61 (0.49)
<i>TOLDraw (N = 114)</i>	17.74 (4.20)
<i>TOLDSS (N = 114)</i>	11.54 (2.61)

Note. SimonSays30 = total score out of 30 on the Simon Says task; Border DCCS = total score out of 12 on the border dimension test trials; SOFBquestion = Second Order False Belief question out of 1; TOLDraw = total score out of 30 on the Picture Vocabulary subtest of the Test of Language Development-Primary 3; TOLDSS = the standard score on the Picture Vocabulary subtest of the Test of Language Development-Primary 3.

Table 3

Bivariate correlations between the Simon Says, Border DCCS, SOFB question, and verbal skills

	<i>SimonSays30</i> (<i>N</i> = 113)	<i>Border DCCS</i> (<i>N</i> = 114)	<i>SOFBquestion</i> (<i>N</i> = 114)	<i>TOLDraw</i> (<i>N</i> = 114)
<i>SimonSays30</i>	--	--	--	
<i>Border DCCS</i>	.20*	--	--	
<i>SOFBquestion</i>	.17	.32***	--	
<i>TOLDraw</i>	.41***	.45***	.35*	
<i>Age</i>	.16	.28**	.35***	.44***

Note. SimonSays30 = Total score out of 30 for Simon Says task; Border DCCS = Total score out of 12 on the Border Dimensional Change Card Sort; SOFBquestion = Second Order False Belief question; TOLDraw = Total score out of 30 on the Test of Language Development: Picture Vocabulary subtest; Age = Age in months.

* $p < .05$ (2-tailed). ** $p < .01$ (2-tailed). *** $p < .001$ (2-tailed).

Table 4

Means (Standard deviations) of cooperative and competitive behaviours in the cooperative and competitive tasks.

	<u><i>Cooperative Task</i></u>	<u><i>Competitive Task</i></u>
<i>Behaviour</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
<i>Cooperative</i>	6.44 (6.85)	4.96 (6.71)
<i>Competitive</i>	9.01 (10.89)	7.73 (6.77)

Note. $N_s = 114$.

Table 5

Bivariate Correlations between each pairs' behaviours in the Cooperative and Competitive Tasks

	<u>Prop Coop B</u>		<u>PropDur Coop B</u>	
	Coop Task	Comp Task	Coop Task	Comp Task
<i>Prop Coop A</i>	.69**	.72**	--	--
<i>PropDur Coop A</i>	--	--	.45**	.32*

Note. *Ns* = 57; A = partner A; B = partner B; Coop = Cooperative Task; Comp = Competitive Task; Prop Coop = Proportion of cooperative behaviours to total behaviours; PropDur Coop = Proportion of the duration of cooperative behaviours during the total time.

p* < .05 (2-tailed). ** *p* < .01 (2-tailed). **p* < .001 (2-tailed).

Table 6

Bivariate Correlations between EF composite, SOFB question, TOLD raw score, Age in months and the dependent variables in both the Cooperative and Competitive tasks.

	EF composite (N = 113)		SOFBquestion (N = 114)		TOLDraw (N = 114)		Age (N = 114)	
	Coop Task	Comp Task	Coop Task	Comp Task	Coop Task	Comp Task	Coop Task	Comp Task
<i>Prop Coop</i>	.22*	.08	.07	.04	.11	-.01	.07	.05
<i>PropDur Coop</i>	.13	.10	.03	.02	.10	.01	.04	.09

Note. EF composite = Sum of the Simon Says and Border DCCS z-scores SOFBquestion = Second Order False Belief question; TOLDraw = Total score out of 30 for the Test of Language Development: Picture Vocabulary subtest; Age = Age in months; Prop Coop = Proportion of cooperative behaviours to total behaviours; PropDur Coop = Proportion of the duration of cooperative behaviours during the total time.

* $p < .05$ (2-tailed).

