

Children's Performance and Social Behaviour during Competitive Games with (simulated) Peers

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Statement of Contributions

Nicole Gevaux was the sole author for Chapter One: General Introduction, Chapter Three: Children's Attributions for Game Outcome and Explanations for Resource Distribution, and Chapter Four: General Discussion. These chapters were written under the supervision of Dr. Elizabeth Nilsen, and at the time of dissertation submission, were not written for publication.

This thesis consists of portions that were written for publication (abbreviated version of Chapter Two: Contextual and Individual Factors in Relation to Performance and Social Behaviours). Exceptions to sole authorship of material are as follows: This research was conducted at the University of Waterloo by Nicole Gevaux under the supervision of Dr. Elizabeth Nilsen. Nicole Gevaux designed the study with consultation from Dr. Elizabeth Nilsen. Nicole Gevaux and Kate Van Kessel collected the data for the study. Nicole Gevaux was responsible for data analysis with consultation from Konstantyn Sharpinskyi. Nicole Gevaux drafted the manuscript, to which Dr. Elizabeth Nilsen contributed intellectual input. Dr. Elizabeth Nilsen provided guidance and/or input during each step of the research and provided feedback on draft manuscripts. The manuscript was submitted for publication to a scientific journal.

Abstract

Young children are exposed to competitive environments daily, yet relative to cooperative situations, less is known about the factors that influence children's behaviour during competition. While there is debate in society whether encouraging children to behave competitively is beneficial or detrimental, this work supports the position that competition is an unavoidable context in our social world that children must learn to navigate in order to be successful. My doctoral dissertation examines which contextual and individual factors relate to children's behaviour within a competitive environment. I seek to understand how children behave socially towards others and perform on the task, as well as how they explain their behaviours during the game as well as the outcome. To achieve my research objectives, an interactive competitive online game was created that allowed observation of different types of children's behaviours within an experimentally controlled environment. Children ($N = 143$; ages 4 to 9) competed against virtual opponents wherein they had to click on target objects faster than their opponent, with the game outcome rigged. Following the games, children sent messages to their opponents and indicated the number of stickers that should be given to the opponent, as well as a neutral peer after the competition had ended. Children were also asked to give verbal explanations about why they thought they won or lost against each opponent, as well as explanations for the sticker distributions they gave. Chapter one provides a theoretical background and review of the literature relevant to children's behaviour during competition, as well as an overview of the aims and hypotheses of this research. Chapter two explores how context (game outcome, opponent gender) and individual characteristics (gender, socio-cognitive skills) relate to children's task performance and social behaviour towards competitors. Chapter three investigates children's beliefs and attributions about the game outcome, as well as their

reasons for their pre-and-post game resource distributions to others, exploring the insight or motivations behind their behaviours. Chapter 4 integrates the findings from chapters two and three, highlighting their importance and exploring themes within results, and implications arising from this work. The measured dependent variables in this study included task performance (measuring both speed and accuracy for clicking on target objects), prosociality of messages sent to opponents, number of stickers distributed to opponents and the neutral peer, nature of their attributions for winning versus losing, and whether the explanations for their sticker distributions were based on merit. Girls performed significantly better than boys, but only when they were winning. Children with better emotion regulation performed significantly better than children with low emotion regulation when winning. The prosociality of messages was not related to individual or contextual factors, but sticker distributions were predicted by children's ToM (higher ToM related to fewer stickers) and gender (when winning, girls gave more stickers to their opponents than boys). Engaging in the competitive game did not influence children's sticker distribution to an unknown peer. Children gave more internal attributions for winning (attributed success to personal factors) and more external attributions for losing (attributing failure to factors about their environment or opponents). Children most often made merit-based explanations for sticker distributions to opponents, and higher merit-based reasoning reflected higher sticker distribution in the losing condition. Findings highlight the importance of considering the interplay of individual and contextual factors when examining children's behaviour during competition.

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Chapter One: General Introduction

During their early years, as they develop social competence, children learn to identify the nature of a social context and adapt their behaviours accordingly. Competition is a particularly complex social context which children and adults navigate on a regular basis. Imagine a child just starting her first day of preschool, entering a classroom and being overwhelmed with the abundant options of toys and activities to choose from. She selects the craft table, sitting next to two other children as they all share from the large bin of craft supplies to make their own picture. Suddenly, the teacher announces that at the end of the first day, the child who creates the “best” picture will win a prize. As more children gravitate towards the craft table after this announcement, the communal bin of supplies starts to empty. The most desirable craft supply (glitter) is no longer available for everyone to share. The girl is then faced with a dilemma, how does she compete to gain access to the resource that is now in short supply, and desired by every other child at the table? Does she ask politely and sit and wait her turn (hoping it does not run out first, or that the other child forgets to share with her later)? Does she physically grab the glitter bottle from the child next to her (ensuring that she has access to it, but possibly damaging the relationship)? Does she negotiate with the child sitting next to her to trade some glitter for another craft supply? Or does she sit in silence, and never achieve her goal of having sparkles on her picture? When she first sat down at the table, she was not faced with any type of social dilemma, as cooperation with her classmates was easier to navigate when there were enough resources for everyone.

This scenario illustrates the complexity of social environments, namely, how environments can shift rapidly from cooperative to competitive, how children need to consider the motivations of their peers in competitive environments, and the tension between wanting to

win while still maintaining positive relationships with their peers. To develop social competence, it is vital for children to be able to meet their own needs and achieve their personal goals in these competitive situations, while also considering how their future relationships with friends and classmates might be influenced by being either too aggressive or too passive in this environment.

While variations do exist, across the global society, competition is pervasive in most social environments: in education, in the corporate world, in the arts, in healthcare, as well as in our more personal environments such as with family and friends (Porter, 2008). Competition in these domains has also intensified dramatically in the last several decades, corresponding with our growing population and the disparate increase in cost of living. While competition is an unavoidable social context within our world, there has been debate about whether encouraging young children to behave competitively, and whether consciously planning to engage them in competitive environments from a young age, may be helpful or harmful to their social and personal development (Porter, 2008). This debate has also extended to real-life policy implications. In 2014, the Ontario Soccer Association (OSA) eliminated scorekeeping and standings for athletes under the age of 12, as part of a long-term player development strategy to keep youth involved in sports. This decision was met with resistance from parents as well as some experts in sports psychology, who argued that competition is an essential part of youth sports, and that removing an official scorekeeping section from the OSA website, or a final awards ceremony does not eliminate the fact that players are still very aware of who has won or lost each game (Snelgrove & Wigfield, 2019). This decision was made based on the argument that removal of scorekeeping in youth sports eliminates the stress on children's physical and mental health that comes with competition, while preserving the benefits of having fun, getting exercise, and learning skills of cooperation to work with a team (Sullivan, 2022). However, other

researchers suggest that while over-emphasis on winning is detrimental to child and youth athletes' wellbeing (and that enjoyment and effort are the critical elements to foster in youth sports), that removing scorekeeping and standings is not the answer to enhance wellbeing. Instead, it is recommended that a balanced approach from both parents and coaches is taken, where competition and scorekeeping is preserved, but that the focus of the competitive environment be made on cooperation with teammates, skill building, coping with emotions, and behaving according to an appropriate code of conduct, instead of only emphasizing winning (Cote, 2013; Daniels, 2007).

Regardless of one's views about whether we should decrease the amount of competition children are exposed to, these contexts will continue exist. As such, it is important for children to learn how to successfully engage within these contexts and for parents and educators to know how best to support such learning. As a first step in helping children to navigate competition, it is important to know how children understand and behave within this social context, as well as the individual and situational factors associated with how they make sense of and respond to competition.

Overarching Aims

My overarching aim for this doctoral dissertation is to examine which contextual and individual factors relate to children's behaviour within a competitive environment. Within a competitive game context, I aim to gain a deeper understanding of how children behave socially towards others and how they perform. By manipulating different aspects of a game (i.e., winning versus losing, gender of opponent) and measuring individual characteristics (e.g., gender and socio-cognitive skills), I examine how contextual and individual factors explain (or interact to explain) the variability in children's responses within competition.

In this first chapter I define key terms, outline relevant theories informing my work, then describe the relevant literature relating to the factors examined in my research. In the first chapter I also describe the study conducted, examining the design elements in relation to the overarching research aims. In chapter two, I examine my main research questions (focusing on analysis of children's game performance and social behaviour), and in chapter three, my supplementary research questions (exploring children's perceptions of the context and rationale for behaviour). Finally, in chapter four, I summarize my findings from all analyses in a general discussion and discuss theoretical, methodological and practical implications.

Defining Key Constructs

The terms "competition" or "competitive behaviours" have been used to describe a wide variety of situations or actions within the literature (e.g., from possessing more skills than a competitor in a game of chess, to displaying violent aggression against peers during games), which can lead to considerable confusion and misinterpretation (Richard et al., 2002). Thus, before reviewing the theoretical and empirical literature on competition, it is important to clearly define relevant constructs. Early in the exploration of competition within academia, Greenberg defined competition as the human tendency to desire to excel and do better than our opponents (Greenberg, 1932). Charlesworth (1988) defined competition from an evolutionary perspective as:

Competition can be defined, then, as a situation which occurs whenever an individual needs a resource also needed by another individual or seeks a resource already in the possession of another individual reluctant to share or surrender it. In such a situation the individual can employ a variety of behaviors to acquire the resource, including cooperative behaviors. (pg. 60)

Building on these original definitions to consider a broader range of competitive contexts, for the purposes of this dissertation, the terms *competitive environment* or *competitive context* will be used interchangeably to mean: the social context in which two or more individuals are contending against others to each achieve their personal goals, which are incompatible and mutually exclusive. For example, a competitive environment could be one in which two parties are both striving to obtain a desirable resource for themselves, or to win a challenge or game against one another. Specifying further, the term *competitive game* will be used within this thesis to describe: a time-limited social task or activity with pre-determined rules, in which two or more people are striving to win against their opposing competitor (e.g., by completing the task the fastest, gaining the most desirable resources, earning the most points or tokens, etc.). The term *cooperative environment/cooperative context* in this dissertation will be used to describe a social context in which multiple people are working together to achieve a shared common goal, where each person's goals are compatible and interdependent with other social partners. The term *competitive behaviour* will be used to describe: the actions that children display to further their personal goal of winning or performing well.

Other related constructs which are important to define include *social competence*, or the variety of social behaviours and skills which allow individuals to interact effectively with others (Green & Rehis, 2006). *Prosocial behaviour* is defined as observable social behaviours intended to benefit others, enhance or maintain the relationship between peers (e.g., helping, sharing, cooperating and comforting behaviours; Scourfield et al., 2004).

Theories of Social Development

Before contemplating the specifics of children's behaviours in competition, it is important to consider human social development, and human engagement in competitive

environments, from a theoretical perspective. Adopting a broad lens, Bronfenbrenner's ecological systems theory views child development as a complex system of interactions, which are affected on multiple levels by the surrounding environment. This theory of lifespan development also emphasizes the interrelationship of different developmental processes (including cognitive, social, and biological factors). The intention behind this model was to look beyond individual development and take into account the wider influencing factors and the context (or ecology) which shape a child's development (Bronfenbrenner, 2000). While Bronfenbrenner continuously developed and expanded on this theory, its final form was published in 1994: the bioecological model (Bronfenbrenner & Ceci, 1994). The bioecological model posits that not only is environment a crucial component to consider in children's development, but that individual factors interact with the environment. In this model, the complexity of the environment in which a child develops is described as interconnected circles. The outermost circle or system is the chronosystem (time), encompassing the time period, historical events, and the developmental trajectory of major life transitions. Next is the macrosystem (cultural context) containing the values, beliefs, and social norms of the culture in which the child is developing. Then comes the exosystem (socio-economic context), encompassing the current political system, the child's extended relationships in the community, and the mass media. Next is the microsystem (immediate context), including the child's family, close friends, teachers, and neighbourhood. Relationships within the microsystem are bi-directional, in that other people in this system can influence the child within their environment, and the child themselves will also influence the other people at this level. The mesosystem specifically refers to the interactions between the exosystem and microsystem. Finally, there is the biological or individual system, the innermost circle describing the child's genetics and

developmental stage. This bioecological theory provides a way of understanding children's development which captures the complexity of the different levels of context within their environments, as well as the interaction between the individual's biological processes with their wider environment (Bronfenbrenner & Ceci, 1994). Bronfenbrenner and Ceci's bioecological model informs the aims of my work both in terms of identifying a particular social context when studying child behaviours (i.e., competition) as well as suggesting that one must understand the nature of the context itself (i.e., outcome of the competition) to understand children's behaviour. It also provides a theoretical lens with which to frame the findings within a bigger picture (e.g., how the results of this study are specifically rooted within the current time period or chronosystem, and how that might differ from previous findings from previous decades).

Moving from general childhood development to social development specifically, Beauchamp and Anderson (2010) proposed a theory addressing children's development of *social behaviour* across a variety of contexts. The authors proposed the socio-cognitive integration of abilities model, or the SOCIAL theory, as a framework integrating multidisciplinary perspectives to explain the interacting factors which influence the emergence and development of social skills. The SOCIAL model incorporates both the biological foundations and socio-cognitive skills which promote social development, in addition to the internal (e.g., temperament, personality, neural or physical attributes) and environmental factors (e.g., family environment, SES, culture) that mediate these skills. The SOCIAL model explains the emergence and expression of social skills in both healthy and clinical populations, as well as how biological, psychological and social dimensions are related during the developmental stages of growth, making it particularly relevant to the study of children. In this model, the biological basis of social functioning describes the necessity of the efficient workings of intricate neural systems in

order to facilitate complex and flexible social behaviours. The psychological bases of social functioning expand on Crick & Dodge's 1994 social information processing (SIP) model, where SIP involves distinct problem-solving stages that occur in response to any social situation (i.e., interpreting social cues from a partner, clarifying goals of the interaction, considering alternative responses, selecting and implementing a specific response, and evaluating the outcome or feedback from the social partner). Beauchamp and Anderson's model specifies how the SIP approach provides a framework to understand the psychological component of children's development of social skills, and how this development is related to the maturity of cognitive abilities (e.g., executive function) and potential neural correlates. Finally, the social component of the model highlights how the innate growth of social behaviours, beginning in infancy, are crucial for human development and closely linked with the aforementioned biological and psychological processes. This theory also highlights how disruptions to any of the biological, psychological or social foundations during development (such as brain injury, personal trauma, or restriction of social environments) can lead to deficits in social competence and dysfunction across the lifespan. A key component of the SOCIAL model is the emphasis on how individual factors (including personality, temperament, physical attributes) and external/environmental factors (including family functioning, socioeconomic status, and culture) as well as their interactions are extremely important to consider as mediating factors for children's social behaviour (Beauchamp & Anderson, 2010). In relation to my research, this theory states the importance of considering the interplay between children's biological, psychological and social abilities, which may all play a factor in children's ability to effectively engage in competitive environments. My work seeks to consider a variety of these factors simultaneously (e.g., measuring individual socio-cognitive skills which incorporate both biological and psychological

components, social behavioural outcomes towards opponents, psychological factors influencing children's reasoning for game outcome and social behaviours, and the interplay between these factors).

Theoretical Model of Competition

Considering a theoretical framework specific to competition, one notable theory of competitive behaviour is Charlesworth's theoretical model of resource acquisition (1988). Charlesworth posits that, from an evolutionary perspective (expanding on the earlier works of Darwin and Malthus), access to resources has a major impact on human individual functioning, development, and reproductive potential. This theory states the importance of recognizing all types of human behaviours as an evolutionary adaptation, and in competitive environments specifically, understanding behaviour as goal-directed to acquire resources to satisfy basic biological needs (e.g., for shelter, sustenance, perpetuations of one's genetic material). Valuable resources can be conceptualized on a broader scale besides those only important to human survival, such as a caregiver providing support and attention to a crying infant, young children struggling to obtain the same toy, and adults competing for a valuable employment position. As humans have developed more sophisticated social environments and societal expectations throughout the process of evolution to the modern day, our methods of competing for resource acquisition have also become more complex.

Competition arises when others are seeking the same resources as oneself, or when others already possess valuable resources and are reluctant to share them. According to Charlesworth's theory, infants can initially expect their caregivers to provide resources for them. However, early in childhood, it becomes apparent that one must begin to develop the skills to compete for resources oneself, as well as developing an understanding of diverse social contexts, or when to

use which skills. Charlesworth suggests that resource acquisition in humans almost always contains a social element. For example, strategies or behaviours often used in competitive contexts can be conceptualised under five categories: deception, manipulation, intimidation, aggression, and cooperation. This model conceptualizes that cooperation was developed solely for the purposes of competing for resources, as cooperating and sharing with members of an in-group would directly benefit the individual's goals and make them more likely to succeed against other groups for resources. Therefore, this model suggests that cooperation and competition are deeply intertwined as complimentary social behaviours, as opposed to behaviour on opposite ends of a spectrum (Charlesworth, 1988). This model argues that competition is natural and has necessary advantages, which speaks to how essential it is for children to learn how to effectively navigate this context from a young age. Moreover, in terms of the current study, this theory highlights the importance of investigating how children understand and behave within competition, with attention paid to various forms of behaviour.

Charlesworth also highlights the importance that context has on individual competitive behaviours. As different types and quantities of resources are available in different environments, and this availability can change quickly, it is crucial to consider the effect of context on individual behaviours in competitive environments. He also suggests that in contrast to earlier theories, it is important to consider the effects of individual differences on competitive behaviours. Humans develop rapidly in the early years of life and continue to display substantial changes in behaviour as they age. Furthermore, different individuals can be more or less successful in using their abilities competitively to gain access to resources, as well as more or less successful in social situations generally (e.g., more socially dominant individuals often are better at acquiring various types of resources). Therefore, Charlesworth states that due to the

complexity of human behaviour, it is crucial for theories predicting behaviour in competitive contexts to consider how both environmental and individual factors interact (Charlesworth, 1988). This importance of consideration of the interactions of both types of factors is also in line with Beauchamp and Anderson's SOCIAL model of behaviour (Beauchamp & Anderson, 2010), but furthers this idea in competitive environments specifically. In relation to my dissertation, this theory emphasizes the importance of examining the interplay of contextual and individual factors on individual behaviour but furthers this notion within competitive environments specifically. Furthermore, it suggests that competition is in and of itself a natural and adaptive behaviour that all humans exhibit. The dual necessity of both achieving one's own goals as well as maintaining social relationships is crucial to consider, and directly informed the measured dependent variables within this research.

Cooperation and Competition

When studying the social behaviours of children in competitive environments, it is important to consider the similarities and differences of these behaviours to the ones exhibited in cooperative environments. Cooperation and competition can either refer to the inherent characteristics of a social situation, or the psychological state and personal goals of the people involved in them (Van Avermaet, 1996). While cooperative and competitive behaviours could be viewed as opposites on different ends of a spectrum, as explained above, Charlesworth suggests that cooperation is best viewed as a variant, rather than as a polar opposite, of competition (Charlesworth, 1996). This theory suggests that cooperative behaviours in humans actually developed as a strategy due to competition for resources, in that individuals must form social bonds in order to more efficiently acquire resources, based on broader evolutionary theories (Axelrod & Hamilton, 1981; Charlesworth, 1988; Trivers, 1971).

While prosocial behaviours such as sharing, turn-taking, co-ordinated play and co-operative problem-solving are often thought to be driven by altruistic motives, it is possible that many acts of generosity or prosocial behaviour are actually in service of fulfilling personal motives (Charlesworth, 1996). More recently, the need to move beyond the notion of placing behaviour on a competitive to cooperative continuum has been highlighted, recognizing how one's motivations and behaviours in competitive environments can be more complex than those in cooperative environments, while also being just as adaptive (Kajanus, 2019; Sheridan & Williams, 2006; Udvari & Schneider, 2000). It is often unclear or inconsistent in the literature whether competitive behaviours are seen as healthy or unhealthy, or positive/neutral/negative, often varying from study to study (Richard et al., 2002). More specifically addressing competitive game environments, Charlesworth highlights the importance of games in the concept of human social exchange (maximizing one's rewards while minimizing the cost), which utilize both cooperation and competition simultaneously (Kelly & Thibaut, 1978, as cited in Charlesworth, 1988). Similarly, it has been argued that competitive games help to promote the development of cooperation simultaneously, as children must cooperatively agree with and obey the rules of the game, as well as taking others' perspectives when attempting to use strategic behaviours (Kamii & DeVries, 1980). More recent work with preschool aged children demonstrated that engaging in competitive games fostered growth and development of social skills as well as coping skills for dealing emotionally with losing the game (Parlatan & Sığirtmaç, 2022). Therefore, competitive behaviour in children should not be viewed as always negative or antisocial, but instead as a more complex and necessary ability needed to navigate one's social world.

Empirical findings also support the suggestion that cooperation and competition might be inextricably linked. A common paradigm used to study the interplay between both children's competitive and cooperative behaviours in a group setting is the movie-viewer task, where children must simultaneously cooperate with and compete against their peers to view an interesting cartoon (task first introduced by Charlesworth & LaFreniere, 1983). This methodology has been employed to examine competitive behaviours in children from a wide range of ages and cultural backgrounds (Charlesworth, 1996; Charlesworth & Dzur, 1987; Charlesworth & LaFreniere, 1983; Green, 1988; Green et al., 2003; Sebanc et al., 2003; Whelihan & Charlesworth, 1993). In the movie-viewer task, an apparatus displays a film, shown on a screen hidden behind a curtain, such that only one child at a time may view it, creating a limited resource paradigm. Children in groups of four are given the opportunity to view a cartoon (the desirable resource), with two children needing to help work the apparatus (one pushing a button and the other turning a crank) to make the cartoon available to a third child for viewing, and the fourth child being relegated to a bystander position. Success in this task is measured by calculating the number of seconds each participant views the cartoon. Observational data on social behaviours (e.g., pushing or physical aggression, giving verbal commands to peers, yielding the resource to a peer, offering for a peer to be in the viewer position) are also recorded. The movie-viewer task importantly studies both performance outcomes (how well children are meeting their goals of obtaining the resource) as well as their social behaviours (how they interact with peers) in this competitive situation. During the task, children often quickly learn to cooperate, however, viewing times can vary significantly between participants, demonstrating that they are competing against each other to obtain more of the resource (viewing time) even while co-operating as a group. Charlesworth suggests that the inequitable viewing times are

related to individual differences in the ability to combine cooperating with others with more competitive behaviours, in that children who are more effective at obtaining the resource are best at utilizing both types of behaviours within the same environment. Children who were more successful at viewing the movie displayed both cooperative and competitive behaviours towards their peers during the task. Children who were less successful at obtaining movie-viewing time often helped others more frequently, without asserting themselves into the viewer position, and were subsequently viewed as lower on the social dominance hierarchy as they had not attained their own personal goals (Charlesworth, 1996). Social dominance theory suggests that all human societies form group-based hierarchies, where some individuals receive greater prestige, power or wealth than others, a notion which is understood from a young age. In relation to competition, it is suggested that individuals who are higher on the social dominancy hierarchy would be more successful at achieving their goals in a competitive environment (Sidanius & Pratto, 2001).

Socially competent children are better able to successfully use strategies in groups of peers to both negotiate access to resources as well as maintaining relationships with peers they are competing against, flexibly using both prosocial and coercive strategies to meet their needs (Green & Rechis, 2006). Studies using the movie-viewer task highlight the variability in children's behaviour in relation to their characteristics, with age and gender being associated with effectiveness at utilizing both cooperative and competitive behaviours to meet their goals of obtaining more of the resource (Charlesworth, 1996). While the movie-viewer task demonstrates an early task used to study cooperative and competitive behaviours simultaneously, other methodologies designed to look more specifically at competitive behaviours will be discussed further within the next sections.

In summary, while it is understandable that competitive and cooperative behaviours may be viewed as opposites in some circumstances, the theoretical and empirical findings in this area demonstrate the importance behind avoiding polarized labelling of cooperative behaviour as healthy or adaptive and competitive behaviour as antisocial or maladaptive. Both behaviours are necessary in different social contexts and can be guided by different motivations. In order to develop social competence across diverse contexts, children and adults must use both cooperative and competitive skills simultaneously to best meet their goals in social environments. In this work, I aimed to explore children's diverse behaviours in a competitive environment through a neutral lens, as the behaviours themselves aren't adaptive versus maladaptive, but rather, one needs to consider the context in which they emerge before considering such labels.

Children in Competitive Environments

Children's Understanding of Competitive Environments

The ability to understand the context of competition precedes the ability to effectively engage in competitive environments (Green & Rechis, 2006). Competition is an environment which places complex demands on children's decision making and problem-solving abilities, as they manage their opposing goals of maintaining relationships with peers as well as pursuing personal interests (such as winning or acquiring sufficient resources; Rose-Krasnor, 1997). A balance between these goals can be difficult to achieve, as in competition, children's own needs may be directly in conflict with their peer's needs (Putallaz & Sheppard, 1992). This ability to simultaneously balance one's own needs with the needs of others has foundations in infancy, as babies in their first year of life begin to identify peers as social partners separate from themselves. The understanding of having mutually incompatible goals with another person in a

social context usually emerges around the age of three, becoming more complex in the preschool years (Howes, 1987; Rakoczy et al., 2007).

In the realm of competitive games specifically, the ability to understand and effectively engage in this environment emerges within the preschool years. Schmidt and colleagues (2016) demonstrated that preschoolers are developing the understanding of constitutive rules in competition, namely, that for competition to be possible, all competitors must agree to behave rationally and try to win. This understanding was demonstrated through behaviour: while engaging in a competitive tower-building task against a puppet, 5-year-olds protested when the competitor broke the rules, and when the puppet played irrationally (tried to help the participant win). However, while 3-year-old children protested blatant rule violations, they did not display the same understanding of how their opponent should behave (i.e., did not protest their opponent's irrational behaviour). All children ages 3-5 were able to use strategic moves to pursue their goal of winning the game. Thus, the authors suggest that while 3-year-olds are beginning to demonstrate some understanding of the rules and nuances of competitive environments, the ability to integrate all aspects of competitive gameplay into coherent and consistent actions is not present until the age of five (Schmidt et al., 2016). Preschool aged children also begin to display understanding of having won or lost in simple competitive tasks, as evidenced by positive affect and increased engagement with the experimenter after winning, and negative affect and avoidance of social engagement after losing (Heckhausen, 1984). It is suggested that around the age of three, children develop a gradual internalization of external outcomes in competitive environments, beginning to evaluate their performance and react emotionally to success and failure based on the environment, independently of other's reactions to the outcome. Children before the age of three tend to respond more to the emotional affect

displayed by the experimenter, not exhibiting the same level of understanding of whether they had won or lost (Heckhausen, 1984; Stipek et al., 1992). During competitive games, preschool-age children are also able to successfully use competitive poaching moves to pursue their goals of winning against an opponent (Priewasser et al., 2013). Children in this age range can also effectively understand and subsequently teach a peer about a competitive board game (e.g., demonstrations, verbal explanations of the rules). In a study examining teaching skills in competitive games, while some 4-year-olds were able to teach a peer, the large majority of 6-year-olds successfully demonstrated their understanding of the game to a peer. Children's complexity of explanations and demonstrations while teaching the game continuously increased with age (Brachfeld-Child & Schiavo, 1990). In summary, between the ages of 3-5 years old, children begin to develop the understanding that opponents during a competitive game have different goals: that both players will be trying to win. Furthermore, within this age range, children develop the ability to use competitive moves, and the ability to teach this knowledge to others.

Effects of Being in Competitive Environments

There has been some debate about whether just being immersed in a competitive context may influence social behaviours. Indeed, adults' prosocial behaviours towards others decreases when they are in a competitive context. Epley and colleagues (2006) suggest that during competition, considering another person's perspective will lead to more competitive behaviours (e.g., taking more than their "fair share" of resources). For example, when asked to engage in a common dilemmas task (where participants are given a hypothetical scenario and can choose to act in service of a group or in service of themselves), one group was asked to take the perspective of the other participants, while others were not (control condition). Participants who

were cued to take other's perspectives behaved more selfishly. This 'reactive egoism' results because within competition, individuals expect that others will behave competitively in their own best interests. This response contrasts with that exhibited in cooperative contexts, where perspective-taking reduces selfish behaviours (Epley et al., 2006). There is also evidence that engaging in competition can make adults less prosocial within subsequent contexts. When undergraduates were provided with social comparison information, that their personality traits were either superior (upward condition) or inferior (downward condition), they demonstrated fewer prosocial behaviours in the next days relative to a control condition (no social comparison). The authors reasoned that competition inherent in the social comparison (regardless of direction), induced less empathy for peers, which resulted in decreased prosocial behaviour, even days after the competitive context has ended (Yip & Kelly, 2013).

