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Sibling Rivalry or Sibling Revelry: A Multifactorial Approach to Understanding the Sibling Relationship from the View of Typically Developing Siblings of Children with ASD

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SIBLING RIVALRY OR SIBLING REVELRY: A MULTIFACTORIAL APPROACH TO UNDERSTANDING THE SIBLING RELATIONSHIP FROM THE VIEW OF TYPICALLY DEVELOPING SIBLINGS OF CHILDREN WITH ASD

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Sibling Rivalry or Sibling Revelry: A Multifactorial Approach to Understanding the Sibling Relationship From the View of Typically Developing Siblings of Children with ASD (August 2016)

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The sibling relationship is the longest lasting relationship in a person's life, and therefore significant research has sought to understanding genetic and environmental factors that shape the development of this long-lasting bond. The current study aimed to understand the experience of typically-developing (TD) siblings growing up with a sibling who has an autism spectrum disorder (ASD), and to determine if their experiences differ from neurotypical (NT) siblings (children who do not have a sibling with ASD). The focus of this study was on the TD siblings' perceptions of their own self-concept, social support, parental partiality, and overall satisfaction with his or her sibling relationship. It extends previous research by adding a unique observational component, where the interactions between TD and ASD siblings were compared to the behaviors of NT sibling dyads during structured play tasks, to identify whether or not unique patterns of behavior emerge between TD and ASD siblings as compared to NT siblings. Results demonstrate that self-reported perceptions of social support, parental partiality, satisfaction with the sibling relationship and self-concept did not differ by group; however, certain observed sibling play behaviors did differ by group. Taking these associations one step further, analyses that tested whether self-report measures predicted observed play behaviors were partially supported for the sample as a whole; however,

these predictions did not differ by group. Implications of these results are discussed, with the ultimate goal of bolstering sibling relationship development for all children, particularly those who have a sibling with ASD.

DEDICATION

"*We're sisters- because I don't know what I would do without my sister."*

This dissertation work is dedicated to my sister, my greatest idol and my best friend. As brilliantly successful and determined young professional, I aspire to achieve greatness in my field the way you have already achieved it in yours. Thank you for being my rock, both during this dissertation journey and through life, and for inspiring me to take on the challenges that seem insurmountable. You have always been there to pick me up, dust me off, and kick my butt right back into gear. If there is one take away that is clear in my research, it is that the sibling relationship is the most enduring relationship in a person's life, and there is no one I would rather be stuck with but you.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

Sibling relationships are dynamic, ever evolving bonds between individuals that are influenced by a host of environmental and genetic factors. Growing up with a brother or sister shapes a person's social and emotional development in many ways. Siblings alter broad family dynamics and provide to each other both positive and negative life experiences. Siblings provide a "practice relationship" for how to navigate social interactions with similarly aged peers. The purpose of this study is to understand how a typically developing (TD) child perceives his or her relationship with a sibling who has an autism spectrum disorder (ASD). Additionally, this is the first known study of its kind to have sibling pairs engage in structured play tasks without prior study-specific training or intervention. While previous research has examined the utility of using typically developing siblings as "peer therapists" to teach specific play skills to their siblings with ASD (Celiberti & Harris, 1993; Ferraioli, Hansford, & Harris, 2012; Reagon, Higbee, & Endicott, 2006), this project is unique in that siblings were asked to engage with each other without any study-specific training and with no explicitly stated objectives expected during the play session. Play tasks behaviors of older siblings who have a younger sibling with ASD (TD older siblings) were compared to the play behaviors exhibited by neurotypical older siblings (NT older siblings) to better understand how interactions may be altered when one sibling has ASD. Through self-report measures and structured play tasks, the goal of this project was to capture typically developing siblings' perspectives about their relationships with their siblings who have ASD, as well as to subsequently

observe similarities and differences in play behaviors between pairs of siblings when one has ASD, as compared to pairs of siblings where both children are neurotypical.

Throughout this dissertation, it is important to note that "ASD sibling" refers to the child with ASD and "TD sibling" is the typically developing older sibling in that pair. Contrastingly, a "NT older" refers to the neurotypical older sibling, and "NT younger" refers to the younger neurotypical sibling, where neither child in the family has an ASD diagnosis. These terms will be used consistently to differentiate between the experimental and control groups. Figure 1 is a visual representation of the 4 groups and corresponding labels.

The Sibling Relationship in Typical Development

Research. The majority of people in the United States are raised with at least one sibling, and though the sibling relationship is often one of the longest-lasting in an individuals' life (Cicirelli, 1995; Hernandez, 1997; US Bureau of the Census, 2005; Whiteman, McHale, & Soli, 2011), research investigating the factors that shape and influence the development of this relationship has many areas warranting further empirical attention. To complicate matters further, researchers in the early 1990s identified over 26 different types of siblings that a child can have, and it can be assumed that this number has only increased as the layout of family trees has grown increasingly more complex (Treffers, Goedhart, Waltz, & Kouldijs, 1990).

The sibling relationship in early to middle childhood can be characterized as emotionally uninhibited (Pike, Coldwell, & Dunn, 2005; Dunn, 2002) with siblings demonstrating increased ambivalence toward each other (Dunn, 2002). When at home, children are somewhat stuck with each other, spending more time with each other in

middle childhood than with parents (McHale & Crouter, 1996). This increased time spent together does not automatically foster a warm and loving relationship in all cases. On the contrary, researchers find that most sibling relationships go through bouts of extreme highs and lows, and these intense exchanges occur within the same relationship (Kim, McHale, Osgood, & Crouter, 2006). Other researchers found that some children are naturally affectionate toward one another, providing support and comfort, while other children are hostile and aggressive (Dunn, Slomkowski, & Beardsall, 1994). In sum, no two sibling relationships are exactly alike, and there is significant variability across and within these relationships.

Sibling relationships develop over time, progressing through numerous stages that researchers are still attempting to characterize. In early childhood, siblings begin to take an active interest in each other, providing a means through which sociocognitive development can occur (Dunn & McGuire, 1992). During middle childhood, the relationship becomes more egalitarian, but it is unclear if this is due to a decrease in both siblings' dominance (Buhrmester & Furman, 1990), or if it reflects an increase in power exhibited by the younger sibling at this particular developmental stage (Vandell, Minnet, & Santrock, 1987). Middle childhood can be described as a time when there is an increase in positivity and cooperation between siblings in their interactions, as well as increased conflict (Vandell, et al., 1987). Contrastingly, others describe middle childhood as a time when siblings show a decline in feelings of companionship, with little documented change in affection between siblings (Buhrmester & Furman, 1990). Early research, while calculated in its efforts to characterize specific trajectories of sibling development, provides more mixed results than concrete pathways.

Recent research on sibling development points to a more dynamic, evolving nature with which to characterize the sibling relationship context, and highlights factors such as self-concept, unique characteristics of both siblings, and family dynamics as direct influences on the growth of a sibling relationship (Richmond, Stocker, & Rienks, 2005) that then need to be parsed out and investigated further. As an early step, researchers identified processes and factors that may influence the development of this life-long bond, and this is best understood by "viewing" the sibling relationship through different theoretical lenses.

Theoretical Perspectives

Psychoanalytic Theory. Numerous theories have been posited to better understand the development of sibling relationships over time, highlighting the multidimensional nature of these relationships. During the early 1900s, Alfred Adler and fellow psychoanalytic psychologists focused their research on the growth and development of individual personalities, emphasizing the role that external social influences (e.g., family systems and siblings) in shaping the development of personalities. Adler was interested in how social comparisons and power dynamics within family systems exerted influence over a person's sense of self. His work highlighting the inferiority conflict that often arises between siblings emphasizes the importance of a sibling's sense of egalitarianism in the family, and bolsters more recent work showing that feelings of equal treatment among siblings by parents in a family promoted positive self-esteem in each individual (Whiteman et al., 2011). While feelings of equality amongst siblings is an important factor that exerts influence over the subsequent relationship fostered between siblings, it

is also important to consider how early attachment between individuals in the family context also contributes to these maturing relationships.

Attachment Theory. Attachment theorists (e.g., Bowlby, 1969) focus on early bonds between infants and caregivers and emphasize the critical nature of these early relationships on an infant's survival. Infants are born with innate mechanisms (e.g., crying) that promote caregiver attention, and level of security between mother and child depends upon the level of sensitivity and responsiveness of a caregiver to the infant's needs (Bowlby, 1969). Children learn to use a caregiver as a secure base from which to explore their surroundings, yet these securely attached children know they can return to their caregiver for comfort in times of distress. If fostered appropriately, secure attachments serve as an internal working model for future relationships, particularly important for the establishment of later secure sibling relationships (Dunn & McGuire, 1992). Conversely, a relationship characterized by insecure attachment with a caregiver in early development can lead to later conflict, increased distance between individuals, and general dissatisfaction in both current and future relationships, including those with siblings. Therefore, attachment theorists posit that early responsiveness and security with caregivers forges the basis for secure relationships with siblings (Whiteman et al., 2011). Lasting bonds and early infant-caregiver attachment alters later abilities to connect and create meaningful relationships with others, though the mutuality of benefits and rewards attained across social relationships is also important to consider.

Social Psychological Theory. According to social psychological theory, the bidirectionality of individuals' influences on each other, as well as the cognitive appraisal and understanding of the motivation behind others' behaviors, likely influences sibling

relationship development. Attribution theorists suggest that the ways by which individuals justify their behavior, and their motivations for a particular behavior, directly effects the levels of conflict and harmony between individuals. Attributional theorists focus on understanding motivations that incite behaviors (Heider, 1958). When applied to sibling behaviors, it suggests that when siblings understand and accept a rationale for why their siblings engage in certain actions, less conflict is seen within the relationship.

In addition to gaining an understanding of why siblings engage in certain behaviors, Festinger's Social Comparison Theory (Festinger, 1954) suggests that individuals are hardwired to evaluate their own selves based on their appraisals of how they compare to others around them, particularly when they feel those around them are similar to themselves. Sibling relationships therefore, both due to proximity of a sibling in the environment and genetically hardwired similarities amongst siblings, are prime relationships that foster social comparison (Whiteman et al., 2011). While siblings share genetic and environmental factors, the way they interact with each other and the benefits they perceive in fostering the sibling relationship is also important to consider.

Social Learning Theory. Some social learning theorists emphasize equity theory (e.g., Adams, 1965), highlighting the importance of maintaining a balance between contributions to and rewards gained from a relationship with another person. Dissatisfaction within the relationship is thought to be caused by the belief that there is an imbalance between contributions made toward the development of a relationship and rewards gained from that relationship. Similarly, social exchange theorists posit the importance of the rewards gained from an investment in a relationship (Thiabut & Kelly, 1959). When costs outweigh benefits, an individual withdraws from that relationship,

particularly if a more fruitful relationship is available to them (Whiteman et al., 2011). These theories are important to consider when examining the sibling relationship, as once children reach middle childhood, they are more readily able to seek out other, more fruitful relationships with friends that are not solely limited to the immediate family context.

Social learning theorists also believe that individuals acquire knowledge, attitudes, and beliefs through observation of others' behaviors and subsequent reinforcement (Bandura, 1977). Individuals come to understand their environment by interacting with and observing the interactions of others. In terms of sibling relationship development, influences include parental modeling of behavior (e.g., conflict resolution), which teaches siblings how to handle future interactions with one another, as well as observation and imitation of others' behaviors. When siblings imitate each other in early childhood, they reinforce each other's behavior and function as a mutual model of social learning (Whiteman et al., 2011). While many of these theories focus on dyadic relationships (e.g., bidirectionality of sibling relationships), it is also important to consider the broader family context when understanding both individual maturation and siblings' mutual relationship development.

Family Systems Theory. Family System approaches take the focus of attention away from the individual and center it upon the interactions of the broader context and/or environment in which relationships develop. General systems theorists (e.g., Bertalanffy, 1950) believe that individuals are best understood when studying a family holistically. Family system theorists emphasize the interactive and interdependent nature of family networks, whereby the behaviors of individuals or subgroups influence the broader

system (Minuchin, 1988; Brody, 1998). In a family systems approach, unique boundaries are maintained between subsystems (e.g., immediate vs. extended family), as well as with other members of the family (e.g., between siblings). Rigid boundaries between family members are therefore seen as one of the catalysts for increased family dysfunction (Whiteman, et al., 2011). Additional studies are influenced by the spillover hypothesis (e.g., Engfer, 1988), where subsystems can influence each other through the transference of behavior or emotional qualities across relationships (Pike et al., 2005). This idea of the mutuality of influences on relationship development is also central in a more ecological systems-based approach.

Ecological Systems Theory. The ecological system theory (e.g., Bronfenbrenner, 1979; 1986) is one additional framework used to not only understand siblings, but also broad family behaviors and relationships. The ecological systems theory emphasizes a multilayered approach, where in the microsystem, the context in which individuals go about their daily lives is considered, including the home environment and neighborhood. Subsequently, the mesosystem, exosystem, and macrosystems take into account factors that influence these contexts, including broad societal forces, cultural uniqueness, and the interactions between these systems (Whiteman et al., 2011).

While all of these theories contribute to our understanding of the sibling relationship and provide unique perspectives on development over time, the tightly woven interconnectedness of these characteristics is apparent. After highlighting some of the main theories applied to sibling development, it is clear that a multidimensional theoretical framework is most appropriate. Genetically hardwired dispositions, shared environmental characteristics, availability of social networks, and exchanges with family,

friends, and resources all exert influence over the development of sibling relationships. The interactions between siblings exert influence on each other as well as on relationships with parents, and each dyad exerts influence over other dyadic relationships within the family system as a whole. For the purpose of this study, the main dyadic relationship focused on was that of the sibling pair, though parental and other environmental factors (as discussed below) are also considered.

Broad Influences on Sibling Relationships

While it is not feasible to account for every possible influence on the developing relationship between siblings, many factors uniquely contribute to sibling relationship development.