Figure 1. Puzzle task materials. This includes two 16'' X 20'' puzzles consisting of 24 pieces each (one puzzle of cupcakes and another puzzle of ice cream cones), an 18'' X 22'' wooden frame, a 16'' X 20'' picture model of each completed puzzle, metal-wire holders to place the picture models on, a timer and a scoreboard.



Figure 2. Model for the relationship between the predictor variables and the Proportion of cooperative behaviours in the Cooperative task. EF composite A = Sum of the Simon Says and Border DCCS z-scores for partner A; SOFB question A = Second Order False Belief question for partner A; TOLD raw A = Total score out of 30 for the Test of Language Development: Picture Vocabulary subtest for partner A; Prop Coop Beh A = Proportion of cooperative behaviours to total behaviours for partner A. The same variables with *B* are for the other child in the dyad, partner B.

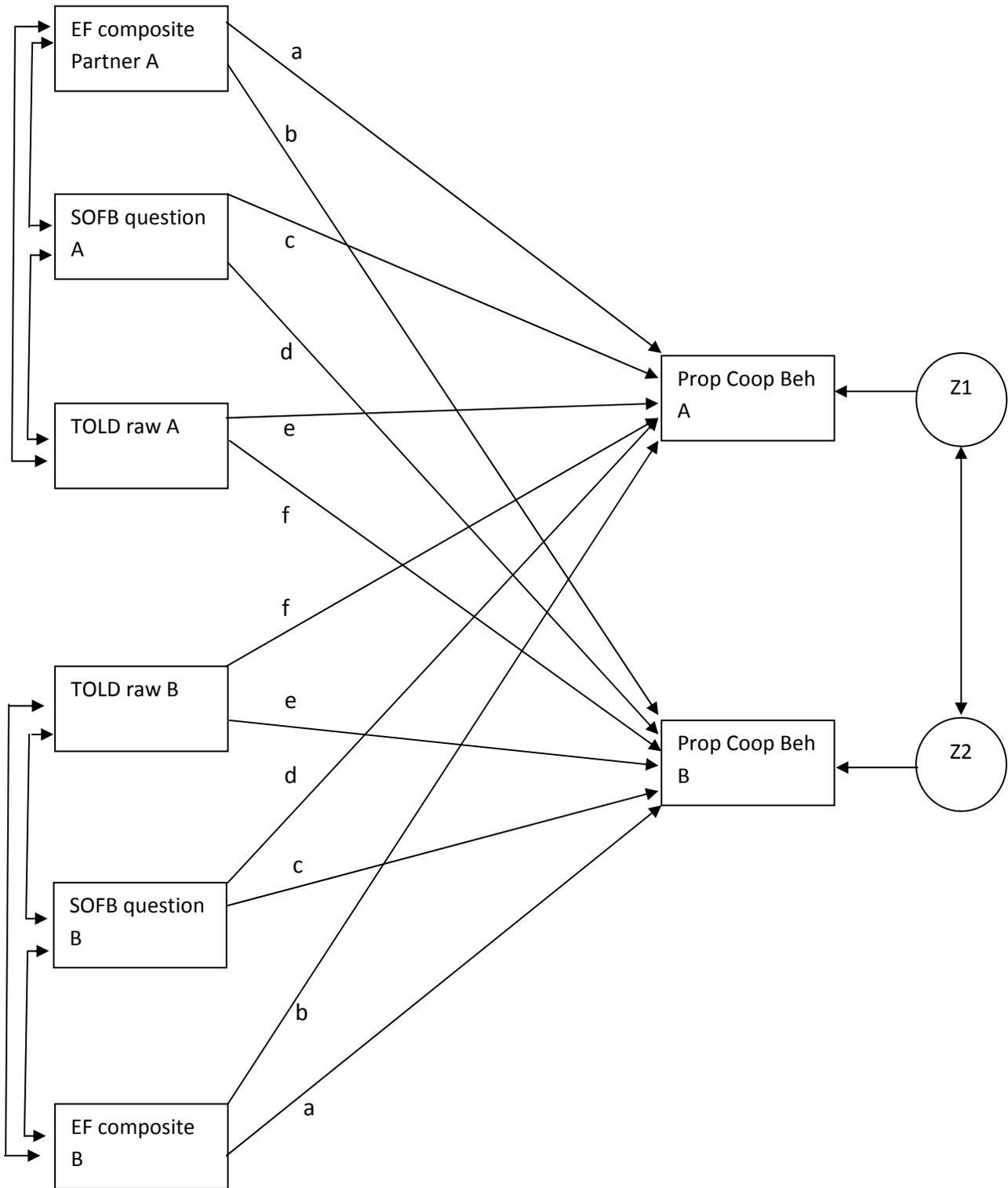
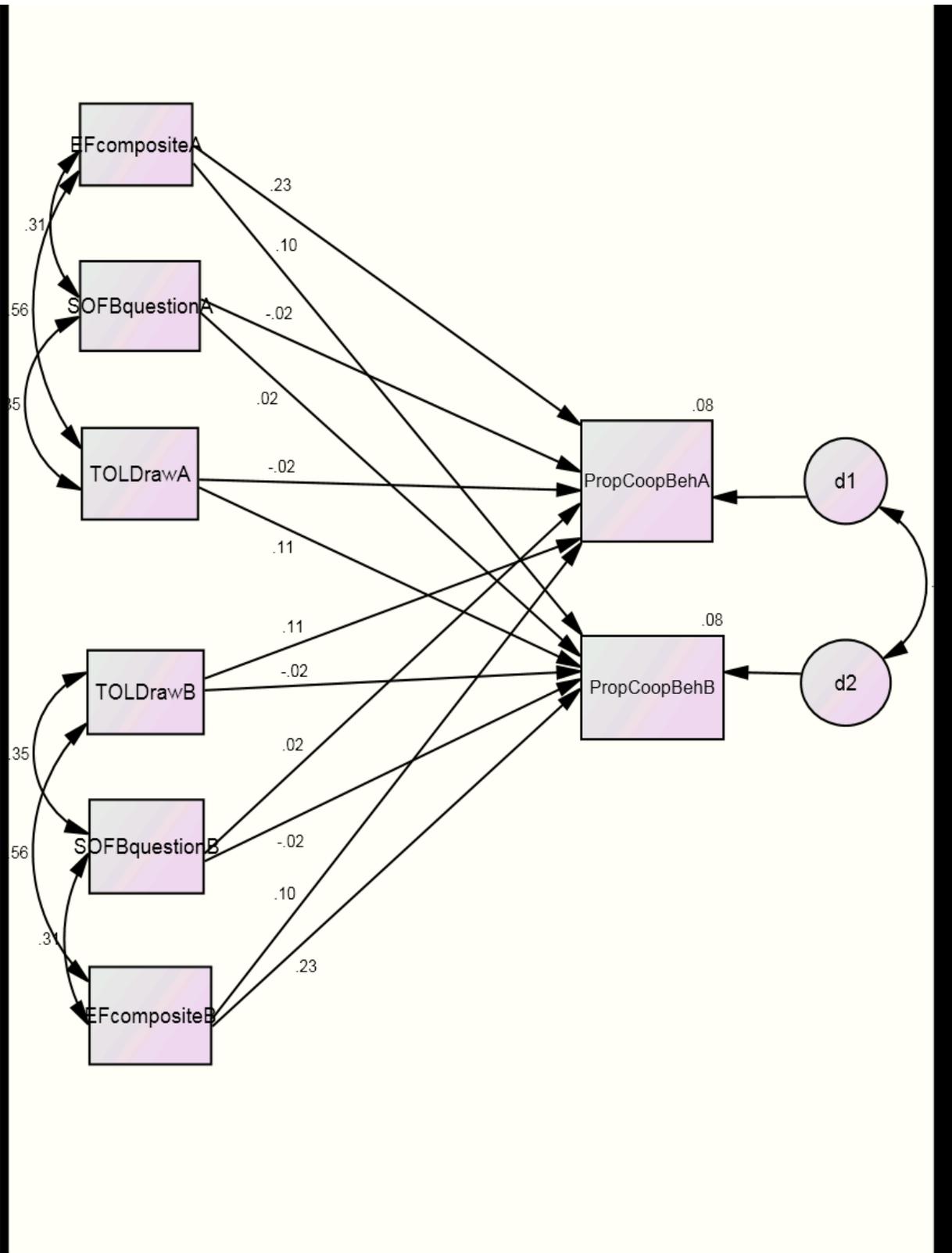