Children, similar to adults, may demonstrate less prosocial behaviour towards others after engaging in competition. Giving valuable resources to others has been conceptualized as one indicator of prosocial behaviour (Hepach et al., 2013), and is often used to measure prosocial behaviour in developmental research. When 10-year-old boys engaged in a bowling game either in competitive or non-competitive conditions, those playing within the competitive conditions (regardless of whether they had won or lost) subsequently made lower donations to charity after the games had finished (Barnett & Bryan, 1974). In a clinical population, when school-aged children with diagnoses of ASD, ADHD or ODD engaged in a competitive interactive video game, teachers rated their level of engagement and communication with peers as lower than those children who played a cooperative video game (Creighton & Szymkowiak, 2014). During a colouring task, 4–6-year-old children in the competitive condition were less generous in their resource distributions to an unknown peer after the task, compared to those in a control

condition. This was true both for resources that their peer would use in the competitive colouring task (crayons), and also for resources unrelated to the task (stickers). This finding suggests that being in a competitive environment makes children less prosocial towards an unknown peer, compared to being in a neutral environment (Pappert et al., 2017).

Despite the work described above suggesting that competitive environments may decrease prosocial behaviour, other studies do not yield similar findings. For example, contrary to expectations, Eriksson and colleagues (2021) did not find that 4-6-year-olds who played competitive board games (several days a week for six weeks) demonstrated differential amounts of cooperative or prosocial behaviours following the gameplay, relative to groups of children who played cooperative games. Children who played the competitive games did display more competitive behaviours after the gameplay, but not more physically or verbally aggressive behaviours. The authors suggest that their findings demonstrate that engaging in both competitive and cooperative games can benefit children socially, and that competitive games in particular may promote development of children's abilities to agree on rules and take other's perspectives (Eriksson et al., 2021). Similarly, Zan and Hildebrandt (2003) found that 6-year-olds did not display an increase in aggressive behaviours after engaging in a competitive board game. These authors suggest that competition can allow children to develop their social skills of negotiating successfully with peers, a skill which aligns both aspects of engaging socially using context appropriate behaviours, while striving to achieve one's personal goals.

There also may be broader social benefits for children engaging in competition. In particular, participation in organized sports, which inherently involve competition, is associated with developing social competence, fostering relationships with peers, communication skills, enhancing cooperation with others (e.g., teammates), building self-efficacy and feelings of

competence, and understanding social conventions and rules (Felfe et al., 2016; Super et al., 2018, Harlow et al., 2020). Further benefits of competition have been found within academics. In an undergraduate population, Rosol (2013) found that the introduction of a large-scale group competition environment into classrooms (the “Kudos Challenge”) over a period of several months resulted in numerous benefits. These included higher exam scores, increased classroom participation, and more volunteering behaviours from students compared to classrooms who did not engage in the competition. For school-aged children with diagnoses of ASD and ADHD, engaging in a competitive game against peers resulted in improved motivation and performance on the task, in comparison to engaging in a non-competitive condition task (Geurts et al., 2008).

Given the differential findings in the literature, more research is needed to determine whether engaging in competition decreases or facilitates children’s prosocial behaviours towards others, and the conditions under which either outcome may result. This thesis addresses this gap with a focus on contextual factors, such as whether game outcome may have a particular influence on children’s behaviours after they engage in competition.

Contextual Factors Influencing Competitive Behaviours

Game Outcome

Of course, not all competitive contexts are the same, and factors within these environments affect children’s behaviours. One particularly salient factor is the result or outcome of the competitive game. Early work provides evidence that game outcomes influence children’s social behaviour towards others in competitive contexts: school-age children who were assigned to a winning condition made significantly more donations of valuable toy items relative to those in a losing or control condition (Isen et al., 1973). Similarly, school-aged children who lost a competitive bowling game gave fewer tokens to charity relative to the children who won the

game. The authors suggest that winning leads to increased feelings of positive affect as well as a sense of higher dominance status relative to others, which may be the reasons behind winning children subsequently displaying more altruistic behaviour towards others in need (Barnett & Bryan, 1974). While engaging in a rigged competitive card game between preschool aged children and an experimenter, during a “winning streak”, children displayed more positive affect, and while losing displayed more negative affect. Also, while losing, children acted impulsively as demonstrated by more rule-breaking behaviours (e.g., taking over the game when it was the opponent’s turn; Donzella et al., 2000). Together, these studies suggest that in the context of competitive games, losing can result in children behaving less altruistically or less prosocially towards others.

In addition to game outcome influencing children’s *social* behaviours, it may also affect future *performance* in the competitive game. Playing a rigged competitive game on an electronic tablet, preschool aged children performed better in the game after receiving feedback that they had won or tied against their virtual opponent, but no improvement in performance was seen after losing (Gevaux & Nilsen, 2019). Within the context of soccer, game outcome was the predominant determining factor on post-game stress reported for 10–12-year-old girls and boys (with more wins resulting in lowest self-reported stress; Scanlan & Passer, 1978; Scanlan & Passer, 1979). Thus, it is possible that losing competitive games elevates children’s stress, which then results in poorer outcomes in terms of both performance and prosocial behaviour. While losing seems to result in more negative outcomes for children during competitive games, additional studies are needed to replicate these limited previous findings.

Individual Factors Influencing Competitive Behaviours

As highlighted in Beauchamp and Anderson's (2010) and Charlesworth's (1996) theories of behaviour in social and competitive environments, there are individual factors which may interact with the contextual factor of game outcome on children's behaviours. This notion is a central focus of my work. In addition to contextual factors, how children respond to competitive environments will also depend on their own characteristics. In the following section, I will review the individual characteristics of focus for my dissertation: attributions, gender, theory of mind, executive functioning, and emotion regulation.

Attributions for Success and Failure

Within competitive games, the nature of the game outcome gives clear cues to success and failure (where one is aware of winning versus losing). While I have already discussed how winning or losing a competition can affect children's behaviours, it is also important to understand *why* experiencing success or failure in this context might influence behaviour. Understanding children's attributions for winning and losing may explain some of the variability in children's responses to game outcome. In this section, I will examine the theoretical background behind attributions for success and failure, and how attributions may subsequently influence behaviour. In the third chapter, my work aims to further explore this individual, internal factor of children's attributions for the outcome of the competition, and how their attributions may relate to other individual factors (e.g., gender or socio-cognitive skills).

Attributions for success and failure as described by Weiner's (1985) attributional theory of motivation and emotion suggests that there are core reasons that individuals attribute as the cause of their success or failure in environments where there is salient information about personal achievement. These attributions for success and failure can be distilled into three themes (based on confirmatory factor analysis): stability (i.e., stable or unstable), controllability

(i.e., controllable or uncontrollable), and locus (i.e., internal or external locus of causality).

According to the theory, the three dimensions of causality directly influence individuals' emotions in achievement-related situations (e.g., by eliciting anger, gratitude, guilt, hopelessness, pity, pride, and shame), which then guide behaviour. Therefore, this theory demonstrates that beliefs and thoughts (or attributions) relate to emotions, and finally actions (Weiner, 1985).

Weiner suggests that individual's pursuit of "why" things happen in achievement contexts is the pursuit of a deeper understanding of our environment, and our own influences on it, or in other words the pursuit of mastery over one's environment (White, 1959, as cited in Weiner, 1985). Therefore, the motivation behind forming attributions is the pursuit of knowledge, an understanding of how to effectively manage oneself and therefore manipulate our environment in ways that provide advantages (Kelley, 1973). In the context of competitive games, understanding children's attributions for their success and failure, or winning or losing the game, may be able to help us further understand their social and behavioural reactions in this environment.

Experiments examining attributions for success and failure often employ similar methodology, in which subjects are first provided with information on their outcomes of an (often rigged) achievement related scenario (e.g., feedback on a score of an academic achievement test, or the outcome of a competitive game). Participants are then asked to verbally explain why they believe that outcome occurred, using a semi-structured free response style format (Weiner et al., 1985). This methodology has been used across a wide range of studies to investigate children's attributions for success and failure. For example, in a competitive game environment, one study facilitated children winning or losing against a competitor in a rigged computer game, and then asked participants about why they thought they had succeeded or failed (Nelson & Cooper, 1997). Another example includes using rigged memory tasks, where children

receive pre-determined feedback (whether they did better or worse than their peers) on a memory recall task after hearing a story (Wigfield, 1988). Similar methodology has also been used to investigate attributions for academic success and failure, such as asking children to reflect on test scores (that may or may not be experimentally manipulated) or report card grades (Benölken, 2015; Dickhäuser & Meyer, 2006; Lohbeck et al., 2017; Ryckman & Peckham, 2015; Stipek and Gralinski, 1991; Williams et al., 2008).

Within the attribution literature, it has been suggested that not only do individuals make attributions for their success and failure within a particular situation, but further, individuals may display a personal attribution *style* in response to success and failure across multiple contexts. Early foundations of the work on personal attributional styles were developed by Seligman and Maier, who indicated that both animals and humans may exhibit “learned helplessness” in the face of the perception of that one’s own behavior cannot alter the presence of inevitable aversive events (Seligman & Maier, 1967). Building on this phenomenon, Dweck and Reppucci (1973) linked learned helplessness to attributions for outcomes in achievement contexts, demonstrating that some children do not perform the actions necessary for success, even though they are capable and motivated to do so. These children who were more likely to “give up” when faced with failure took less personal responsibility for situational outcomes (both success and failure), and any responsibility that was taken was attributed to their abilities, instead of their efforts. Children who instead displayed persevering response styles (in comparison to this learned helplessness style) more often attributed personally controllable factors (such as effort) for achievement outcomes (Dweck & Reppucci, 1973). More recently, Dweck has adapted her discussion of personal attribution styles to describe individuals as either having a growth mindset (believing that abilities can be developed, demonstrating an internal, unstable, controllable

attributional style) or a fixed mindset (believing that abilities are innate and cannot be changed, demonstrating an external, stable, uncontrollable attributional style; Dweck, 2017). Another dichotomy many authors have used to describe individual attributional styles is the self-enhancing versus self-depreciating attributional style. An individual has a self-enhancing attribution style when they attribute successes to internal causes and failures to external causes, and those that have a self-depreciating style attribute their failure to internal causes and success to external causes (Benölken, 2015; Dickhauser & Meyer, 2006; Burgner & Hewstone, 1993; Lohbeck et al., 2017; Parsons et al., 1982; Schunk et al., 2007; Rueger & George, 2017).

Associations between Attributions and Outcomes

In children specifically, self-enhancing attributional styles have been found to relate to a range of positive outcomes such as higher self-esteem, self-efficacy, and more positive academic self-concept. From a behavioural outcome perspective, children with self-enhancing attribution styles also show better school performance. On the other hand, children with self-depreciating attributional styles are more at risk of negative outcomes in these areas (Banks & Woolfson, 2008; Chase, 2001; Chodkiewicz & Boyle 2014; Cini, 2007; Lohbeck et al., 2017; Núñez et al., 2005). For children with anxiety difficulties, it has been suggested that attributional style can play a large role in their understanding of situations in their environment, (e.g., having external locus of control and making stable attributions for negative outcomes), with this attribution style therefore relating to more avoidance behaviour in novel, social or anxiety provoking contexts (Bell-Dolan & Wessler, 1994). Similar findings have been demonstrated for children with depressive symptoms, in that a learned-helplessness attributional style (with external locus of control over their environment) results in more avoidant behaviour and less approach to engaging with and putting effort into tasks (Fincham et al., 1987). Therefore, it has been

suggested that children with a self-enhancing attributional style would show more approach to tasks, while those with a self-depreciating style would demonstrate more avoidance. Children who attributed their success in a rigged computer game to internal causes (such as ability) and failure to external causes (such as issues with the computer program), were significantly more likely to express interest in engaging with computers in the future, or approach to engaging in similar environments (Nelson & Cooper, 1997). In competitive sports, one study found that children with self-enhancing attributional styles also show more approach to future tasks. While 8–14-year-olds with higher self-efficacy attributed their failures in competitive sports to lack of effort, those with lower self-efficacy attributed failures to lack of personal ability. Children with higher self-efficacy and self-enhancing attributional styles showed more motivation and approach behaviours towards competitive sports in the future (Chase, 2001). During a seven-week sport camp, 8 to 13-year-old children who gave more internal, stable and controllable attributions for their success also demonstrated both higher self-esteem and better performance outcomes in the physical and social domains of competitive sports (Weiss et al., 1990).

In summary, it seems that individuals may have personal attribution styles in response to success and failure, which are stable over time and across environments. Investigating this individual factor of children's attributions for success and failure (or their attribution styles) may give us more information into the variance in their behaviours in response to winning and losing competitive games. Although there is some previous work on children's attributions for success and failure in competitive environments, the majority of the current literature focuses on attributions for academic success or failure, with some studies also investigating competitive sporting environments. While it has been previously suggested that game outcome can influence

children's behaviour, I am striving to deeper understand how children are reasoning internally about these game outcomes.

Gender

One important factor to examine in the consideration of individual differences which influence children's behaviour in competition is gender. The term gender is used in this thesis to describe the gender identity or expression in which children personally identify with. Gender refers to the socially constructed identities of female, male and gender-diverse people, shaping how individuals perceive themselves and others, and also how they interact with each other and behave in social settings (Heidari et al., 2016). Although an increasing number of children and youth describe themselves as transgender, gender fluid, or nonbinary (Diamond, 2020), the majority of previous literature has looked at gender in terms of binary categories (girl/boy). Thus, in the overview of the past literature in the sections below, binary categories are used.

Gender and Social Behaviour

Across a variety of social contexts, girls are often described as more prosocial than boys (Eisenberg et al., 2013). A meta-analysis examining the prosocial behaviours in school-aged children found that finding significant gender differences across studies varied based on methodological characteristics (e.g., type of prosocial behaviour measured, the type of informant and the methods of evaluation used; Fabes & Eisenberg, 1998). More recent work employing multiple methods of measuring prosocial behaviour has shown in both preschool and school-aged children, that teachers rated girl's behaviour as being more prosocial than boys. However, children's own responses to hypothetical social situations (measured via expressed prosociality) as well as researcher's observations of children's behaviour while playing with peers did not elicit any gender differences (Bouchard et al., 2008; Bouchard et al., 2015). It has been suggested

that perceiving girls to be more prosocial than boys may be due to pre-conceived notions, the specific items on adult-report scales, or both (Eisenberg et al., 2006). However, other studies which also employ both teacher report and observational methodology demonstrate that in the preschool age range specifically, boys display significantly more antisocial behaviours (including verbal and physical aggression) than girls (Coie et al., 1982; Maccoby & Jacklin, 1980; Walker, 2004; Walker, 2005). It has been suggested that while aggressive behaviours are linked to unpopular social status for girls in this age range, the same detrimental effects of antisocial behaviours on social relationships are not observed within boys. In fact, some level of aggressive behaviours in young boys may instead be related to social dominance. Therefore, being socially competent with one's peers may require different behaviours for girls versus boys (Walker et al., 2002). This suggestion is in line with Charlesworth's theoretical model of competition, as it suggests that individual differences (such as gender) may play a large role in the development of socially competent behaviour, which may be further differentiated across different contexts (Charlesworth, 1988). In adult research, men and women have also been found to display different types of competitive behaviours, with men displaying more overt, aggressive, or status driven tactics, while women more frequently engage in subtle, safe or solitary competitive behaviours (Benenson & Abadzi, 2020). As prosocial behaviour and social competence can be viewed on such a broad spectrum, it is important to consider the specific context in which children's behaviour is happening, as well as how prosocial behaviour is being measured, when examining this construct. There are inconsistent findings with respect to whether there are measurable gender differences in children's prosocial behaviour – and of particular focus in the present work, within competitive environments.

Gender and Competitive Environments

For both preschool and school-aged children, boys have been found to gravitate towards competitive environments and competitive games to a greater extent than girls, and that they therefore have more experience in competing with others in overt ways (Benenson et al., 2002, Roy & Benenson, 2002). Boys tend to play in larger groups than girls, show more emphasis on social dominance hierarchies, and use more directive and assertive speech with the aim of influencing their peers. On the other hand, girls tend to opt for playing in smaller groups and engaging in activities with a cooperative nature, with more of an emphasis on fairness and turn-taking (Archer 1992; Maccoby, 1988; Maccoby & Jacklin, 1987). However, this is not to say that girls do not exhibit competitive behaviour.

Within a competitive context, boys and girls may use different strategies and exhibit different behaviours, though the findings are not uniform. Some studies using the movie-viewer competitive task described previously have shown that both groups of boys and girls did not differ in their use of verbal commands and demands to peers, or subsequent access to the resource, measured by time spent viewing the movie (Charlesworth & Dzur, 1987; Sebanc et al., 2003). Other work has found that during this task, boys display physically competitive behaviours (e.g., pushing peers out of the way), but girls more often used verbally competitive behaviours (e.g., commanding a peer to move; Green, 1988). Girls have also demonstrated more efficiency at gaining access to/sharing the movie viewer compared to boys, suggesting that employing both cooperative and competitive behaviours simultaneously led to increased use of the resource overall. However, for both groups of girls and boys, resource use was inequitable amongst all participants, demonstrating that both girls and boys displayed competitive behaviours and some type of social dominance hierarchy (Charlesworth, 1996; Green et al., 2003).

Girls and boys also engage in competition in different ways during other competitive tasks and games. During a competitive board-game task, played in pairs of 4–6-year-old children, boys were found to demonstrate a wider variety of social behaviours during gameplay in comparison to girls. Specifically, boys demonstrated more commanding, competitive, domineering, playful, and emotionally expressive behaviours (Brachfeld-Child & Shiavo, 1990). In a resource distribution task where children ages 3 to 12 were asked about their distribution preferences, girls tended to prefer cooperative (equitable) distributions, whereas boys showed a preference for competitive distributions where superiority was demonstrated (Knight & Chao, 1989). Preschool aged boys display more competitive poaching moves than girls (taking more resources from opponents than a communal pile), even when the understanding of the competition and socio-cognitive skill levels were equivalent between genders (Priewasser et al., 2013). Benenson and colleagues have suggested that while both boys and girls may be equally *competent* in competitive environments, in terms of capabilities of engaging in competitive and aggressive behaviours, the difference in behaviours observed has to do with how *comfortable* children of different genders are in behaving competitively. This hypothesis was supported when no gender differences in affect were found while playing a competitive board game when a tall barrier was between participants and opponents, however girls displayed significantly more discomfort in the competitive environment when the barrier was removed (Benenson et al., 2002). This finding is congruent with Walker and colleagues' suggestion that behaviours which demonstrate social competence may be different for boys and girls (Walker et al., 2002), and highlights how in competitive contexts specifically, children may have an understanding of gender-based norms on what is deemed as “acceptable” behaviour.

Contextual Factors Interacting with Gender on Competitive Behaviour

In line with Beauchamp and Anderson's (2010) theory of social development across different environments (which highlights the importance of considering both contextual and individual factors), the current literature demonstrates that not only is the individual factor of gender important to consider in competitive environments, but that other contextual factors interacting with gender can shed further light on the nuances behind children's behaviours. For example, Roy and Beneson (2022) found that during a resource distribution task, when resources were plentiful (and all players could win the game), 9–10-year-old girls chose not to engage in competitive behaviours. However, under conditions of resource scarcity, girls did engage in competitive behaviours, such as interfering with other's acquisition of resources. In contrast, both 9–10-year-old boys, as well as 4-5-year-old children of both sexes, used the same amount of interference competitive behaviours whether resources were scarce or plentiful. These findings demonstrate how age, gender, and context of resource availability may all interact to influence children's competitive behaviours. In a resource collecting game, 4-6-year-old boys displayed more competitive behaviour than girls, measured by number of competitive moves taking resources from other players, instead of from a communal pile (Weinberger & Stein, 2008). Similarly, 4-5-year-old boys displayed more competitive behaviours during regular non-competitive free activities (e.g., breakfast). Girls did express competitive behaviours, but more often during organized activities compared to free activities. Boys also more often displayed physical competitive behaviours while girls displayed more verbal competitive behaviours (Tsiakara & Digelidis, 2014). Although there are many types of contextual factors in competitive environments which may interact with gender, given the research aims of my thesis, I will focus my review on the gender of opponent and game outcome.

Gender of Opponent. There are mixed findings on boys' and girls' reactions to same or different-gendered opponents during competition. One study demonstrated that for 6-year-old classmates engaging in the movie-viewer task, both boys and girls were more successful at obtaining resources (viewing time) when competing against girls (Green et al., 2003). Similarly, within a competitive dodgeball game, 11- to 14-year-old girls performed better when competing against other girls but showed a decline in performance when competing against boys. Boys, however, demonstrated no difference in performance based on gender of opponent (Weisfeld, et al., 1982). Girls playing a resource collecting game in mixed-gender groups showed more competitive moves, compared to when they were playing against other girls. Boy's behaviour did not change based on the gender of their opponent. Both boys and girls displayed the same level of understanding and competence in strategic moves during the game. (Weinberger & Stein, 2008). Adding complexity to the understanding of the interplay between gender and opponent gender in competition, Moelyn and colleagues (1979) work demonstrates that other individual factors, such as age are important. Girls aged 7-9 showed more competitive behaviours when playing a board game against boys, compared to when playing in same-gender groups. Boys aged 7-9 were always highly competitive regardless of the gender of their opponents. Both boys and girls aged 4-5 behaved more competitively when playing against opposite sex partners, while also performing more poorly against opposite sex partners, in that they obtained less rewards (Moely et al., 1979). This finding demonstrates that not only does gender interact with other contextual factors (including context of gameplay and gender of opponents) on children's behaviour, but that other individual differences (such as age) may also play a further role.

Game Outcome. A number of studies have found that boys and girls react differently to competitive game outcomes. After losing a rigged computer game, 8-to-12-year-old girls made

fewer negative comments and gestures in response to the taunts of a confederate peer than boys (Underwood et al., 1999). Interactions between game outcome and gender were demonstrated by McGuire and Thomas (1975), where during a rigged competitive bowling game, 9-10-year-old boys in the competitive losing condition (receiving feedback about low competence) were found to be the least generous of any group (measured by donating tokens to an unknown child after the game). The experimental manipulations did not have any effect on girl's sharing behaviours, indicating that their social behaviour was not affected by the game outcome (McGuire & Thomas, 1975). Demonstrating different results, a recent study with preschool-age children found that when children received feedback that they were losing (in a rigged game), boys sent more prosocial messages to their opponents (compared to the winning or tying conditions). Girls who lost repeatedly became continuously less prosocial over time in their messages towards an opponent, with no difference in prosociality while winning or tying (Gevaux & Nilsen, 2019). Other work has demonstrated that boys and girls view the purpose of competition differently, and therefore place differential importance on game outcome. Specifically, Wei and Hendrix (2009) found that, after playing a math-based competitive computer game against virtual opponents, school-aged boys reported that the most important or memorable parts of their experience were related to the game outcome (win/loss) whereas girls focused more on the social aspect of the relationships built with other players during the game. Taken together, these findings demonstrate that girls and boys may react differently to winning and losing competitive games, and that their perceptions of what is important in competitive environments may be a factor as to why.

Socio-Cognitive Skills

Beyond consideration of gender, this study also explores the effects of other individual factors: children's socio-cognitive skills on their behaviour during competition. Specifically, theory of mind, executive functioning, and emotion regulation have been associated with children's behaviours during competition.

Theory of Mind

One factor that plays a significant role in children's behaviour in competitive environments is Theory of Mind (ToM). Theory of mind describes the understanding of another person's mental state, and how others may have different thoughts, beliefs, knowledge, intentions and feelings to oneself (Wellman & Liu, 2004). Premack and Woodruff were the first researchers to investigate ToM, initially studying the ability in chimpanzees. They conceptualized Theory of Mind as the ability to impute mental states to oneself and to others, and the ability to make inferences about what other people believe, which in turn helps predict what others will do (Premack & Woodruff, 1978). There is some evidence of emerging ToM abilities in infancy, with research suggesting that implicit elements of this ability can be seen as early as the second year of life, in infants' spontaneous helping, communicative, and eye-gaze behaviours (Träuble et al., 2010; Slaughter, 2015; Onishi & Baillargeon, 2005). Evidence for more explicit, verbally demonstrated ToM skills have been found to emerge in the preschool age range, with substantial improvement shown between the ages of 3-5 years (Perner & Lang, 1999; Slaughter, 2015). While some researchers see ToM as a unitary construct, others suggest that this ability is a gradual development of understanding a number of different but related concepts. In this view, the first stage of development of knowledge is referred to as first-order theory of mind (i.e., I think that you are thinking...). First-order TOM refers to the collection of abilities often generally referred to as ToM within the literature and emerges around the ages of 3-5. First-order

understanding of ToM can be further broken down into understanding of diverse desires (others may have different desires or preferences), diverse beliefs (others may have different beliefs about a situation), knowledge access (others may have different levels of knowledge about a situation), and finally understanding of emotions (a person may outwardly display emotions that differ from their internal state; Wellman & Liu, 2004). The second phase of knowledge acquisition is referred to as second-order ToM (i.e., I think that you think that she thinks...). This phase of ToM development begins to emerge around the ages of 6-7, after first-order ToM abilities are fully developed. Developing second-order ToM is a crucial part of understanding the intricacies of social interactions, as it describes the ability to understand what someone thinks about another person's thoughts (Perner & Wimmer, 1985). Finally, there is some evidence that an even more advanced third-order ToM ability (i.e., I think that you think that she thinks that another person thinks...) begins to develop in late adolescence and is not fully formed until early adulthood (Dumontheil et al., 2010). Third-order ToM focuses largely on situations that use metaphor, irony, double deceptions, and complex narratives (Wellman & Liu, 2004). For the purposes of my dissertation, as I am studying children's abilities specifically, only first- and second-order ToM will be discussed further.

ToM abilities have been found to show strong links to social competence across a range of different environments. A recent meta-analytic review by Imuta and colleagues (2016) demonstrated that, collapsed across all studies, a significant association emerged between children with higher ToM scores and higher scores on concurrent measures of prosocial behavior. The association of ToM with prosocial behaviour was evident for several different subtypes of prosocial behavior (helping, cooperating, comforting). The relationship between ToM and prosocial behaviour was slightly stronger in children aged 6 years or older, relative to

younger children, and was similar for boys and girls. Therefore, there is strong evidence that being able to explicitly consider what other people are thinking and feeling is related to children's tendencies to act prosocially (Imuta et al., 2016).

ToM abilities also play a crucial role in being able to develop effective strategies against an opponent in competitive environments. Early studies on ToM in competitive environments often employ a valuable resource paradigm to understand children's abilities to use strategic moves against competitors. A frequently used experimental competitive task is for two children to play a game involving a nickel and a dime hidden underneath two cups, and while the opponent is not looking, the participant removes one coin. If the opponent incorrectly picks the empty cup afterwards, the participant gets to keep their coin (Flavell et al., 1968; Selman, 1980; Shultz & Cloghesy, 1981). Children who are more successful on this task require both first-order ToM (thinking about which cup the opponent might choose), as well as second-order ToM abilities (understanding that the opponent will think about what the participant is thinking in order to try and win). In this task, analysis of ToM abilities is measured by children's verbal introspective reports on their thought processes behind their moves (Flavell, 1977). Other similar competitive games and tasks have been used in more recent work to study how ToM relates to school-aged children's competitive behaviours, and the use of ToM abilities strategically. In the "sender-receiver" game, one child is the sender, who knows the location of a piece of candy hidden inside one of two boxes. The sender points to one box, which may or may not contain the candy. The receiver then chooses a box to open, and, if they find the candy, they get to keep it, but if they select the wrong box, the sender will receive the candy. Within this task, 6-7-year-old children were able to use strategic ToM, evidenced by the tendency to use sophisticated deception moves on the first trial (Sher et al., 2014).

Younger children have also shown the ability to use ToM strategically in competitive games. Children aged 3-5 with better ToM abilities made more poaching behaviours during a competitive game (collecting beads either from a communal pile or an opponent's pile). These poaching behaviours were intensified when children's opponents first used the competitive moves against them, indicating participants were learning competitive strategies from their peers. Children who failed the first-order false belief tasks did not appear to have the ability to use competitive poaching moves, even after observing their opponents use them first (Priewasser et al., 2013).