Temperament. Temperamental characteristics of siblings have a significant impact on the development of the sibling relationship (Dunn & McGuire, 1992). Dunn and colleagues demonstrated that children with a more hostile, rigid, or active temperament often reported more conflicted relationships with their siblings (Munn & Dunn, 1989). Similarly, other researchers have highlighted the importance between understanding the match between sibling temperamental styles in preventing sibling conflict (Boer, 1990; Dunn & McGuire, 1992). Brody and colleagues suggest that when there is a mismatch between siblings' temperaments, positive qualities of one sibling may buffer or counteract the effects of a more difficult temperament in the other; however, siblings with similar temperaments frequently yield stronger and less conflicted relationships (Stoneman & Brody, 1993; Brody, 1998).

Family Cohesion. The closeness and connectedness of the family unit plays an important role in sibling relationship development in numerous ways. For example,

contrary to what may be expected, there is some evidence to suggest that disharmonious family environments can influence the sibling relationship in a positive way. When faced with a tumultuous home environment, siblings may seek out or provide comfort, nurturance, and support from each other (Jenkins, 1992; Jenkins, Smith, & Graham, 1989). Often because of the mutually experienced lack of warmth from caregivers, siblings look to each other for increased social contact, and tend to confide more in each other as opposed to friends due to their shared negative experiences (Dunn & McGuire, 1992). Sadly, some researchers have found intense sibling loyalty develops when parents are uninvolved with their children (Bank & Kahn, 1982; Dunn & McGuire, 1992). The lack of positive social contact between siblings in these types of environments shapes relationship development as children mature.

Parental Partiality. While no two children are alike, parental partiality, or distinctly different treatment of siblings by parents in a family unit, can negatively influence sibling closeness. In families where mothers show increased partiality toward one sibling, increased hostility and conflict are reported (Boer, 1990; Brody & Stoneman, 1987; Brody, Stoneman, & Burke, 1987; Bryant & Crockenberg, 1980; Stocker, Dunn, & Plomin, 1989). In a longitudinal study conducted by Richmond and colleagues (2005), children who felt their sibling was favored by parents across time exhibited more externalizing behaviors, demonstrating the negative influence of parental partiality has on both siblings involved. When one sibling feels less favored, he or she may exhibit internalizing or externalizing behaviors to elicit a response from a parent, expressing more anger and resentment toward the favored sibling. In contrast, the sibling who feels

more favored is likely to exhibit similar negative behaviors if he or she then feels a reduction of favoritism in the parent-child relationship (Yahav, 2007).

While differential parenting often increases conflict among siblings, parental involvement in sibling conflict can mediate and reduce negative feelings among siblings. While early research found a positive correlation between parental involvement in arguments and number of arguments between siblings (Brody & Stoneman, 1987; Brody et al., 1987; Dunn & Munn, 1986), further studies suggest that when parents play a more "direct" role by modeling, intervening, supervising, and coaching their children through conflict within the sibling relationship, the children exhibit increased social competence and independence (Finnie & Russell, 1988).

Self-Concept. As researchers begin refine their conceptualization of factors that influence the dyadic sibling relationship, some attempt to better understand the impact of this relationship on an individual's self-concept. In a study looking at the perceptions of sibling, parent, and friend relationships and the impact of those perceptions on psychological adjustment, researchers found that warmth in a sibling relationship was associated with a higher self-worth (Stocker, 1994). Interestingly, a compensatory model was also described, suggesting that it is possible that stronger sibling or friend relationships could buffer the impacts of a less cohesive parental relationship, or vice versa (Stocker, 1994). Decreased perceived parental partiality was also associated with stronger ratings of self-concept (Zervas & Sherman, 1994). Nonetheless, these studies highlight the impact of sibling, friend and family relationships on an individual's self-esteem and self-worth.

Socialization. Relationships with friends, family members, and siblings shape the development of a person's self-concept. When children have a warm and nurturing relationship with others, they may feel accepted and supported, leading to feelings of heightened self-worth (Zervas & Sherman, 1994). Feelings of self-competence may then foster confidence in interacting with others and increase feelings of affection within these relationships. Contrastingly, when children feel rejected or unsupported, they may feel lonely or inadequate. The impact of a lower self-worth may cause the individual to withdraw in social situations, therefore reducing the opportunity and frequency with which he or she can develop more stable relationships (Zervas & Sherman, 1994).

Satisfaction within the relationship. The strongest predictor of well-being among a sample of 65 year old male Harvard alumni was the quality of the relationship they reported with their sibling during college (Vaillant & Vaillant, 1990), demonstrating the impact of the sibling relationship on feelings of satisfaction and general well-being over the lifespan. While measures of well being have been validated for use in children, fewer studies to date have investigated the feelings of satisfaction with the sibling relationship in young children. Nonetheless, it is believed that the quality of sibling relationship in early development impacts feelings of satisfaction both early and later in life (Sage & Jegatheesan, 2010).

While satisfaction with the sibling relationship can be influenced by a host of factors, some research suggests it is the perception of sibling behaviors that may increase satisfaction. For example, maintenance behaviors, or behaviors exhibited by each individual to continue or strengthen the sibling relationship are associated with relationship satisfaction (Myers & Rittenour, 2012). Interestingly, maintenance strategies

are largely communicative behaviors that contribute to relationship quality (McNallie & Hall, 2015), and this has implications for siblings who show deficits in social or communicative behaviors, further discussed below.

Life Events. Because no child grows up in an isolated, impenetrable bubble, it is important to consider life events that can occur in families that would disrupt the family environment and ultimately impact the sibling relationship. Chronic, long-lasting stressors such as marital discord, parental mental illness or divorce are unique circumstances associated with future increased risk for emotional and behavioral issues in children (Gass, Jenkins & Dunn, 2007). Shorter term 'life events' that are considered normal occurrences (e.g., moving to a new school, bereavement) can have equally significant impacts on psychological health (Goodyer, 2001), and should be considered when attempting to understand environmental influences on sibling relationship development. Some research supports the idea that a positive sibling relationship can buffer the impact of stress during times of discord within the family. In a study conducted in 2007, researchers found that more affectionate siblings are less likely to show a change in reported internalizing problems after experiencing stressful life events (Gass et al., 2007). This again demonstrates the need to foster warm and affectionate relationships between siblings in early childhood.

Consistency over time. Sibling relationships are highly consistent across the developmental lifespan of early childhood through adolescence. Numerous studies show that maternal reports of sibling negative and positive behaviors are consistent over time, with greater stability within the relationship evident at 5-10 years (middle childhood), and declines in sibling intimacy during adolescence (Dunn, Slomkowski, & Beardsall,

1994). In addition to parent report, observational measures at age six were significantly correlated with internalizing and externalizing behaviors between siblings measured seven years later (Dunn, et al., 1994). Additionally, researchers hypothesize that the stability of positive social behaviors seen from early childhood to adolescence is due to learned social competencies in young childhood that then endure through adolescence and foster later social development (Kramer & Kowal, 2005). Other longitudinal work highlights the notion that when sibling relationships become more stable over time, sibling rates of depression decline (Richmond et al., 2005). Additionally, the quality of the sibling relationship in early and middle childhood is predictive of children's adjustment in late childhood and adolescence (Bank, Burraston, & Snyder, 2004; Dunn et al., 1994; Hetherington, Henderson, & Reiss, 1999; Slomkowski, Rende, Conger, Simons, & Conger, 2001; Stocker, Burwell, & Briggs, 2002). Therefore, it is critical to foster quality sibling relationships early in child development.

Birth Order. The effect of birth order on sibling relationships has been studied since the late 1800s, when Galton analyzed the family structure of a group of British scientists (1874). He concluded that, because the majority of scientific leaders were firstborns, this overrepresentation was due to the rights granted to them by primogeniture, or the inheritance of everything by the firstborn, at the exclusion of the siblings (Galton, 1874). While this idea seems antiquated, later scientists concluded that birth order did influence sibling psychological adjustment, (e.g., Ansbacher & Ansbacher, 1956), but researchers have yet to identify the specific impact of birth order on sibling functioning. For example, do firstborn children experience feelings of jealousy and animosity toward a younger sibling, perhaps due to the belief that this additional individual is depleting

familial resources (Blake, 1981; McHale, Updegraff, & Whiteman, 2012)? Does entering a family as a second born child increase the likelihood that the individual will exhibit externalizing behaviors to elicit attention from parents? As with most research in the field, the results are mixed and tend to suggest that birth order is one piece of a larger set of factors exerting influence over the sibling relationship (Minnett, Vandell, & Santrock, 1983).

Gender. Same-sex and mixed-sex sibling dyads have been studied since the 1950s, to better understand the impact of gender, or gender differences, between siblings and how it shapes their growing relationship (Brim, 1958; McHale et al., 2012). Some researchers attribute variability within sibling relationships to differences in girls' versus boys' perspectives on close relationships (Maccoby, 1998), though again this is an area where the research is mixed. Contrastingly, other researchers show females report more affectionate sibling relationships overall (Furman & Buhrmester, 1992). Results become even more complex when considering same sex versus mixed sex dyads of siblings, as again the findings are inconclusive (Cole & Kerns, 2001; Stewart, Verbrugge, & Beilfuss, 1998; Stocker, Lanthier, & Furman, 1997).

The Sibling Relationship When One Child Has ASD

ASD is a neurodevelopmental disorder characterized by deficits in social communication as well as restricted interests and repetitive behaviors (APA, 2013). Current epidemiological studies estimate the prevalence of ASD as high as 1 in 68 children, representing a 28% increase over prior estimates (Baio, 2014). Most appropriately characterized as a spectrum disorder, the variability of behavioral presentation and the range of severity of maladaptive behaviors impact family dynamics

in different ways. Social deficits, a core component of an ASD diagnosis, can lead to difficulties interacting with siblings and parents early in development, contributing to broad deficits in navigating relationships as the child grows older.

While parents and siblings are frequently more tolerant of socially awkward behavior or atypical social interactions, peers are often less forgiving, and therefore social relationships outside of the family may be even more difficult. Amongst peers, children with ASD have difficulty with social interaction and some research suggests these children may become more isolated due to a lack of knowledge about appropriate social skills (Bass & Mulick, 2007). Knowing that the social trajectory of children with ASD is not as strong as typically developing children, it is important to understand the factors that will bolster meaningful relationships in the family context (i.e., siblings), helping to enhance prosocial skills and positive interactions with peers to foster broader overall social development.

The sibling relationship in ASD. While neurotypical sibling relationships are complex and multifaceted, additional challenges are presented when one sibling has an ASD. Research focusing on sibling relationships when one or both children have ASD is multifaceted and multidirectional. Some previous research focused on coping behaviors and emotional and behavioral adjustment of children who have a sibling with ASD (e.g., Hastings 2003a), while others investigated the factors that may influence this sibling relationship, such as gender, self-concept, or number of additional siblings in the household (e.g., Rivers & Stoneman, 2008). Furthermore, some researchers took it a step further and suggested the possible benefits to training TD siblings to act as therapists for their ASD siblings (Ferraioli et al., 2012). While the research characterizing the impact of

growing up with an ASD sibling is still somewhat in its early stages, the importance of understanding the complexities of this relationship is currently receiving increasing attention in the research community.

Research in TD sibling development. Many early studies suggest that TD siblings who are otherwise developing normally are adversely affected by growing up with a sibling who is disabled (Coleby, 1995). Some TD siblings exhibit higher rates of behavioral and emotional issues (Griffith, Hastings, & Petelas, 2014; Hastings 2003a; Orsmond & Seltzer, 2007), and fewer prosocial behaviors (Hastings 2003a; Knott, Lewis, & Williams, 1995) when compared to NT siblings. Research has also shown that TD siblings report less intimacy, less initiation of prosocial behaviors, and less nurturance in their relationship with their ASD sibling when compared to NT dyads (Kaminsky & Dewey 2001). Similarly, it is hypothesized that TD siblings are less prosocial even in the peer context because the sibling with ASD is less likely to seek out or initiate interactions with his or her TD sibling (Kaminsky & Dewey, 2001). More recent studies suggest that TD siblings may be more avoidant and less involved with their sibling when compared to siblings who do not have a disability (Walton & Ingersoll, 2015).

Contrastingly, many studies show TD siblings are just as well-adjusted as neurotypical siblings (Dempsey, Llorens, Brewton, Mulchandani, & Goin-Kochel, 2012; Kaminsky & Dewey, 2002; Mates, 1990; Pilowsky, Yirmiya, Doppelet, Gross-Tsur, & Shalev, 2004; Stoneman, 2001; Verte Royers, & Buysse, 2003). In a study by Kaminsky and colleagues, positive outcomes such as less conflict within the sibling relationship, higher reported self-esteem, and higher self-concept were reported by TD siblings as compared to neurotypical siblings (Kaminsky & Dewey 2002). Other studies suggest

higher levels of admiration, tolerance, empathy and selflessness in TD siblings (Ross & Cuskelly, 2006; Ferraioli & Harris, 2010). Additionally, when considering both parent and teacher reports of internalizing and externalizing disorders in TD siblings, TD siblings did not exhibit an increased prevalence of behavioral symptoms (Dempsey, et al., 2012; Shivers, Deisenroth, & Taylor 2013, Hastings & Petelas, 2014) and demonstrated significantly less aggression toward their ASD sibling (Walton & Ingersoll, 2015). Similarly, in a study that used both qualitative and quantitative measures, TD siblings didn't differ on self-report measures of cohesion; however, NT dyads reported more cohesion in their relationships. Interestingly, in the study, mothers of NT dyads rated their children's sibling relationships as more negative than those mothers in the ASD group (McHale, Sloan, & Simeonsson, 1986), suggesting that mothers of a child with ASD may maintain a more open and accepting view of their children's' sibling relationships compared to mothers who have NT children.

Positive views of the sibling relationship are not only reported by parents. TD siblings report greater admiration and less quarreling and competition with their ASD sibling as compared to neurotypical siblings (Kaminsky & Dewey 2001). Additional studies that looked at prosocial and emotional adjustment found that TD siblings report enhanced psychosocial and emotional development (Macks & Reeve, 2007). Even when looking at sibling adjustment, while taking into consideration factors such as gender and family size, conclusions do not support the need for "special intervention" for TD siblings (Mates, 1990).