Figure 3. The relationship between the predictor variables and the Proportion of cooperative behaviours in the Cooperative task. Only the path from the actor effect of EF composite to the dependent variable is significant at $p < .05$.



Appendices

Appendix A

Cooperative Instructions:

*We are having a contest to see how **fast** two people can finish a puzzle of cupcakes/ice cream cones (show model) by **working together**.*

You want to beat the other teams! First, let's come up with a team name for you guys. What do you want your team name to be? Decide with each other and then Rachael will write it on the score board. (put their team name up on the scoreboard for them to see) (if need help, ask about favourite animal)

Okay, here are the pieces (uncover the pieces laid out on the table) for you to use to make the puzzle. Your job [child's name] is to put the pieces in the right spot for this half of the puzzle (point to the model/the side of the wooden frame that child is seated on) and your job [child's name] is to put the pieces in the right spot for this other half of the puzzle (point to the model/the side of the wooden frame that the other child is seated on). But, you're allowed to help each other with each other's halves if you want.

When you are each finished your team's puzzle, your whole team's puzzle should look like this (point to model) and you are done!

The only rules are that you must keep the pieces face down like they are right now, unless you or you are using the piece on the puzzle. So, for example, if I turn this piece over and look at it, what should I do with it? E.g., you can use it or you can use it or if no one is using it, you turn it back over (Get child to respond with options, prompt if necessary)

[If child leaves over during task, remind them "Remember to turn the piece over if no one is using it."]

Depending on the condition, ask relevant manipulation of perspective questions:

[PUT UP DIVIDER]

But, before you begin, I want you to think about a question and circle your answer on this paper [give child appropriate paper and a pencil]:

Other perspective "What colour of pieces do you think [other child's name], will be looking for to finish his/her half?"

Self perspective "What colour of pieces do you think you will be looking for to finish your half?"
(Then remove paper)

*Okay, so as soon as I say GO! try to finish your team's puzzle as fast as you can. Remember team _____, you want to **work together** to be the fastest team to finish!*

As soon as you are both finished your team's puzzle, we will record your team's time on the scoreboard. I'll be recording the time with this timer (show timer).

Remember you want to be the fastest team! Any questions?

On your mark, get set, GO! (start timer)

When finished (stop timer and write time on score board):

Okay, that was really fast! Good job team!

Appendix B

Individual Instructions:

*We are having a contest to see how **fast** each of you can finish a puzzle of cupcakes/ice cream cones (show model).*

You want to beat the other person! First, come up with a name for yourself. What do you want your name to be? Decide on your own and then Rachael will write it on the score board. (put each of their names up on the scoreboard for them to see) (if need help choosing, ask about favourite animal)

Okay, here are the pieces (uncover the pieces laid out on the table) for you to use to make the puzzle. Your job [child's name] is to put the pieces in the right spot for this half of the puzzle (point to the model/the side of the wooden frame that child is seated on) and your job [child's name] is to put the pieces in the right spot for this other half of the puzzle (point to the model/the side of the wooden frame that the other child is seated on). But, you're allowed to help each other with each other's halves if you want.

When you are each finished your halves of the puzzle, they should look like this (point to model) and you are done!