In summary, it seems evident that not only does ToM facilitate prosocial behaviour in cooperative environments, but it also allows children to develop competitive strategies and use deception in order to perform well and win in competitive environments.

Other individual factors have been found to interact with ToM when investigating children's behaviour in competitive environments. While preschool aged boys with better ToM had higher levels of (teacher-reported) aggressive or disruptive behaviour, girls with higher ToM displayed more prosocial behaviour. The author suggested that aggressive behaviour may be more socially adaptive in preschool boys, with better ToM abilities allowing them to become more socially dominant compared to peers with low ToM (Walker, 2005). However, other researchers have argued that weaker ToM is linked to less adaptive behaviours in social contexts. In a rigged competitive card game, preschool aged children with lower ToM and executive functioning (EF) abilities were more likely to respond negatively or aggressively towards their peers and the experimenter after losing (behaviour measured through observational coding), suggesting that ToM may be linked to higher levels of non-adaptive aggression that may harm future relationships, specifically in competitive environments for young children (Hughes et al.,

2001). Similarly, Huyder and colleagues found that during a cooperative task, better ToM was associated with lower levels of competitive behaviours in younger children (aged 5-8), but for older children (aged 9-12), EF planning skills and verbal abilities related to less competitive behaviours. The findings suggest that the social context of the task, ToM, EF and age may all have interacting components which paint a more complicated picture about children's social behaviour with peers, and that different socio-cognitive skills may play different roles at various ages (Huyder et al., 2017). Overall, the literature suggests that ToM abilities are associated with children's social navigation skills in different contexts, including competition. However, there is only preliminary data on how other contextual or individual factors may also interact with ToM abilities in competitive environments.

Executive Functioning

Executive functioning is a collection of cognitive abilities that are relevant to social cognition and social behaviour. In developmental psychology, EF is used as an umbrella term to describe the range of cognitive processes which are necessary for the control of thoughts, emotions and behaviours in the pursuit of goals (England-Mason & Dewey, 2023). EF encompasses the higher-order cognitive processes which are largely facilitated by the prefrontal cortex area of the brain (Zelazo & Müller, 2010). While there are several models of EF proposed in the literature, it is most commonly described as consisting of three core components: working memory (the ability to hold information in mind while updating and monitoring it), cognitive flexibility (the ability to shift between mental sets or states) and inhibitory control or inhibition (the ability to inhibit an automatic response; England-Mason & Dewey, 2023). These three core components of EF were proposed by Miyake and colleagues (2000), who examined the structure of EF in adults using latent variable analyses. These three factors may also demonstrate the unity

of a single EF construct, through strong correlations between each of the three components (Miyake et al., 2000). Researchers have posited similar structures of EF for children, namely, that there are three analogous components of working memory, inhibition and cognitive flexibility work together to build “higher order” executive functions (Diamond, 2006; Diamond, 2013). There has also been further evidence through experimental studies that EF can be conceptualized as a unitary structure in childhood (Brocki & Bohlin, 2004; Hughes et al., 2010; Karr et al., 2018; Nilsen, et al., 2016; Wiebe et al., 2011). While the structure may be unitary early in development, the three components of EF may become more differentiated as children age (Karr et al., 2018).

EF abilities begin to emerge in infancy, with rudiments of working memory, cognitive flexibility, and inhibitory control being demonstrated in infants around 6-9 months old (Cuevas & Bell, 2010; Diamond, 1991; Reznick et al., 2004; Striano et al., 2006). Within the preschool years between the ages of 3-5, EF abilities show considerable development and increased flexibility (Garon, et al., 2008; McCormack & Atance, 2011; Zelazo & Müller, 2002). The development of EF abilities during the preschool years has been found to relate to the development of social cognition and moral development, indicating the importance of this ability in relation to components of social competence (Diamond, 2006; Perner & Lang, 2000). Throughout middle childhood between the ages of 6-9 years, all three components of EF abilities continue to show significant developments (Best & Miller, 2010; McCormack & Atance, 2011).

Preliminary evidence has demonstrated how EF may help individuals to perform better and engage in an adaptive social manner with peers during competition. An fMRI study in adults demonstrated that playing a competitive computer game against another player resulted in the activation of a common frontoparietal network subserving executive functioning. The inferior

parietal and medial prefrontal cortices were found to be selectively associated with playing the competitive game. These regions of the brain are activated when using one's EF abilities, with this study demonstrating that they were similarly activated during competition. In contrast, the orbitofrontal cortex was engaged in cooperative gaming contexts. In both types of game conditions, a common frontoparietal network subserving executive functions and the anterior insula (involved in autonomic arousal) were activated (Decety et al., 2004). For children, weaker EF abilities in 5-year-olds (as well as weaker ToM) were associated with negative reactions to losing in rigged competitive game (e.g., negative verbal comments, accusations, whining, cheating, and physical aggression), suggesting that these abilities help children to behave more prosocially after losing (Hughes et al., 2001). However, other work has found that EF may be more related to regulating appropriate behaviours within cooperative contexts and may not be indicated in competition. Huyder and Nilsen investigated children's behaviour while switching between competitive and cooperative contexts, with 5-8 years olds engaging in either a cooperative or competitive puzzle task in pairs. Children with better inhibitory control abilities exhibited less competitive behaviours during the cooperative task. However, no factors of EF abilities related to children's behaviours within the competitive context (Huyder & Nilsen, 2012).

In competitive organized sporting environments, a study of child and youth soccer athletes (age 8-16 years old) tested player's inhibitory motor control, working memory, and alerting/orienting/executive attention abilities. Talented athletes (playing at the highest national level) performed significantly better on a task of inhibitory motor control in comparison to amateur athletes (playing at the regional level). The authors suggested that the inhibition domain of EF allows the talented athletes to quickly make and execute effective decisions during

competitive gameplay, in a more efficient manner than the amateur athletes. This demonstrates how better EF abilities may allow young athletes to have better performance outcomes during competition (Verbugh et al., 2014). There has also been some evidence for the reciprocal influence of competition and EF abilities in youth. Adolescents engaging in a computerized game with a physical component over a 10-week period demonstrated that those in the competitive condition displayed more gains in EF abilities compared to those in the cooperative or neutral conditions. The authors suggested that the findings demonstrate how competitive games environments specifically may help youth to develop EF abilities, more so than cooperative or neutral gaming contexts (Staiano et al., 2012).

In summary, there is mixed preliminary evidence available regarding how EF abilities are associated with behaviour during competition. While some studies have found that better EF allows children to display less aggressive social behaviours in competitive contexts, other studies have found that EF only facilitates decreased competitive behaviours in cooperative contexts where such behaviour would be less appropriate (Hughes et al., 2001; Huyder & Nilsen, 2012). Given the differential findings, it is important to understand if there are important contextual factors within the competitive context that may affect the role that EF plays.

Emotion Regulation

Emotion regulation abilities may also play an important role in children's behaviour in competitive environments. Emotion regulation (ER) describes the ability to respond to one's environment with emotions that are socially acceptable and appropriate for the specific context in which one is immersed (Cole et al., 1994). The early stages of ER abilities begin to develop in the toddler years, with these skills becoming further established by the preschool age range (approximately 3-5 years) as children begin to understand the social context rules of the

appropriateness of displaying certain emotions (Zeman et al., 2006). Children with better emotion regulation abilities are more socially competent, displaying better outcomes in relation to relationships with peers, higher group status, and more prosocial behaviours (Maszk et al., 1999; Stifter et al., 2006). Conversely, low ER in preschool age children relates to poor adaptation to social situations (Eisenberg et al., 2000) and externalizing or aggressive behaviours towards peers (Cohen & Mendez, 2009). For preschool aged children, emotion regulation has been found to be one of the most important predictors of prosocial behaviour (in comparison to other individual differences such as temperament; Blair et al., 2004). Furthermore, longitudinal research demonstrates that emotion regulation abilities in preschoolers predicted social skills, positive friendship quality, and greater peer acceptance throughout later childhood (Blair et al., 2015).

In the competitive context of organized sports, emotional states and subsequent regulation can directly affect performance, individual cognitive functioning, physical functioning (e.g., motor control), and motivation levels (Uphill et al., 2009; Vallerand & Blanchard, 2000). However, the relationship of emotion and performance is not as simple as positive emotions leading to positive performance outcomes, and negative emotions resulting in negative performance outcomes (Jones, 2012). Rather, being unable to cope with a flood of positive emotions could also hinder performance behaviours (e.g., becoming too excited or complacent after scoring one goal so that future performance suffers). Therefore, it is equally important that participants in competitive environments can cope with positive emotions during gameplay, as well as negative emotions (Uphill & Jones, 2004). Gross's process model of emotion regulation refers to ER as the processes in which individuals may influence their emotional state, when and how they experience and express emotions. This model suggests that unlike coping, which is

specifically focused on decreasing negative emotional experience, that ER instead encompasses the ability to effectively maintain, process and display both positive and negative emotions (Gross, 1998). In addition to performance outcomes, better ER abilities and utilization of strategies to enhance ER have been related to benefits in adolescent athlete's overall wellbeing (Britton et al., 2019). In a study of school-age and adolescent competitive athletes, self-report measures indicated that when participants used ER strategies during competition (e.g., cognitive reappraisal) during competition, they had better social and mental health outcomes (including confidence, reduced loneliness, increased social connection; Kim & Tamminen, 2022).

In competitive contexts outside of sports, there is preliminary evidence that children's ER may relate to their behaviours in competition. Regarding online competitive video games, adolescents who played more often regulated their emotions more during the game, compared to adolescents who did not play often, suggesting that there is a reciprocal relationship between exposure to competition and increased ER abilities in that context (Gaetan et al., 2016). There is also preliminary evidence that ER might interact with other skills such as EF, as well as contextual factors during competition. While playing a rigged competitive puzzle game (with pieces missing), 6–11-year-old boys could see a video screen of their opponent (a confederate child actor) who quickly completed the puzzle (commenting how easy the task was, and that they would win). Participants were either instructed to self-regulate any displays of emotion during the competitive task or were given no instructions on self-regulation (control condition). Boys with better ER abilities in the self-regulation condition had better performance on a post-puzzle inhibitory control task, compared to those in the control condition. These findings show evidence for how higher ER facilitated better inhibitory control task performance, but only in certain contexts within competitive environments (Walcott & Landau, 2004). While there is some

preliminary evidence that ER abilities may be associated with performance or social outcomes in competitive environments, most of the previous literature focuses on older age groups (such as adolescents or adults) or specifically on organized sporting environments. More research is therefore needed on how ER abilities may relate to children's successful navigation of other types of competition.

Current Investigation

Addressing Limitations of Literature

The theories of Bronfenbrenner and Ceci, Beauchamp and Anderson, and Charlesworth all posit that to understand the complexity of children's behaviours, we need to study multiple factors that may influence their actions in specific environments. However, the majority of research on children engaging in competition has focused on either context or individual differences, without understanding how they may interact. This research aims to take a different approach by examining the interplay between several contextual and individual factors which may impact behaviour in this environment.

Furthermore, while many studies examine only one dimension of social behaviour, this work aims to investigate two different aspects: both what children are saying to their opponents, as well as what they are doing. Capturing different aspects of social behaviour is important, as previous research demonstrates that in social environments, measuring what children are *saying* to their peers may demonstrate different results, compared to measuring they are *doing* (Valcke & Nilsen, 2022). Furthermore, this work simultaneously captures the natural tension between maintaining social relationships while also striving to perform better than one's opponent. Therefore, by investigating children's behaviour across multiple dimensions, I am able to capture a more fulsome picture of children's responses to competitive environments.

Finally, I aim to expand on the current literature about children's attributions for success and failure beyond just exploring why children believe they have succeeded or failed in a competitive game. This research takes a further step in studying whether their attributions may be shaped by contextual factors and associated with individual factors.

To address my research aims, I created an experimental task in which children's game performance, social communication, and social behaviours when competing against opponents could be captured. As social communication and behaviour from a peer can have a strong reciprocal influence on children's own communication and behaviour (Mikami et al., 2007; Sadler et al., 2011), I created an experimental game with virtual opponents that had programmed behaviours which were consistent across all participants. In this way, I created an experimental competitive environment that was able to isolate the factors of interest and make consistent the influence from an opponent. In doing so, I was able to explore whether contextual factors of interest, namely game outcome and opponent gender affected children's performance and social behaviour in a competitive game environment.

Additionally, I assessed children's socio-cognitive skills so that I could examine whether the individual factors of ToM, EF and ER, as well as the child's identified gender were associated with their performance and social behaviours. Importantly, with this methodology and by using MLM analyses, I was able to explore whether the factors of interest related to children's repeated behaviours over time. By periodically asking children about their attributions for the (rigged) game outcome, I was able to investigate their attributions for success and failure during the competition and look at how these related to contextual and individual factors.

Finally, I wanted to explore whether the experience of being in a competitive environment would influence children's subsequent social behaviour towards a peer who was not

involved in the competitive task (i.e., not an opponent). To measure this, social behaviour via resource distribution to an unknown peer was measured before and after the entire competitive game was completed.

Research Questions and Hypotheses

This study explores whether the following factors influence children's game performance, prosociality of communication and prosociality of behaviour towards opponents (during a competitive game) and an unknown other (after a competitive game). To investigate the research questions, children's behaviour during the game was measured in three different ways:

- a. **Performance** on competitive task (i.e., how well they did on the task)
- b. Prosociality of communication: **messages** sent to opponents following each trial of the competitive game
- c. Prosociality of behaviour towards opponents: **resource (sticker) allocation** to opponent after each condition of the competitive game

The main research questions are as follows:

- 1) Do the contextual factors of: **game outcome** (i.e., whether they have won or lost), and **gender of opponent**, affect children's behaviour during a competitive game?

Hypothesis 1: Children will display better performance outcomes after perceiving that they have won previous games but will not after feedback that they have lost (as demonstrated in previous work; Gevaux & Nilsen, 2019).

Hypothesis 2: Children who won against their opponent in the competitive game will give more generously in the resource allocation task to that opponent (compared to when participants lost against their opponent; Barnett & Bryan, 1974; Isen et al., 1973).

2) Do the individual factors of: **age, gender** and socio-cognitive skills (**ToM, EF, ER**) relate to children's behaviour during a competitive game?

Hypothesis 3: Children with better EF abilities will display better performance on the competitive task overall, compared to those with lower EF abilities.

3) Are there interactions between contextual and individual factors in predicting children's behaviour during a competitive game?

Hypothesis 4: Girls will perform better on the competitive game when competing against other girls, with boys showing no effect of gender of opponent on performance (Weisfeld et al., 1982).

Hypothesis 5: Children with better ER abilities will send more prosocial messages to their opponents during the competitive game while losing, compared to those with lower ER (Razza & Blair, 2009; Liddle & Nettle, 2006).

Hypothesis 6: Children with better ToM abilities will give fewer resources to their opponents after losing, compared to those with lower ToM abilities (Wu & Su, 2014).

4) Does being in a competitive environment affect children's social behaviour *generally*? This research question was addressed by measuring resource allocation to an unknown peer after competition.

Hypothesis 7: Children will give fewer resources to the unknown peer after engaging in the competition, compared to their pre-competition resource distribution (Pappert et al., 2017).

Further to the hypotheses regarding the main research questions, this work further aimed to explore in the supplementary analyses: which attributions do children make for winning or losing games, and how do these relate to their individual characteristics? What are children's

reasons given for their social behaviour (i.e., rationale for resource distributions to opponents and a neutral peer)? Given the exploratory nature of the supplementary work, no firm hypotheses were generated.

Process of Designing of Experimental Competitive Game

Due to the COVID-19 pandemic, the in-person format of the originally proposed study (involving dyads of children within a school setting) needed to be altered to a virtual format. Children were tested by a researcher during an online videoconferencing session. To simulate the experience of playing a competitive game with peers, a game was designed that could be played online against virtual opponents. The information technology staff in the department of psychology assisted in the programming of an interactive, online game that was interesting and child-friendly, easy to understand, played on a personal device in their home, and could be modified based on the child's skill level. The online game was hosted on the university servers, accessible to participants via a URL link sent by the researcher during the testing session. The participant's performance data from the game was stored confidentially on the university server.

There were several considerations made during the design of the competitive game (see Figure 1 for screenshots of each component of the game). First, the game needed a naturalistic feel of being in competition with a peer, while at the same time allowing manipulation of the actions and gender of opponents, as well as the game outcome (i.e., so all participants would experience both winning and losing). To capture the nature of being in competition with a peer, each child played against four other virtual players, whom they were told were children of similar ages, playing from their own homes. The object of the game was designed as a resource collection paradigm, in that children collected as many target objects as possible from the screen by clicking on them, while the opponent was trying to do the same. To try to reduce practice

effects across conditions, the category of target objects differed for each condition, with a counterbalancing feature built into the program.

Second, the game outcome had to be believable (i.e., as opposed to the researcher just informing participants that they had won or lost). The game was rigged so that each participant would win against two opponents and lose against two opponents. To achieve this, the program was designed so that during the winning conditions, the opponent would click half as many objects on the screen as the participant during the game (i.e., for every two target objects a participant clicked on the screen, one random other target object would disappear from the array, indicating the opponent had clicked that one). During the losing conditions, the opponent would collect twice as many objects as the participant (i.e., every time a participant clicked one target object, two additional random target objects would disappear from the array). In this way, the game outcome was actually based on the experience of gameplay itself. To ensure participants had a clear understanding of each game outcome, feedback was provided afterwards about whether they had won or lost each trial of the game. This design feature allowed for investigation of whether previous game outcome had an influence on participant's subsequent performance or social behaviours in the next trial. Three trials per condition were programmed so that the effects of the same participant winning or losing repeatedly over time could be examined. Therefore, over four opponents/conditions, each participant played 12 trials of the competitive game.

Third, the game needed to have different opponents for each condition. To achieve this, at the beginning of each condition, the name and gender of each opponent was introduced (e.g., "Next you will play against a girl named Sally".) The selection of opponent names aimed to choose names that were less common for children today, while also being commonly associated with a single gender (Sally, Jenny, Jason, and Trevor). The creation of four different opponents

was done to investigate any differences in behaviour towards peers of different genders, as there were two girl and two boy virtual opponents.

Fourth, there needed to be a process to capture children's actual performance during the competitive game. Performance was measured by calculating the number of target objects they clicked on, subtracting the number of non target objects clicked on, for each trial. In this way, I could measure how well children did both across repeated trials in the same condition (i.e., with the same opponent) as well as across conditions.

Fifth, I needed to capture different aspects of children's social behaviour during the competitive game: their communicative utterances as well as their allocations of a desirable resource. To achieve this goal, after the feedback screen about their performance on each trial, children were presented with a screen indicating they could record a message for their opponent (and were told that their opponent was doing the same). It was explained that they would hear all of their opponent's messages after the games, to remove the influence of what an opponent says on their own statements (e.g., saying something prosocial because their opponent said something nice first). To measure children's social behaviour (i.e., prosociality as indicated through resource distribution) towards their opponents, before and after playing each peer, participants were asked to distribute virtual "stickers" that appeared on the screen. This design element allowed for the investigation of children's unspoken social behaviours towards others, with more stickers distributed demonstrating greater prosociality towards their opponents. This manipulation of the experimental design allowed for the investigation of whether children became more or less prosocial towards their opponents after competing against them, to explore whether these social behaviours might be influenced by game outcome.

Finally, I aimed to determine whether competition in general affects children's subsequent social behaviour towards others. To achieve this, the children were also asked to allocate virtual stickers towards an unknown peer before and after the entirety of the competitive game experience. This investigates the influence of just being in a competitive environment on social behaviour towards peers that are not opponents.

Chapter Two: Contextual and Individual Factors in Relation to Performance and Social Behaviours

An abbreviated version of the following chapter has been submitted to an academic journal and is currently under review for publication.

Introduction

Learning to successfully navigate the nuances of one's diverse social world is a crucial aspect of social development. Social competence is associated with many important outcomes throughout children's development including forming close peer relationships, academic performance, and school readiness (Ashiabi, 2007; Denham, 2006; Lindsey, 2002). Engaging in socially competent ways requires that children show sensitivity to variations in context and adapt their actions accordingly (Bierman & Welsh, 2000). For instance, learning which behaviours are acceptable on the playground versus in the classroom, or how interacting with a sibling holds different boundaries than interacting with a stranger. While children show sensitivity to variations in context in infancy (Elkins, 2016), it is during the preschool years that children begin to understand that some contexts require prosocial or cooperative behaviours, while other situations are more competitive in nature and require different behaviours (Green & Rechis, 2006).

Engaging in competitive environments is a regular aspect of everyday life; both for adults (e.g., competing against co-workers for a promotion) and for children (e.g., playing competitive games against peers on the playground). Cooperation and competition with others are both necessary and interlaced behaviours, as learning how to cooperate with others in order to share resources is a crucial skill. However, because others are also striving to gain resources for themselves, competition becomes an inevitable part of the human social experience

(Charlesworth, 1988). Acquiring the ability to engage in this competitive cooperation demonstrates a major developmental task for children. They must learn to compete successfully against their peers for resources, while at the same time preserving a relationship and not socially alienating themselves from their peers (Charlesworth, 1996). Theoretical models of social behaviour suggest that it is vital when studying children's competitive behaviours to examine both the contextual and individual factors (as well as their interactions) which may influence their behaviours (Beauchamp & Anderson, 2010; Charlesworth, 1988). In the present work, we examine how children behave within competition, exploring whether both contextual and individual factors impact children's game performance, as well as their social behaviour towards opponents and non-opponents.

Children's Understanding and Behaviour within Competitive Contexts

Children's understanding of competitive games, including the concepts of winning and losing, as well as the rules for gameplay, emerges during the preschool years (Heckhausen, 1984). However, while 3-year-olds understand that their opponent is trying to win, they struggle to fully comprehend that this is in opposition to their own personal goals (Perner & Roessler, 2010; Priewasser et al., 2013). Five-year-olds understand both the rules of the competitive environment, as well as the fact that their opponent should be striving to win against them (Schmidt et al., 2016a). In terms of social behaviour, preschool and school-aged children are less likely to share or distribute resources to peers, and less likely to display reciprocity of social behaviour and communication with peers (Huyder & Nilsen, 2012; Nilsen & Valcke, 2018; Pappert et al., 2017) within competitive contexts (versus cooperative contexts). Thus, at an early age children understand the social nuances of competitive environments and behave in diverse ways within these contexts relative to cooperative contexts.

Interestingly, the social behaviours elicited during competition may extend to subsequent contexts after the competition has ended. For instance, preschool age children demonstrated decreased prosocial behaviour (distributed fewer resources) towards opponents following a competitive task relative to children who were in a neutral environment (Pappert, et al., 2017). Similarly, school-age children who participated in a competitive game made fewer donations to a charity compared to other children in a non-competitive condition (Barnett & Bryan, 1974). School-aged children with behavioural and learning difficulties displayed fewer prosocial classroom interactions with peers and teachers after playing competitive games, compared to those in the cooperative game condition (Creighton & Szymkowiak, 2014). Engaging in competitive activities may alter children's attitudes towards peers, exposing them to situations in which others may gain an advantage and/or are seeking the most resources for themselves, so that children's subsequent resource distributions were less generous (Pappert et al., 2017). Similarly, adults who were in a competitive context showed a subsequent reduction in prosocial behaviours (e.g., display less empathetic behaviours, are less likely to volunteer to help others; Yip & Kelly, 2013). It may be the case that social comparisons (inherent within competition) decrease feelings of empathy, which in turn result in fewer helping behaviours (Yip & Kelly, 2013). Together, this body of work suggests that increased exposure to situations where peers could gain advantage, individuals' prosocial behaviour decreases even after the competitive context has ended.

However, decreases in prosocial behaviour are not universally found. For instance, cooperative, prosocial, nor antisocial behaviour did not differ between preschoolers who repeatedly engaged in either cooperative or competitive board games over the course of 6 weeks (Eriksson et al., 2021). Moreover, studies on children's participation in competitive sports

demonstrate numerous positive outcomes (for both typically developing and socially vulnerable youth), including increased prosocial behaviour, peer relationships, understanding social conventions and rules, subjective health and well-being, and school performance (Felfe et al., 2016; Harlow et al., 2020; Super et al., 2018). Qualitative research has demonstrated that engaging in competitive environments such as sports can have positive impacts on preschool children's development, including physical literacy, social skills, and understanding of winning and losing (Harlow et al., 2022). Furthermore, a meta-analytic review revealed a multitude of positive outcomes to preschool children's engagement in organized sports (either in a competitive, team or individual environment), including the development of social competence, building relationships with peers, developing communication, cooperation, self-efficacy and perceived competence, and understanding social conventions and rules, as well as some evidence of negative outcomes (disagreements with friends and peers, feeling frustrated and overwhelmed, perceptions of failure; Harlow et al., 2020). As much of the work in this area examines outcomes from competitive sports, which often takes place inside of a cooperative team environment, more research is needed to investigate the factors that impact children's behaviour within (and following) individual competitive environments.

Contextual Factors within Competition

Specific contextual factors within competitive environments affect children's social behaviour. For example, group size in competitive environments is associated with preschool-aged boys' behaviour, with more competitive behaviours (i.e., taking resources directly from a peer instead of a communal pile) emerging in large groups compared to dyads (Benenson et al., 2001). Also, familiarity with opponents impacts behaviours, with preschoolers' behaving more competitively (e.g., issuing more commands, sharing less, taking more resources) towards

friends while playing a board game in comparison to their behaviours towards acquaintances (Brachfeld-Child & Schiavo, 1990). However, in other competitive contexts outside of games, young children tend to favour members of their in-group when providing allocations of desirable limited resources (Lee et al., 2018). This suggests that competitive games may demonstrate a unique context in which children behave differently towards their peers, compared to other types of competitive scenarios.

Of focus to the present study, the outcome of competitive games can impact children's social behaviour. For instance, winning competitive games elicits prosocial behaviours (such as giving prizes to other children), whereas losing competitive games results in less prosocial behaviours, such as donating fewer resources to a "poor" child or to charity (Barnett & Bryan, 1974; Isen et al., 1973). For both preschool and school-aged children with behavioural challenges (based on teachers' ratings of temperament), losing competitive games has been shown to increase antisocial behaviours, such as angry or aggressive interactions with opponents (Donzella et al., 2000). The outcome of competitive games (i.e., winning/tying/losing) has been identified as a determining factor for children's post-game stress, which may account for the reduction in children's prosocial behaviours while losing (Scanlan & Passer, 1979). However, research on school-aged children with behavioural difficulties (diagnoses of ADHD and/or ODD) demonstrated that winning competitive games can also increase antisocial behaviours towards opponents (Ohan & Johnston, 2007). Thus, the impact of game outcome for children's behaviour towards their opponents is unclear, with few studies examining this within a typically developing population. This said, preliminary work found that preschool-aged who won performed better on subsequent trials (versus when losing), and that children became less prosocial over time after losing (but only for girls, Gevaux & Nilsen, 2019). With the aim to

replicate and further explore, the present study investigates children's game performance and social behaviours towards opponents following wins/losses. Of course, there is likely to be variability in how children respond to winning versus losing. Thus, we examined the associations between children's characteristics and their behaviour during a competitive game, seeking to determine whether such associations differed by game outcome. Furthermore, we assessed their behaviour towards a child not involved in the games (to explore whether competition in general impacts social behaviour). As well, we examine the role of children's socio-cognitive skills in their behaviour during the competition, exploring the interplay between both individual and contextual factors.

Individual Differences Impacting Children's Behaviour in Competition

In addition to contextual factors, children's individual characteristics relate to how they behave socially and perform in competitive contexts (Green et al., 2003). The focal individual factors in the present study are children's gender¹ and socio-cognitive skills.

Gender

Within social contexts, girls are often perceived as more likely to exhibit prosocial behaviours than boys by teachers (Bouchard et al., 2015; Eisenberg et al., 2013). Observational studies also support this claim that boys are more prone to antisocial behaviour towards peers (Coie et al., 1982; Maccoby & Jacklin, 1980; Walker, 2004; Walker, 2005). However, there is also conflicting evidence, as other research employing observational measures do not always reveal gender differences on prosocial behaviours within both-preschool and school-aged children (Bouchard et al., 2008; Bouchard et al., 2015; Eisenberg et al., 2006). It has been

¹ The term gender is used to describe the gender identity or expression in which children personally identify. An increasing number of children and youth describe themselves as transgender, gender fluid, or nonbinary (Diamond, 2020). However, past work tended to examine gender solely in binary terms.

suggested that perceived gender differences in prosociality may be due to pre-conceived notions, the specific items on adult-report scales, or both (Eisenberg et al., 2006). Thus, it is unclear whether there are measurable gender differences in children's social behaviour – and of particular focus in the present work, whether this is the case within competitive environments.