Factors that Influence ASD Sibling Relationship Development

BAP. Biologically related siblings share similar genetic makeup and the majority of siblings grow up in a shared home environment. When considering the genetic overlap between siblings, researchers found that TD siblings had substantially elevated scores on a broad autism behavior questionnaire as compared to neurotypical dyads (Hurley, Losh, Parlier, Reznick, & Piven, 2007). This suggests that the shared broad autism phenotype (BAP) characteristics, or the subclinical presentation of autism symptoms considered by many as a phenotypic expression of the genetic risk for ASD (Piven, 2001), may significantly impact the TD siblings' interactions with his or her ASD sibling in autism-specific ways (Constantino, Lajonchere, Lutz, Gray, Abbacchi, McKenna, … Todd, 2006). Greater expression of BAP in the sibling was also associated with increased adjustment difficulties (also moderated by autism severity) in more recent studies (Meyer, Ingersoll, & Hambrick, 2011; Mohammadi & Zarafshan, 2014). Contrastingly, in a study by Walton and Ingersoll, authors found that BAP was related to psychosocial difficulties, but only when additional family stressors were present, suggesting that perhaps having a sibling with ASD is protective and attenuates the negative characteristics of sibling BAP (2015).

In a recent study conducted by Petelas and colleagues, the diathesis-stress model was applied to a study that investigated how BAP characteristics in the TD sibling may interact with environmental and family factors to predict TD sibling functioning (2012). Researchers found that sibling relationships were more negative as behavior problems increased in the ASD sibling. TD siblings with greater BAP characteristics reported greater behavioral problems (Petelas, Hastings, Nash, Hall, Joannidi, & Dowey, 2012),

and it was similarly replicated for boys in more recent studies (Walton & Ingersoll, 2015). These studies suggest that TD siblings, particularly male TD siblings, exhibit behaviors commonly associated with the autism spectrum at a subclinical level, therefore potentially influencing the behavioral and social exchanges in significant ways and simultaneously putting them at risk for emotional or behavioral difficulties.

Autism Severity. It is important to consider the severity of the ASD behaviors exhibited by the ASD sibling and how these maladaptive behaviors could impact both the TD sibling and the relationship as a whole. Increased severity of ASD symptoms may lead a TD sibling to feel a burden of responsibility for the care of his or her ASD sibling (Orsmond & Seltzer, 2007). TD siblings often reported significantly higher amounts of stress and stressful life conditions (Benderix & Sivberg, 2007), particularly as they got older. Other research shows that ASD symptom severity was positively associated with adjustment difficulties in TD siblings, further mediated by maternal depression (Meyer, et al., 2011). Similarly, TD siblings of severe ASD children showed increased scores on an ASD behavioral screener as compared to TD sibling dyads (Constantino, et al., 2006), suggesting a possible relationship between symptom severity in the ASD sibling and subclinical presentation of symptoms in the TD sibling. Some research suggests that as ASD severity increases, challenges and stressors become more impactful on the TD sibling (Smith & Elder, 2010). Lastly, TD siblings in families with a less severe ASD sibling had fewer adjustment problems overall. However, it is important to note that this particular study also reported no overall negative effect of having an ASD sibling on TD sibling adjustment (Hastings, 2003b).

Gender. ASD symptom presentations are different for males and females. Similarly, the way TD siblings respond to a sibling with ASD can be gender dependent, as often females take on a more nurturing role toward helping their sibling with ASD (Beyer, 2009). While ASD is appropriately considered a spectrum disorder, the behavioral phenotypes of males and females with ASD are qualitatively different (Zwaigenbaum, Bryson, Szatmari, Brian, Smith, Roberts,…Roncadin, 2012). Early research suggests females with ASD have lower mean levels of cognitive functioning than boys, and increased mean levels of severe intellectual dysfunction (Lord & Schopler, 1985). More recent research conflicts with early studies, and finds boys exhibit more repetitive behavior symptoms (McLennan, Lord, & Schopler, 1993), and that higher functioning girls may be less likely to receive a diagnosis as compared to higher functioning boys (Zwaigenbaum, Bryson, Szatmari, Brian, Smith…Roncadin, 2012). Interestingly, more recent research suggests that gender may moderate the impact of having a sibling with ASD. Specifically, Walton and Ingersoll demonstrated that older brothers of children with ASD were at significantly higher risk of hyperactivity and peer difficulties (2015).

Birth Order. A recent article published by Martin and Horriat suggests birth order may have unique influences on the behavioral presentation of ASD across siblings (2012). Their findings suggest that second born children who are diagnosed with ASD exhibit more severe symptoms, and second-born children are more frequently diagnosed with ASD than first-born children (Martin & Horriat, 2012). Researchers from this study speculated that a genetic predisposition may result in a first-born child displaying subclinical levels of diagnostic symptoms (e.g., broad autism phenotype (BAP)

characteristics), but a second-born child exhibiting full-blown symptoms due to an additive effect of genetic mutations in parents over time. Tomney and colleagues also found that birth order significantly moderated the presentation of behavioral symptoms, but only when the child with ASD was older (Tomeny, Barry, & Bader, 2014). Though these results have yet to be replicated in larger samples, it sheds light on the possible impact of genetics on the unique behavioral presentations of first-born versus second-born siblings who have ASD.

Factors that Influence ASD Family Relationship Development

Stress & Resilience. A family unit is altered when a child is diagnosed with ASD (Meadan, Halle, & Ebata, 2010; Meadan, Stoner, & Angell, 2010; Morgan, 1988). The amount of reported stress or strain within the family environment can be dependent on the size of the family, as when there are more TD siblings in a home, the amount of responsibility and caretaking may be more dispersed across family members (Beyer, 2009). Additionally, parents report increased levels of stress in their own lives when their child is diagnosed with ASD (Rao & Beidel, 2009). Researchers who investigated the impact of resiliency factors (e.g., family connectedness, positive meaning making of the diagnosis, etc.) on family relationship development found that many families with a child with ASD are highly resilient (Bayat, 2007). While resilience can buffer some of the negative impacts of having a sibling with ASD (Giallo & Gavidia-Payne, 2006), it is important to investigate further factors that can be more easily controlled within the family environment.

Differential Parenting. In a study by El-Ghoroury and colleagues, parents initiated more play behaviors with their ASD sibling as compared to their TD sibling,

suggesting that parents may attempt to compensate for their child's disability level (El-Ghoroury & Romanczyk, 1999). Interestingly, it has also been suggested that TD siblings show similar compensatory strategies when engaging with their siblings who has a disability (O'Brien, Slaughter, & Peterson, 2011). However, increased feelings of differential parenting reported by TD siblings were associated with lower persistence to engage with their ASD sibling. Therefore, when TD siblings were dissatisfied with the differential parenting, the sibling relationship was negatively affected (Rivers & Stoneman, 2003). Similarly, perceived parental partiality was correlated with the quality of the relationship between siblings (McHale et al., 1986), suggesting that when siblings were displeased with differential parenting, the quality of the sibling relationship was adversely impacted (Rivers & Stoneman, 2008).

Factors that Influence TD Sibling Relationship Development

Self-Concept & Adjustment. While some research shows TD sibling self-concept development requires no significant need for intervention (Mates, 1990), other research suggests that TD siblings' self-appraisals influence the development of prosocial interactions among TD siblings with their ASD siblings (Verte, et al., 2003). Additionally, TD children in this study who report having lower self-concepts exhibited less social skills, suggesting that a more positive view of the self is needed to feel confident to interact with others in one's environment. However, this study concluded that overall, siblings are no more susceptible to adaptive problems as compared to neurotypical siblings (Verte, et al., 2003).

The self-reported relationship quality between TD and ASD sibling pairs in early childhood is predictive of TD sibling adjustment in later childhood. Positivity within the

sibling relationship was more strongly linked with later child adjustment than sibling conflict (Pike, Coldwell, & Dunn, 2005), suggesting that a positive relationship in early childhood is predictive of a more prosocial relationship over time. Thus, it is particularly important to focus on the development of this relationship when one sibling has ASD.

Socialization & Satisfaction. TD siblings who are more socially skilled are more favorably influencing the social skill development of their sibling with ASD (Brewton, Nowell, Lasala, & Goin-Kochel, 2012). Similarly, social support moderated the impact of autism severity on TD sibling adjustment in families with a child with ASD (Hastings, 2003b). All of these studies highlight the need to empower TD siblings with strong social skills, both as a buffer against the negative impacts of having a severely ASD sibling, but also as a coping strategy. Self-reported high levels of warmth in relationships with friends or mothers predicted significantly better outcomes in TD sibling adjustment, suggesting a compensatory relationship (Stocker, 1994).

Psychoeducation. Just as it is important to develop strong social skills in a TD sibling, it is also important to provide adequate, developmentally appropriate education about ASD to the TD sibling (Glasberg, 2000). Reported knowledge about ASD by the TD sibling was associated with the quality of sibling relationship, indicating that with increased knowledge about the behaviors exhibited by their ASD sibling comes a more meaningful relationship between TD sibling and his or her sibling with ASD (Roeyers & Mycke, 1995). Similarly, when researchers considered sibling knowledge of ASD and the coping strategies used by TD siblings when faced with stress relating to their sibling with ASD, they found that TD siblings are at an increased risk for internalizing behavior

problems. Investigators hypothesize that this may be due to a lack of knowledge about what having an ASD sibling means (Ross & Cuskelly, 2006).

While many parents view having a sibling with ASD as positive (Hutton & Caron, 2005), researchers note the benefits that positive support, effective coping strategies, open discussion, planning and sensitivity can have on facilitating more positive relationships between TD siblings and their siblings with ASD (Beyer, 2009). Particularly notable is the TD siblings' increased difficulty understanding, finding meaning, and or managing the impact of having a sibling with ASD when the behavioral presentation of ASD is severe (Smith, Elder, Storch, & Rowe, 2015). Though researchers and interventionists tend to focus treatment efforts on the child with ASD, it is important to empower the TD sibling through education, support, open communication, and providing a safe environment for the expression of feelings (Evans, Jones, & Mansell, 2001; Kramer, 2010; Petalas, Hastings, Nash, Dowey, & Reilly, 2009; Sage & Jegatheesan, 2010; Tsao, Davenport, & Schmiege, 2012). Research on expressed emotion within ASD families suggest it is an important aspect to understand, particularly when cultivating a successful family treatment plan (Griffith, Hastings, Petelas, & Lloyd, 2015). Unfortunately, research seems to show more negative impacts than positive impacts of having a sibling with ASD, even when compared to other disabilities (Bagenholm & Gillberg, 1991; Hodapp & Urbano, 2007; Knott et al., 1995, Orsmond & Seltzer, 2006; Ross & Cuskelly, 2006; Rivers & Stoneman, 2003. While an increased level of understanding of the disability leads to better relationship between siblings (Ünal & Baran, 2011), it is essential that researchers identify ways that growing up with an

ASD sibling impacts TD sibling functioning over time, with the ultimate goal of strengthening the bond between TD siblings and their siblings with ASD.

Current Study

This current study sought to investigate the TD sibling experience in growing up with an ASD sibling. The focus of this particular research is on the TD sibling, and how having a sibling with ASD impacts self-reported feelings of self-concept, socialization, parental partiality, and overall satisfaction with his or her sibling relationship. This study extends previous research by adding a unique observational component, where the interactions between TD and ASD siblings were compared to the behaviors of neurotypical NT sibling dyads during structured play tasks. The observational data collected by the research team was then analyzed along with results from self-report measure results, to identify whether or not unique patterns of behavior emerge between TD and ASD siblings as compared to NT siblings.

Most previous research utilizes parent report as the primary method for understanding the sibling relationship (Constantino et al., 2006; Hastings 2007; Macks & Reeve, 2007). To our knowledge, this study is the first of its kind to gather TD siblings' reports about their perceptions of the sibling relationship, while simultaneously utilizing a structured play-based observational task to provide an objective assessment of play-based interactions between siblings. Observation is often viewed as the most objective and reliable way to study processes within families (Hetherington, 1994), and thus by observing siblings playing with each other in structured tasks, researchers will be better equipped to identify ways in which interaction patterns differ between NT sibling dyads, and TD/ASD dyads. Once relational differences are identified, this information can be

used to create more effective interventions for both the child with ASD and his or her TD sibling, if specific deficits are found.

Research Questions and Hypotheses

Research Question 1: Do children's reports of (a) self-concept, (b) social support, (c) satisfaction with their sibling relationship, and (d) parental partiality differ across groups?

Hypothesis 1: It was hypothesized that TD and NT siblings would report similar mean levels of self-concept (e.g., Verte, et al., 2003), but that TD siblings would report increased feelings of parental partiality compared to NT siblings (e.g., Rivers & Stoneman, 2008) due to the need of their caregivers to provide more attention and assistance to their sibling with ASD (e.g., El-Ghoroury & Romanczyk, 1999). Additionally, TD siblings were expected to report less social support (e.g., Kaminsky & Dewey, 2001) and less satisfaction with their sibling relationship (e.g., Kaminsky & Dewey, 2001) due to the likelihood of limited prosocial interactions with their ASD sibling and increased frustration with having a sibling who has a disability.

Research Question 2: Do children's observed behaviors during a structured play task (i.e., quality of cooperation, quality of negotiation, quality of teaching, positive verbal engagement, negative verbal engagement) differ across groups?

Hypothesis 2: It was hypothesized that NT siblings would be more cooperative than TD siblings due to the likelihood of greater positive social interactions, and increased likelihood of time spent in cooperative play (more time and opportunities to practice cooperative play) with their fellow NT sibling, but TD

siblings would provide more overall encouragement to their ASD sibling as compared to neurotypical sibling pairs (El-Ghoroury & Romanczyk, 1999).

Research Question 3: What are the associations between self-reports of self-concept, social support, satisfaction with the sibling relationship, and parental partiality and observed play behaviors exhibited during structured play tasks, when controlling for covariates, regardless of group?

Hypothesis 3: It was hypothesized that self-concept, social support, and satisfaction with the sibling relationship would be positively associated with observed positive and prosocial interactions during the structured play task; while parental partiality would be negatively associated with positive, prosocial interactions, regardless of group (e.g., Verte, et al., 2003).

Research Question 4: Do the aforementioned associations differ depending on the child's group (TD sibling vs. NT older)?