The only rules are that you must keep the pieces face down like they are right now, unless you or you are using the piece on the puzzle. So, for example, if I turn this piece over and look at it, what should I do with it? E.g., you can use it or you can use it or if no one is using it, you turn it back over (Get child to respond with options, prompt if necessary)

[If child leaves over during task, remind them "Remember to turn the piece over if no one is using it."]

Depending on the condition, ask relevant manipulation of perspective questions:

[PUT UP DIVIDER]

But, before you begin, I want you to think about a question and circle your answer on this paper [give child appropriate paper and a pencil]:

Other perspective "What colour of pieces do you think [other child's name] will be looking for to finish his/her half?"

Self perspective "What colour of pieces do you think you will be looking for to finish your half?"
(Then remove paper)

Okay, so as soon as I say GO! try to finish your half of the puzzle as fast as you can. Remember _____ and _____, you want to be the fastest person to finish your half!

As soon as you each finish your half of the puzzle, we will record each of your times on the scoreboard. I'll be recording the time with this timer (show timer).

*Remember you want to be the fastest person! Any questions?
On your mark, get set, GO! (start timer)*

When finished (stop timer and write time on score board):

Okay, that was really fast! Good job both of you!

Appendix C

Instructions – Border Dimensional Change Card Sort Task

Materials

- Two boxes with slots on the tops
- 2 target cards (one blue boat and one red rabbit); 16 test cards (8 red boats and 8 blue rabbits); 7 test cards with black borders

Method

The child is seated beside you (the researcher) at a small table, on which two sorting trays are placed.

Task Order:

Standard Version

Instructions:

“Look at these two boxes. They each have an opening for a card to be put inside. On the front of this box is a blue boat (point to appropriate box) and on the front of this box is a red rabbit (point to appropriate box).”

“Here are different cards. One card has a blue rabbit (show appropriate card), another card has a red boat (show appropriate card).”

“We are going to play a game. This is the colour game. In the colour game, all the red ones go in this box (point to box), and all the blue ones go in that box (point to box). We don’t put any red ones in that box. No way. We put all the red ones over here (point to box), and only the blue ones go over there (point to box).”

Then, you demonstrate card sorting to the child with two cards (i.e., one blue rabbit and one red boat) interactively, explaining the basis of your behaviour to the child. During the demonstration trials, you will point to target cards when explaining the rules:

“So remember, if it’s a red one, then it goes here (point to appropriate box). If it’s a blue one, then you have to put it there (point to appropriate box). Here’s a red one. So, I am going to put this red one here (put the card in the box).”

“So remember, red ones go here, blue ones go there (point to appropriate box). If it is a blue one, then you have to put it there (point to appropriate box). Here’s a blue one. Can you help me put this blue one in the box? (Wait for the child to help you put it in. This is to encourage him/her to participate in the sorting and provide opportunity to correct child). Okay, now you get to play the game.”

The child is then shown six cards (red and blue boats and rabbits) that are drawn in a random sequence with the constraint that the same type of card is not presented on more than two consecutive trials. For each card drawn, the experimenter states the relevant rules explicitly:

“If it’s a red one, then it goes here. If it’s a blue one, then it goes there”

Then, the experimenter labels each card in terms of the relevant dimension only:
E.g. *"This is a blue one"* or *"This is a red one"*

Then, the experimenter asks the child:
"Where does this go?"

When child responds by placing the card in one of the boxes, you respond in a neutral, non-evaluative, non-corrective fashion:
e.g., *"Let's do another."*

If child asks during game:

"Where should I put it?"

Experimenter replies:

"Put it where you think it should go".

Test Trial Score: /6

After 6 trials, children are asked to sort by the other dimension:

"Ok, now we're not playing the colour game any more. Now we are playing the shape game. In the shape game, all the boats go into this box, and all the rabbits go into that box. Here is a boat. Where does it go?"

The child is then shown six cards (red and blue boats and rabbits) that are drawn in a random sequence with the constraint that the same type of card is not presented on more than two consecutive trials. For each card drawn, the experimenter states the relevant rules explicitly:

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

Then, the experimenter labels each card in terms of the relevant dimension only:
E.g. *"This is a boat"* or *"This is a rabbit"*

Then, the experimenter asks the child:
"Where does this go?"