Early in development, boys accrue more exposure to competitive environments (Weinberger & Stein, 2008). Preschool aged girls tend to gravitate towards cooperative play in smaller groups, whereas boys gravitate towards competitive play in larger groups (Fabes et al., 2004; Maccoby, 1999), with these preferences more distinct when children play with same-gendered peers (Jacklin & Maccoby, 1978). Moreover, school-aged girls tend to show more interest in games that emphasize storylines as opposed to a focus on competition (Lawry et al., 1994; Inkpen et al., 1994). For athletic competition specifically, even when possessing comparable abilities, school-aged girls tend not to perform as well compared to boys (particularly in mixed-gender competitive contexts; Green et al., 2003; Gneezy & Rustichini, 2004; Weisfeld et al., 1982). In youth sports, research has shown that adolescent boys self-reported higher levels of self-confidence and perceived competence in their abilities, as well as higher antisocial behaviours towards teammates and opponents (e.g., criticizing, deliberately provoking others), compared to female athletes (O'Connor et al., 2020).

However, as per theories on children's social behaviour (e.g., Beauchamp & Anderson, 2010) the effect of an individual factor, such as gender, may depend on the specific context, such as the gender of an opponent or the game outcome. Indeed, girls, while competing against other girls, show the fewest amounts of competitive behaviours (i.e., taking resources from others instead of from a communal pile), while boys display significantly more when playing against same-gendered peers (Weinberger & Stein, 2008). The importance of gender of one's opponent

has also been shown with young adolescent girls performing better (in a dodgeball game) when competing against other girls but showing a decline in performance when competing against boys; whereas boys demonstrated no difference in performance based on gender of opponent (Weisfeld, et al., 1982). Furthermore, when competing in same-gendered groups, larger groups result in more competitive behaviours in boys (compared to smaller groups), however girls showed no difference in behaviour based on group size (Benenson et al., 2001).

Past work has also demonstrated that there may be gender differences in children's responses to winning and losing competitive games. After a competitive game, when asked about the most important or memorable parts of their experience, school-aged boys focused mostly on the outcome of the game (whether they won or lost). In contrast, girls focused more on the relationships built while playing (Wei & Hendrix, 2009). After receiving feedback that school-aged children were losing a competitive game, boys were less likely to behave prosocially towards a peer. For girls, neither the competitive environment nor the feedback that they had lost affected girls' subsequent prosocial behaviour towards their peers (McGuire & Thomas, 1975). Other research, conversely, found that when preschool aged boys lost a game, they behaved more prosocially towards opponents relative to when they were won, whereas girls became less prosocial over time after losing repeatedly (Gevaux & Nilsen, 2019).

While there has been some research investigating children's response to competitive environments (mostly during physical games and sports), there is a paucity of work looking at whether similar gender differences are found in other competitive game contexts. The literature on whether game outcome differentially affects boys' and girls' behaviour is also sparse, contradictory, and given changing gender roles over time (Giuliano, 2019), may be outdated. Therefore, more investigation is needed to clarify how gender, gender of opponent, and outcome

of the game affects children's abilities to both perform well and interact socially with peers in competitive contexts.

Socio-Cognitive Skills

Children's social competence is associated with growth in socio-cognitive skills, likely operating in a reciprocal fashion whereby strong socio-cognitive skills facilitate social engagement (Devine et al., 2016; Razza & Blair, 2009), and, in turn, social interactions promote socio-cognitive development (Hammond et al., 2012). Three skills that have been implicated as crucial for the development of social competence include emotion regulation, theory of mind, and executive functioning abilities (Blair et al., 2015; Liddle & Nettle, 2006; Razza & Blair, 2009; Riggs et al., 2006). While there is empirical work demonstrating how these skills support social competence in general, there is only preliminary information available about how these abilities are associated with children's behaviours specifically within competitive environments.

Emotion Regulation. Emotion regulation (ER) encompasses the behavioural, cognitive, and physiological abilities to manage emotional arousal and promote effective social functioning (Rydell, et al., 2003). ER is a crucial skill for young children to be able to successfully navigate social situations with their peers such as conflict (Green & Rehis, 2006). Within competitive environments, adolescent's greater use of ER strategies (such as cognitive reappraisal) has been found to produce more favourable outcomes during sports competition, such as feelings of pleasant emotions, perceived competence, confidence, satisfaction, reduced emotional and social loneliness, and increased intentions to return to competition (Kim & Tamminen, 2002). Emotion regulation can affect athlete's performance, cognitive functioning, physical functioning (e.g., motor control), and motivation levels (Jones, 2012; Uphill et al., 2009; Vallerand & Blanchard, 2000). In competitive sports, the ability to cope with both positive emotions as well as negative

emotions has been indicated in athlete's performance (Uphill & Jones, 2004). It has also been suggested that there is a reciprocal relationship between exposure to competition (through online games) and increased ER abilities (Gaetan et al., 2016). However, no research with children has specifically investigated the influence of ER on social behaviours during competition. It is possible that ER may play a role in several aspects of competition, including children's responses to different game outcomes, both in terms of their social behaviour and performance (e.g., allowing them to maintain their levels of effort and skill despite winning or losing). Of course, it is also possible that ER interacts with context, in our case with winning or losing. That is, past work has found that it was only within the self-regulation condition (but not control condition) of a competitive puzzle task that ER related to boys' post-puzzle EF task performance (Walcott & Landau, 2004).

Executive Functioning. EF encompasses the higher order cognitive processes crucial for controlling, monitoring, and regulating thoughts, behaviour, and emotions (Carlson et al., 2013). In particular, EF includes the components of working memory (holding in mind and updating information), cognitive flexibility/shifting (shifting one's attention or thought), and inhibitory control (inhibiting an automatic response; Garon et al., 2008). EF has been found to support children's social behaviour generally (Riggs et al., 2006). Within competitive contexts, the role of EF is more unclear. Engaging in competitive games activates a frontoparietal network associated with EF (Decety et al., 2004). Moreover, taking part in competitive games may help to develop EF abilities (Staiano et al., 2012). However, other studies have found that EF relates children's behaviours within cooperative, but not competitive context (Huyder & Nilsen, 2012). Thus, more research is needed to clarify whether (and how) EF relates to social behaviour and

performance outcomes within competition, and whether such associations depend on the game context (such as while winning or losing).

Theory of Mind. Reflecting another aspect of socio-cognitive abilities, theory of mind (ToM) refers to the understanding that others have mental states that differ from oneself (Wellman & Liu, 2004). ToM helps individuals interpret and predict the actions of others, therefore aiding effective interactions with peers across a range of social environments, and subsequently the development of social competence from early childhood into adolescence (Ashiabi, 2007; Grueneisen et al., 2015; Imuta et al., 2016; Razza & Blair, 2009; Sidera et al., 2013). Interestingly, while better ToM is associated with more cooperative or prosocial behaviours in some contexts (Wu & Su, 2014), it is also linked to competitive behaviours, such as using deception or strategic moves to trick competitors (Priewasser et al., 2013; Sher et al., 2014; Sidera et al., 2013). 3-5-year old's ToM abilities supported them in achieving their goals (gaining stickers) in a competitive context, but did not relate to goal completion in a cooperative context (Tsoi et al., 2017). Better first-and second order theory of mind abilities (as well as interactions with ToM and working memory ability), have been found to relate school-aged children success in deceiving opponents, and therefore better performance on a computerized competitive game (Prodan et al., 2023). Thus, in competitive contexts, ToM may highlight divergent interests and increase attempts to gain advantage. As the existing evidence paints a complex picture of how ToM abilities relates to children's behaviour in competitive environments, more research is needed to understand whether ToM has a different role based on whether one looks at performance or social behaviour, as well as whether associations differ by the contextual factors of the competitive games.

The Current Study

Framed within the theoretical models suggested by Beauchamp and Anderson (2010) and Charlesworth (1996), the present study investigates how both contextual (i.e., game outcome, opponent gender) and individual factors (i.e., gender, socio-cognitive skills), as well their interplay, are associated with children's behaviour in a competitive game. We examine children's responses in terms of 1) how children perform during the game; 2) their communication towards opponents (messages sent); and 3) their social behaviour towards opponents (resource distributions). To understand whether children's social behaviour shifts as a result of being in competition, we also examine their resource distribution to an unknown peer before/after the competitive game. Assessing children's behaviour in different ways is important as past work shows that what children say versus what they do is impacted by different factors (Valcke & Nilsen, 2022).

By providing insight into the specific factors (or their interactions) that affect children's behaviour within competition, our work allows for determining the skills that may facilitate appropriate and flexible social behaviour across diverse situations for children; a crucial component of social competence (Bierman & Welsh, 2000). Beyond theoretical relevance, information about the factors that help children to thrive within competition, as well as which children may need additional help navigating these contexts, is useful for parents, educators, clinicians and coaches, as they support children's social development.

Method

Participants

145 4- to 9-year-old children were recruited from elementary schools across Ontario, from youth sports clubs across Canada, from a university database of families interested in participating in research, and from an ad posted on the international website Children Helping

Science. As our study examines social communication and interaction, data from children with a diagnosis of autism spectrum disorder were not included ($n = 2$). There were no other diagnostic exclusionary criteria. The resulting sample was 143 participants ($M_{age} = 92.24$ months; $SD = 17.83$ months; 69 girls/74 boys²). 83.4% participants spoke English as their first language ($n = 121$). Half of participants spoke only English ($n = 71$), while the other half also spoke additional languages at home or in school ($n = 71$). Ethnic backgrounds of participants included: 49.0 % Caucasian, 22.1 % Asian/Pacific Islander, 17.9% Multi-Racial, 2.1% Latin/Hispanic, 0.7% Aboriginal, and 8.3% preferring not to answer. Education level of a university degree or higher for the parent registering for the study was reported for 75.2% of participants ($n = 109$).

Procedure

Parents/guardians gave written consent and children gave verbal assent to participate before the session. Each child was tested individually in an online session via MS Teams led by a researcher. Prior to the session, parents completed online questionnaires using the Qualtrics platform on their child's demographic information, EF and ER abilities. In the session, tasks were administered in a standardized order to ensure consistency in the experiences across participants, as using a fixed order can help ensure that individual differences in children's performance cannot be attributed to variance in task administration (Beneson et al., 2013). The order was as follows: vocabulary task, EF tasks, ToM battery, competitive game. The socio-cognitive tasks were administered by the researcher sharing their screen with visual stimuli, as well as giving verbal instructions for each task. Children were asked to either give verbal answers, or point to certain stimuli, in these tasks. The competitive game was developed as an

² Parents/caregivers were asked about their child's preferred gender identity, including a blank "other" option where they could write in their child's gender identity. All parents/caregivers indicated their children identified as girls or boys.

interactive online game, that the participant navigated through (e.g., clicked on items) on their own screen, while sharing their screen with the researcher. During the competitive game, the researcher provided instructions verbally.

Competitive Game

To evaluate the effect of game outcome and gender of opponent, children played a series of rigged games against a boy or girl opponent (therefore the four game conditions were: winning against a girl, losing against a girl, winning against a boy, losing against a boy). Each game condition was comprised of three consecutive trials so that the effects of game outcome on behaviour over successive experiences could be investigated. All participants experienced every game condition. Thus, the design was a 2 (game outcome) x 2 (opponent gender) x 3 (trial) repeated measures design. Both children's performance (how well they did on the game) and their social behaviour (verbal messages to opponents, sticker distribution to opponents – and, subsequently to an unknown peer) were assessed.

The nature of the competitive game was that children had to click on objects of a certain type as fast as possible while a virtual opponent attempted to do the same. The researcher first instructed the children how to play the competitive game using a practice trial (Figure 1a), asking them to click on all of the target objects (sea creatures) but not non-target objects (miscellaneous objects). As the child clicked on the target objects, those objects disappeared from the screen, indicating the child had “collected” them. Children were then informed they would play a series of similar competitive games against other children (of similar age) who were also playing online from different locations. The stated goal of the competitive game was to collect as many target objects as possible, but that the other player would be trying to do the same. Unbeknownst to the participants, the other “players” were virtually programmed players. The researcher also

informed participants that after each trial, the program would record their voice to send a message to the other player, and the other players would be sending a message to them (which they would hear transcripts of after the last game).

Participants completed the twelve trials (in sets of three within each of the four game conditions). Before each game condition, an introduction screen introduced the (virtual) opponent (giving their name and gender), and identified the target objects (fruit, animals, clothing, or desserts) (Figure 1b). For each of the trials, the participant played against the same opponent and collected the same target object. The order of game conditions and target objects were counterbalanced across participants.

During each trial (Figure 1c), participants clicked on target objects from a screen containing a grid of target and non-target objects. Importantly, (non-clicked) target objects also disappeared during gameplay, as a function of the computer program. These disappearing objects signalled that the opponent had clicked those objects first. In the winning game conditions, for every two target objects the participant clicked on, one other random target object disappeared from the screen (simulating an opponent who slower at collecting objects). In the losing game conditions, for every one object the participant clicked, two other target objects disappeared (simulating an opponent who was faster at collecting objects). Thus, regardless of each participants' actual number of target objects clicked, they would experience winning and losing game outcomes.

Following each trial, a feedback screen was displayed (Figure 1d), providing the results of the (rigged) game (i.e., consistent with the winning/losing conditions) using a simple bar graph. For instance, in the winning conditions, the bar displayed above the participant's name was larger than the opponent's bar and had a star on it. The researcher also provided verbal

feedback about whether the participant had won or lost, stating: “for this game, the screen shows that [you/opponent’s name] clicked the most objects, so [you/they] won”.

After the feedback screen, a message screen was displayed (Figure 1e), which stated “[opponent’s name] is sending you a message!”. The participant was prompted by the researcher (“what would you like to say to [opponent’s name]?”) to record their own message to the opponent. The audio and video during the game was recorded by the MS Teams software, and subsequently transcribed. If participants responded, “I don’t know” or did not respond after 10 seconds, the researcher again prompted the participant to record a message if they wished (“you can say anything you want to [opponent’s name]”). If the participant responded a second time that they did not know what to say, or refused to answer, the next trial was started. All trials of the game were then repeated using the same format: playing the game, game outcome feedback, and messages to opponents.

After the four game conditions were completed, the researcher read participants the messages that were supposedly sent from their opponents and, finally, debriefed children about the virtual nature of their opponents.

Dependent Variables. As a measure of participant’s performance on the competitive game, a total score for each trial was calculated by the game (the number of target objects collected, minus non-target objects). Social behaviour towards opponents was assessed in two ways: through 1) social communication (coded prosociality of the messages sent to opponents after each trial) and 2) resource distribution (stickers allocated to opponents before and after each game condition; described further below). To understand whether the competitive game context in general influenced children’s inclination to be prosocial towards peers that they are not

competing against, resource allocation (stickers distributed) to an unknown peer before and after the entire competitive game was also measured.

Coding of Messages. Each message sent by participants was coded by two research assistants who were unaware of any experimental (e.g., condition) or individual (e.g., gender) factors. The coders rated each statement on a seven-point Likert scale ranging from -3 (very antisocial) to +3 (very prosocial). Coders were informed that (more) prosocial messages were those that could improve the relationship between the participant and opponent, such as praise of the opponent (e.g., “you are really good at playing”) or polite statements (e.g., “thanks for playing with me”). In contrast, statements towards the antisocial end of the scale constituted messages that would be a detriment to the relationship, such as criticism of the opponent (e.g., “you are bad at this”), or bragging about oneself (e.g., “I collected way more than you”). Inter-rater reliability between coders for 25% of the dataset (i.e., 37 participants) was calculated by intraclass correlations ($ICC = .94$), demonstrating excellent reliability.

Resource Allocation. Giving valuable resources to others has been demonstrated as one behavioural indicator of prosocial behaviour (Hepach et al., 2013), with previous studies on resource distribution demonstrating that children view stickers as valuable resources (Chernyak & Sobel, 2016; Grocke et al., 2015; Kanngiesser & Warneken, 2012). Therefore, during the competitive game, we asked children to make sticker allocations to the other players. Specifically, before competing against each opponent/each game condition, the experimenter asked how many stickers should be allocated to the opponent by stating: “Now you will play some games against [opponent’s name]. But first, you get to decide if he/she gets any stickers in their envelope. How many stickers should I give him/her? 0, 1, 2 or 3?” The researcher showed on the screen a visual depiction of three stickers and an envelope each time the participant was

asked to distribute stickers. Next, at the end of the game condition against that opponent, the participant was again asked to allocate (0-3) stickers to that opponent, using a similar script. Thus, we were able to capture whether children's resource allocations to opponents shifted as a result of game outcome. This procedure was repeated four times, once for each opponent/game condition.

In addition, before and after the competitive game, participants were asked to make two sticker allocations to an unknown peer. The first allocation took place before the competitive game started, and involved giving stickers to an unknown child (the participant was told that they would not meet or compete against them). The researcher stated "There is another child who will play this game with me tomorrow. You get to decide if they get any stickers. How many stickers should I give them? 0, 1, 2 or 3?". A similar procedure was conducted at the end of the competitive game (after the last trial with the final opponent, but before the participant read the messages from opponents). The participant was asked to allocate (0-3) stickers to the unknown peer. The aim of this allocation was to investigate whether taking part in a competitive game environment made children more or less prosocial to an unknown peer that they would not meet or play against, even after the competition had ended.

Executive Functioning Tasks

Cognitive Flexibility. Participants completed a subset of trials from the Flexible Item Selection task (FIST; Jacques & Zelazo, 2001) and the modified FIST (Dick, 2014), measuring cognitive flexibility. The FIST (for ages 3-5 years old) and modified FIST (for ages 6–10 years old) tasks display strong convergent validity with other measures of cognitive flexibility, as well as high person and item reliability (Dick, 2014). Items were selected from each version to create a shorter task that had a wider range of difficulty than either individual task, so that it could

accurately capture cognitive flexibility levels across the studied age range, while being a reasonable length to administer during testing. In this task, children were shown a set of cards with visual stimuli and were asked to select cards that matched on various dimensions (colour, shape, size, quantity), and label why they matched (Figure 2). Children either responded verbally (by stating the left, middle or right card), or by pointing to the screen with a parent stating whether they were pointing to the left, middle or right card. One demonstration trial, one practice trial, and three test trials from the FIST, and four test trials from the modified FIST, were included in this task. Scores on this task ranged from 0 to 18.

Working Memory. Participants completed the digit span task from the Wechsler Intelligence Scale for Children, 5th edition (WISC-V; Wechsler, 2014a). Digit span tasks, including the WISC-V task, have been found to load onto factors of working memory in factor analytic studies (Wiebe et al., 2011; Wechsler 2014b). The digit span task demonstrates excellent internal consistency (reliability coefficients for this age range: $r = .89 - .92$; Wechsler, 2014b). Children repeated sequences of digits (continuously increasing in length) in forwards and backwards order, after hearing them read aloud by the researcher. A total score was calculated by combining scores from forwards and backwards sections, ranging from 0 to 32. This task was discontinued after two consecutive scores of 0 within the same item.

Inhibition. The Inhibition subtest from A Developmental Neuropsychological Assessment, 2nd edition (NEPSY-II; Korkman et al., 2007a) was then administered, adapted to an online format (namely, each arrow was presented on the screen one at a time, as opposed to several rows of arrows at one time). The original inhibition task demonstrates excellent test-retest reliability within this age range (coefficients between $r = .83 - .96$), and good convergent validity with other measures of inhibition (e.g., DKEFS colour word interference task; Korkman

et al., 2007b). In this task, children labelled rows of arrows over two conditions: the naming condition (e.g., labelling an upward pointing arrow as “up”) and the inhibition condition (e.g., labelling an upward arrow as “down”), out of a possible total score of 40. The score used to reflect the participant’s inhibitory control during analysis was the standardized residuals created from regressing the total correct score of the inhibition condition on the total correct score of the naming condition, with a higher score indicating better inhibitory control abilities.

EF Composite Variable. As previous research suggesting that EF abilities within the preschool and school-aged range may be represented by a single construct (e.g., Brocki & Bohlin, 2004; Hughes et al., 2009; Wiebe et al., 2008; Wiebe et al., 2011), a composite measure of EF was created to reduce the number of predictor variables in analyses.³ The composite score was created by calculating the mean score of the standardized scores (z-scores from the cognitive flexibility and working memory tasks, residual change scores on the inhibition task) from the three EF tasks. All task-based measures of executive functioning were significantly correlated at the $p > .01$ level, except between measures of inhibition and cognitive flexibility ($p = .162$). The internal consistency (Cronbach’s alpha) of the composite did not improve greatly when any measures were removed and examined as a 2-factor composite variable, thus the three components were retained. Similar previous work utilizing an EF composite variable also found non-significant correlations between inhibitory control and cognitive flexibility tasks with an in-person study, with the authors similarly chose to retain all three variables into a composite measure (Valcke & Nilsen, 2022). The same method was chosen here, due to the theoretical basis of EF being a unitary construct with these three dissociable components (Miyake et al., 2000), previous findings that tasks measuring these three constructs do not always have strong

³ The creation of a latent EF variable was attempted but there was a low model fit, as is common in the measurement of children’s EF (Camerota et al., 2020). Therefore, a composite variable was used.

correlations (Camerota et al., 2020), and to simplify the statistical models and reduce Type 1 error rate.

Theory of Mind

Wellman and Liu's (2004) battery of ToM tasks, and Perner and Wimmer's (1985) false belief version of ice-cream story were used to assess children's ToM skills. Both ToM tasks demonstrate good reliability and validity (Beaudoin et al., 2020; Hiller et al., 2014). Each section presented within the task reflected one aspect of ToM, namely the understanding of: diverse desires, diverse beliefs, knowledge access, contents false belief, hidden emotions, and second order false beliefs. The six sections of the task were comprised of a story presented verbally by the researcher, while displaying relevant pictures on the screen. During the storytelling, the participant answered questions investigating their ability to understand the minds of the characters in the stories (e.g., understanding that a character in the story does not know what is hidden in a box, while they themselves have seen what is inside, would earn one point). Correct answers for each question were either scored (using the original scoring system developed by the authors) as 0.5 or 1 point, with either one or two total points awarded per story. Total ToM battery scores ranged from 0 to 8.

Vocabulary

Expressive vocabulary is one of the key components of the oral language skills necessary for language development in children (Henry & MacLean, 2003; Hoff et al., 2014). For the purposes of this research, given that we are assessing children's verbal communication to opponents, vocabulary abilities were included as a control variable to ensure that findings were not just capturing differences in verbal abilities. Children completed the expressive vocabulary subtest of the Wechsler Individual Achievement Test, 3rd edition (WIAT-III; Wechsler, 2009). In

this task, children verbally responded with a word that corresponded to a picture presented on the screen and matched a definition read aloud by the researcher. A total score ranging from 0 to 17 was calculated. This task was discontinued after 4 consecutive items with a score of 0. This task demonstrates good test-retest reliability (across the age range used in this study) of $r = 0.65-0.78$ (Breux & Frey, 2010), and good convergent validity with other measures of vocabulary (Breux & Miller, 2009).

Parent Questionnaires

While the socio-cognitive skill tasks intended to capture children's abilities to actively demonstrate their skills during the research session, the parental questionnaire scores intended to capture children's abilities to use their ER and EF skills in their daily lives across a variety of environments, as previous work indicates that these two types of measures are assessing different underlying mental constructs (Toplak et al., 2013).

Emotion Regulation. The emotion regulation subscale of the Emotion Questionnaire (EQ; Rydell et al., 2003) was used to assess parent's perceptions of their child's emotion regulation abilities in every-day situations. 24 items reflecting children's ability to regulate anger, fear, sadness, and positive emotions/exuberance were rated on a Likert scale from 1 (Doesn't apply at all) to 5 (Applies very well). For the purposes of this study, the participant's total emotion regulation score was used, with higher scores indicated better emotion regulation abilities. Total scores ranged from 24 to 120. The EQ demonstrates good test-retest reliability for all emotion regulation subscales (Rydell et al., 2003). The internal consistency of the EQ for this sample was excellent, $\alpha = .91$.

Executive Functioning. Parent's perceptions of their child's executive functioning abilities were measured by the Childhood Executive Functioning Inventory (CHEXI; Thorell &

Nyberg, 2008). The CHEXI assesses children's difficulties with executive functioning (with subscales of working memory, planning, (behaviour) regulation and inhibition) in their everyday settings. Participants rated 24 items on a Likert scale from 1 (Definitely not true) to 5 (Definitely true). A total EF score was used, with lower scores indicate better executive functioning abilities in everyday settings (and higher scores indicated more executive dysfunction). Total scores ranged from 24 to 120. The CHEXI demonstrates adequate test–retest reliability, and good diagnostic validity for measuring EF in children (Thorell & Nyberg, 2008). The internal consistency of the CHEXI for this sample was excellent, $\alpha = .97$.

Results

Preliminary Analyses

As decided in advance, based on best practice criteria for identifying and managing outliers (Aguinis et al., 2013; Cohen et al., 2013), statistical outliers of ± 3 SD were identified in the data. Outliers were discovered for the following tasks: inhibition task standardized residuals ($n = 5$), EQ total score ($n = 1$). These outliers were subsequently Winsorized to reduce the extremity of the scores. No variables violated normality assumptions based on Kline's criterion ($|\text{skew}| \leq 3$; $|\text{kurtosis}| \leq 10$; 1998).

Missing task data, due to participant choice to discontinue that specific task, were as follows: [vocabulary task ($n = 1$), cognitive flexibility task ($n = 4$), working memory task ($n = 4$), inhibition task ($n = 8$), theory of mind task ($n = 3$), competitive game ($n = 4$)]. Missing data for full parental questionnaire were as follows: [demographic questionnaire ($n = 2$), EQ ($n = 3$), CHEXI ($n = 4$)]. Missing items on the EQ and CHEXI (1.50% of EQ data, 2.28% of CHEXI data) were analyzed using Little's MCAR test to determine whether they were omitted at random. As per a non-significant test for EQ ($p = .484$), missing items were imputed using

answered items in SPSS by multiple imputation (5 imputations were conducted, and then averaged together to create an estimated data point for each missing value). Little's MCAR test for the CHEXI was significant ($\chi^2 = 229.17$, $df = 189$, $p = .024$), and therefore missing items were not imputed. The participants with missing items on their CHEXI questionnaires ($n = 9$) were therefore not given a total score for this questionnaire, and their total scores were recorded as a missing data point.

As the four conditions in the competitive game task were counterbalanced across participants, there were 24 orders of conditions across participants. Order effects were investigated using mixed ANOVA analyses to analyze whether the first or last condition presented to each participant affected dependent variable outcomes. No significant order effects ($ps > .686$) nor interaction effects involving order ($ps > .235$) emerged.

Descriptive Statistics and Correlational Analyses

Children's socio-cognitive skills task scores and parents' responses on questionnaires are included in Table 1. Children's behaviour during the competitive game (performance, message prosociality, and sticker distribution to opponents) are presented by condition, in Table 2.

Bivariate correlations between socio-cognitive skills tasks, parental questionnaires, age (in months), and gender (Table 3) revealed that children's socio-cognitive skills task scores (but not parental questionnaire scores) improved significantly with age. Children's socio-cognitive skills task scores (EF composite, ToM, vocabulary) were all significantly correlated ($ps < .01$), consistent with past work (Bosacki, 2000; Carlson et al., 2004a; Jacque & Zelazo, 2005; Müller et al., 2012). Parental report questionnaires (EQ and CHEXI) were also correlated with each other ($p < .01$). Parents' report of their children's EF and ER showed few correlations with task performance. Bivariate correlations between independent variables (age, gender, vocabulary, EF

composite, ToM, EQ, CHEXI) and dependent variables (performance, message prosociality, sticker distribution) by condition are presented in Table 4.

Data Analytic Plan

To account for the dependency of observations (with each participant completing all trials for each condition), linear mixed modeling was used (MLM). The models were estimated using *REML* (restricted maximum estimation) and *nloptwrap optimizer* packages in R, which provide unbiased estimates for samples of any size. As missing data are frequent in research with multiple assessment and data points, the restricted maximum estimation method was used as it allows for the retention of all participant data (both at the within-person and between-person levels) to estimate the model parameters (Snijders & Bosker, 2011). Therefore, all participants were included in each MLM model. For the competitive game, data for each condition was only included in analyses if participants completed all three trials of that game condition (a small number of participants did not finish all conditions as they chose to discontinue the task, $n = 7$). A random intercept was defined for each model, with all observations (trials) nested within each individual participant. Below, results of statistical analyses are organized by dependent variable. Analyses were considered adequately powered to estimate unbiased regression coefficients, standard errors, and variance components, as more than 50 units were available at the participant level (Maas & Hox, 2005; Paccagnella, 2011). In our sample, the power is increased as the model uses every individual time-specific data point from each of the 143 participants.