Hypothesis 4: Hypotheses about group differences in these associations were not specified due to the lack of any previous research examining associations between self-report and play based interaction tasks for children with ASD siblings. While differences were expected to emerge, specific patterns or differences by group were exploratory due to the lack of prior research.

Chapter 2

Methods

Participant Recruitment:

Following review and approval of all study procedures by the University of Miami Institutional Review Board, families with two children between the ages of 7 and 12 years, where the older child is typically-developing and the younger child has a diagnosis of ASD, were recruited to participate through the University of Miami Center for Autism and Related Disabilities (CARD). Information was distributed to CARD families through weekly email blasts, on the CARD social media websites, at parent and group therapy meetings, in flyers distributed to registered families, and through communications with community partners and local autism organizations. Neurotypical families were recruited through local pediatric practices in Miami, advertisements in local elementary schools, community establishments (libraries, churches, community centers, coffee shops, etc.), and through word of mouth.

Eligibility Criteria:

To be eligible to participate in this study, all participating family members had to speak English fluently. Standardized measures and demographic information forms were provided in English, and thus all participating children and at least one parent had to speak English. Additionally, families had to have two biologically related children (no step brothers or sisters) between the ages of 7 and 12 years. When families participated who had more than two children living in the home, the research team requested that the two children participating be the two closest in age (within the 7-12 age range and where

the child with ASD was younger), or that the TD sibling participating in the ASD group was as close in age as possible to the child on spectrum.

ASD Families. Families who participated in the ASD group had to have a younger child on the autism spectrum who met the established cutoff on the ADOS-2. Eligible families also had to have another child who was biologically related to the child with ASD. Finally, the TD sibling could not have a clinical diagnosis of ASD.

Neurotypical Families. Similar to the ASD families, neurotypical families had to have two biologically related children who did not have a diagnosis of ASD.

Current Sample:

A total of 21 typically-developing families and 29 ASD families were recruited. Sixty-six additional families called with initial interest in the study, but ultimately did not participate for a variety of reasons (e.g., children were not in the age range, scheduling conflicts, older sibling had ASD). Of the 66, one family completed the ADOS-2 evaluation, but did not return to complete the other study measures due to scheduling conflicts; therefore their data were not included in the present study. Three families who called to express interest were ineligible because the parents were primarily Spanish speaking.

Measures:

Autism Diagnostic Observational Schedule – Second Edition (ADOS-2; Lord et al., 2012). The ADOS-2 is a semi-structured, play-based observational measure used to assess communication, social interaction, play, and restricted and repetitive behaviors. One of five modules is chosen based on the child's language level and chronological age, and can take anywhere from forty to sixty minutes to administer. Semi-structured

activities, or "presses," are presented as a means by which to elicit responses that capture behaviors commonly exhibited by individuals with ASD, and scores that reach a particular cutoff (varies by module) are considered "on the spectrum." Individual items are scored on a 3-point scale from 0 (no abnormality consistent with ASD) to 3 (clear and significant abnormality or deficit related to ASD). Extensive reliability and validity data have been published on the ADOS-2, and it is considered a "Gold Standard" diagnostic assessment tool (*see* Gotham, Risi, Pickles, & Lord, 2007). Interrater (r = .82 to .93) and test-retest (r = .59 to .82) reliability across modules and ASD-specific domains has been well established, and adequate internal consistency and discriminant validity have been published as well (Lord, Rutter, DiLavore, & Risi, 2001).

Gotham and colleagues also created a new Comparison Score Index (Gotham, Pickles, & Lord, 2009), allowing the most appropriate module to be used for each child, while simultaneously allowing severity scores across modules to be compared. The majority of children participating in this research project were administered a Module 3 ADOS-2 assessment (n= 22), requiring them to participate in structured play activities, as well as to verbally engage in the discussion of specific prompts with the examiner. Children with only phrase speech were administered a Module 2 (n= 1), and children who were nonverbal or who spoke using single words only were administered a Module 1 (n= 6). Modules 1 and 2 rely more heavily on play-based interactions with the examiner.

Piers-Harris Children's Self-Concept Scale – Second Edition (Piers, Herzberg, 2002). The Piers-Harris Children's Self-Concept Scale is a self-report questionnaire used to quantify overall feelings of self-concept in children and adolescents. A 60-question measure, children are asked to answer specific statements about themselves using a "yes

or no" answering format (i.e.," I am easy to get along with" or "I am different from other people"). The measure yields six subscale scores (1) PHY= Physical Appearance and Attributes, (2) INT= Intellectual and School Status, (3) HAP= Happiness and Satisfaction, (4) FRE= Freedom from Anxiety, (5) BEH= Behavioral Adjustment and (6) POP= Popularity. The summation of all subscale scores yields an overall Total Score (TOT). Widely used in both research and clinical settings, previous studies support robust reliability and validity of this measure (Piers, Herzberg, & Harris, 2002). Cronbach's α reliability estimates for the Pier's Harris Total Score in the older siblings in this sample was .90. Reliability estimates for each subscale are summarized in Table 1.

Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985). The SRQ is a self-report measure designed to better understand the qualities of a sibling relationship. This 48-question measure yields subscale scores for (1) Warmth/Closeness, (2) Relative Status/Power, (3) Conflict and Rivalry among siblings, as well as an overall Total Score (Furman & Buhrmester, 1985). In a subsequent study, Furman and Buhrmeister reported internal consistency coefficients ranging from .71-.81 for children in third, sixth, ninth and twelfth grades. Additionally, alpha coefficients for the 55 of the 60 alphas (15 scales for each age group) were greater than .60, indicating sufficient reliability and validity of the measure (Buhrmester & Furman, 1990). In the present study, internal reliability coefficients for older siblings in both groups on the factor scales ranged from .67-.90, again indicating sufficient internal reliability of the measure. Reliability estimates for subscales and factor scales are summarized in Table 1.

Social Responsiveness Scale – Second Edition (SRS-2; Constantino & Gruber, 2012). The SRS-2 is a parent-report measure that captures dimensions of interpersonal

behaviors, communication and repetitive or stereotypic behaviors commonly associated with a diagnosis of ASD. A 65 question measure, the SRS-2 yields subscale scores including (1) Social Awareness, (2) Social Cognition, (3) Social Communication, (4) Social Motivation, and (5) Restricted Interests and Repetitive Behaviors, as well as an overall Total Score. Parents rate their child on a 4-point Likert scale ranging from 0 (never true) to 3 (almost always true). The Total Score represents an index of the severity of a child's social skills deficits. Higher scores on subscales as well as on the total score indicate increased impairment in each domain. T-scores from 60-75 indicate mild-moderate impairment, while 76 and higher are considered severe impairment (Constantino & Gruber, 2012). The SRS-2 is well utilized in research and clinical populations, and has previously demonstrated robust reliability and validity (Bolte, Poustka, & Constantino, 2008). In this study, Cronbach's α reliability estimates for the subscale scores ranged from .69- .84, indicating robust internal reliability for all scales except Social Awareness (α = .29). Additionally, the alpha coefficient for the Total Score was .92. Refer to Table 1 for a summary of individual alpha coefficients.

Social Support Scale for Children (SOCSS; Dubow & Ullman, 1989). The SOCSS is a self-report measure used to quantify feelings of social support in children. This 41-question measure quantifies the frequency of supportive behaviors as well as the size and identity of support networks available to a child. It is divided into (1) Family Support, (2) Teacher Support, (3) Peer Support, and also yields an overall Total Score. Extensive analyses verifying reliability of the SOCSS are reported in Dubow and Ullman (1989), and the measure is still frequently used in research to quantify children's levels of perceived social support in various environmental contexts (Lamis, Wilson, King, &

Kaslow, 2014). In the current study, alpha coefficients ranged from .91-.95 for all subscales, and the alpha coefficient for the Total Score was .98. See Table 1 for individual alpha coefficients.

Wechsler Abbreviated Scale of Intelligence – Second Edition (WASI-II; Wechsler, 2011). The WASI-II is an individually administered brief instrument used to assess the verbal, nonverbal, and overall cognitive ability of individuals between 6-90 years of age. For this study, the abbreviated version was used to attain estimates of verbal (VCI), nonverbal (PRI), and overall intelligence (FSIQ). Four subtests were used; Vocabulary and Similarities provide a measure of verbal intelligence, and Matrix Reasoning and Block Design provide a measure of nonverbal intelligence. An overall full-scale intelligence quotient was derived from the summation of these four subtest scores.

Qualitative Questionnaire. Each child was asked to name his or her 3 favorite things about his or her sibling, as well as his or her 3 least favorite things about his or her sibling. This information contributes to our understanding of the qualitative aspects of the sibling relationship not previously captured by quantitative methods.

Coding for Sibling Interaction Tasks

A modified coding scheme created previously in a psychology research lab at the University of Miami was used to quantify sibling behaviors during structured play tasks (Mohapatra, 2011). Siblings were asked to participate in a Puzzle Task and a Teaching Task together. For the purposes of this dissertation, the TD sibling's behavior was coded (for families who have a child with ASD) and the NT older child's behavior was coded (for neurotypical families). Modifications to the original coding scheme were needed to capture more mature means by which older children interact (the original coding system

was created for children between the ages of 4-6 years, and was updated to capture behaviors more developmentally appropriate for older children, between the ages of 7 and 12 years). Refer to Appendix 1 for a copy of the coding manual.

All videos were coded by the investigator of this study. Additionally, a graduate student trained on the coding procedure recoded a subset (20%) of videos to assess inter-rater reliability. In the present study, Cohen's Kappas calculated for ordinal data in the puzzle task coding ranged from .474 to .873; percentage agreement between coders for each item ranged from 70-90%, with an overall average percentage of agreement at 86.25%. Refer to Table 2 for individual Kappas and percentage agreement for each individual play task code.

Cooperation (Puzzle) Task Coding: Siblings were asked to complete a puzzle to assess how well they work together in order to complete a task. Siblings were given 10 minutes in which to complete the puzzle before the examiner reentered the room and discontinued the task. All children utilized the full 10 minutes for the puzzle task. Four 5-point Likert scales were used to quantify the (1) Quality of Negotiation between siblings, (2) Quality of Cooperation between siblings, as well as (3) Global Positive Verbal Engagement and (4) Global Negative Verbal Engagement of the older sibling. Frequency counts were tallied to quantify the total number of negative statements as well as total number of Positive Statements, which were used to determine verbal engagement global codes.

Teaching Task Coding. Lastly, the TD sibling (or NT older sibling) was provided instructions and was asked to teach his or her sibling to build a structure using blocks. The older sibling was told to keep the instructions to him/herself, and told not to show

his/her younger sibling the directions provided. Behaviors were again coded for the duration of the task. Coding was used to identify the total number of Rule Violations (touching of the younger sibling's blocks or showing of the directions to the younger sibling) and a 5-point Likert scale was used to quantify (1) Overall Quality of Teaching, (2) Global Positive Verbal Engagement, and (3) Global Negative Verbal Engagement.

Procedure:

Families attended a 2-hour evaluation where all questionnaires and diagnostic measures were collected. Families who had a child with ASD were asked to schedule an additional 45-minute visit where the ADOS-2 was administered so as to confirm ASD diagnosis prior to participation in the study; however, the majority of families chose to complete all tasks in a single visit.

The following is a breakdown of procedures once the family arrived at the CARD Center: Families checked in and were met in the waiting room by research staff. Approximately 15 minutes were allotted for parents and children to receive a verbal overview of the consent by trained research staff. Subsequently, one parent and each child reviewed and signed the consent and assents, respectively, and any questions about the procedures during the visit were answered at that time. The participating parent was then escorted to a quiet research room where he or she was asked to complete two sets of questionnaires independently on the computer. The first set of questionnaires was regarding the parent's older child, and the second set of questionnaires was regarding the parent's younger child. The parent was also asked to complete a demographic questionnaire at that time.

Simultaneously, each child was escorted to separate research rooms to complete their respective study activities. As mentioned above, if the family had a child with ASD, the first assessment conducted with the investigator was the ADOS-2 to confirm the diagnosis of the child with ASD. Following the ADOS-2 evaluation, or following the consenting process for neurotypical families, one child remained in the consenting room and completed cognitive testing (WASI-2) with the investigator, while the other sibling sat with a trained research assistant who asked them a series of standardized questionnaires (Piers Harris Self-Concept Scale, Sibling Relationship Questionnaire, and Social Support Appraisal Scale). Visual supports were provided to help the children remain on task and understand the answer options for each measure. Refer to Figure 1 for an example of the visuals provided. The research assistant also presented each sibling with the Qualitative Questionnaire, emphasizing yet again that answers about what a child liked most and disliked most about his or her sibling would be kept strictly confidential.

Finally, both siblings engaged in the two structured play activities (described above). Each child was given a $10 Amazon gift card as compensation for their time, and questions or concerns that arose during the visit were addressed prior to families leaving the research space.

Chapter 3

Analytic Approach

Research Question 1: Do children's reports of (a) self-concept, (b) social support, (c) satisfaction with their sibling relationship, and (d) parental partiality differ across groups (TD sibling vs. NT sibling)?

To address research question one, Pearson product-moment correlations were conducted to identify whether the means for the dependent variables [(a) self-concept, (b) social support, (c) satisfaction with their sibling relationship, and (d) parental partiality] were the same across comparison groups (TD sibling vs. NT older). There was only one significant correlation (p= .047) (i.e., satisfaction with the sibling relationship and parental partiality); therefore, independent samples t-tests were conducted to compare means across groups.

Research Question 2: Do children's observed behaviors during a structured play task (i.e., quality of negotiation, quality of cooperation, quality of teaching, positive verbal engagement, negative verbal engagement) differ across groups (TD sibling vs. NT sibling)?

To address research question two, Pearson product-moment correlations were first conducted to determine whether significant associations exist between the play behaviors. Because numerous correlations were identified as significant, one way MANOVAs were used to test the hypothesis that the means for the dependent variables [(a) quality of negotiation, (b) quality of cooperation, (c) quality of teaching, (d) number of rule violations, (e) positive verbal engagement, (f) negative verbal engagement were the same across comparison groups (TD sibling vs. NT sibling). As part of the multivariate

procedure, an omnibus test, Wilks' Lambda, was examined to control for Type I error (rejecting the null hypothesis when it is true). When this overall test is significant, it is permissible to inspect whether the dependent variables differ as a function of group.