When child responds by placing the card into one of the boxes, you respond in a neutral, non-evaluative, non-corrective fashion:
e.g., *"Let's do another."*

Test Trial Score: /6

Border Version – Colour game

Instructions:

Remove the already-sorted cards from the sorting boxes, reserving three blue rabbits and four red boats. Set the remaining cards aside.

During demonstration trials, make sure to point to target cards when explaining the rules.

Combine the four red boats and three blue rabbits with the additional Border test cards. Say:

“Okay, you played really well. Now I have a more difficult game for you to play. In this game, you sometimes get cards that have a black border around it like this one [showing a red boat with a border]. If you see cards with a black border, you have to play the color game. In the color game, red ones go here and blue ones go there [pointing to the appropriate boxes]. This card’s red, so I’m going to put it in here [placing it in the appropriate box]. But if the cards have no black border, like this one [show them a red boat without a border], you have to play the shape game. In the shape game, if it’s a rabbit, we put it here, but if it’s a boat, we put it there [pointing to the appropriate boxes]. This one’s a boat, so I’m going to put it in here [placing it in the appropriate box]. Okay? Now it’s your turn.”

The border version consists of 12 trials. On each trial, repeat the rules:

“If there’s a border, play the color game. If there’s no border, play the shape game”

On each trial, select a test card (ensuring that the same type of test card—with or without a border—is not selected on more than 2 consecutive trials), label the card as having a border or not, and ask the child where it goes.

If child asks during game:

“Where should I put it?”

Experimenter replies:

“Put it down where you think it should go”.

After the child sorts it, simply say:

“Let’s do another.”

For example, *“Remember, if there’s a black border, you have to play the color game. But if there’s no black border, you have to play the shape game. Here’s one with a black border. Where does it go? [Children sort] Let’s do another.”*

Children are asked to sort 12 cards (6 with and 6 without borders).

As in the standard version, respond to children in a neutral, non-evaluative, non-corrective fashion.

Test Trial Score: /12

Appendix D

Coding Criteria: Cooperative Behaviours

Cooperative Behaviours					
Initial Behaviour	2 points	1 point	1 point	1 point	1 point
Child Picks up Other Child's Piece	<p>a. puts OC's piece in the right spot on OC's half of the puzzle</p> <p>b. tries to put OC's piece in the right spot on OC's half of the puzzle →</p>	<p>a. places piece face-down/face-up closer to OC than before</p> <p>b. tosses/puts piece on OC's half of puzzle (without trying to find the right spot)</p> <p>c. hands OC piece →</p> <p>d. Verbalization: "this is yours" →</p> <p>e. looks in OC's direction to see when OC is ready →</p> <p>f. looks at OC's half (model or puzzle) (e.g., to see if a piece goes there) →</p>	<p>a. hands OC piece →</p> <p>b. tosses/puts piece on OC's half of puzzle (without trying to find the right spot) →</p> <p>c. places piece face-down/face-up closer to OC's half →</p> <p>d. Verbalization: "this is yours" →</p>	<p>a. looks in OC's direction to see if OC knows what to do with OC's piece →</p>	<p>If sees that OC doesn't know where to put OC's piece:</p> <p>a. Child tells OC where to put it</p> <p>b. Child shows OC where to put it</p> <p>c. Child puts it in right spot</p>