Three MLM models were run for each of the dependent variables (i.e., performance score, prosociality of messages, stickers distributed to opponents, stickers distributed to unknown peer), for a total of twelve models. Performance score and prosociality of messages were modeled as a function of game outcome, opponent gender and trial. Stickers distributed to

opponent was modeled as a function of game outcome, opponent gender and pre-game versus post-game timing. Stickers distributed to unknown peer was modelled as a function of pre-game versus post-game timing. Additionally, all DV's were modeled as a function of the children's individual characteristics of age (in months), gender, EF composite, ToM, EQ, and CHEXI scores.⁴

The first exploratory model for each DV included only main effects, while the second included interactions of theoretical interest. To obtain the most parsimonious model, non-significant interactions that were unrelated to the stated hypotheses were trimmed in a third model. The main effects and trimmed models are both presented for the dependent variables in which significant interactions effects emerged (for dependent variables in which no significant interactions emerged, only the main effects models are presented). Significant two-way interactions were further probed in R testing for simple effects, using *emmeans* or *lmer* packages (depending on whether the variables were continuous or dichotomous).

Prior to analyses, all continuous variables (age, EF composite, ToM, EQ, CHEXI) were centered at the grand mean. Dummy coding was used for categorical predictors, with gender coded as 0 = girl and 1 = boy, game outcome coded as 0 = win and 1 = lose, opponent gender coded as 0 = girl and 1 = boy, and pre-game or post-game timing coded as 0 = pre-game and 1 = post-game.

Performance

⁴ As task-based and parental-report scores for socio-cognitive skills may be capturing different aspects of children's abilities (i.e., performing on demand in a lab setting versus the using skills in daily life), exploratory models separating these assessment types were run preliminarily. The results were not different from using a singular model with all predictors included, therefore those complete models are reported here.

When examining participant performance (i.e., number of target objects collected during competitive game), the main effects model and trimmed model (presented in Table 5) revealed multiple significant main effects and two significant interaction terms.

The main effect of game outcome was statistically significant and negative ($\beta = -3.21$, 95% *CI* [-3.56, -2.85], $t(1506) = -15.55$, $p < .001$), demonstrating that children performed better in the winning condition. Due to the game programming, more objects were available to be collected by participants in the winning condition (as in the losing condition, the “opponent” collected more objects at a faster rate than the participant). Therefore, this unsurprising main effect of game outcome simply reflects the nature of the programming, and follow-up analyses on performance in the winning vs. losing conditions were not examined. The effect of trial was statistically significant and positive ($\beta = 0.43$, 95% *CI* [0.22, 0.65], $t(1506) = 4.00$, $p < .001$), showing that children improved in performance over time (likely due to practice effects on the task). The main effect of gender was statistically significant and negative ($\beta = -1.43$, 95% *CI* [-2.56, -0.30], $t(1506) = -3.65$, $p = .013$), demonstrating that across all conditions, girls performed better than boys. The effect of vocabulary was statistically significant and negative ($\beta = -0.38$, 95% *CI* [-0.63, -0.13], $t(1506) = -3.03$, $p = 0.003$), demonstrating that children who had lower vocabulary scores performed better on the competitive task⁵. The effect of the EF composite was trending towards significance and positive ($\beta = 0.85$, 95% *CI* [-0.06, 1.76], $t(1506) = 1.03$, $p = 0.066$).

The significant main effects were further qualified by two significant two-way interactions. The interaction between gender and game outcome was statistically significant and

⁵ This effect was surprising and may be explained by children with better vocabularies tending to mentally label the objects as they competed (rather than merely using visual cues), thereby slowing performance. Regardless of reason, vocabulary was included in subsequent analyses to account for the effect.

positive ($\beta = 1.55$, 95% CI [0.85, 2.25], $t(1506) = 4.34$, $p < .001$). Analysis of estimated marginal means revealed that the contrasts for performance in the winning condition for girls vs. boys was significantly different ($\beta = 2.21$, $SE = 0.60$, $t(144) = 3.66$, $p = .002$), whereas in the losing condition there was no significant difference between genders on performance ($\beta = 0.66$, $SE = .060$, $t(144) = 1.09$, $p = .699$). In other words, when winning, girls performed significantly better than boys, and when losing, both genders performed similarly. This interaction is depicted in Figure 3.

The interaction effect of EQ and game outcome was statistically significant and negative ($\beta = -0.06$, 95% CI [-0.09, -0.04], $t(1506) = -4.73$, $p < .001$). This significant interaction was followed up using simple slopes analyses, demonstrating that in the winning condition, ER abilities were positively associated with children's performance ($\beta = 0.06$, $SE = 0.02$, $t = 2.34$, $p = .002$), whereas in the losing condition, there was not a significant association ($\beta = -0.00$, $SE = 0.02$, $t = -0.17$, $p = .87$). Therefore, children with better emotion regulation show better performance in the competitive game when they are winning (Figure 4).

Prosociality of Messages

With respect to children's messages to opponents, the MLM models revealed no significant main effects or significant interaction terms (Table 6). These results suggest that children's messages to their opponent did not vary by whether they won or lost, the gender of their opponent, or their own gender or socio-cognitive skills.

Stickers Distributed to Opponents

For the dependent variable of sticker distribution to opponents, the main effects model and trimmed model (presented in Table 7) revealed multiple significant main effects and one significant interaction term.

A significant main effect of timing (pre-game or post-game) was found, ($\beta = 0.18$, 95% *CI* [0.08, 0.28], $t(1006) = 3.65$, $p < .001$), indicating that participants gave more stickers to opponents after playing against them. A significant main effect of game outcome was also found ($\beta = 0.16$, 95% *CI* [0.06, 0.26], $t(1006) = 3.01$, $p < .001$), indicating that children gave more stickers to opponents in the losing condition. The effect of ToM was statistically significant and negative ($\beta = -0.11$, 95% *CI* [-0.22, -0.00], $t(1006) = -2.00$, $p = 0.044$), demonstrating that children with lower ToM scores distributed more stickers to their opponents. The main effect of gender was statistically significant and negative ($\beta = -0.35$, 95% *CI* [-0.60, -0.11], $t(1006) = -3.54$, $p = .005$), indicating that in general, girls distributed more stickers to their opponents than boys.

The main effects of game outcome and gender were qualified by a significant interaction ($\beta = 0.24$, 95% *CI* [0.05, 0.43], $t(1006) = 2.47$, $p = 0.014$). Analysis of estimated marginal means revealed that the contrasts for sticker distribution in the winning condition for girls vs. boys was significantly different ($\beta = 0.47$, $SE = 0.13$, $t(162) = 3.54$, $p = .003$), whereas in the losing condition there was no significant difference between genders on sticker distribution ($\beta = 0.23$, $SE = 0.13$, $t(162) = 1.73$, $p = .313$). This demonstrates that when winning, girls gave significantly more stickers to their opponents than boys, and when losing, both genders gave similar distributions (Figure 5).

Stickers Distributed to Unknown Peer

When examining children's sticker distribution to the unknown peer, the MLM models revealed no significant main effects or significant interaction terms (Table 8). This indicates that children's inclination to distribute items to another unknown child did not vary after engaging in a competitive game, and individual factors also did not play a role in children's distributions.

Discussion

The results of this chapter highlight the significance of the specific individual factors (i.e., theory of mind, emotion regulation, and gender) and contextual factors (i.e., game outcome), that contribute to children's performance and social behaviours during a competitive game. Furthermore, depending on which aspect of social behaviour is examined, our findings indicate that there can be different factors which influence them. As per Beauchamp and Anderson's SOCIAL theoretical model, our findings highlight the importance of examining both individual differences in socio-cognitive skills, as well as the environmental factors which may moderate these skills (Beauchamp & Anderson, 2010). In light of Charlesworth's theoretical model of competitive behaviours, the results from this chapter support the suggestion that individual differences can play a key role on behaviour in competition, and that individuals differ in the efficacy of competitive abilities (Charlesworth, 1988). In support of both theories, a number of interactions between contextual and individual factors were found to influence both performance and social behaviour, highlighting the complexity of interwoven variables which effect children's behaviour during competitive games.

Performance Outcomes

Our first focus was on how well children performed within the competitive game (operationalized in our task as the number of target objects collected). Interactions between game outcome and both gender and emotion regulation yielded insights into how winning and losing effects children's performance.

The significant interaction between gender and game outcome demonstrated that girls performed significantly better than boys when they were winning. However, there was no gender difference in performance in the losing condition. Thus, interestingly, within this online

competitive game, our findings differ from past work on gender and performance outcomes, which found that (for athletic competitions), girls tend not to perform as well compared to boys regardless of game outcome (Green et al., 2003; Gneezy & Rustichini, 2004; Weisfeld et al., 1982). In fact, we found that in a winning context, girls performed significantly better in the competitive game than boys. The contrast in results across past work and the current study may be reflective of changes in girls' exposure to competitive contexts. While past research suggests that boys have more exposure to competitive environments than girls (Fabes et al., 2004; Maccoby, 1999; Weinberger & Stein, 2008), this is changing in our current society. More recent work has demonstrated that increasing numbers of girls and women are now regularly engaging in competition such as sports, with enrollment numbers of female youth athletes (in the USA) improving steadily every year for the past 30 years (Staurowsky et al., 2020; Gregg & Gregg, 2017). Given this, it would be of interest to determine whether the findings here would be replicated for other types of competitive tasks (e.g., in-person games or in athletics).

The finding that girls sometimes performed better on our competitive task is consistent with previous findings on similarly aged girls' superior performance on (non-competitive) cognitive tasks (Raaijmakers et al., 2008; Wiebe, et al., 2008). Therefore, it is possible that girls did better within this competitive context because they generally had stronger cognitive skills to produce this effect. However, the interaction effect indicates that girls only outperformed boys in the winning condition. This may indicate that girls' performance is reduced through experiencing a series of game losses (e.g., reduced effort and/or disrupted abilities), or that winning provided additional boosts to their performance (e.g., through increased motivation/effort). This theory would be consistent with attributional theory and findings on gender differences for attributions for success and failure, which will be thoroughly explored in chapter three. Previous work

suggests that girls often make internal attributions for losing, in that their failure is due to personal factors about their own performance abilities (while boys typically do not display the same attribution style for failure; Benölken, 2015; Burgner & Hewstone, 1993; Dickhauser & Meyer, 2006; Nelson & Cooper, 1997). This theory regarding attributions may fit with the findings in this chapter, in that the perception of repeated losses may cause girls to enter a state of helplessness which results in decreased performance, as they believe that their personal abilities are not good enough to win. As this research is the first of its kind to highlight this interaction effect, additional work would be needed to clarify exactly why girls only outperform boys while winning.

In contrast to previous literature demonstrating that girls performed worse on competitive tasks against other girls, while boys performed similarly regardless of opponent gender (Green et al., 2003, Weisfeld, et al., 1982), no significant interactions between gender and opponent gender (nor 3-way interactions involving gender factors and game outcome) emerged in this chapter. One reason for this finding may be that girls are now more comfortable engaging in competition with opponents from all genders, as this situation is presented to them often in mixed gender school settings, as well as competitive extra-curriculars like sports (which are now often co-ed in younger age groups). Another explanation for the non-significant effect of opponent gender may be that in our study, while children were aware that their virtual opponents were girls or boys (based on their names and pronouns presented in the task), their actual interactions with the opponents did not give any salient cues that were gender specific (as they never see the opponent, hear their voice, etc.). Therefore, it is possible that in this virtual gaming environment, there are far fewer cues to remind participants of the gender of the opponent they are playing against, therefore creating a null effect on the participant's behaviour.

Another significant interaction finding was that children with better ER performed better than children with low ER, but only when winning. In other words, in the winning conditions, better ER was associated with better performance. However, this was not the case in when losing, with ER showing no association with children's performance. While regulation of negative emotions (such as feeling upset or disappointed) is an important aspect of emotion regulation during competition, the regulation of positive emotions and exuberance is also an important factor to consider when measuring ER (Uphill & Jones, 2004). Regulation of both positive and negative emotions was encompassed in the measurement of children's ER in this chapter, with items asking parents about regulation of their children's positive emotions (e.g., exuberance) as well as negative emotions (e.g., anger; Rydell et al., 2003). While we cannot determine precisely what emotions children experienced when winning or losing, our findings suggest that children with better ER were better able to manage their positive emotions while winning (e.g., excitement), such that they were able to stay focused on the task. Past work finds that better emotion regulation abilities can lead to more positive performance outcomes in youth sports (Jones, 2012). It has been previously suggested that the regulation of and coping with positive emotions during competition is directly related to performance outcomes in a sporting context (Gross, 1988; Uphill & Jones, 2004). Within this study, it is possible for children in this age range, that losing may have been a universally difficult experience, no matter how well developed their ER abilities were. Therefore, it may have been the case that children's ER skills were not developed enough to help them continue to perform better (than those with lower abilities) while in the losing condition. This chapter finds empirical support for the notion that higher ER abilities are associated with the performance of children when winning.

Finally, the results indicated a non-significant trend between EF and performance. These results somewhat speak to other preliminary findings from previous work, suggesting that better EF abilities may relate to improved competitive performance (Verbugh et al., 2014). This result fits with the nature of the competitive task in this study, as children may be using their inhibitory control abilities to avoid clicking non-target objects, or their cognitive flexibility to switch between looking for different types of target objects. This finding suggests that further follow-up on the link between EF skills and performance in competition may be warranted.

Social Behaviour

We did not find evidence that any of the factors examined related to what children *said* to their opponents. However, when examining children's distribution of stickers, we found main effects for individual and contextual factors, as well as interactions between these. Thus, similar to previous work (e.g., Valcke & Nilsen, 2022), we see that different measures of social behaviour yield different associations. Addressing the null finding for the messages first, we did not find, as expected that children's messages to opponents varied by the competitive game outcome. It may be the case that the children in this age range have already learned from experience with previous competitive games (e.g., at school, camps, playdates) what is socially appropriate to say to others during games regardless of game outcomes. Indeed, the overall ratings of prosociality were on the prosocial side of the scale. Furthermore, the presence of both a parent/caregiver and the researcher hearing what they were saying to opponents likely reinforced the expectations in their minds that they should send polite messages (despite the researcher providing reminders that they could say anything they wanted).

In contrast to children's verbal messages, their resource distributions to opponents varied by individual and contextual factors. We found a significant main effect of timing (pre-game or

post-game), indicating that participants gave more stickers to opponents after playing against them. Past work has found that, during competition, children behave more prosocially towards peers they are familiar with (Brachfeld-Child & Schiavo, 1990). Thus, it may be that as children gained familiarity through the trials, they felt inclined to be more prosocial towards them. However, given the limited social interaction between the child and their opponent (especially as they did not read any of the opponent messages until after the resource distribution), may not account for this main effect. Alternatively, children's increased sticker distributions after the game could reflect a merit-based distribution style, suggesting that because their opponent had now completed the game, participants felt they deserved more stickers afterwards based on effort, regardless of how well the opponent did. Indeed, previous work has demonstrated that children within the preschool and school-age ranges show a tendency and preference to distribute resources based on merit (Baumard et al., 2012; Kanngiesser & Warneken, 2012; Nelson & Dweck, 1977; Sigelman & Waitzman, 1991). Consistent with this notion, the main effect of game outcome indicated that overall, children distribute more generously when they lose, again, suggesting a merit-based distribution style (i.e., rewarding their opponent more generously when they have performed well).

Similar to children's performance outcomes, there was an interaction between gender and game outcome on their distributions of stickers towards opponents. When winning, girls gave significantly more stickers to their opponents than boys. When losing, boys and girls made similar sticker distributions. These findings correspond with previous literature that suggests that game outcome can interact with gender on children's level of prosocial behaviour towards peers (Gevaux & Nilsen, 2019; McGuire & Thomas, 1975). It also corresponds with findings that boys demonstrate more selfish behaviours in their resource distributions compared to girls (e.g.,

hoarding resources, favouring members of an in-group, giving less-preferred resources to out-group peers; Benozio & Diesendruck, 2015), although our findings specifically demonstrated this only in the winning condition. While there is debate in the current literature about whether girls actually behave more prosocially than boys (or whether this is just a perception of adult observers), the significant main effect of gender found in this chapter corroborates previous findings that girls actually do exhibit more prosocial behaviour towards peers (Coie et al., 1982; Maccoby & Jacklin, 1980; Walker, 2004; Walker, 2005). The results from this chapter further this notion in a competitive game environment. However, we found an interaction between gender and game outcome on children's social behaviours, suggesting the importance of contextual factors. In this case, it is possible that boys are more merit-based in their distributions, as they were sparing with their resources given to opponents after they had won but distributed similarly to girls after losing. This chapter also provides further information on the importance of considering the context of game outcome, namely how winning can result in boys showing less prosocial behaviour towards peers.

We also found that children with better ToM distributed fewer stickers to opponents. While there is evidence that better ToM is associated with more prosocial resource distribution in non-competitive environments (Wu & Su, 2014), higher ToM abilities have also been linked to more competitive behaviours. That is, because ToM allows children to better understand the minds of their competitors (e.g., predicting that others will exhibit competitive behaviours during games, or that their opponent will aim to gain the most resources for themselves) they tend to engage in more competitive behaviours (Nilsen & Valcke, 2017; Priewasser et al., 2013; Sher et al., 2014; Sidera et al., 2013; Tsoi et al., 2017). Our findings support the notion that children who are better able to use their ToM skills to understand the nature of the competitive game may

subsequently behave less prosocially towards their opponents, as they have a more developed understanding of other's motives in a competitive context.

Impact of Competitive Environments on Future Social Behaviour

In the present work, we did not find a significant difference in children's distribution of stickers to an unknown child before engaging in the competitive game versus afterwards. These findings indicate that being in a competitive environment did not affect the prosociality of their behaviours towards a peer after that context had ended. There were also no significant effects of individual factors (such as gender or socio-cognitive skills) on children's resource distribution to an unknown peer. It is possible that if children are making distributions based on merit, it would make sense that there was no difference in pre versus post game sticker distributions, as this unknown child had not yet done anything to warrant those resources. There has been debate whether just being in a competitive environment can have negative effects on social behaviour afterwards, with some research demonstrating that adults and children demonstrate less prosocial or sharing behaviours even towards others not involved in the competition (Barnett & Bryan, 1974; Creighton & Szymkowiak, 2014; Pappert et al., 2017; Yip & Kelly, 2013). On the other hand, other work has demonstrated no antisocial effects of young children being in competitive game environments compared to cooperative contexts (Eriksson et al., 2021). It is important to note that some studies investigating this phenomenon deployed competitive versus neutral or cooperative conditions, however our methodology instead utilized pre versus post competitive game resource distribution as a measure of social behaviour. In general, previous work has demonstrated positive social benefits of children's participation in competitive environments such as organized sports, although it is important to note that these also contain a cooperative element (Felfe et al., 2016; Super et al., 2018, Harlow et al., 2020). Therefore, our findings

contribute to the current literature by demonstrating that children were not less prosocial in their resource distributions to unknown peers after engaging in a competitive game, and this competitive environment did not have a detrimental effect on their prosociality.

Limitations and Future Directions

While this chapter yields interesting findings regarding factors influencing how children navigate competitive contexts, there are limitations to take into account when considering the results. One limitation was the limited nature of the interaction between children and their (virtual) opponents. This methodology is likely more applicable to capturing social interaction in the online realm, a paradigm which is becoming more prevalent in children's daily lives (O'Keeffe & Clarke-Pearson, 2011). Further, as children sent messages without knowing the content of the messages sent by their opponent, this experiment does not accurately capture the reciprocal nature of social interaction. While this was designed intentionally (so that the children's initial instincts of what to say to their opponent were not influenced by the valence of messages they received), further work should aim to replicate these findings in a more realistic social environment where children do receive social cues and messages from their partners. Furthermore, the nature of playing a competitive game online may have led children to suspect that their opponents were not real. This being said, some of the statements that children generated to opponents (e.g., "Thanks for playing Jason, do you want to come play at my house tomorrow?"), in addition to the fact that most participants expressing surprise during the debriefing session, suggest that this was not the case for most children.

The sample of this study demonstrated some diversity in terms of ethnic backgrounds of participants, with fewer than 50% identifying as Caucasian (compared to the general Canadian population, where approximately 69.8% of residents identify as Caucasian; Government of

Canada, Statistics Canada, 2022). The diversity of socio-economic status was skewed towards the higher end, (using parental education level as a proxy for SES) as over 75% of the respondent parents had an education level of a university bachelor's degree or higher. Replication of these results using a more diverse socio-economic sample would be beneficial, as previous research has indicated that children from lower SES environments may be less willing to share resources with an unknown peer, likely due to necessity to safeguard available resources in their home environments (Safra et al., 2016).

Conclusions

The findings from this chapter regarding gender differences in competitive games shed new light on how girls and boys can perform and behave socially in different ways during competition, and also the importance of considering the contextual factor of game outcome in relation to gender. Overall, the findings of girls performing better and behaving more prosocially than boys may demonstrate a shift in girl's familiarity with competitive environments, in comparison to older literature suggesting that girls consistently displayed poorer outcomes than boys. When considering the importance of socio-cognitive skills, the findings demonstrate that both theory of mind and emotion regulation abilities can play an important role in children's performance and social outcomes in competition, but that again these individual factors may interact with context to give a more in-depth picture of children's behaviour. Together, the findings speak to the importance of considering the complex multitude of both contextual and individual factors on children's performative and social behaviour in competitive contexts.

Chapter Three: Children's Attributions for Game Outcome and Explanations for Resource Distribution

In addition to addressing the main research questions regarding children's performance and social behaviour within a competitive game, I aimed to explore children's *interpretations* of the game context and *thoughts* about their social behaviour. In this chapter I will discuss children's beliefs and attributions about the game outcome, as well as their reasons for their resource distributions to others, providing results from an analysis of open-ended questions posed to children throughout the competitive games. Through these further analyses, the overarching goal was to determine whether there is an association between how they interpret a situation and how they respond, and to uncover the level of insight or motivations children have for their behaviours. More specifically, the research aims of this chapter were to examine whether children's **attributions for success and failure** were internal or external, and whether these attributions showed associations with individual characteristics, or to their performance and social behaviour. Furthermore, I sought to determine the **reasoning behind the resource distributions** to both their opponents and an unknown peer, whether they were based on merit, fairness or pro/antisociality, and whether these explanations differed based on contextual or individual factors. This inquiry will advance the understanding of children's behaviours towards different types of peers during competition, and whether their reasoning for distributions may vary based on whether they directly compete with an opponent, versus someone they don't have any interaction with. This expands on previous literature by exploring not only how are children distributing to opponents, but also their personal explanations as to *why* they are giving those distributions.

Introduction

Attributions for Success and Failure

As demonstrated in the second chapter, game outcome can affect children's behaviour in competitive contexts in a variety of different ways. It may be the case that how children perform and behave socially during competitive games is related to how they are understanding and conceptualizing winning or losing, or in other words the attributions they are placing on their success or failure. Taking a step back from competition, in achievement contexts generally, there has been a large body of research investigating children's attributions for success and failure, how these attributions may vary based on contextual and individual differences, as well as how they relate to different emotional and behavioural responses.

As discussed in the first chapter, Weiner's attributional theory of motivation and emotion suggests that in achievement related contexts, there are main perceptual reasons that individuals attribute as the cause of their achievement (or lack thereof). Weiner suggested that perceived causes of success and failure are focused on three common themes: stability (i.e., stable or unstable), controllability (i.e., controllable or uncontrollable), and locus (i.e., internal or external locus of causality; Weiner, 1985). Attributions from an internal locus of causality relate to an individual's ability, effort, mood, etc., while attributions stemming from an external locus of causality relate to environmental factors: about others, properties of the task, and luck or chance.

Building on the notion of attributions, individuals have been found to display personal attribution styles. Both children and adults can display a self-enhancing attribution style: attributing successes to internal causes and failures to external causes, or the opposite self-depreciating style: attributing failure to internal causes and success to external causes (Schunk et al., 2007). Self-enhancing attributional styles in children can relate to a range of positive outcomes, including better self-esteem, more positive academic self-concept and better school

performance. Children with self-depreciating attributional styles are unfortunately at higher risk for adverse outcomes in self-perceptions and academic achievement (Banks & Woolfson, 2008, Chodkiewicz & Boyle 2014; Cini, 2007; Lohbeck et al., 2017; Núñez et al., 2005). Children with a self-enhancing attributional style often show more approach to novel or difficult tasks, while those with a self-depreciating style demonstrate more avoidance (in addition to symptoms of anxiety and low mood, which are also linked to avoidance behaviours; Bell-Dolan & Wessler, 1994; Fincham et al., 1987; Nelson & Cooper, 1997). In the context of competition, it is important to ask the question: do children's attributions for success and failure also apply to winning and losing competitive games, and how do such attributions relate to social behaviour?

Associations between Individual Characteristics and Attributions

Much of the current literature studying the associations between children's individual characteristics and their attributions has focused on gender. There have been mixed findings on how gender plays a role in children's attributions towards success and failure. When school-aged children completed a rigged computer-based task, boys tended to attribute failures to unstable external causes (e.g., computer malfunctioning). On the other hand, girls tended to provide unstable, external attributions for success (e.g., the task was easy), and stable, internal attributions for failure (e.g., having low ability; Nelson & Cooper, 1997). Another task-based study which experimentally manipulated success and failure demonstrated that even younger children aged 4-6 years old also displayed attributional gender differences, with boys giving more internal attributions for success and girls giving more internal attributions for failure (Burgner & Hewstone, 1993). Research on attributions for academic achievement demonstrates that school-aged boys attribute success on achievement tests of mathematics to personal ability, and failure to bad luck, while girls show the opposite effects, attributing success in mathematics

to luck, and poor performance to low personal abilities (Stipek & Gralinski, 1991). Other studies on attributions for achievement in mathematics have demonstrated similar findings, that school-aged girls tend to have a more ‘self-depreciating’ attributional style (attributing success to external factors such as luck and failure to internal factors such as ability), compared to boys who display the opposite ‘self-enhancing’ attributional style (Benölken, 2015; Dickhauser & Meyer, 2006). In gifted school-aged children (identified based on scores above the 95th percentile on an academic achievement test), boys were found to state their innate abilities as their reason for success, whereas girls focused more on effort or “working hard” as their explanations for success across a wide variety of subjects (Assouline et al., 2006). Recent research on 7- and 8-year-old children’s attributions for academic outcomes across multiple subjects demonstrated that boys gave positive, self-enhancing reasons for their success while girls provided more negative, self-deprecating attributions for failure (Lohbeck et al., 2017).

However, in contrast, other findings have suggested that gender does not play a significant role in children’s attributional styles. On a memory task when receiving rigged feedback about success or failure, most school-aged children in the success condition judged effort (an internal cause) to be the most important factor in their performance, while those in the failure condition attributed their performance mostly to task difficulty (an external factor). No significant gender differences between girls’ and boys’ attributions were observed (Wigfield, 1988). When asking students about their attributions for their personal academic achievement in mathematics, despite the hypothesis that girls would display a self-deprecating attribution style, no gender differences were found between girls’ and boys’ attributions for either their own perceptions of their math abilities, or in their expectations of current achievement (Parsons et al., 1982). Similarly, in the realm of competitive sports, one study of 8–13-year old’s personal

attributions for success and failure in relation to performance and social outcomes during a 7-week competitive sports camp did not find gender differences between attributions for success and failure on either outcome domain (Weiss et al., 1990). Another study investigating 8–14-year-old girls and boys' attributions to success and failure on a competitive sports task also found no gender differences (Chase, 2001).

While a majority of past work suggests that girls display a self-depreciating attributional style and boys display a self-enhancing style, other studies yield different findings. Therefore, in this chapter I aimed to further investigate how gender relates to children's responses to success and failure in a competitive game. While findings in the second chapter highlight girl's better performance and more generous resource distributions towards opponents in a competitive game (but only when winning), in this chapter I aimed to investigate if attributional styles differ based on gender.