Since the omnibus test for the MANOVA was significant, further examination of the univariate F tests for each dependent variable was used to assess which mean across groups is higher.

Research Question 3: What are the associations between self-reports of self-concept, social support, satisfaction with the sibling relationship, and parental partiality and observed play behaviors exhibited during structured play tasks, when controlling for covariates that are significantly different across groups in the entire sample of older siblings?

To address research question three, a series of multiple hierarchical setwise regression analyses were conducted to examine associations between the significantly correlated self-report scales and four observed play behaviors. First, separate multiple regressions were used to examine the unique contribution of the self-report measures to each of the observed play behaviors, controlling for child covariates that were statistically significantly different across groups. Child demographic variables were entered first as a set, to examine the percent of variance explained by this set of predictors. Then, child self-reported variables were entered, to examine the unique contribution of these variables to observed play behaviors. A separate regression model was examined for each of the significantly correlated self- report and observed play behaviors. Given sample size constraints, only child covariates that were significantly different across groups were included in the models. The best model was evaluated in terms of: (a) the overall R^2

statistic, indicating the proportion of variance in the dependent variable explained by the linear combination of the independent variables in the model; (b) the partial r^2 statistic, which is the amount of variance uniquely associated with the last set entered, in this case, child self-report variables; and (c) examination of the Standardized Beta (ß) coefficients for each of the independent variables entered in each set, indicating the relative strength and direction of the associations with the dependent variable.

Research Question 4: Do the aforementioned associations differ depending on the child's group (i.e., whether the child has a sibling with ASD or not), again controlling for significant covariates between groups?

Using the same hierarchical setwise multiple regression models described above, a third set of variables was added to test a moderation model. Multiplicative two-way interactions between the self-report variables and child group were created for self-report variables. Interactions were created based on the prior analyses identifying which self-report variables are associated with the observed play behaviors. Only one interaction variable per model was added as a predictor for each of the four observed play behavior models due to sample size constraints. These models tested whether the associations between self-report measures (i.e., self-concept, social support, satisfaction, parental partiality) and observed play behaviors (i.e., quality of negotiation, quality of cooperation, quality of teaching, positive verbal engagement, negative verbal engagement), differ across the two groups. The unique contribution of these interactions was determined by examining (a) the partial r^2 statistic, which is the amount of variance uniquely associated with the last set entered, in this case, interaction variables; and (d) the

Standardized Beta (ß) coefficients for each of the independent variables entered in this final set, indicating the significance and direction of the moderation.

Qualitative Questionnaire Exploratory Analyses

To explore the more qualitative aspects of a sibling relationship, older siblings were asked to name their three most and three least favorite things about their sibling. This was left completely open to interpretation by the children, and therefore many varying answers were reported. To quantify the qualitative responses, answers were coded based on whether (1) the comment was an independent observation of the sibling, (e.g.,. “he is nice”, “she is too competitive”), or (2) the comment was a dyadic observation involving both the child and his or her sibling (e.g., “she shares her toys with me”, “we fight a lot”). Chi square analyses were conducted to determine whether siblings in the TD vs. NT groups reported significantly different individual or dyadic responses.

Chapter 4

Results

Measure Reliability and Validity

An a priori power analysis was conducted using guidelines by Cohen (1992) in order to determine an appropriate sample size for the current study and for the proposed set of multivariate analysis of variance (MANOVA) and multiple regression analyses. For a MANOVA, with two groups, a minimal sample size of 64 sibling dyads was required for detecting significant mean differences with a medium effect size, α = .05, and power = .80. A multiple regression analysis with 6 predictors requires a minimum sample size of 97 children for detecting significant findings with a medium effect size, α = .05, and power = .80. In this present study, 50 sibling dyads are included in analyses, so it is important to note that analyses are under-powered. Implications of the lack of adequate power are discussed in the limitations section below.

To ensure the normal distribution of data, each variable was examined for outliers, homoscedasticity, and kurtosis. Skewness values for all variables were less than 4, and kurtosis values for all variables were less than 10. No assumptions were found to be violated. Cronbach's alpha coefficients were calculated for all measures to ensure adequate internal reliability, and are reported in the measures section above and are summarized in Table 1. Additionally, the data were examined to detect potential outliers by utilizing calculations of standardized residuals. Data were screened for z-scores with standardized residuals >3.29. One outlier was identified; however, regression analyses conducted with and without that individual yielded the same result, so no cases were excluded from analyses.

Participant Demographics

Participant demographic data are presented to fully characterize the families who participated in the study; however, it is important to note that statistical analyses for the four research questions were only conducted comparing TD siblings to NT older siblings (2 groups). Descriptive statistics including gender, race, and ethnic distribution were generated for all 4 groups (ASD sibling, TD sibling, NT older, NT younger), and are summarized in Table 4. Additionally, Table 5 summarizes the distribution of children's age, cognitive functioning (IQ), ASD severity (as defined by the ADOS-2 severity score in the ASD sample only), and BAP characteristics across the typically developing and neurotypical groups.

To further characterize the families who participated, Table 6 summarizes caregiver characteristics including their relationship to the children participating, gender, race, ethnicity, and highest educational degree attained. In this sample, one family identified as a single caregiver home, and therefore Caregiver 2 demographics were not reported.

Table 7 captures broad household demographics of the families in this sample including parental relationship status, family socioeconomic status, and languages spoken in the home. While all families spoke English fluently at the research visit, some reported that they speak both Spanish and English in their homes.

Group Differences. Independent samples t-tests (for continuous variables) and chi square analyses (for dichotomous or nominal variables) were conducted to assess whether statistically significant differences in demographic characteristics existed across experimental and control groups. No significant differences were found across groups for

any of the following: span of time between siblings (in months), marital status in the home, household language, age, race, ethnicity and gender of the older sibling, younger sibling race and ethnicity, household socioeconomic status, and highest level of educational attainment for both caregiver 1 and caregiver 2 across groups. Significant mean differences ($p < .05$) were found between groups for the younger siblings' age $t(48) = 2.075$, $p = .043$, and the younger siblings' gender χ^2 (1, n= 50) = 5.41, p= .020. Specifically, the ASD sample was significantly younger than the NT younger group. Additionally, there were significantly more males in the ASD group when compared to the NT younger group.

Means, ranges, and standard deviations for age, span of time between siblings (in months), as well as measures of intellectual functioning, BAP characteristics, and ASD severity in the ASD group are summarized by group in Table 5. No significant differences were found between the older sibling groups' intellectual functioning. However, means for younger siblings' intellectual functioning were significantly different $t(48) = 2.904$, $p = .006$. The IQ's of younger siblings in the ASD group were significantly lower than the IQ's of children in the NT younger sibling group. Furthermore, BAP characteristics, as measured by the SRS-2 Total t-scores were significantly higher in the NT older group when compared to the TD group $t(48) = 2.096$, $p= .045$. Implications for these results are discussed below. Notably, all analyses for research questions 1-4 are comparing the two older sibling groups (TD sibling and NT older groups), and no significant differences were found across those two groups, except for BAP characteristics. Therefore, BAP characteristics were entered as a covariate in all

subsequent regression analyses. Means and standard deviations by group are summarized in Table 8.

Research Question 1

Do children's reports of (a) self-concept, (b) social support, (c) satisfaction with their sibling relationship, and (d) parental partiality differ across groups (TD sibling vs. NT sibling)?

This research question aimed to identify whether differences existed between TD sibling and NT older siblings' self-report of a their perceived (a) self concept, (b) social support, (c) satisfaction with the sibling relationship, and (d) parental partiality. Self-concept was quantified using the Piers-Harris Children's Self-Concept Scale Total T-Score. Social support was quantified using the Social Support Appraisals Scale Total Score. Satisfaction with the sibling relationship was quantified using the Warmth/Closeness Factor Scale score on the Sibling Relationship Questionnaire. Finally, parental partiality was quantified using the Rivalry Factor Scale of the Sibling Relationship Questionnaire. Means and standard deviations for all variables by group are summarized in Table 8.

Correlations. First, Pearson product-moment correlations were conducted to determine whether there were significant correlations between the four self-reported measures, as summarized in Table 9. A significant correlation was found between the Warmth/Closeness and Rivalry Factor Scales of the Sibling Relationship Questionnaire ($r(50) = .282$, $p = .047$). No other self-report measures were correlated.

Mean Differences. Independent samples t-tests were subsequently conducted for each self-report measure to identify whether group means differed between TD sibling

and NT older groups. Refer to Table 8 for means and standard deviations for self-report measures by group. No significant differences were found on any of the self-report measures across groups.

Research Question 2:

Do children's observed behaviors during two structured play tasks (a) quality of negotiation, (b) quality of cooperation, (c) quality of teaching, (d) positive verbal engagement, (e) negative verbal engagement differ across groups (TD sibling vs. NT sibling?

Correlations. Pearson product-moment correlations were first conducted to determine the correlation between scores for both the Puzzle Task and Teaching Task, and are summarized in Table 10. Significant correlations were identified between Puzzle Task Quality of Negotiation and Puzzle Quality of Cooperation r (49) = .587, p= .000, Quality of Teaching r (47) = .482, p= .001, and Teaching Rule Violations r (47) = -.493, p= .000. In addition Puzzle Quality of Cooperation was significantly correlated with Quality of Teaching r (47) = .704, p= .000 and Teaching Rule Violations r (47) = -.572, p= .000. Puzzle and Teaching Positive Verbal Engagement were correlated r (47) = .443, p= .002, and Teaching Rule Violations were also correlated with Teaching Positive Verbal Engagement r (47) = .301, p= .040.

Mean Differences on Puzzle Task. To address research question two, a one-way MANOVA was used to test the hypothesis that the means for the dependent variables in the Puzzle Task [(a) Quality of Negotiation, (b) Quality of Cooperation, (c) Positive Verbal Engagement, (d) Negative Verbal Engagement] are the same across comparison groups (TD sibling vs. NT older). Bonferroni correction was used to control for Type I

error by setting the alpha level at .05 divided by the number of outcome variables. Wilks's Λ= .652 was significant, F (4, 44) = 5.884, p = .001, permitting us to look at the univariate F tests to determine group differences. The multivariate η^2 based on Wilks's Λ was strong, .35, indicating that 35% of the multivariate variance of the dependent variable is associated with the group factor. Refer to Table 11 for the means and standard deviations by group on the Puzzle Task.

Further examination of the univariate F tests revealed significant mean differences between groups on Puzzle Task Quality of Cooperation F(1, 47) = 8.631, p= .007 and Puzzle Task Positive Verbal Engagement F(1, 47) = 8.631, p = .005. Analysis of group means indicated that NT siblings exhibited stronger cooperation with their sibling with ASD. Contrastingly, TD siblings expressed significantly more positive verbal statements during the Puzzle Task.

Mean Differences on the Teaching Task. A second one-way MANOVA was used to test the hypothesis that the means for the dependent variables in the Teaching Task [(a) Quality of Teaching, (b) Rule Violations, (c) Positive Verbal Engagement, (d) Negative Verbal Engagement] were the same across comparison groups (TD vs. NT older). Again, Wilks's Λ= .713 was significant, F (4, 42) = 4.217, p = .006, indicating it is permissible to inspect whether the dependent variables differ as a function of children's group. The multivariate η^2 based on Wilks's Λ was strong, .29, indicating that 29% of the multivariate variance of the dependent variable was associated with the group factor. Refer to Table 12 for means and standard deviations by group on the Teaching Task.

Examination of the univariate F tests revealed significant group mean differences on Teaching Task Rule Violations F(1, 45)= 5.150, p = .028 and Teaching Task Positive

Verbal Engagement F(1, 45)= 10.452, p = .002. Analysis of group means demonstrated that TD siblings engaged in significantly more rule violations than siblings in the NT older group. Similarly to the Puzzle Task, TD siblings engaged in more positive verbal exchanges with their younger sibling compared to NT older siblings.

Research Question 3:

What are the associations between self-reports of self-concept, social support, satisfaction with the sibling relationship, and parental partiality and observed play behaviors exhibited during structured play tasks, when controlling for significant covariates (i.e. BAP)?

Correlations. Pearson product-moment correlations were conducted to determine whether self-report measures were significantly related to observed play task behaviors. Refer to Tables 13 through 20 for correlation matrices comparing all self-report measures to observed play task measures. Older sibling reported self-concept was positively correlated with Puzzle Task Quality of Negotiation r (49) = .303, p = .034. Older siblings' reported feelings of parental partiality were positively correlated with Puzzle Task Negative Verbal Engagement (r (49) = .345, p = .015). Finally, a non-significant but trending association demonstrating older siblings' perceptions of peer support being negatively correlated with Teaching Task Rule Violations (r(47)= -.278, p = .059) was observed. No significant associations were found between self-report measures and puzzle cooperation, puzzle positive verbal engagement, teaching quality of teaching, or teaching negative or positive verbal engagement.

Regression Analyses. Based upon the significant patterns of correlations discussed above, a series of multiple hierarchical setwise regression analyses were conducted to

examine associations between the self-report scales and the observed play behaviors. Specifically, two separate regression models were examined for each of the significantly correlated self-report and play task pairings: (1) Self- Concept as a predictor of Puzzle Task Quality of Negotiation, and (2) Parental Partiality as a predictor of Puzzle Task Negative Verbal Engagement. Only one-child demographic variable was statistically significantly different across groups (i.e., BAP characteristics) so this was entered into the model first, to examine the percent of variance explained by this predictor. Then, the child self-reported variable was entered in a second block, to examine the unique contribution of this variable on the observed play behavior.