Note. OC = Other Child

Cooperative Behaviours

Initial Behaviour	1 point	1 point
Child Looks Over at Other Child/ OC's Half of Puzzle	<p>a. places piece that OC already holding in correct spot</p> <p>b. 'cooperative' statements e.g., "we're doing great!"</p> <p>c. points to where a piece should go →</p> <p>d. asks OC if needs help →</p> <p>e. offers words of encouragement →</p> <p>f. offers verbal assistance/helpful statements e.g., "this goes here"; "you need this piece"; "she needs those pieces" "I'll keep looking for your pieces" →</p> <p>g. looks in OC's direction (e.g., to see if OC can get piece in place) →</p> <p>h. advises or corrects OC about where OC's puzzle pieces should go →</p> <p>i. tries to find where OC's piece goes on OC's half →</p> <p>j. points to model to show OC where piece should go →</p> <p>k. tries to find a piece for OC</p> <p>l. tries to/fixes OC's half of the puzzle/puzzle frame</p>	<p>a. points to where a piece should go</p> <p>b. places piece that OC already holding in correct spot</p> <p>c. offers verbal assistance ("this goes here")</p> <p>d. points to the model to show OC where piece should go</p> <p>e. tries to find a piece for OC</p> <p>f. puts piece face-down/face-up closer to OC's half</p> <p>g. tries to find where OC's piece goes on OC's half</p>

Cooperative Behaviours

Initial Behaviour	1 point	1 point
Other Child Asks for (Child's) Help	<p>a. stops work on own puzzle to focus on OC/OC's half of puzzle →</p> <p>b. Verbalizes agreement to help e.g., "I'll help"</p>	<p>a. points to model to show OC where piece goes</p> <p>b. helps to put piece in right spot physically/tries to find where OC's piece goes on OC's half</p> <p>c. offers suggestion of where to put piece</p> <p>d. passes a piece to OC</p> <p>e. helps OC reach a piece</p> <p>f. moves frame closer to OC</p> <p>g. helps OC find a puzzle piece that OC is looking for/needs</p> <p>h. finds OC's missing puzzle piece</p>

Coding Criteria: Competitive Behaviours

Competitive Behaviours		
Initial Behaviour	1 point	1 point
Child Picks up Other Child's Piece	<p>a. puts piece back face-down further away from OC</p> <p>b. hides piece from OC</p>	<p>a. puts piece back face-down/face-up where it was</p> <p>b. verbalizes why they put a piece back face-down: e.g., "Not mine!"</p> <p>c. puts piece face-up, but further away from OC</p>

Competitive Behaviours		
Initial Behaviour	1 point	1 point
Child Looks Over at Other Child/OC's Half of Puzzle	<p>a. tries to block OC's access to puzzle pieces</p> <p>b. tries to take OC's pieces off of OC's half</p>	<p>a. verbal bragging about own half in comparison to OC's: "I've only got 3 pieces left" "I'm done"; "I've done more than you" "What was my time?"; "How fast did I finish?"</p> <p>b. behavioural bragging about own half in comparison to OC's: e.g., victory dance</p> <p>c. negative comments about OC's progress on puzzle: "Wow, you're slow" "You're so slow"</p>

Competitive Behaviours		
Initial Behaviour	2 points	1 point
Other Child Asks for Child's Help	<p>a. responds with aggressive response e.g., "Stop bothering me!"</p>	<p>a. continues with work on own puzzle, ignoring OC</p> <p>b. responds with unhelpful response e.g., "I don't know"</p>

Competitive Behaviours

Initial Behaviour	2 points	1 point
Other child tries to help	<p>a. verbally refuses OC's help e.g., "I don't want/need your help!"; "I can do it myself!"</p> <p>b. grabs piece back from OC's hand with OC's resistance (i.e., OC doesn't let go)</p> <p>c. reacts aggressively – i.e., tries to hit the other child or spit at the other child</p> <p>d. tries to push OC away</p>	<p>a. ignores/stops OC's behavioural attempts to help</p> <p>b. denies or refuses help (e.g., helpful advice from OC about where a piece should go) e.g., "No, it doesn't"; "It doesn't go there"</p> <p>c. ignores verbal advice from OC about where a piece should go or what they should be doing e.g., continues working without changing behaviour/shifting focus</p> <p>d. takes a piece from OC's hand without OC's resistance (i.e., OC lets go)</p> <p>e. tries to stop OC from moving pieces to where they should go</p>