Beyond explorations of the individual characteristic of gender, recent work has suggested a theoretical model of the relationship between mindsets (beliefs about the malleability of self-attributes) and the use of emotion regulation strategies (Schroder, 2021). Additionally, there is preliminary evidence that in adults, emotion regulation may be a mediating factor between growth/fixed academic mindsets and negative emotions experienced while studying (Dong, 2022). However, there has been no work to date investigating associations between children's socio-cognitive skills (such as EF, ToM and ER) and their attributions for success and failure. Thus, the current chapter aims to explore any associations between individual factors and attributions, as findings may expand on results found in the previous chapter. For example, the second chapter demonstrated that ER related to performance when winning, therefore in this

chapter I seek to further explore this by determining whether ER also relates to attributions of game outcome.

Children's Reasoning behind Resource Distributions

Further to understanding children's attributions of success and failure during a competitive game, in this dissertation, I sought to understand children's reasons behind their resource distributions to others during the competitive games. In their broader social world (both within and outside of competitive contexts), children are expected to regularly navigate interactions where they must consider the deservingness of others from a resource perspective (Nancekivell et al., 2013). Preschool and school-age children generally tend to prefer equal distributions of resources, as well as make equal allocations of desirable resources themselves when they are the ones in control of the distribution (Baumard et al., 2012; Burns & Sommerville, 2014; Geraci & Surian, 2011; Shaw & Olson, 2013). However, young children's preferences and tendencies towards making equal distributions in limited resource scenarios can shift when further contextual cues are presented, such as allocating more resources to someone who exhibits greater effort during a task (Baumard et al., 2012). When children are responsible for making their own distributions in limited resource scenarios, merit-based norms are often found, with preschoolers and school-aged children allocating resources based on how much effort recipients put into a task (Baumard et al., 2012; Kanngiesser & Warneken, 2012; Nelson & Dweck, 1977; Sigelman & Waitzman, 1991). Furthermore, the characteristics of the recipients can influence the distributions they receive, such as the findings that preschool-age children generating more equal distributions when the recipient is a collaborator versus a competitor (Nilsen & Valcke, 2018), a friend versus an acquaintance (Moore, 2009), or the child's relative status in a classroom-based dominance hierarchy (Charlesworth, & LaFreniere, 1983). While

previous work shows that broader context affects children's distributions, this dissertation focuses on understanding whether specific features of competition affect children's distributions to others (in the previous chapter), and in this chapter, whether children's reasoning behind their distributions show similar effects.

Current Research Aims

While the previous chapter investigated *how* children were behaving socially towards their opponents and an unknown peer, this chapter further explores *why* they were behaving in that manner. Firstly, the analyses in this chapter addressed the questions: are children making internal or external attributions for success and failure in a competitive game context? Do children's attributions differ by contextual factors (e.g., opponent gender), or relate to individual factors (e.g., gender, age, or socio-cognitive skills)? For the scope and purposes of this chapter, the focus was directed towards internal/external attributions (not stable/unstable or controllable/uncontrollable), as the majority of the literature focuses on internal and external attributions in particular (Benölken, 2015; Burgner & Hewstone, 1993; Dickhauser & Meyer, 2006; Lohbeck et al., 2017). If the results indicate that girls are indeed making more internal attributions for failure and external attributions for success (and boys vice versa), this will fit with previous literature indicating that boys display more self-serving attributions styles in competition. However, given that girls are increasingly engaging in competitive contexts (Staurowsky et al., 2020; Gregg & Gregg, 2017), there may not be the same sort of gender differences in attributions as demonstrated in past work.

Additionally, this chapter further explores what type of explanations children give about their resource distributions (e.g., whether they are showing a tendency to distribute based on equality versus merit). Investigating the explanations children give about their resource

distributions, and whether these differ based on contextual factors, is important to consider when studying why children exhibit prosocial or antisocial behaviour towards others. The analyses in this chapter also address the questions: what reasons are children ascribing to their resource distribution after engaging in a competitive game against virtual peers? Are their distributions based on feeling prosocially or antisocially towards the recipient, or on a basis of equality or merit? Do their reasons differ based on contextual factors or factors about their recipients (e.g., game outcome, opponent gender, distributing to an opponent versus an unknown peer)? The literature indicates that children of this age often make resource distributions based on merit (when there are contextual clues to do so; Baumard et al., 2012; Kanngiesser & Warneken, 2012), therefore we expect in this competitive environment that many children will be doing the same.

Method

To explore children's attributions for why they believed they won or lost against each opponent, during the competitive game they were asked: "Why do you think you won and (opponent's name) lost? (after the winning conditions) or "Why do you think (opponent's name) won and you lost?" (after the losing conditions). This question was asked after participants had completed all three trials against each opponent (i.e., asked four times in total). If children did not respond, they were prompted a second time, and if they refused to respond again this was noted. Answers were recorded by written transcripts. Similar methods have been utilized in previous studies examining children's attributions for success and failure (Burgner & Hewstone, 1993).

To investigate children's explanations for their sticker distributions, after the post-condition distribution to each of the four opponents, the researcher asked: "Why did (opponent's

name) get that many stickers?". After the entire competitive game to investigate their distributions to the unknown peer, they were asked "Why did the other child get that many stickers?" If children did not respond, they were prompted a second time, and if they refused to respond again this was noted. All responses were recorded using written transcripts.

Coding

The attributions for game outcome and explanations for sticker distribution were categorically coded from written transcripts by two research assistants who were unaware of any experimental (e.g., condition) or individual (e.g., participant gender) factors. Coders met with a researcher who explained the coding scheme, demonstrated how to code several items, and then practised coding as a group (comparing and discussing codes amongst one another). Following the training, the primary coder coded 100% of the data, with these codes being used in analyses. The second coder coded 25% of the data, to examine the inter-rater reliability of the coding scheme.

Regarding the attributions for game outcome, the coders categorized each statement into one of three categories: 1. Internal attributions (whether winning or losing was attributed to *factors within the participant* such as personal ability, effort, or demographic variables. E.g., "I am the best at this game" or "I practiced more so I won" or "I won because I am older".), 2. External attributions (whether winning or losing was attributed to *factors outside of the participant's control*, such as the environment or factors about the opponent. E.g., "She was fastest" or "my mouse was sticky"), and 3. Neutral attributions (unrelated responses/ unclear statements that do not contain attributions. E.g., "just because, I don't know" or "she won because she won the star"). Statements could only be coded into one category. Coding internal and external statements based on these criteria is consistent with previous literature using similar

coding schemes (Burgner & Hewstone, 1993; Williams et al., 2008), based on the definitions of internal and external attributions from Weiner's attribution theory (Weiner, 1985). For the coding of participant's explanation of the game outcome, inter-rater reliability between coders for 25% of the dataset (37 participants, 4 explanations per participant) was calculated by intraclass correlations ($ICC = .90$), demonstrating excellent reliability.

For the explanations of sticker distribution, the coders categorized each statement into one of five categories: 1. Prosocial statements (conveying prosocial or positive intentions, such as wanting the opponent to feel good or expressing positive feelings towards the opponent. E.g., "I felt sorry for them, so I gave them 3 stickers"), 2. Antisocial statements (conveying antisocial or negative intentions, such as wanting the opponent to feel bad or be punished. E.g., "he beat me, so I only gave him one sticker"), 3. Equality based statements (indicating the distribution was based on equality or fairness between multiple peers. E.g., "I gave her two because I gave Sally two before"), 4. Merit based statements (indicating the distribution was based on merit or performance, such as someone's ability or effort. E.g., "they did a bad job" or "he tried his hardest, so he gets three."), which were then further categorized as positive (e.g., referencing high ability/effort) or negatively valenced (e.g., referencing low ability/effort), and 5. Other statements (unrelated to the distribution. E.g., "I just felt like giving two" or "I don't know why I gave her that"). For coding participant's explanation of sticker distributions, inter-rater reliability between coders for 25% of the dataset (37 participants, 5 explanations per person) was calculated by intraclass correlations ($ICC = .95$), demonstrating excellent reliability.

Results

Attributions for Game Outcome

For attributions of game outcome, proportions of responses by category (split by participant gender, opponent gender, and game outcome) are presented in Table 9. The descriptive data showed that when winning, both girls and boys most often gave internal attributions for their success, and when losing, both genders most often gave external attributions for their failure.

To analyse participant's game outcome attributions in relation to contextual and individual factors, a logistic mixed model (estimated using *ML* and *Nelder-Mead optimizer*) was fitted in R to predict internal vs. external attributions. A random intercept was defined for each model, with all observations (4 per participant) nested within each individual. The dependent variable of attribution was first modeled as a function of the experimental conditions of game outcome and opponent gender, and the children's individual characteristics of age (in months), gender, EF composite, ToM, EQ, and CHEXI score. Prior to analyses, all continuous variables (age, EF composite, ToM, EQ, CHEXI) were centered at the grand mean. The first exploratory model included only main effects, while the second included interactions of theoretical interest. Finally, to obtain the most parsimonious model, non-significant interactions were trimmed in the third model. Dummy coding was used for all categorical variables, with gender coded as 0 = girl and 1 = boy, game outcome coded as 0 = win and 1 = lose, opponent gender coded as 0 = girl and 1 = boy, and attributions coded as 0 = internal, 1 = external. To analyse the relationships between children's attributions and their social and performance behaviours during the competitive game, bivariate correlations were conducted.

For the categorical variable of attributions, the main effects model examining the influence of contextual and individual factors (presented in Table 10) revealed two significant main effects. The second model revealed no significant interaction effects, therefore only the

first model is presented. The main effect of game outcome was found to be statistically significant and positive ($\beta = 16.12$, 95% CI [8.49, 30.62], $p < .001$). This indicated that children were significantly more likely to give internal attributions for their perceived success in the winning condition, and more likely to give external attributions for their failures in the losing condition. The main effect of age was also statistically significant and positive ($\beta = 1.05$, 95% CI [1.03, 1.08], $p < .001$). This demonstrates that older children were significantly more likely to make external attributions for the game outcome, while younger children more often gave internal attributions.

For the correlation analyses exploring the effects of in-game behaviour in relation to attributions, no significant results were found (Table 11). Therefore, children's attributions were not found to be related to their social behaviours or performance during the competitive game.

Explanations for Sticker Distribution

For children's explanations about their sticker distributions, proportions of responses by category (split by gender and condition) are presented in Table 12. The descriptive statistics showed that participants most often gave explanations for distributions to opponents based on merit, regardless of gender or condition. The majority of merit-based explanations across conditions were positively valenced (80.6%, e.g., "They tried their hardest" or "They won the games"), while a smaller percentage were negatively valenced (19.6%, e.g., "Because he didn't win any of the games", "She was clicking too slowly"). In the winning condition (i.e., when the opponent lost), 60.8% of merit statements were positive and 39.1% of statements were negative. In the losing condition (i.e., when the opponent won), 96.2% of merit statements were positive and 3.8% of statements were negative. These descriptive statistics suggest that in the losing condition, children's merit-based statements were often positive, praising performance or effort

when the opponent won. However, in the winning condition, it appears that their statements had more variability in valence, either still praising their efforts when the opponent lost (positive valence) or stating that their performance was poor (negative valence). For their explanations for distribution to the unknown peer, participants most often responded in the other category, indicating that they could not articulate a clear reason for their distribution (again regardless of gender or condition)

As merit-based explanations were by far the most commonly endorsed category, to further investigate whether children's sticker distributions were associated with a tendency to give merit-based explanations, two merit scores were calculated for each participant (one for each game outcome condition). Scores ranged from 0-1, measuring the proportion of times that each participant gave a merit-based explanation for their distributions. The merit scores were created to evaluate how much children's distributions were based on their perceived deservingness of the recipient. To investigate the relationship between children's sticker distributions to opponents, and their explanations for those distributions, bivariate and partial (controlling for age) correlations were conducted for sticker distribution and merit scores by winning/losing condition.

Partial correlation analyses exploring the relationship between stickers distributed and merit scores by condition (Table 13) revealed that merit scores were significantly and positively related to sticker distribution in the losing conditions ($p < .001$) but not the winning conditions ($p = .068$). This indicates that in the losing condition, children who gave more merit-based explanations also gave more stickers to the opponents (who had just won the game). However, this association was not found for the winning condition. Age was also significantly and positively correlated to post-game sticker distribution in the losing conditions, and merit scores

in both conditions ($ps < .01$), but not to post-game sticker distribution in the winning condition ($p = .205$).

Discussion

Attributions for Winning and Losing

Investigating children's attributions for success and failure during the competitive game, the results show that children gave more internal attributions for winning, or attributed their success to personal factors about themselves. On the other hand, they made more external attributions for losing, attributing failure to factors about their environment or their opponents. This suggests that the majority of the children in this sample are displaying a self-enhancing attribution style, taking personal responsibility for their successes and attributing responsibility to their environment or their opponents for their failures. However, one methodological factor that could have influenced this finding was how the script was worded, as in order to achieve consistency across conditions, children were always asked about the game outcome by first placing the emphasis on the winner (i.e., "why do you think that you/opponent *won*, and opponent/you *lost*?"). This factor potentially may have cued them to think about the winner as it was mentioned first.

Of note, in the present study, gender differences in children's attributions did not emerge. This contrasts with past work where a number of studies found that girls display more self-depreciating attributional styles (blaming internal causes for failure and attributing external causes to their success) and boys show more self-enhancing attributional styles (citing external causes for failure and internal causes for success). This pattern of attribution styles based on gender has been found across a variety of ages in both rigged competitive game experiments (Burgner & Hewstone, 1993; Nelson & Cooper, 1997), as well as attributions for academic

achievement (Benölken, 2015; Dickhauser & Meyer, 2006; Lohbeck et al., 2017; Stipek & Gralinski, 1991). However, such gender differences in attributions have not been consistently found, similar to the findings in this work. Similar attributional styles were demonstrated for both boys and girls within the context of a memory task involving received rigged feedback of success and failure (Wigfield, 1988), when asking students about their attributions for personal academic achievement in mathematics (Parsons et al., 1982), and when investigating the relationship of attributions to physical and social achievement, self-efficacy and approach motivation in competitive sports (Chase, 2001; Weiss et al., 1990). An important future direction will be to examine whether girls' increased exposure, familiarity, and confidence in competitive environments (compared to in the past; Gregg & Gregg, 2017; Staurowsky et al., 2020), means reduced gender differences in the attributions for success/failure made by girls.

The findings of the attribution analyses also demonstrated the unexpected finding that older children were more likely to make external attributions about game outcome, whereas younger children were more likely to give internal attributions. In the literature, some previous research also suggests that there are differences in children's attributions based on age. One study of gifted children in grades 3-11 demonstrated that the older age group were more likely to attribute task difficulty (an external factor) to failure on complex academic tasks, compared to younger age groups (Assouline et al., 2006). In a study of children in grades 2-6 who received rigged feedback after a memory task, younger children consistently gave the explanation that luck (an external factor) was the main cause of both their successes and failures, in comparison to older children who gave more internal attributions such as effort (Wigfield, 1988). Other research demonstrated that older children make more "logical" attributions for success and failure, such as demonstrating an increased understanding of one's abilities and successfully

predicting future performance on related tasks, compared to younger children (Nicholls, 1979). The current findings reflect that during an online competitive game, younger children are taking more personal responsibility for the outcome of the game, while older children were attributing the outcome to external factors such as the environment or their opponent. Similar to the findings by Nicholls (1979), the results from this study may indicate that as children age, they are better able to logically understand when an outcome may be due to personal factors in some situations, versus other situations where outcomes are more likely to be due to factors beyond their control. In this online competitive game context, children may understand that playing a brief game for the first time against unknown opponents is a low-stakes environment over which they have limited control, and that the game outcome is not necessarily a strong reflection of their personal attributes.

No other individual factors besides age were associated with children's attributions. It may be the case that while individual factors such as socio-cognitive skills are not associated, other individual factors such as self-esteem or self-efficacy are more closely related to attributions, which has been found in a small number of previous studies (Chase, 2001; Fielstein et al., 1985; Weiss et al., 1990). Therefore, while it was beyond the scope of the current study, future work should seek to understand which other individual factors besides socio-cognitive skills might be related to children's attributions specifically during competitive games.

Interestingly, there were no relationships found between children's attributions and their behaviour during the game (i.e., their performance, social communication or resource distribution). This suggests that the other individual factors described in the previous chapter were driving their behaviours during the competitive game, as opposed to their attributions for the outcome. Moreover, the fact that individual differences did not relate to attributions, and that

attributions did not relate to behaviour, imply that attributions were not the mechanism behind the findings in the previous chapter.

Implications Regarding Attributions

As engaging in competition is unavoidable in children's social world, it is important for children to learn to navigate both potential outcomes of success or failure in this context. Studying their attributions helps us to create a deeper understanding of children's reactions in these competitive contexts, in that children were largely taking personal responsibility for their successes and diffusing responsibility to external factors for their failures. Research has demonstrated that children with self-enhancing attribution styles demonstrate increased confidence in their abilities and perform better academically, compared to those with self-depreciating styles (Banks & Woolfson, 2008; Chodkiewicz & Boyle 2014; Núñez et al., 2005). Furthermore, past work has shown that children with diagnoses such as depression, learning disabilities, ADHD and ASD are more at risk of having self-depreciating attributional styles (Barnhill & Myles, 2001; Tabassam & Grainger, 2002). Children with diagnoses such as ADHD and ODD are also at increased risk of aggression and antisocial behaviour towards peers during competitive games (Hughes et al., 2001; Ohan & Johnston, 2007). Therefore, it is important to consider how for high-risk children in particular, attributional styles, diagnoses of mental health or behavioural difficulties, and behaviours in competitive situations may be linked (although in this non-clinical sample, attributions were not found to relate to social behaviours). Alternately, it is possible that behavioural difficulties may moderate the associations between attributions and behaviour (with no relationship for typically developing children). Previous findings have demonstrated efficacy of methods such as cognitive behavioural therapy (CBT) for retraining attributional evaluations in children with learning difficulties and motivational/self-esteem

difficulties (demonstrating positive progress in reading skills, and parent-report levels of motivation and self-esteem; Toland & Boyle, 2008). In competitive game environments, evidence for the efficacy of attribution retraining interventions in children has also been demonstrated. 11- to 12-year-olds displaying maladaptive attributional styles demonstrated increases in intrinsic motivation, perceived success and attributions for success after intervention (Sinnott & Biddle, 1998). Therefore, previous literature suggests while there is evidence to suggest that children with self-depreciating attributional styles are at risk for a variety of negative outcomes, there are interventions that can help. The findings of this chapter contribute important indications that in competitive games, children's attributions for success and failure may change with age. Furthermore, my findings give the important suggestion that girls do not universally display self-depreciating attributional styles during competition.

Explanations for Resource Distribution

Regarding children's explanations for their resource distributions, the results demonstrated that children most often made merit-based explanations for distributions to opponents. This is in line with much of the current literature that when children are responsible for distributions themselves, they often make them based on merit, or how much effort someone has put into a task (Baumard et al., 2012; Kanngiesser & Warneken, 2012; Nelson & Dweck, 1977; Sigelman & Waitzman, 1991). Older children were more likely to give merit-based explanations for distributions across both winning and losing conditions. This finding relates to similar previous work indicating that with increasing age (between the ages of 3-8 years old), children are more likely to understand and accept merit-based distributions when appropriate context for the distribution is provided (Schmidt et al., 2016b). Other findings with 3–8-year-olds similarly indicate that older children allocated resources more meritoriously than younger

children, and that increasing with age, children weighed more moral concerns (equality, merit, and others' welfare), when determining allocation of resources (Rizzo et al., 2016). Therefore, this chapter contributes further evidence that children are more likely to consider merit during self-led resource distribution scenarios with increasing age.

Considering children's merit-based explanations in relation to their actual sticker distribution to opponents, results demonstrated that children's merit scores were related to their distributions in the losing condition, in that higher merit-based reasoning reflected higher sticker distribution. No association was found in the winning condition. Children almost always made "positive" merit-based statements in the losing condition, praising the opponent's effort or performance. These findings are likely due to the fact that in the losing condition, the opponent had just won the game, giving the children a clear, merit-based reason to reward them with more stickers. In the winning condition, the opponent's performance was inferior, therefore there was no clear merit-based reason to distribute more stickers to them.

The explanations children made about their distributions to an unknown peer differed from those about their opponents, most often making statements in the other/unknown category. This indicates that they could not communicate a clear reason for making a distribution to the unknown peer. This finding highlights the importance that context can play on children's prosocial behaviour and resource distribution in competitive environments, as their explanations differed for distributions towards opponents versus unknown peers. It is likely that with their opponents, children had some sort of basis of performance or effort in which to explain their distributions. However, as they had never interacted with their unknown peer, they had no contextual clues as to why they should distribute a certain number of resources to that person. In

general, this chapter provides support for the importance that context (who the recipient is) makes when considering children's explanations about their resource distribution towards others.

Implications Regarding Explanations for Resource Distributions

Understanding why children display certain social behaviours in different contexts is important for developmental researchers to understand, so that this knowledge can be passed on to educators and parents of young children. This chapter highlights that the children from our study strongly considered merit as a basis for resource distribution to opponents after playing against them. It further highlighted how their merit-based explanations were almost always positively valenced when the opponent had won, but less so when they lost. This demonstrates that young children are placing strong considerations on quality of performance when determining how much their opponents should be rewarded or compensated after a competition, building on similar findings from previous research (Baumard et al., 2012; Kanngiesser & Warneken, 2012; Nelson & Dweck, 1977; Sigelman & Waitzman, 1991). From a practical standpoint, it is important for parents, educators and coaches to understand this tendency, with these results highlighting how children's thinking and reasoning for distribution of rewards is based on an opponents' performance, when they themselves hold the power.

Conclusions

In summary, this chapter analysed the attributions children made about the outcome of the competitive game, finding that both boys and girls displayed self-serving attribution styles. Examining children's explanations for their resource distributions indicated that most children made merit-based explanations for their resource distribution to opponents, and that their tendency to make merit-based statements was related to increased distribution of stickers in the losing condition only. These exploratory analyses aimed to dig deeper into children's

understanding and explanations of why the game outcome happened, as well as their reasoning behind their own social behaviour.

Chapter Four: General Discussion

Competition is present across various domains in children's daily lives. Effectiveness in this context means simultaneously pursuing one's own goals, while managing social relationships with opponents and peers. As there are multiple goals (which sometimes conflict with one another) within competition, children need to utilize different social behaviours to effectively navigate this environment. The overarching aim of this research was to investigate children's behaviours within, and reactions to, a competitive game. Across the main and supplementary analyses discussed in chapters 2 and 3, a number of significant findings emerged. These demonstrate both *how* children behave in a competitive game, and also give insight as to *why* they are acting in these ways. Through these findings, I met the principal goal for this research: gaining insights into key contextual and individual factors influencing children's social and performance behaviours during a competitive game. Some hypotheses, generated based on the available literature on children's behaviour in competition, were found to be supported or partially supported. In this chapter, the significant findings from chapters 2 and 3 will be interpreted, overarching themes of all results will be considered, then interpreted in light of the theoretical models introduced in chapter 1, and finally implications and applications of this research will be discussed.

Summary of Results

Performance

Revisiting children's performance in the competitive game, results from chapter 2 indicated that the context of game outcome had a significant impact on performance, while interacting with other individual factors. The first hypothesis that children would display better performance outcomes after the perception that they had won previous trials, but not after losing,

was based on previous similar work demonstrating this pattern (Gevaux & Nilsen, 2019). Interestingly this was supported in this research, but only for girls. Firstly, a significant interaction between game outcome and gender demonstrated that girls performed significantly better than boys when winning. While losing, both boys and girls performed similarly. Further, a similar result emerged that the first hypothesis was supported only for those with higher ER abilities, in that those children displayed better performance when winning, but that ER did not make a difference on performance in the losing condition. For both findings on performance, the interactions indicated that performance improved in the winning condition for one group (either girls or those with higher ER), but in the losing condition all groups performed similarly. Chapter three demonstrated that children were more likely to make internal attributions for success (that their winning had to do with factors about themselves), and external attributions for failure (that their losing had to do with factors about their opponents or environments).

Taken together, it could be possible that when children are winning, they are taking personal responsibility for the outcome and therefore could feel more capable and motivated to improve their performance, whereas while losing they may feel as if there is nothing they can do to change the outcome. Therefore, children who have certain individual factors (e.g., girls or those with high ER), when winning are effectively able to put in effort to improve their performance, as they may feel that this is within their internal, personal control. While previous work has investigated children's attributional styles based on individual factors such as gender (Benölken, 2015; Burgner & Hewstone, 1993; Dickhauser & Meyer, 2006; Lohbeck et al., 2017; Nelson & Cooper, 1997; Stipek & Gralinski, 1991), no other research to date has simultaneously considered multiple contextual and individual factors related to attributions, as was investigated in the previous chapter.

The fourth hypothesis, that girls would perform better on the competitive game when competing against other girls, with boys showing no effect of gender of opponent on performance, was based on previous work indicating that girls perform worse when competing against boys (even when actual ability levels are equivalent; Weisfeld, Weisfeld, & Callaghan, 1982). This hypothesis was not supported, and, moreover, there were no significant findings regarding gender of opponent throughout this research. The lack of findings in this research regarding gender of opponent differ from past work, that, while speculative, may be indicative of girls now be responding differently to competition compared to in the past. Although, it may also be the case that the specific nature of this competitive game played a role in the findings that girls performed better while winning, as children did not actually see their virtual opponents (similar to previous literature suggesting that girls were less comfortable competing against classroom peers when they were face to face compared to boys; Benenson et al., 2002).

The third hypothesis, that children with better EF abilities will display better performance on the competitive task (compared to those with lower EF abilities), was based on preliminary literature suggesting that better EF abilities may relate to improved performance in competitive environments (Verbugh et al., 2014). Furthermore, this was anticipated due to the nature of the task itself (i.e., that children may use their inhibitory control abilities to not click on non-target objects, or use cognitive flexibility to effectively switch to seeking new target objects for each opponent). The third hypothesis was not fully supported, as the association between children's EF and their performance on the task was trending towards significance (in the predicted direction). Furthermore, EF was not found as a predictor for any of the outcomes throughout this study. This suggests that the other imperative socio-cognitive skills indicated in this research (ToM and ER) are more strongly associated with children's behaviour in competitive

environments. Moreover, it may be the case that EF abilities may be more related to social behaviours in *cooperative* environments, with past work finding that EF related to behaviours during cooperative tasks (including the decrease of competitive behaviours), but not to social behaviours in competitive contexts (Huyder & Nilsen, 2012).

Social Behaviours

While there were no significant contextual or individual effects for children's messages to opponents, there were a number of significant factors which related to their sticker distribution. Without looking at both types of social behaviour, I may have assumed that all children were interacting in the same way if I had only studied their communication. This finding builds on previous work (which also supported the SOCIAL model) demonstrating the importance of measuring multiple types of social behaviour in developmental research (Valcke & Nilsen, 2022). The supplementary analyses also helped identify *why* children made different types of distributions toward peers that they won/loss against, as well as those they never engaged with.

Factors associated with children's social behaviours did not always align with the hypotheses. For instance, the fifth hypothesis that children with better ER will send more prosocial messages while losing (compared to those with lower ER), was based on previous literature indicating that children with better ER abilities are more likely to behave prosocially towards peers and maintain long term relationships (Blair et al., 2004; Blair et al., 2015). I predicted this skill would be especially relevant to children's prosociality when losing. In this competitive game context, I did not find that ER abilities (nor any other factor) related to children's messages. Furthermore, the second hypothesis that children who won would give more generously in the resource allocation task to that opponent (compared to when participants

lost) was also not supported (formed based on previous work demonstrating that children were less generous to peers after losing; Barnett & Bryan, 1974; Isen et al., 1973). Considering the significant contextual factors related to children's distribution behaviours, children gave more stickers to their opponents after playing against them (compared to before). In chapter 2, I speculated that these distributions could have possibly been made based on merit, in that their opponents had put in effort playing the game, and therefore had "earned" more stickers compared to before they had played. Indeed, results from the supplementary analyses demonstrated that most children gave explanations for their distributions to opponents based on merit. Therefore, this work highlights the importance of examining children's *reasoning* behind their social behaviours during competition.