Regression Model 1. As discussed above, older sibling self-concept was positively correlated with Puzzle Task Quality of Negotiation $r(49) = .303$, $p = .034$. Therefore, a regression analysis was conducted to assess whether older sibling self-concept predicted Puzzle Task Quality of Negotiation, when controlling for BAP characteristics in the older sibling. There were two models that were examined. The first model include BAP characteristics as a covariate. However, BAP characteristics did not account for a significant amount of variance in Puzzle Task Quality of Negotiation, $R^2 = .03$, $F(1, 47) = 1.485$, $p = .229$; and when self-concept was included in the next set of predictors, self-concept was not significant, $R^2_{\Delta} = .07$, $F(1, 46) = 3.578$, $p = .065$. Therefore, a second regression analysis was conducted without BAP in the model. This second model (without controlling for BAP) found that self-concept was significantly related to Puzzle Task Quality of Negotiation $F(1, 47) = 4.764$, $p = .034$. The sample multiple correlation coefficient was .303, indicating that approximately 9% of the variance of the Puzzle Task

Quality of Negotiation can be accounted for by older siblings' ratings of their perceived self-concept.

Regression Model 2. As discussed previously, older siblings' feelings of parental partiality was positively correlated with Puzzle Task Negative Verbal Engagement (r (49) = .345, p = .015). Therefore, a regression analysis was conducted to assess whether older sibling perceived parental partiality predicted Puzzle Task Negative Verbal Engagement, when controlling for BAP characteristics in the older sibling. There were two models that were examined. The first model include BAP characteristics as a covariate. However, BAP characteristics did not account for a significant amount of variance in Puzzle Task Negative Verbal Engagement, $R^2 = .001$, F (1, 47) = .030, p = .863; though when parental partiality was included in the next set of predictors, parental partiality was significant, $R^2_{\Delta} = .13$, F (1, 46) = 6.860, p = .012. Therefore, a second regression analysis was conducted without BAP in the model. This second model (without controlling for BAP) found that parental partiality was significantly related to Puzzle Task Negative Verbal Engagement F (1, 47) = 6.358, p = .015. The sample multiple correlation coefficient was .345, indicating that approximately 12% of the variance of the Puzzle Task Quality of Negotiation can be accounted for by older siblings' ratings of their perceived parental partiality.

Research Question 4: Do the aforementioned associations differ depending on the child's group (i.e., whether the child has a sibling with ASD or not)?

Using the same hierarchical setwise multiple regression models described above, an additional set of variables was added, to test a moderation model. Multiplicative two-way interactions between the self-report variables and child group were created for the

two same sets of associations tested above (i.e., self-concept X group, parental partiality X group). Only one interaction variable per model was added as a predictor for each observed play behavior models due to sample size constraints. Therefore, two separate models tested whether the associations between (1) self concept and Puzzle Task Quality of Negotiation, and (2) Parental Partiality and Puzzle Negative Verbal Engagement, differed by group.

Moderation Model 1. A regression analysis was conducted to determine whether the older sibling self-concept predicted Puzzle Task Quality of Negotiation differentially by group; however, the moderation term was not significant $F(1, 45) = .205$, $p = .653$. Refer to Table 21 for the standardized Beta coefficients at each step.

Moderation Model 2. A second regression analysis was conducted to determine whether the older sibling parental partiality predicted Puzzle Task Negative Verbal Engagement differentially by group. Similar to the previous results, moderation term was not significant $F(1, 45) = .544$, $p= .465$. Refer to Table 21 for the standardized Beta coefficients at each step.

Qualitative Questionnaire Results

To explore the more qualitative aspects of a sibling relationship, older siblings were asked to name their three most and three least favorite things about their sibling, and responses were coded based on whether the content was about the sibling as an individual (e.g.,. “he is nice”, “she is too competitive”), or about the sibling pair as a dyad (e.g., “she shares her toys with me", “we fight a lot”).

Chi square analyses revealed no significant difference between groups on the frequency of individual or dyadic comments made by the older sibling about the younger

sibling for both positive χ^2 (1, n= 49) = .726, p= .867 and negative χ^2 (1, N= 50) = 1.279, p= .734 statements about their sibling.

Chapter 4

Discussion

Sibling relationships are multifaceted, and are often considered one of the most enduring relationships in a person's life. This relationship may be even more complex when one sibling has a diagnosis of ASD. Therefore, this study aimed to characterize the sibling relationship from the point of view of TD older siblings of children with ASD, and to compare these relationships to NT older siblings whose brothers or sisters do not have a diagnosis on the spectrum. The first goal was to capture older siblings' views of their social environment and feelings about themselves from their own perspective. The second goal was to examine how the siblings interacted with one another during a play task. The third and fourth goals were to determine if self-reported perceptions and observed play behaviors were associated in any way, and to understand if these relationships differed if one's sibling has ASD. Results demonstrated that self-reported perceptions of social support, parental partiality, satisfaction with the sibling relationship and self-concept did not differ by group; however, select observed sibling play behaviors did differ by group. Taking these associations one step further, analyses that tested whether self-report measures predicted observed play behaviors were partially supported for the sample as a whole. However, in the final set of analyses, the predictive associations were not statistically significantly when testing whether they were different by group.

Results of descriptive analyses revealed significant group differences that should be addressed. ASD siblings were significantly younger than NT younger siblings, and there were significantly more males in the ASD group than in the NT younger group. In

the ASD group, children ranged in age from 84-139 months (Mean = 102 months), while in the NT younger group, children ranged from 88-132 months (Mean = 111 months). Refer to Table 5 for further descriptive information. While it is unclear why the ASD children were younger than their NT younger counterparts in this particular sample, it is not surprising that there were more males in the ASD group given the increased prevalence of diagnosis among males (1 in 42) compared to females (1 in 189; Baio, 2014). Therefore, we would expect more males in the ASD sample when compared to a neurotypical comparison group. As to the age difference, it is possible that the ASD sample is younger because CARD targets recruitment of families at the earliest age possible, shortly after initial diagnosis, but this is purely speculative.

ASD younger children also had lower IQ estimates than the NT younger sample. While this is not surprising given the high comorbidity estimates of ASD and intellectual disability (LaMalfa, Lassi, Bertelli, Salvini, & Placidi, 2004), with some suggesting that intellectual disability is the most common comorbidity with ASD (Matson & Shoemaker, 2009), it is also critical to consider the strengths and limitations of the measure used to capture estimates of intelligence in this study, which is more thoroughly discussed in the limitations section below.

Finally, scores on a measure of BAP were significantly higher in the NT older group than the TD sibling group. This finding is interesting given the a priori hypothesis that siblings of children with ASD (TD siblings) would score higher than NT older siblings who do not have a sibling on spectrum. In the TD sibling group, none of the parent reported scores fell above the cutoff for clinical significance (T score > 59). However, in the NT older group, three of the 21 children scored above the T score cutoff

of 59. T scores for those children were 62, 66, and 68, which fall in the mild (T-score cutoff below 65) to moderate (T-score cutoff below 75) range. Further investigation into the level of intelligence for these three children was notable yet inconclusive, given that none of the children fall within the Average range of intellectual functioning. Rather, two of the children scored in the above average range (FSIQ SS= 111 and 119), and one child scored in the below average range (FSIQ SS= 81); therefore it is difficult to conclude that differences in intellectual functioning are contributory. It was thought that perhaps that social deficits exhibited in individuals with lower intelligence may be a partial explanation for these differences in BAP characteristics, but this is likely not the case given the range of intelligence scores in these individuals. Additional discussion of the impact of BAP scores is reviewed in the future directions section below.

Given that measures of BAP were completed by a parent, it is possible that differences in these two group means can be partially attributed to parental bias. Perhaps parents of a child with ASD see their older, TD child as more socially competent when comparing their TD child to their sibling with ASD, and therefore parents rate their TD children's social behaviors as within normal limits. Contrastingly, NT parents may be more hypercritical of their children when considering their children's social competence when compared to the other NT children in the household. Nonetheless, due to sample size limitations, no families were excluded from the present analyses. However, further research excluding or perhaps containing a separate NT sibling group that is above clinical cutoff for BAP characteristics is warranted to better understand whether it is a measurement issue, or if there are truly meaningful differences in the social functioning of individuals in these groups.

Research Question One. The hypothesis for research question one, examining the differences by group of self-report measures, was not supported. Children in both the TD sibling and NT older groups did not differ on their reports of their perceived self-concept, parental partiality, social support, and overall satisfaction with their sibling relationship. While it was hypothesized that group differences would likely arise, these findings are encouraging. Results from this study suggest that having a sibling with ASD does not necessarily alter an older siblings perceptions of themselves, their family dynamics, or their perceived social support.

The notion that perceived self-concept is comparable across groups supports previous research suggesting TD siblings are similarly adjusted to neurotypical siblings (Dempsey, et al., 2012; Kaminsky & Dewey, 2002; Mates, 1990; Pilowsky, et al., 2004; Stoneman, 2001; Verte, et al., 2003), and that having a sibling with ASD does not necessarily warrant targeted therapeutic intervention above and beyond the normal population (Mates, 1990). Additionally, it is important to consider the population from which this sample of ASD/TD children was drawn. Families were recruited through the Center for Autism and Related Disabilities (CARD), and therefore these families are already receiving significant family support and tailored services through the CARD organization. It is possible that the lack of group differences can be partially attributed to the benefits of being a CARD family, and may not generalize to families who do not receive such substantial family support services and resources.

Research Question Two. The hypothesis for research question two, examining whether group differences exist in how older siblings interact with their younger sibling, was supported. First, significant correlations between individual play task codes suggests

a relationship, in the sample as a whole, between certain ways that children interact with their sibling. Specifically, within the puzzle task codes, quality of negotiation and cooperation were significantly correlated, suggesting that siblings who are more likely to map out a strategy prior to beginning the construction of the puzzle are subsequently more cooperative with each other during the play task.

Across play tasks, quality of cooperation during the puzzle task was positively associated with quality of teaching and negatively associated with rule violations during the teaching task. This suggests that children who cooperate more during the puzzle task provide better quality of teaching and fewer rule violations during the teaching task. Similarly, a negative association was demonstrated between quality of negotiation on the puzzle task and rule violations on the teaching task, suggesting that children who outline a plan prior to the start of the puzzle task demonstrate less rule violations during the teaching task. Puzzle and teaching task positive verbal engagement were significantly correlated, suggesting that more positive verbalizations during completion of the puzzle were related to more positive verbalizations during the teaching task.

The final significant correlation showed that rule violations during the teaching task were positively correlated with positive verbal engagement during the teaching task, which is an unexpected but interesting association. It is possible that for younger siblings who were struggling to complete the teaching task, older siblings were more likely to provide encouragement, but when verbal praise and visual demonstrations failed, these children were also more likely to step in and help their younger sibling to succeed in completing the required task. This is supported by research that suggests TD siblings often choose to take on caretaking-like responsibilities for their affected sibling (Cuskelly

& Gunn, 2003, Tudor & Lerner, 2015), and that older siblings in NT families often increase their dominance over their younger siblings while in play in middle childhood (Buhrmeister & Furman, 1990).

When comparing the means by group, several significant differences in play task behaviors were observed. First, NT older siblings were more cooperative during the puzzle than TD siblings. One potential partial explanation for this finding is that some of the social deficits exhibited by children with ASD may be hindering cooperative play with their TD sibling, particularly when compared to NT children. This idea also lends support to the notion of teaching siblings to act as therapists for their sibling with ASD (Celiberti & Harris, 1993) or including them more broadly in sibling treatment (Ferraioli, et al., 2012). It is also possible that NT siblings choose to engage more frequently in puzzle or cooperative tasks when playing at home, as contrasting research demonstrates that often TD siblings report less involvement and more avoidance of their sibling with ASD than NT siblings (Walton & Ingersoll, 2015). TD siblings may not choose to approach their sibling with ASD to play when left to unstructured free time at home, and therefore have more limited experience when asked to complete the puzzle.

Second, TD siblings use more positive verbal engagement when completing the puzzle task than NT older siblings. This suggests that children who have a younger sibling with ASD are more likely to provide positive encouragement during unstructured play. This lends support to prior research that also demonstrated that children with siblings on the ASD spectrum were more likely to use praise and encouragement when interacting with their ASD sibling (El-Ghoroury & Romanczyk, 1999). This finding bolsters the idea that there are benefits to having a sibling with a disability, including

increased feelings of admiration, tolerance, empathy and selflessness towards their sibling with a disability (Ross & Cuskelly, 2006; Ferraioli & Harris, 2010).

Third, TD older siblings who have a younger sibling with ASD violate teaching rules more than NT older siblings. It is possible that given the social and communication deficits exhibited by children with ASD, TD siblings felt more obligated to jump in and assist their sibling when verbal or visual strategies were not successful, as often older siblings of children with a disability take on a caretaking or mentor-like role in play and likely want to see their younger sibling succeed (Tudor & Lerner, 2015). Similarly, the TD child may have observed parent involvement in the day to day tasks of their sibling with ASD, and therefore felt it best to intervene and assist in a similar way to that which they had observed at home. In addition, children with ASD often demonstrate rigid patterns of behavior and low frustration tolerance, so TD siblings may have felt it best to intervene prior to a display of significant behavioral disturbance by their sibling with ASD.

Finally, TD older siblings who have a younger sibling with ASD use more positive verbal engagement when given a structured play task. Similar to the results demonstrated in the play task, this lends support to the idea that having a sibling with a disability may foster increased positive social responses and encouragement in a TD sibling (El-Ghoroury & Romanczyk, 1999), and again highlights a potential benefit of having a sibling with a disability.

Research Question 3. The hypothesis for research question three, which looked at whether self-report measures and observed play task behaviors were associated, was supported. Self- concept was positively predictive of puzzle quality of negotiation,

suggesting that more favorable self-appraisals leads to an increased likelihood that the older sibling would talk through a plan and strategize about how to complete the puzzle with their younger sibling in the sample as a whole. While prior research has mostly investigated how play behaviors can predict an individual's self-concept, it is has not often been considered in the reverse. Our hypothesis was that perhaps having positive self-esteem would be related to enhanced overall play behaviors with a younger sibling. Considered in a different way, perhaps a lack of positive self-concept limits one's confidence in approaching social situations, including interactions with siblings. Previous literature suggests that children perceive their own actions as the reason for their success, so perhaps with decreased self-concept, children would not view their behavior as successfully and therefore not play as well with others (Bunker, 1991).

Parental partiality was positively correlated with puzzle negative verbal engagement, meaning that perceptions of greater parental partiality were associated with increased negative statements spoken during the puzzle task. If a child feels like their younger sibling gets more attention from his or her parents, he or she is more likely to say negative things to that sibling while completing the puzzle task. This is in support of similar research that demonstrated that in families where mothers show increased partiality toward one sibling, increased hostility and conflict between siblings was reported (Boer, 1990; Brody & Stoneman, 1987; Brody, Stoneman, & Burke, 1987; Bryant & Crockenberg, 1980; Stocker, Dunn, & Plomin, 1989).

It is important to consider that parental partiality can also be defined in multiple ways. Perhaps TD siblings feel like their parents are more partial because they spend more time taking their sibling with ASD to school, therapies, medical specialists, and

other special services, or that his or her parents spend more time trying to improve the social functioning of their child with ASD. In the sample as a whole, perhaps there are additional siblings in the family, and therefore the partiality is increased time spent with other members of the family, with less time focused on the TD or NT older sibling. It would be interesting to obtain qualitative descriptions of what children view as "parental partiality." The children were all older children, so perhaps some of the increased parental partiality is due to their perspective that a younger child needs more assistance, and/or perhaps some of the increased negative verbalizations are a result of picking up on contextual factors within the family that are quite normal. Future studies should consider using mixed dyads and consider assessing younger siblings' perspectives, as well as parent-reports to examine family factors in a more comprehensive manner.

Research Question 4. The hypothesis for research question four, which looked at whether the aforementioned associations detailed in research question three differed by group, was not supported. No differences were found in the above associations by group, so regardless of if you have a brother or sister with ASD or not, increased self-concept is associated with better negotiation, and increased parental partiality is associated with more negative verbal engagement during unstructured play tasks. While these results are again encouraging and suggestive of similar relationships between ASD/TD and NT sibling pairs, it is important to consider sample size limitations for this particular type of analytical approach. This and other study challenges are discussed further in the limitations subsection below.

Conclusions, Limitations, and Future Directions

Results of this study conclude that, generally, having a sibling with ASD does not necessarily lead to less favorable outcomes in terms of TD sibling functioning or sibling interactions. On the contrary, having a sibling with ASD may be beneficial, and may heighten an older sibling's awareness of the challenges faced by his or her brother or sister. Our results show that having a sibling with ASD may foster a more compassionate response in times of difficulty, in that TD siblings use more positive and encouraging statements in unstructured play settings when compared to their NT peers.

Furthermore, self-appraisals and social support resources are highlighted as being beneficial contributors to the quality of sibling relationships in this study. Fostering good self-esteem in all children, regardless of sibling diagnosis, may lead to more favorable interactions and stronger relationships between siblings over time. Importantly, no significant differences in peer, teacher or family social support were found in this sample, suggesting that children are getting comparable levels of support in these areas, regardless of whether they have a sibling with ASD.

Results demonstrating that children engage in more negative verbal exchanges with their sibling if they feel there is more parental partiality in the home is also an important finding to consider. Numerous studies have shown that parental partiality can lead to lower self-esteem, increased behavior problems, and difficulties within sibling relationship (McGuire, Dunn, & Plomin, 1995; Shebloski, Conger, & Widaman, 2005; Stocker, 1995). It is of particular note when considering the other results of this study, which demonstrate that increased self-esteem is associated with more positive play behaviors between siblings. Therefore, while not a direct result of sibling interactions, the

impact of parent and family factors significantly contribute to the fostering of relationships between siblings, and parental partiality may significantly hamper relationship quality between siblings and broader individual self-esteem.

Therapeutic intervention, if sought out at this stage, should focus on bolstering self-concept and increasing communication with parents. When considering a lifespan perspective, intervention may be more appropriate as these children mature into early and later adulthood. Themes from research investigating the perspectives of adults with siblings on spectrum suggest TD siblings feel a heightened sense of burden, increased responsibility and difficulty with maintaining a beneficial sibling relationship in adulthood (Davys, Mitchell, & Haigh, 2015). Particularly noteworthy are concerns of the TD siblings increased feelings of stress, stronger desires for autonomy, and other difficulties faced as siblings age (Davys et al., 2015). Therefore, early conversations between parents and siblings, as well as advanced preparation for siblings with ASD as they mature is essential to limiting TD siblings stress and fostering positive sibling relationships as siblings age.

Limitations. It is important to note several limitations to the current study that should be addressed in future research. Most notable is the lack of adequate sample size given the a priori power analyses conducted. While group differences were detected, larger samples are essential to be sure that associations found represent true group differences. Furthermore, the sample utilized in this study was highly selective, requiring the sibling with ASD to be the younger sibling in the dyad, so future studies that include both older and younger siblings with ASD would further elucidate the differences by birth order.

As discussed previously, all families who participated in the study were included in the statistical analyses; however, it is worth noting that three of the NT older siblings surpassed the established cutoff for ASD spectrum behaviors on the SRS-2. While one can argue that these three individuals should be excluded due to their perceived social deficits, it may also be more representative of the broader typical population. In a recent study conducted by Walton & Ingersoll, researchers reported that 9.7% of their TD sibs fell within the Severe range, and 21.5% fell in the Mild-Moderate range (2015). Researchers kept these children in their samples to demonstrate the range of BAP in their TD sample. Certainly larger studies that include a subsample of children who do not have a formal diagnosis but demonstrate above average deficits in social functioning would contribute to our understanding of this sub-clinical population.

Most of the children participating in this study were from high socioeconomic backgrounds, limiting the generalizability of these findings to the population at large. In addition, the sample was racially rather homogeneous and again not representative of the broader population. While this does not discount the research findings presented, future research should aim to include an ethnically, racially, and socioeconomically diverse population to determine whether these factors contribute to the quality of sibling relationships.

The play task coding created for this study has not yet been applied to other research contexts. While modified from previous coding criteria created by Mohapatra and colleagues (2011), age-appropriate developmental differences between samples warrant the replication of this coding scheme in future studies. While interrater

agreement in this study was high (>80% overall), use of the coding scheme by other research groups would strengthen its clinical utility.

One additional limitation, though not central to the research questions addressed above, is in regards to the measure of intelligence used for the present study. After administering the WASI-2 to 100 children, the investigator feels that while adequate for TD and NT siblings, it may not be the best indicator of intelligence for children with ASD. In this sample, children who were nonverbal would have benefitted from testing that was not so verbally-loaded. It is likely that some of the children in the ASD sibling sample have higher IQ scores not reflected in their scores for the present study. Future researchers should diversify their measures of intelligence to capture all children's best potential.

Future Directions. While some of the ideas and modifications for future work are presented above, additional areas of relevant study are suggested below. First, because there were significant associations between parental partiality and sibling interactions, it would be interesting to include measures of parental perceptions of their own partiality as well as a measure of overall family cohesion. Further measures of parental perception of the sibling relationship would also be worthwhile, to better understand whether parents view sibling relationships as maladaptive, or whether they feel their children are interacting in a healthy way. Often reports by parents and children are discrepant (De Los Reyes, Augenstein, Wang, Thomas, Drabick, … & Rabinowitz, 2015), and it would therefore be beneficial to understand how views of sibling relationships differ within the family context.

Due to sample size limitations, covariates were often excluded from analyses to increase power. However, with larger sample sizes, it would be interesting to better understand how some of the broader contextual information gathered impacts sibling relationship functioning. For example, are there differences in sibling response based on their siblings' level of intellectual functioning or autism severity? Is there any impact of having additional siblings in the household? What are the characteristics of siblings who are interacting more prosocially compared to those who are having more difficulties? Do children who receive outside therapies benefit from more positive interactions with their siblings? How do these responses and relationships change over time?

One additional further direction worthy of further study is the impact of psychopathology on sibling interactions. In a review by Buist and colleagues, siblings of children with ASD are considered at increased risk for internalizing and externalizing disorders (Buist, Dekovic, & Prinzie, 2013). Incorporating measures of broad psychopathology into this battery would be worthwhile to better understand whether siblings' interactions are at all hampered by other disorders. This is also critical when considering whether therapeutic intervention is an appropriate next step for these children.

In conclusion, it is important to nurture and foster healthy sibling relationships for all children, due in large part to the lasting duration of this relationship across the lifespan. While many challenges can arise between siblings, particularly those of siblings who face disability, early therapeutic intervention targeting prosocial ways of interacting and communicating can be highly beneficial, particularly for those siblings who voice frustration or difficulty engaging with their ASD sibling. In contrast, it is also important

to highlight and continue to encourage the positive, supportive aspects of the sibling relationship when one child has ASD. Taken a step further, it is likely that NT siblings could benefit from learning about how increased compassion and support provided between TD/ASD siblings is shared. Despite the frequent focus of research on the adverse effects of having a sibling with ASD, this research finding has strong positive clinical utility, beyond its statistical significance. Perhaps NT children would benefit from spending time with families who have a child with a disability, to gain an understanding for the differences in their own sibling relationships and an appreciation for the positive and unique bonds these children share. While complex, future research clarifying those key variables that can strengthen sibling relationships is essential.

Table 1
Internal Consistency Coefficients

Measure	*Cronbach's α*
Piers-Harris Self-Concept Scale	
Physical Appearance	.612
Freedom from Anxiety	.858
Intellectual/School Status	.784
Behavioral Adjustment	.720
Happiness/Satisfaction	.482
Popularity	.738
Total Score	.900
Sibling Relationship Questionnaire, Child Report	
Prosocial	.495
Maternal Partiality	.772
Nurturance of Sibling	.676
Nurturance by Sibling	.892
Dominance of Sibling	.863
Dominance by Sibling	.832
Paternal Partiality	.790
Affection	.831
Companionship	.670
Antagonism	.854
Similarity	.672
Intimacy	.724
Competition	.824
Admiration of Sibling	.836
Admiration by Sibling	.843
Quarreling	.922
Factor: Warmth and Closeness	.904
Factor: Status/Power	.693
Factor: Conflict	.904
Factor: Rivalry	.669
Social Responsiveness Scale, 2nd Edition	
Social Awareness	.288
Social Cognition	.705
Social Communication	.840
Social Motivation	.685
Restricted Repetitive Behaviors	.780
Total Score	.918
Social Support Appraisals Scale	
Peer Support	.948
Family Support	.952
Teacher Support	.907

Overall Total Support	.977

Table 2

Cohen's Kappas and Percentage Agreement for Play Task Coding

	Kappa	*% Agreement*
Puzzle Task:		
Quality of Cooperation	.804	90%
Quality of Negotiation	.672	80%
Positive Verbal Engagement	.873	90%
Negative Verbal Engagement	.804	90%
Teaching Task:		
Quality of Teaching	.630	90%
Number of Rule Violations	.651	70%
Positive Verbal Engagement	.865	90%
Negative Verbal Engagement	.474	90%

Table 3

Measures and who completed what

Measure	*Parent*	*ASD SIB*	*TD SIB*	*NT OLD*	*NT YNG*
Demographic Questionnaire	✓				
Social Responsiveness Scale, Second Edition	✓	✓			
ADOS-2		✓			
WASI-2			✓	✓	✓
Piers-Harris Children's Self-Concept Scale			✓	✓	
Sibling Relationship Questionnaire			✓	✓	
Social Support Appraisal Scale			✓	✓	
Structured Play Tasks		✓	✓	✓	✓

Table 4

Child Demographics by Group

	TD OLD *n (%)*	*ASD YNG* *n (%)*	*NT OLD* *n (%)*	*NT YNG* *n (%)*
Gender				
Male	13 (44.8%)	23 (79.3%)	7 (33.3%)	10 (47.6%)
Female	16 (55.2%)	6 (20.7%)	14 (66.7%)	11 (52.4%)
Race				
White	26 (87.9%)	26 (87.9%)	18 (85.7%)	18 (85.7%)
Black	2 (6.9%)	2 (6.9%)	2 (9.5%)	2 (9.5%)
Asian	1 (3.4%)	1 (3.4%)	0	0
Multiracial	0	0	1 (4.8%)	1 (4.8%)
Ethnicity				
Hispanic	21 (72.4%)	21 (72.4%)	10 (47.6%)	10 (47.6%)
Non-Hispanic	8 (27.6%)	8 (27.6%)	11 (52.4%)	11 (52.4%)

Table 5

Child Demographics by Group (con't)

	TD OLD *Range* *M (S.D.)*	*ASD YNG* *Range* *M (S.D.)*	*NT OLD* *Range* *M (S.D.)*	*NT YNG* *Range* *M (S.D.)*
IQ				
FSIQ	81-127 101.62 (11.82)	40-119 81.38 (26.87)	72-120 103.76 (14.96)	76-116 97.76 (12.07)
VCI	85-129 102.72 (9.63)	45-128 80.41 (26.93)	73-119 102.10 (14.42)	79-121 98.62 (10.92)
PRI	74-130 99.93 (14.56)	45-120 82.31 (25.90)	75-125 104.33 (15.23)	75-119 97.57 (13.48)
Age (in months)	100-155 128.97 (14.90)	84-139 102.66 (13.18)	103-154 133.86 (15.89)	88-132 111.10 (15.51)
ASD Severity ADOS-2		4-10 7.66 (1.61)		
BAP Char. SRS-2	38-59 44.66 (4.78)		37-68 49.10 (8.81)	37-90 48.95 (11.23)
Span of Time Between Sibs (in months)	0-61 26.31 (14.14)		0-43 22.76 (9.57)	