Regarding individual factors, children with better ToM distributed fewer stickers to opponents compared to those with lower ToM. Therefore, the sixth hypothesis that children with better ToM abilities will give fewer resources to their opponents after losing, compared to those with lower ToM abilities was partially supported. There was no interaction with the contextual factor of game outcome as predicted, with children with better ToM giving less generously to opponents regardless of whether they had won or lost. I believe that this finding contributes to previous work demonstrating that better ToM abilities can make children behave in more competitive ways within this context, as they are better tuned into the divergent goals between themselves and their peers, and thus more affected by the competition (Priewasser et al., 2013; Sher et al., 2014; Sidera et al., 2013; Tsoi et al., 2017). This finding also expands on previous work by demonstrating that children with better ToM also behave more competitively in their resource distribution towards opponents, even when the distribution is unrelated to advantage in the competition. This was found to be true even in this context when the competition against that

opponent had ended (while the majority of the previous literature on ToM examines children's competitive moves *during* the game).

In relation to the significant interactions between contextual and individual factors, game outcome interacted with gender on children's sticker distribution to opponents, with boys giving significantly fewer stickers than girls after winning. While losing, both groups distributed similarly. These results may primarily speak to previous findings demonstrating that girls are often generally more prosocial in their resource distributions to peers than boys (Benozio & Diesendruck, 2015), while adding further contextual information about the importance of winning on resource distribution behaviours compared across genders.

Engaging in a competitive game had no influence on sticker distribution to an unknown peer (who the children would not meet or compete against). This finding did not support the seventh hypothesis that children will give fewer resources to the unknown peer after engaging in the competition. Contrary to some studies showing that engaging in competition makes children less prosocial afterwards (Barnett & Bryan, 1974; Creighton & Szymkowiak, 2014; Pappert et al., 2017), our research instead reflected other similar findings that competition did not have any impact on children's social behaviour afterwards (Eriksson et al., 2021; Zan & Hildebrandt, 2003). Exploring further in the supplementary analyses, most children responded in the "other" category when asked why they gave the unknown peer that number of stickers, showing that they could not articulate why they gave that distribution. It is unlikely that this finding was due to a general lack of insight into distributions, as when asked about distributions to opponents, children most often gave merit-based explanations, demonstrating ability to explain their reasoning in that context. Instead, it is likely that this competition did not impact social behaviour towards others after the game had ended (in contrast to previous work: Barnett &

Bryan, 1974; Creighton & Szymkowiak, 2014; Pappert et al., 2017; Yip & Kelly, 2013). This finding may be related to the context of this specific study, in that online competitive games could be viewed as lower stakes environments, and therefore less influential to subsequent prosocial behaviour. However, it may also indicate that there are not detrimental effects of competition for children in general. It is also important to consider that the methodology here examined children's behaviours pre and post game, as opposed to comparing competition to a cooperative context, and therefore cannot speak to whether competition makes children more or less prosocial than other types of contexts.

Themes within Results

From a broader perspective, a few themes emerged within the findings from both chapters 2 and 3, indicating the importance of a specific factors across multiple outcome variables. These themes will now be summarized to consolidate the numerous findings from the previous section.

First, findings demonstrated that the contextual factor of game outcome is important to consider when studying children's behaviours within competition. Significant results emerged from this research relating to game outcome on children's performance, social behaviour towards opponents, and attributions for success and failure. Therefore, it is crucial to consider how winning (interacting with individual factors) can have a substantial positive impact on certain children's performance and social behaviours in competition, whereas children's attributions can be changeable based on whether they won or lost.

Second, several gender effects emerged, with the findings converging towards the same picture: that girls are displaying better outcomes (in certain contexts) during competition than would be expected based on previous research. These findings may have emerged due to the shift

in the broader social context, wherein girls are gaining increased exposure to being in competitive environments in this day and age (e.g., the significant rise in girls and women in competitive sports). In this study, girls performed better than boys after feedback that they were winning, they were more generous to opponents after winning, and contrary to the previous literature, they displayed the same self-enhancing attributional styles as boys in this competition.

Finally, considering individual factors, socio-cognitive skills (ER and ToM) were indicated to play a significant role both in children's performance as well as social behaviour. However, these effects were not found consistently across outcome variables. Therefore, socio-cognitive skills were found to play a modest role when considering performance and social behaviour within this competitive context.

Theoretical Perspectives on Current Findings

Using a theoretical lens to examine findings emerging from this research, the results can be interpreted through Charlesworth's evolutionary theory of competition, Beauchamp and Anderson's SOCIAL theory, as well as Bronfenbrenner and Ceci's bioecological systems theory of development.

First, the finding that children with better ToM abilities were less generous in their resource distribution to opponents gives an interesting perspective on Charlesworth's evolutionary theory of competition for resources. Charlesworth suggests that all competition evolves from an innate need for humans to compete for valuable resources needed to sustain life, and that even cooperation with others within one's ingroup is merely a product of this drive to compete for resources (Charlesworth, 1988). Previous work has also demonstrated that better ToM abilities make children better able to understand competitive contexts and use their abilities to acquire more resources than their opponents (Priewasser et al., 2013; Sher et al., 2014; Sidera et al.,

2013; Tsoi et al., 2017). Through the lens of Charlesworth's theory, it would make sense that children with higher ToM may be more influenced by the context of the competition, as they may be more likely to perceive the competitive intentions of their opponents and act in a reciprocal way (similar to the findings in adults of reactive egoism; Epley et al., 2006). Of course, almost all of the participants seemed to be guided by some social norms of prosociality or merit, in that they were rarely giving zero stickers to opponents. However, as the peers in this context were only interacted with in an online setting, and participants may understand that therefore there would be little chance of any type of future collaboration with their opponents, it follows that children with a better developed understanding of the competition would give fewer resources in this situation. Through an evolutionary lens, it would be considered to be adaptive or advantageous behaviour for children to generally be less generous to others in which they had no scope for future collaboration with, and no hope of future gains. This interpretation aligns with the finding that children with superior ToM abilities gave fewer resources to their opponents. This possibility has been suggested by other studies, namely how better ToM abilities allow children to be more flexible across contexts when predicting the resource sharing behaviour of ingroup and outgroup members. Children's ToM skills specifically contribute to the development of their increasingly sophisticated social reasoning abilities (Chai et al., 2022).

Expanding further to consider children's development across a variety of social contexts, several findings from this research provide support for Beauchamp and Anderson's SOCIAL theory. Namely, that it is crucial to consider both individual and contextual factors as well as their interactions to fully understand children's behaviour within social environments (Beauchamp & Anderson, 2010). First, the current findings demonstrated that while there were no significant contextual or individual predictors of children's social communication to

opponents during the game, several contextual and individual factors were related to their social behaviour or resource distribution to opponents. Furthermore, a number of significant main effects found were further qualified by interactions, including that girls performed better than boys, that children with better ER performed better, and that boys gave less generously to opponents, but only while winning. Without looking at both individual and contextual factors, some of the important nuances in understanding children's behaviour within competition would have been obscured. Finally, the findings regarding children's attributions support the importance of using a psychological lens on behaviour as suggested in the SOCIAL model. That is, the findings on how children are making internal attributions for winning and external attributions for losing, highlight the importance of considering how children internally make sense of their social environment.

Finally, considering the broader developmental lens of Bronfenbrenner's bioecological systems theory, the findings on how girls are performing better and behaving more prosocially than boys while winning a competition, and that they are displaying self-serving attributional styles for winning and losing, are important to view through the perspective of this model. In the winning condition, girls were outperforming boys. This would not have been predicted by previous work, which suggest that girls should perform worse than boys regardless of the game outcome (when playing against mixed-gender opponents; Weisfeld, et al., 1982). The findings on girls making self-serving attributions are also in contrast to the majority of the previous literature, which would suggest that girls display self-depreciating attribution styles (Benenson et al., 2002; Burgner & Hewstone, 1993; Green et al., 2003; Moely et al., 1979; Nelson & Cooper, 1997; Stipek & Gralinski, 1991; Weinberger & Stein, 2008). The discrepancy in our findings may relate to shifts in the general norms for genders, in particular for girls in competition.

Viewing the findings in this way, as embedded within a time/place, is in line with the bioecological systems theory. Bronfenbrenner and Ceci highlight how all human social behaviour is rooted within different interacting levels of context or ecology. The outermost circles of context include the chronosystem, encompassing the time period, as well as the macrosystem, containing the values, beliefs and social norms of the culture in which the child is developing (Bronfenbrenner & Ceci, 1994). Instead of viewing my findings here as discrepant from the literature, Bronfenbrenner's model highlights the strong importance of considering the time period and cultural views of gender norms when interpreting these results. Much of the previous literature on gender in competition is quite dated, with many of the key studies on gender in competition dating back to the 1970's, 80's and 90's (Barnett & Bryan, 1974; Brachfeld-Child & Schiavo, 1990; Burgner & Hewstone, 1993; Charlesworth, 1996; Charlesworth & LaFreniere, 1983; Heckhausen, 1984; Howes, 1987; Isen et al., 1973; Kamii & DeVries, 1980; Knight & Chao, 1989; Maccoby, 1988; Maccoby & Jacklin, 1987; Moely et al., 1979; Nelson & Cooper, 1997; Scanlan & Passer, 1979; Stipek et al., 1992, Weisfeld, et al., 1982; Whelien & Charlesworth, 1993). It is quite possible that the findings from older studies were reflective of girl's behaviours and experiences during a time when girls were not as encouraged to engage in competition or behave competitively towards others. Several decades later, the findings likely reflect a shift in the chronosystem and macrosystem in which children are developing. In North America (where my participant sample was drawn from), girls are being encouraged more than ever before to participate in competition and perform well against opponents (Gregg & Gregg, 2017; Staurowsky et al., 2020), highlighting a shift in our cultural values and expectations of gender. Bronfenbrenner and Ceci's theoretical model is important to consider in the context of this research, as children's understanding, and embodiment of gender

norms is probably one of the most rapidly shifting individual factors from a cultural and societal perspective.

Implications of Findings

Methodological Considerations and Limitations

It is important to note that research on children's behaviour in social situations can be significantly impacted by the methodology used and the experimental environment. Therefore, the results of the current research must be interpreted within the context of the study itself, specifically in an online competitive game against virtual opponents. It is important to consider that the discrepancy in findings between the current study and past literature may be due to differences in experimental context, as much (but not all) of the previous work in this area was conducted in-person against other children, with whom the participants may have had pre-existing relationships.

The most significant methodological consideration is the creation of a social context in an online virtual format. Due to the COVID-19 pandemic, the originally proposed research (to be conducted in-person) was adapted to children playing the competitive game online against virtual peers. Previous findings on conducting virtual research with children highlights some of the challenges of this methodology (e.g., technological difficulties such as children struggling to use a computer mouse, adapting in-person tasks to online formats) as well as benefits (e.g., reducing socio-economic barriers to participation in research, increasing diversity of research samples; Shore et al., 2023). One major difference between an online vs. in-person study, would be if this research had continued in-person, participants would have had constant, naturalistic cues from their opponents which may have influenced their own behaviours. In the originally proposed research, I had planned to consider the opponent's social behaviours, given the strength of

reciprocity of children's behaviours in social contexts (Huyder & Nilsen, 2012; Nilsen & Valcke, 2018; Pappert et al., 2017). While considering the contextual variable of opponent's behaviour would have been reflective of typical in-person competitive environments, shifting to a virtual format allowed us to narrow in on the effects of the other contextual variables: game outcome and gender of opponent. It is possible that with an in-person format, the influence of the opponent's behaviour may have overshadowed any effects of the other contextual factors. Therefore, conducting this research in a virtual setting allowed us to discover several significant findings related to game outcome. Another aspect of the virtual format is that children may have suspected their opponents were not real children (as they were told at the beginning of the session), but controlled by computer programming. During the experimental task, the researcher would make a note if participants made any comments suggesting or speculating that their opponents may not be real. While 85% of participants did not mention suspicions about their virtual opponents, 15% made comments questioning if they were real (e.g., "Is Sally really playing?"). It is possible that children who did suspect their opponents were virtual could have behaved differently, with less incentive for them to behave prosocially towards them. A final consideration for the social context of my online study is that parents/caregivers were required to sit next to their children throughout the duration of the study, to help facilitate technological support (e.g., starting the video conferencing session and adjusting the settings, sharing the screen, setting up the online game). In an in-person study, children in a school setting would most likely be alone with the experimenter and their opponent without parents observing their behaviours. While the parents were instructed not to respond to what the child was doing or prompt them in any way, it is possible that the physical presence of the parents in the room may have influenced children's behaviours (e.g., children communicating more prosocially towards

opponents). The presence of a parental observer might possibly have been a factor in the non-significant findings regarding children's social communication to opponents, as children were largely sending prosocial or neutral messages to opponents during the experiment. Furthermore, the nature of the virtual game meant that it was necessary to prompt children to send messages to their opponents, rather than just letting them converse with one another naturally during the game, as would likely happen in an in-person experiment. The prompted nature of communication may have also influenced the prosociality of children's messages. These considerations were one of the reasons this study examined both social communication and social behaviour, as the expectation of children always saying "nice" things to opponents or peers may be more embedded into their understanding of societal rules. However, as children were able to distribute different amounts of stickers, this allowed me to better capture the nuances of the level of pro-sociality they were demonstrating towards others.

A further consideration regarding the methodology of this study was the adaptation of the socio-cognitive skills tasks (originally intended for in-person facilitation) to an online format. Whenever possible, I aimed to achieve continuity of the online version of the task to its original in-person format. For tasks that required participants to give a verbal response to looking at pictures or a verbal cue from the experimenter (including the expressive vocabulary, digit span and theory of mind tasks), the online formatting of the tasks were almost identical to how they would have been delivered in-person. For tasks that required participants to point to their response (i.e., the flexible item selection task), I enlisted the help of the parent or guardian to confirm which stimulus card the child was pointing at by labelling them (as right/middle/left or top/middle/bottom card), to eliminate any errors or confusion with the experimenter misjudging what the child was pointing at through the video screen. For tasks that originally included an

element of timing to see how fast participants could complete them (i.e., the inhibition task), this component had to be removed to ensure that there was no influence of technology over a participant's scores (e.g., a delay in viewing the stimuli could result in a worse score compared to a participant with a faster internet connection). Furthermore, for the inhibition task, as it is crucial for the experimenter to follow along with exactly which stimuli the participant was labelling for scoring purposes, stimuli had to be presented individually one at a time on the screen, instead of in rows on a stimulus card as originally indicated.

Further to the discussion on the measurement of EF abilities, the findings of this research are consistent with previous work finding that lab-based measures of EF abilities and parent-report measures of EF abilities in everyday life did not correlate with one another (Toplak et al., 2013). This research furthers these previous findings in an online testing environment (where the participants are engaging with research but from their own homes), suggesting that task-based measures of EF continue to seem to measure a different presentation of EF abilities, compared to those witnessed by parents in their child's real-world environment.

Practical Implications and Applications

Beyond the specific methodological considerations informed by this research, practical implications may be useful to parents, educators and coaches of young children when providing support and guidance about navigating competitive environments. As competitive environments are a complex and nuanced social context, it is important to consider the following questions: is being in competition, and engaging in competitive behaviours beneficial or detrimental for children? Should cooperation or prosocial behaviour always be the focus of encouragement in children? Considering the risks of a child becoming upset about the game outcome, or getting

into an argument with peers, is encouraging engagement in competitive environments advantageous?

Engaging in Competition

The first important practical implication that this work highlights is that being in competitive environments was not inherently detrimental to children's subsequent social behaviour. Competition is a natural and unavoidable part of human existence. Some previous literature has found that engaging in competition (or competitive games specifically) had detrimental effects on children's social interactions or prosocial behaviour towards peers or adults (Barnett & Bryan, 1974; Creighton & Szymkowiak, 2014; Pappert et al., 2017). However, the results of my study showed that children did not behave less prosocially to an unknown peer after engaging in a competitive environment. Furthermore, children were generally more generous in their distribution of stickers to opponents after playing against them, regardless of the game outcome. These findings contribute to other similar research indicating that engaging in competitive games does not have detrimental social outcomes for children and may have more positive benefits than engaging solely in cooperative environments (Eriksson et al., 2021; Rosol, 2013; Zan & Hildebrandt, 2003). Therefore, if parents or educators feel conflicted about whether encouraging children to play competitive games may be harmful or beneficial, this research demonstrates that, within the social measures studied in the present work, there were no negative social outcomes associated with competition. Furthermore, as competitive environments are more socially difficult to navigate than cooperative environments (where every participant's goals are the same), children's exposure to such contexts allows for opportunities to build their understanding, familiarity, and skills related to engaging in competition. Previous evidence suggests that engaging in competitive games can facilitate the development of socio-cognitive

skills such as EF (Staiano et al., 2012), and how developing the abilities to simultaneously meet one's own needs in competition while maintaining social relationships is a key part of developing social competence (Green & Recheis, 2006). Therefore, children should not be discouraged from participating in competitive environments as they provide opportunities to help them develop these crucial skills. Furthermore, engaging in competition that also has a cooperative element (such as team sports) have been demonstrated to have a multitude of social and personal benefits to children (Felfe et al., 2016; Harlow et al., 2022; Super et al., 2018).

Children learn important skills through competitive contexts and limiting exposure may prevent the development of such skills. However, it is also important to consider that being in environments that are overly competitive can be detrimental to children's well-being, such as research demonstrating that making test scores a competition between classmates in a middle school increased levels of worry and negative emotionality (Hoferichter & Raufelder, 2017). Similar research suggests for adolescents in Korea, a more competitive school climate was related to higher academic performance, but reduced individual life satisfaction (Rudolf & Lee, 2023). While learning how to successfully engage in competition is a beneficial life skill, being immersed in excessively competitive environments can be harmful to children's well-being. Thus, it is important to be able to distinguish healthy from unhealthy competitive contexts (and not avoid ALL competition). Social comparison theory suggests that making continuous or excessive upwards and downwards social comparisons against one's peers may be harmful to one's mental health, wellbeing and self-esteem, and that competitive environments may naturally draw out these comparisons (Festinger, 1954, Garcia et al., 2013). However, work in this area also highlights that all human societies participate in competition, and that it is an unavoidable social context (Andrason, 2016). Further research in this area indicates that self-compassion can

be beneficial for helping mitigate the potential negative effects of competition and social comparisons, including athletes' well-being and their ability to deal with adversities in sports (Röthlin et al., 2019). Therefore, it is important to continue to explore this area, as this research does, of how to help children successfully navigate competitive environments, as they are an unavoidable part of our social environment.

Another practical consideration is that encouraging children to only behave altruistically towards others (at the cost of not achieving their own personal goals), and to never be assertive or competitive would be detrimental to the development of social competence. This notion may be particularly important for girls, as research shows that societal expectations and gendered socialization influences girls to be prosocial, attentive to others and responsible, whereas boys are more often encouraged to be autonomous and goal directed (Letendre, 2007; Moretti et al., 2001; Surrey, 1991). These societal expectations may play a significant role in the previous findings that boys are more comfortable in and more often engage in competition (Fabes et al., 2004; Maccoby, 1999). Particularly as this work highlights how previous findings on girls' behaviours in competition may no longer be accurate for this day and age, as girls are increasingly engaging in competition from a young age (Gregg & Gregg, 2017; Staurowsky et al., 2020), it is also important to consider how one's own perceptions of societal gendered expectations may factor into personal feelings and perceptions of girls and boys' behaviours during competition.

Being immersed in competition creates opportunities for children to learn to navigate tricky social situations, and they need support from adults to develop understanding and competence in this complex social context. When discussing competition with children of all genders, it is important to help children consider and navigate a range of topics and issues that

might arise (including emotions emerging after winning/losing and how to effectively cope with them, the importance of the game outcome to the child, how to navigate relationships with peers while competing against them, and how to pursue one's own goals by exerting effort and improving performance). As being an effective competitor can be a crucial part of social dominance hierarchies (Walker 2002; Walker 2005), it is important for parents and educators to acknowledge the real-world benefits of children being successful in competition. Therefore, adults should engage in discussions and learning with children about the multitude of important and nuanced factors within this environment, such as how winning and performing well can be important as well as being a fair or good competitor towards peers. Discussing these subtle distinctions and divergent goals is important, as opposed to blanket statements encouraging prosocial behaviour towards others no matter the context, or “protecting” children from feeling negative emotions after losing (e.g., instead implementing the expectation that everyone always wins/gets a prize; Cote, 2013; Daniels, 2007).

Skills Associated with Competition

The socio-cognitive skills implicated in this research regarding children's behaviour in competitive contexts (namely emotion regulation and theory of mind abilities), may be beneficial to target in areas of treatment for children who struggle to effectively engage in competition. ER training specifically has been shown to benefit social relationships and social skills of children with clinical diagnoses in other environments (Arabi et al., 2020; Macklem, 2011). Interventions targeting emotion regulation may also help children develop better performance in competition, and as the results of this study suggest, particularly while winning. Theory of mind was another socio-cognitive skill implicated in relation to children's social distribution behaviours within this study (although in this case, it cannot be stated definitively whether being less generous to

opponents is necessarily equal to being more effective in competition). While there has been mixed evidence on the effectiveness of ToM training in relation to improving general social skills for children with diagnoses of ASD (Adibsereshki et al., 2015; Begeer et al., 2011), other work on ToM training suggests that it made young children from non-clinical populations significantly better at using deception, a common skill used when engaging in competition against others (Ding et al., 2015). Therefore, these findings may give further insight into which socio-cognitive skills could be targeted in treatment to help children succeed in competition. Furthermore, improving their ToM may make children better able to understand how others normally behave during competition, and that any competitive or deceptive behaviours from their opponents are common behaviours while playing the game, rather than a personal slight towards them.

Considerations for Clinical Populations

In addition to the implications for typically developing populations, the results of my work have implications for clinical populations. While this work did not compare the behaviours of clinical populations to typically developing children, previous work demonstrates that children with diagnoses relating to behavioural difficulties (e.g., ADHD, ODD, ASD) may have a harder time navigating competitive environments, displaying significantly more aggression in these contexts (Hughes et al., 2001; Ohan & Johnson, 2007). Furthermore, previous work has highlighted how the game outcome (e.g., losing) can exacerbate aggressive behaviour in children with behavioural difficulties even further (Hughes et al., 2001). While I cannot speak specifically to the effects of competition on clinical populations based on this research, the current study highlights the importance of examining children's social behaviours towards others in multiple ways. Developing a deeper understanding of these nuances of competitive social contexts, and

understanding of other's behaviours, may help prevent misunderstandings of peer's intentions (which could in turn cause more antisocial behaviour towards the peer that is excessive to the game context, damaging the relationship).

Conclusions

Acknowledging the importance of both contextual and individual factors, this work addresses the novel question of which factors affect children's performance and social behaviours within a competitive context. From a contextual focus, the findings highlight the enormous importance that game outcome has within competition, including implications on performance, resource distributions to opponents, and attributions about success and failure. This research also demonstrates the association of socio-cognitive skills on children's behaviour in competition, namely how ER abilities relates to improved performance while winning, and how ToM abilities are associated with less generous resource distribution. In terms of gender, within my work, girls were found to perform better and be more prosocial in their resource distribution while winning. Both girls and boys were also found to display self-serving attributional styles for success and failure. These findings diverge from past studies, potentially due to changing norms and experiences of competition for girls. Finally, this work suggests that being immersed in a competitive environment does not make children less prosocial towards others afterwards. As competition is a complex and multifaceted social context, this research gives novel insights into which factors allow children to balance their goals of performing well and interacting with opponents in this environment.

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Appendix

Tables

Table 1

Descriptive Statistics for Socio-Cognitive Skills and Parental Questionnaire Scores

Task/Questionnaire	<i>n</i>	<i>M</i>	<i>SD</i>
Expressive Vocabulary	142	7.37	3.26
EF Composite	140	-0.03	0.79
(modified) FIST	139	14.76	2.54
Digit Span	139	12.37	3.47
Inhibition	135	0.49	0.78
Theory of Mind	140	5.99	1.43
EQ (parent-report ER)	140	84.81	18.76
CHEXI (parent-report EF)	134	62.51	16.38

Table 2*Descriptive Statistics of Competitive Game Measures*

Condition: Game Outcome/ Opponent Gender	DV: Mean Performance Score (across 3 trials)				DV: Mean Prosociality of Messages Score (across 3 trials)				DV: Mean Stickers Distributed (across 2 time points)			
	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy
<i>n</i>	138	136	139	138	138	136	139	138	138	136	139	138
<i>M</i>	14.52	11.34	14.27	11.02	0.89	1.01	0.89	0.86	1.83	2.04	1.88	1.99
<i>SD</i>	5.28	2.63	5.22	3.30	1.04	1.11	1.18	1.16	0.89	0.84	0.88	0.83

Note. Gender coded as 0 = girl, 1 = boy. A mean score for performance, prosociality of messages, and number of stickers distributed to opponent was calculated for each condition. Differences in *n* between conditions relate to some participants choosing to terminate the experimental task early. Regarding performance scores, the game design allowed participants to perform better in the winning condition, as there were more possible objects to be collected (as in the losing condition, the opponent collected more objects).

Table 3
Bivariate Correlations between Measures

	Expressive Vocabulary	EF Composite	FIST	Digit Span	Inhibition	Theory of Mind	EQ	CHEXI
Age (in months)	.667** <i>n</i> = 142	.581** <i>n</i> = 140	.494** <i>n</i> = 139	.563** <i>n</i> = 139	.183* <i>n</i> = 135	.528** <i>n</i> = 140	-.008 <i>n</i> = 140	-.096 <i>n</i> = 134
Gender	-.106 <i>n</i> = 142	.009 <i>n</i> = 140	-.093 <i>n</i> = 139	-.074 <i>n</i> = 139	.179* <i>n</i> = 135	-.140 <i>n</i> = 140	-.011 <i>n</i> = 140	.051 <i>n</i> = 134
Expressive Vocabulary	-	.527** <i>n</i> = 140	.500* <i>n</i> = 139	.449** <i>n</i> = 139	.167* <i>n</i> = 135	.528** <i>n</i> = 140	-.062 <i>n</i> = 139	-.060 <i>n</i> = 133
EF Composite	-	-	-	-	-	.491** <i>n</i> = 140	.090 <i>n</i> = 137	-.160 <i>n</i> = 132
FIST	-		-	.520** <i>n</i> = 138	.122 <i>n</i> = 134	.412** <i>n</i> = 139	.004 <i>n</i> = 136	-.018 <i>n</i> = 131
Digit Span	-		-	-	.244** <i>n</i> = 134	.476** <i>n</i> = 139	.107 <i>n</i> = 136	-.238** <i>n</i> = 131
Inhibition	-		-	-	-	.136 <i>n</i> = 135	.107 <i>n</i> = 132	-.154 <i>n</i> = 127
Theory of Mind	-		-	-	-	-	.101 <i>n</i> = 137	-.222* <i>n</i> = 132
EQ	-		-	-	-	-	-	-.470** <i>n</i> = 134

Note. * $p \leq .05$; ** $p \leq .01$. Gender coded as 0 = girl, 1 = boy.

Table 4*Bivariate Correlations between Independent and Dependent Variables by Condition*

Condition: Game Outcome/ Opponent Gender	DV: Mean Performance Score (across 3 trials)				DV: Mean Prosociality of Messages Score (across 3 trials)				DV: Mean Stickers Distributed (across 2 time points)			
	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy	Win/ Girl	Lose/ Girl	Win/ Boy	Lose/ Boy
Age (in months)	-.099	.157	-.074	.160	.273**	.201*	.212*	.145	.075	.158	.135	.246**
Gender	-.139	-.069	-.178*	-.087	-.129	-.160	-.130	-.071	-.292**	-.154	-.286**	-.153
Vocabulary	-.251**	-.063	-.148	.030	.150	.196*	.073	.106	.110	.190*	.176*	.194*
EF Composite	.072	.205*	.038	.164	.231**	.129	.067	.178*	.020	.104	.013	.118
Theory of Mind	.047	.221*	.078	.138	.162	.138	.173*	.108	-.031	.052	-.047	.071
EQ	.178*	.124	.224**	.028	-.040	-.116	.031	-.010	.063	.039	.076	.065
CHEXI	-.148	-.117	-.127	-.085	.000	-.013	.052	-.053	-.036	-.061	.003	-.021

Note. * $p \leq .05$; ** $p \leq .01$. Gender coded as 0 = girl, 1 = boy. A mean performance score, mean prosociality of messages score, and mean number of stickers distributed to opponents score was calculated for each condition.

Table 5*MLM Models (Main Effects and Trimmed Models) for Performance*

Parameter		β	p	95% CI	
				Lower Bound	Upper Bound
Main Effects Model	(Intercept)	15.24	<.001	14.40	16.09
	Game Outcome	-3.21	<.001	-3.56	-2.85
	Opponent Gender	-0.21	.249	-0.57	0.15
	Trial	0.43	<.001	0.22	0.65
	Age	0.00	.907	-0.04	0.05
	Gender	-1.43	.013	-2.56	-0.30
	Vocabulary	-0.38	.003	-0.63	-0.13
	EF Composite	0.85	.066	-0.06	1.76
	Theory of Mind	0.44	.092	-0.07	0.96
	EQ	0.03	.261	-0.02	0.07
	CHEXI	-0.01	.598	-0.05	0.03
Parameter		β	p	95% CI	
				Lower Bound	Upper Bound
Trimmed Model	(Intercept)	15.63	<.001	14.76	16.49
	Game Outcome	-3.98	<.001	-4.48	-3.48
	Opponent Gender	-0.21	.244	-0.56	0.14
	Trial	0.43	<.001	0.22	0.65
	Age	0.00	.906	-0.04	0.05
	Gender	-2.20	<.001	-3.39	-1.02
	Vocabulary	-0.38	.002	-0.63	-0.14
	EF Composite	0.85	.066	-0.06	1.76
	Theory of Mind	0.44	.092	-0.07	0.96
	EQ	0.06	.019	0.01	0.11
	CHEXI	-0.01	.599	-0.05	0.03
	Gender x Game Outcome	1.55	<.001	0.85	2.25
	EQ x Game Outcome	-0.06	<.001	-0.09	-0.04
	Gender x Opponent Gender	-0.28	.432	-0.98	-0.42

Note. Random Effects for both models: $ICC = 0.44$. Game outcome was coded as 0 = win, 1 = lose. Opponent gender was coded as 0 = girl, 1 = boy. Gender was coded as 0 = girl, 1 = boy.

Table 6*MLM Model (Main Effects and Trimmed Models) for Message Prosociality*

	Parameter	β	p	95% CI	
				Lower Bound	Upper Bound
Main Effects Model	(Intercept)	1.07	<.001	0.83	1.32
	Game Outcome	0.02	.671	-0.07	0.11
	Opponent Gender	-0.05	.279	-0.14	0.04
	Trial	-0.05	.095	-0.10	0.01
	Age	0.01	.127	-0.00	0.02
	Gender	-0.27	.113	-0.60	0.06
	Vocabulary	-0.03	.416	-0.10	0.04
	EF Composite	0.08	.536	-0.18	0.35
	Theory of Mind	0.04	.584	-0.11	0.19
	EQ	-0.00	.565	-0.02	0.01
	CHEXI	-0.00	.973	-0.01	0.01
	Parameter	β	p	95% CI	
				Lower Bound	Upper Bound
Trimmed Model	(Intercept)	1.07	<.001	0.83	1.32
	Game Outcome	0.02	.644	-0.07	0.11
	Opponent Gender	-0.05	.278	-0.14	0.04
	Trial	-0.05	.095	-0.10	0.01
	Age	0.01	.128	-0.00	0.02
	Gender	-0.27	.113	-0.59	0.06
	Vocabulary	-0.03	.416	-0.10	0.04
	EF Composite	0.08	.536	-0.18	0.35
	Theory of Mind	0.04	.584	-0.11	0.19
	EQ	-0.00	.808	-0.02	0.01
	CHEXI	-0.00	.973	-0.01	0.01
	EQ x Game Outcome	-0.00	.171	-0.01	0.00

Note. Random Effects for both models: $ICC = 0.51$. Game outcome was coded as 0 = win, 1 = lose. Opponent gender was coded as 0 = girl, 1 = boy. Gender was coded as 0 = girl, 1 = boy.

Table 7*MLM Models (Main Effects and Trimmed Models) for Stickers Allocated to Opponent*

Parameter		β	p	95% CI	
				Lower Bound	Upper Bound
Main Effects Model	(Intercept)	1.95	<.001	1.75	2.14
	Game Outcome	0.16	.001	0.06	0.26
	Opponent Gender	0.02	.712	-0.08	0.11
	Pre-game/Post-game Timing	0.18	<.001	0.08	0.28
	Age	0.01	.170	-0.00	0.02
	Gender	-0.35	.005	-0.60	-0.11
	Vocabulary	0.04	.113	-0.01	0.10
	EF Composite	-0.01	.928	-0.21	0.19
	Theory of Mind	-0.11	.044	-0.22	-0.00
	EQ	0.01	.250	-0.00	0.02
	CHEXI	-0.00	.923	-0.01	0.01
Parameter		β	p	95% CI	
				Lower Bound	Upper Bound
Trimmed Model	(Intercept)	2.01	<.001	1.81	2.21
	Game Outcome	0.04	.612	-0.10	0.17
	Opponent Gender	0.02	.708	-0.08	0.27
	Pre-game/Post-game Timing	0.18	<.001	0.08	0.27
	Age	0.01	.175	-0.00	0.02
	Gender	-0.47	<.001	-0.74	-0.21
	Vocabulary	0.04	.114	-0.01	0.10
	EF Composite	-0.01	.925	-0.21	0.19
	Theory of Mind	-0.11	.045	-0.22	-0.00
	EQ	0.01	.251	-0.00	0.02
	CHEXI	-0.00	.919	-0.01	0.01
	Gender x Game Outcome	0.24	.014	0.05	0.43
	Theory of Mind x Game Outcome	0.07	.088	-0.00	0.13

Note. Random Effects for both models: $ICC = 0.40$. Game outcome was coded as 0 = win, 1 = lose. Opponent gender was coded as 0 = girl, 1 = boy. Timing was coded as 0 = pre-game, 1 = post-game. Gender was coded as 0 = girl, 1 = boy.

Table 8*MLM Model (Main Effects) for Stickers Allocated to Unknown Peer*

	Parameter	β	p	95% CI	
				Lower Bound	Upper Bound
Main Effects Model	(Intercept)	2.29	<.001	2.09	2.49
	Pre-game/Post-game Timing	0.09	.314	-0.08	0.26
	Age	0.01	.078	-0.00	0.02
	Gender	-0.17	.200	-0.43	0.09
	Vocabulary	0.04	.180	-0.02	0.10
	EF Composite	-0.07	.541	-0.27	0.14
	Theory of Mind	-0.09	.130	-0.21	0.03
	EQ	0.01	.242	-0.00	0.02
	CHEXI	0.00	.479	-0.01	0.01

Note. Random Effects: $ICC = 0.38$. Trimmed model not presented as no significant interactions emerged, and no hypotheses regarding interactions were stated. Game outcome was coded as 0 = win, 1 = lose. Opponent gender was coded as 0 = girl, 1 = boy. Timing was coded as 0 = pre-game, 1 = post-game. Gender was coded as 0 = girl, 1 = boy.

Table 9*Percentages of Attributions of Game Outcome*

	Girl Opponent			Boy Opponent		
	Win	Lose		Win	Lose	
Boys	52.1%, 26.8%, 21.1%	18.6%, 62.9%, 18.6%		48.4%, 33.6%, 18.2%	14.1%, 69.0%, 16.9%	
Girls	52.2%, 20.9%, 26.9%	6.0%, 64.2%, 29.8%		55.2%, 19.4%, 25.5%	11.9%, 59.7%, 28.4%	
Both genders	52.2%, 23.9%, 23.9%	12.4%, 63.5%, 24.1%		51.8%, 26.6%, 21.6%	13.0%, 64.5%, 22.5%	

Note. Coding categories: **internal attribution**, **external attribution**, **neutral attribution**

Percentages are calculated based on number of participants who made that category of attribution explanation, divided by the number of participants who completed that condition, then multiplied by 100.

Table 10

Logistic MLM Model (Main Effects) for Contextual and Individual Factors on Outcome Attributions

	Parameter	β	p	95% CI	
				Lower Bound	Upper Bound
Main Effects Model	(Intercept)	0.35	.007	0.16	0.74
	Game Outcome	16.12	<.001	8.49	30.62
	Opponent Gender	1.06	.834	0.64	1.75
	Age	1.05	<.001	1.03	1.08
	Gender	1.48	.169	0.84	2.61
	Vocabulary	1.01	.893	0.90	1.14
	EF Composite	0.88	.601	0.54	1.42
	Theory of Mind	0.86	.233	0.68	1.10
	EQ	1.01	.653	0.98	1.03
	CHEXI	0.99	.282	0.97	1.01

Note. Random Effects: $ICC = 0.08$. Trimmed model not presented as no significant interactions emerged, and no hypotheses were stated for interaction effects. Game outcome was coded as 0 = win, 1 = lose. Opponent gender was coded as 0 = girl, 1 = boy. Gender was coded as 0 = girl, 1 = boy. Outcome attributions were coded as 0 = internal, 1 = external (attributions in the other category were not included in the model).

Table 11*Bivariate Correlations of Attributions for Outcome on Performance and Social Behaviour*

		Attributions for Winning	Attributions for Losing
Performance (mean of trial 3 scores)	Winning Conditions	-.087	
	Losing Conditions		.009
Prosociality (mean of trial 3 messages)	Winning Conditions	-.104	
	Losing Conditions		.161
Post-Game Stickers Distributed	Winning Conditions	.007	
	Losing Conditions		.110
Age (in months)		.323**	.305**

Note. * $p \leq .05$; ** $p \leq .01$.

Attributions were coded as: internal = 0, external = 1, other = missing data.

Table 12

Percentages for Explanations of Sticker Distribution

	Girl Opponent		Boy Opponent		Unknown Peer
	Win	Lose	Win	Lose	
Boys	5.4%, 1.4%, 2.7%, 58.1%, 28.4%	1.4%, 4.3%, 4.3%, 70.0%, 20.0%	4.2%, 1.4%, 2.8%, 68.1%, 23.6%	1.4%, 4.2%, 1.4%, 69.4%, 23.6%	14.3%, 1.4%, 1.4%, 27.1%, 55.7%
Girls	14.9%, 1.5%, 1.5%, 53.7%, 28.4%	0.0%, 1.5%, 3.0%, 64.2%, 31.3%	15.9%, 0.0%, 4.3%, 52.2%, 27.5%	4.5%, 1.5%, 4.5%, 62.7%, 26.9%	22.4%, 0.0%, 6.5%, 14.9%, 55.2%
Both genders	10.1%, 1.4%, 2.2%, 57.2%, 29.0%	1.0%, 2.9%, 3.6%, 67.2%, 25.5%	10.0%, 1.0%, 3.5%, 60.1%, 25.5%	3.3%, 3.3%, 3.3%, 74.8%, 15.4%	18.2%, 1.0%, 4.4%, 21.2%, 55.5%

Note. Coding categories: prosocial, antisocial, equality, merit, other

Percentages are calculated based on number of participants who made that category of attribution explanation, divided by the number of participants who completed that condition, then multiplied by 100.

Table 13*Bivariate Correlations of Sticker Distribution and Merit Scores*

	Post-Game Sticker Distribution (Winning Conditions)	Post-Game Sticker Distribution (Losing Conditions)	Merit Score (Winning Conditions)	Merit Score (Losing Conditions)
Post-Game Sticker Distribution (Winning Conditions)	-	.327(.311)**	-.110(-.150)	-
Post-Game Sticker Distribution (Losing Conditions)	-	-	-	.329(.287)**
Merit Score (Winning Conditions)	-	-	-	.587(.528)**
Age (in months)	.109	.252**	.227**	.254**

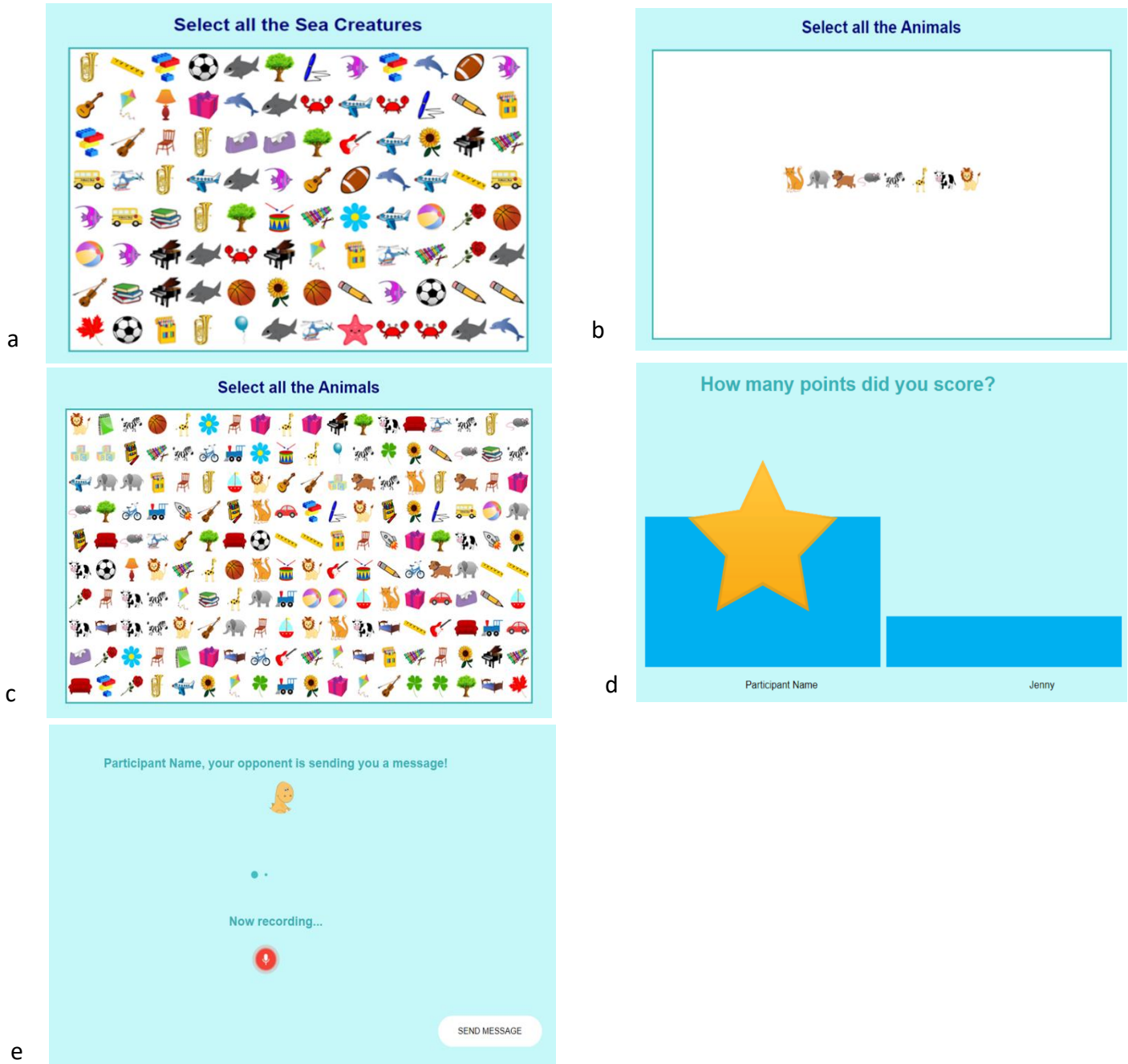
* $p \leq .05$; ** $p \leq .01$

Partial correlations controlling for age in parentheses.

Figures

Figure 1

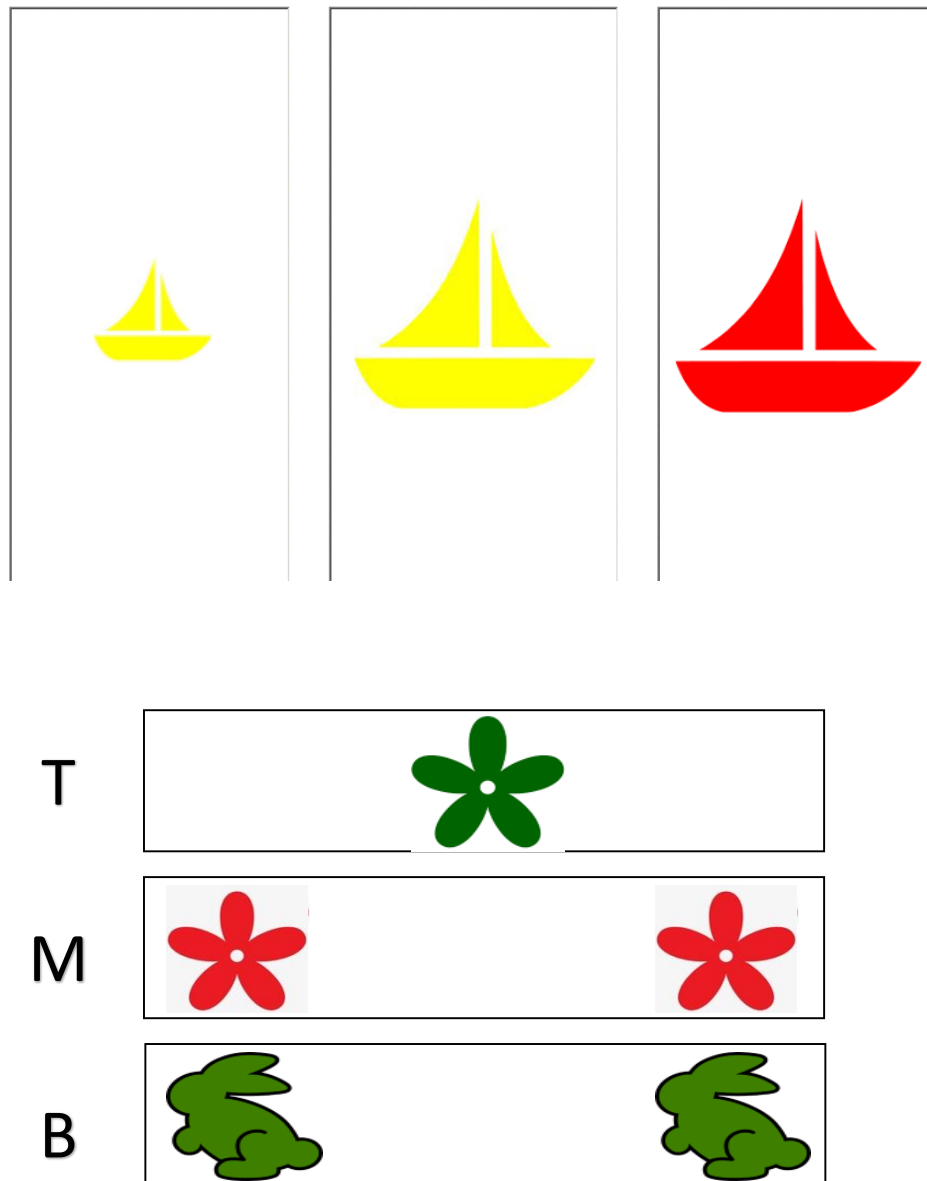
Competitive Game Screenshots



Note. a) Practice screen; b) Target Object Introduction screen; c) Gameplay screen; d) Feedback screen (winning condition); e) Record message screen

Figure 2

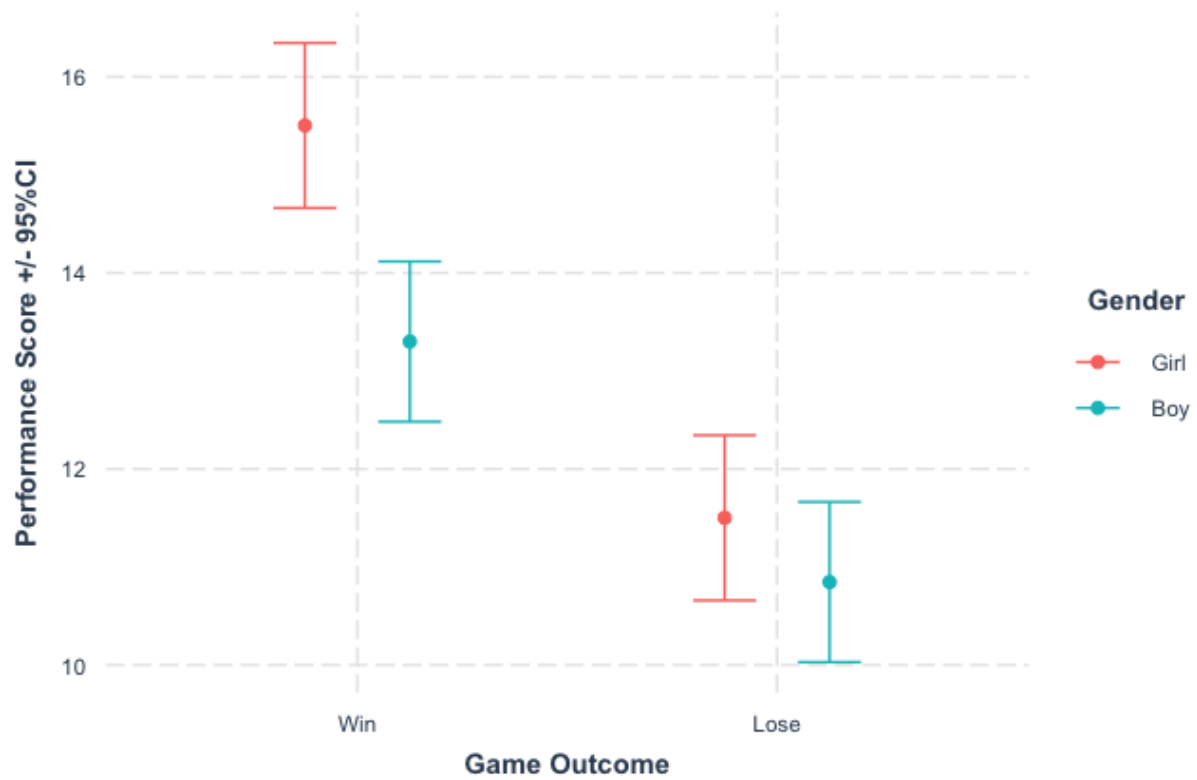
Examples of Stimulus Cards from the Cognitive Flexibility Task



Note. Examples have been modified from original stimulus cards due to copyright permissions.

Figure 3

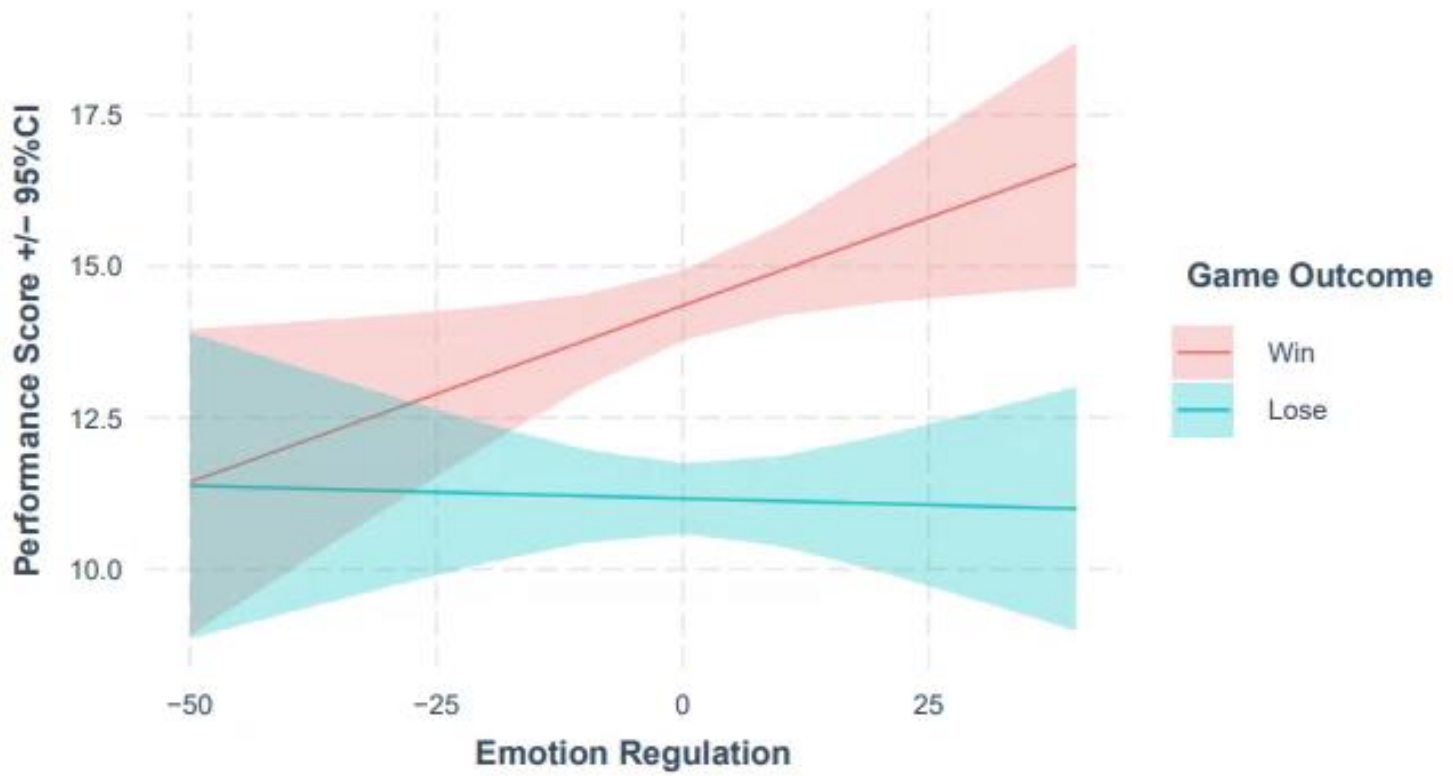
Estimated Marginal Means for Game Outcome on Performance score, for Girls and Boys



Note. Error bars represent 95% CI.

Figure 4

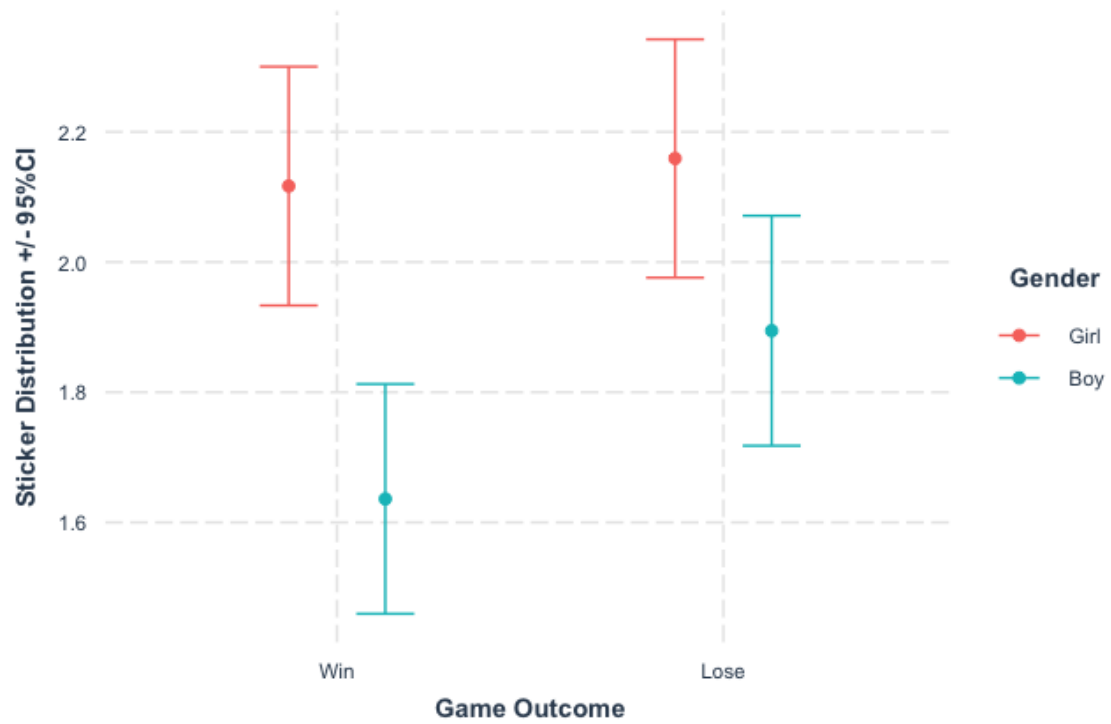
Simple Slopes for Emotion Regulation on Performance score, for Winning and Losing



Note. Outer gradients of slope lines represent 95% CI.

Figure 5

Estimated Marginal Means for Game Outcome on Sticker Distribution to Opponents, for Girls and Boys



Note. Error bars represent 95% CI.