Table 6

Caregiver Demographics

	ASD/TD Group n (%)	NT Group n (%)
Caregiver 1		
Gender		
Male	2 (6.9%)	2 (9.5%)
Female	27 (93.1%)	19 (90.5%)
Relationship To Children		
Biological Mother	27 (93.1%)	19 (95.5%)
Biological Father	2 (6.9%)	2 (9.5%)
Race		
White	26 (89.7%)	18 (85.7%)
Black	2 (6.9%)	2 (9.5%)
Asian	1 (3.4%)	0
Unreported	0	1 (4.8%)
Ethnicity		
Hispanic	21 (72.4%)	10 (47.6%)
Non-Hispanic	8 (27.6%)	11 (52.4%)
Highest Degree Attained		
Partial High School	0	1 (4.8%)
HS/GED	4 (13.8%)	1 (4.8%)
AA/AS/Partial College	3 (10.3%)	3 (14.3%)
BA/BS	14 (48.3%)	6 (28.6%)
MA/MS	4 (13.8%)	5 (23.8%)
MD/PhD/Post Graduate	4 (13.8%)	4 (19.0%)
Unreported	0	1 (4.8%)
Caregiver 2		
Gender		
Male	26 (89.7%)	19 (90.5%)
Female	2 (6.9%)	2 (9.5%)
Unreported	1 (3.4%)	0
Relationship To Children		
Biological Mother	2 (6.9%)	2 (9.5%)
Biological Father	25 (86.2%)	19 (90.5%)
Stepmother	0	0
Stepfather	1 (3.4%)	0
Race		
White	26 (89.7%)	18 (85.7%)
Black	1 (3.4%)	1 (4.8%)
Asian	1 (3.4%)	0
Multi/Biracial	0	1 (4.8%)
Unreported	1 (3.4%)	1 (4.8%)

Ethnicity		
Hispanic	17 (58.6%)	11 (52.4%)
Non-Hispanic	10 (34.5%)	9 (42.9%)
Unreported	2 (6.9%)	0
Highest Degree Attained		
HS/GED	3 (10.3%)	4 (19.0%)
AA/AS/Partial College	5 (17.2%)	2 (9.5%)
BA/BS	13 (44.8%)	5 (23.8%)
MA/MS	4 (13.8%)	6 (28.6%)
MD/PhD/Post Graduate	3 (10.3%)	3 (14.3%)
Unreported	1 (3.4%)	1 (4.8%)

Table 7

Household Characteristics

Parental Relationship Status	*ASD/TD Group n (%)*	*NT Group n (%)*
Married	26 (89.7%)	17 (81%)
Divorced	2 (6.9%)	3 (14.3%)
Separated	1 (3.4%)	1 (4.8%)
Family Socioeconomic Status		
< $20,000	0	1 (4.8%)
$20,000- $39,999	3 (10.3%)	0
$40,000- $59,999	2 (6.9%)	1 (4.8%)
$60,000- $79,999	2 (6.9%)	2 (9.5%)
$80,000- $99,999	7 (24.1%)	4 (19%)
> $100,000	15 (51.7%)	12 (57.1%)
Unreported	0	1 (4.8%)
Languages Spoken In The Home		
English	16 (55.2%)	13 (61.9%)
Spanish	2 (6.9%)	0
Both English & Spanish	11 (37.9%)	8 (38.1%)
Other	0	

Table 8

Means and Standard Deviations of Self-Report by Group

	TD Group *M (SD)*	NT Group *M (SD)*
Satisfaction with the Sibling Relationship	3.62 (.593)	3.32 (.571)
Parental Partiality	2.95 (.527)	2.98 (.337)
Social Support Overall	4.15 (.896)	4.11 (.736)
Family Support	4.32 (1.01)	4.23 (.853)
Peer Support	4.09 (.880)	4.10 (.735)
Teacher Support	4.07 (.903)	3.99 (.776)
Self-Concept	53.30 (8.16)	53.15 (10.77)

Table 9

Pearson r Correlations Between Self-Report Measures

	SRQ-C OS Warmth/ Closeness Factor Scale	SRQ-C OS Rivalry Factor Scale	SSOCS OS Overall Total Support Scale	Piers Harris Self Concept Scale OS Total Score
SRQ-C OS Warmth/ Closeness Factor Scale	1	.282*	-.062	.190
SRQ-C OS Rivalry Factor Scale		1	.156	.046
SSOCS OS Overall Total Support Scale			1	.154
Piers Harris Self Concept Scale OS Total Score				1

*. Correlation is significant at the 0.05 level (2-tailed).

Table 10

Pearson r Correlations Between Play Task Measures

	Puzzle Task: Quality of Negot-iation	Puzzle Task: Quality of Cooper at-ion	Puzzle Task: Positive Verbal Engage	Puzzle Task: Negative Verbal Engage	Teach Task: Qualit y of Teach-ing	Teach Task: Number of Rule Violat-ions	Teach Task: Positive Verbal Engage	Teach Task: Negative Verbal Engage
Puzzle: Quality of Negotiation	1	.587**	.197	-.032	.482**	-.493**	-.026	-.127
Puzzle: Quality of Cooperation		1	.107	-.020	.704**	-.572**	-.112	-.069
Puzzle: Positive Verbal Engage			1	.050	.126	.170	.566**	.046
Puzzle: Negative Verbal Engage				1	.066	.065	-.017	.443**
Teaching: Quality of Teaching					1	-.534**	.018	-.006
Teaching: Number of Rule Violate						1	.301*	.125
Teaching: Positive Verbal Engage							1	.453
Teaching: Negative Verbal Engage								1

**. Correlation is significant at the 0.01 level (2-tailed).

Table 11

Means and Standard Deviations of Puzzle Task Codes by Group

	ASD/TD Group *M (SD)*	NT Group *M (SD)*
Puzzle Task: Quality of Negotiation	2.75 (1.60)	3.29 (1.71)
Puzzle Task: Quality of Cooperation	3.39 (1.23)	4.29 (.90)
Puzzle Task: Positive Verbal Engagement	3.14 (1.46)*	2.05 (1.02)*
Puzzle Task: Negative Verbal Engagement	1.75 (1.14)*	1.48 (.512)*

*. Mean difference is significant at the 0.05 level (2-tailed).

**. Mean difference is significant at the 0.01 level (2-tailed).

Table 12

Means and Standard Deviations of Teaching Task Codes by Group

	ASD/TD Group *M (SD)*	NT Group *M (SD)*
Teaching Task: Quality of Teaching	4.26 (1.51)	4.60 (1.10)
Teaching Task: Number of Rule Violations	3.63 (3.65)**	1.50 (2.40)**
Teaching Task: Positive Verbal Engagement	2.74 (1.40)*	1.55 (1.0)*
Teaching Task: Negative Verbal Engagement	1.41 (.89)**	1.10 (.31)**

*. Mean difference is significant at the 0.05 level (2-tailed).

**. Mean difference is significant at the 0.01 level (2-tailed).

Table 13

Pearson r Correlations Between Self-Report Measures and Puzzle Quality of Negotiation

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Puzzle Task: Quality of Negotiation
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support	-.058	.053	.934**	.832**	1			
SSOCS Overall Total Support	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Puzzle Task: Quality of Negotiation	-.099	-.080	.241	.039	.193	.174	.303*	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 14

Pearson r Correlations Between Self-Report Measures and Puzzle Quality of Cooperation

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Puzzle Task: Quality of Cooperation
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Puzzle Task: Quality of Cooperation	-.131	.042	.111	.052	.018	.073	.177	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 15

Pearson r Correlations Between Self-Report Measures and Puzzle Positive Verbal Engagement

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Puzzle Task: Positive Verbal Engagement
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Puzzle Task: Positive Verbal Engagement	.025	-.085	-.058	-.058	-.118	-.076	.021	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 16

Pearson r Correlations Between Self-Report Measures and Puzzle Negative Verbal Engagement

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Puzzle Task: Negative Verbal Engagement
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Puzzle Task: Negative Verbal Engagement	-.081	.345*	.170	.211	.219	.205	.210	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 17

Pearson r Correlations Between Self-Report Measures and Teaching Quality of Teaching

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Teaching Task: Quality of Teaching
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Teaching Task: Quality of Teaching	-.215	.053	.053	-.045	-.017	.005	.228	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 18

Pearson r Correlations Between Self-Report Measures and Teaching Rule Violations

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Teaching Task: Number of Rule Violations (max 9)
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Teaching Task: Number of Rule Violations	.174	.131	-.278	-.204	-.239	-.257	-.142	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 19

Pearson r Correlations Between Self-Report Measures and Teaching Positive Verbal Engagement

	SRQC OS Warmth/ Close Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Teaching Task: Positive Verbal Engage
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Teaching Task: Positive Verbal Engagement	.042	-.011	-.149	-.173	-.175	-.171	-.062	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 20

Pearson r Correlations Between Self-Report Measures and Teaching Negative Verbal Engagement

	SRQC OS Warmth/ Closeness Factor Scale	SRQC OS Rivalry Factor Scale	SSOCS OS Peer Support Scale	SSOCS OS Family Support Scale	SSOCS OS Teacher Support Scale	SSOCS OS Total Support Scale	PHSCS OS Sibling Total T-Score	Teaching Task: Negative Verbal Engagement
SRQC OS Warmth/Closeness Factor Scale	1							
SRQC OS Rivalry Factor Scale	.282*	1						
SSOCS OS Peer Support Scale	-.119	.106	1					
SSOCS OS Family Support Scale	.022	.283*	.871**	1				
SSOCS OS Teacher Support Scale	-.058	.053	.934**	.832**	1			
SSOCS OS Overall Total Support Scale	-.062	.156	.981**	.939**	.954**	1		
PHSCS OS Total Score T-Score	.190	.046	.213	.040	.172	.154	1	
Teaching Task: Negative Verbal Engagement	-.122	-.118	.083	.143	.146	.123	.087	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 21

Standardized Beta Coefficients for Moderation Analyses

	β Coefficient
Moderation Model 1: Self-Concept and Quality of Negotiation	
Model 1	
Group	-.160
Self-Concept	.302*
Model 2	
Group	-.160
Self-Concept	.358
Interaction Term	-.084
Moderation Model 2: Parental Partiality and Negative Verbal Engagement	
Model 1	-.163
Group	-.083
Parental Partiality	
Model 2	-.158
Group	.111
Parental Partiality	-.222
Interaction Term	

*. Significant at the .05 level (2 tailed)

Figure 1

Group Labels.

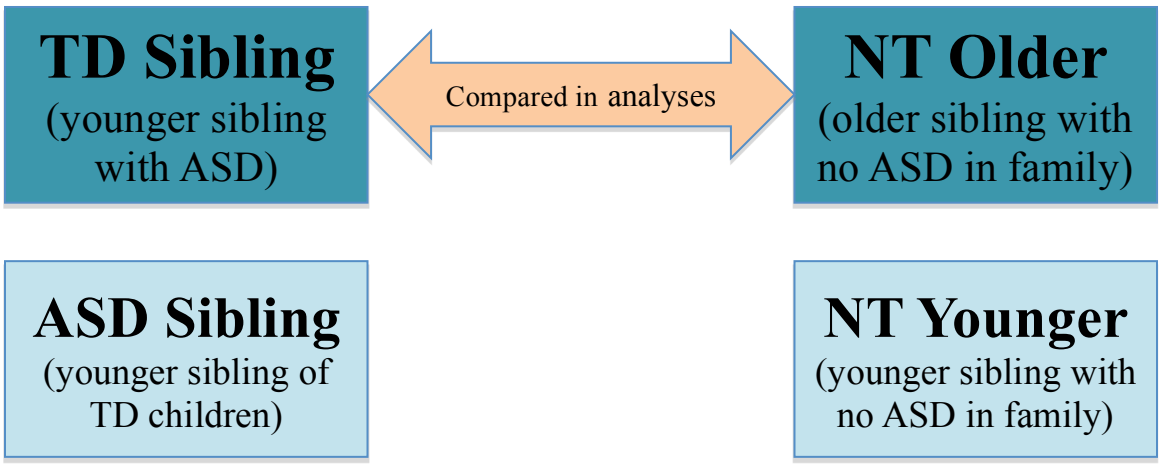

Figure 2

Sample visual provided during visit.

	**My sibling <u>almost always</u>** gets treated **better**
	**My sibling <u>often</u>** gets treated **better**
	We get treated about the **<u>same</u>**
	**I <u>often</u>** get treated **better**
	**I <u>almost always</u>** get treated **better**

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Appendices

Coding for Puzzle Task

Directions: Begin timing once the examiner has read the directions and has left the room. Stop timing when examiner enters the room to either 1) redirect siblings or 2) help siblings complete the puzzle. Do not code behaviors when examiner is in the room or if one of the siblings leave the room (e.g., to go to the bathroom or to get water).
Only the older sibling's comments are coded.
The following behaviors are global codes based upon behaviors observed throughout the interaction:

***Quality of Negotiation*:** This is to assess if the older sibling was able to negotiate which side of the puzzle to complete

- 1 = Older sibling immediately began construction of puzzle and disregards younger sibling's presence. Younger sibling is not engaged with the puzzle task or simply follows the older sibling's lead, or no discussion is had regarding how to tackle the puzzle task.
- 2 = Older sibling immediately begins construction of puzzle and ignores younger sibling's suggestion (ex. younger sibling might make a suggestion and older sibling does not respond but might acknowledge the statement was made by making eye-contact or looking at younger sibling)
- 3 = Older sibling listens to younger sibling's suggestion and complies (i.e., I think we should start with the edges).
- 4 = Older sibling makes suggestion and younger sibling complies (i.e., first we need to flip over all the pieces).
- 5 = Older and younger sibling effectively negotiates (each suggests a plan and they compromise) and compromise on how to begin to complete the puzzle (i.e., how about I do x, and (the other) I do y)

Quality of Cooperation: This assesses the older sibling's overall quality in cooperating with younger sibling to complete puzzle

- 1 = Neither sibling worked on the puzzle, or one of the siblings was distracted for a significant portion of the time the puzzle was being completed
- 2 = Older sibling completed puzzle by self not allowing the younger sibling to help at all.
- 3 = Older sibling worked in parallel with younger sibling to complete puzzle, both worked independently for the majority (greater than 50%) of the task time.
- 4 = Older sibling attempted to cooperate (at least one attempt) but was directive when completing the puzzle (greater than 10 directive statements)
- 5 = Older and younger siblings worked cooperatively together to complete puzzle for the majority (greater than 50%) of the time, and fewer than 10 directives were given by the older sibling.

Global Code of Positive Verbal Engagement: moments of shared positive affect include comments by the older sibling directed at the younger sibling that convey

encouragement, success, or kindness. Do not include directive statements (i.e., place it here).

1 = complete absence of positive statements
2 = 1-2 instances of shared positive statements
3 = 3-5 instances of shared positive statements
4 = 6-8 instances of shared positive statements
5 = >8 instances of shared positive statements

Global Code of Negative Verbal Engagement moments of shared negative affect include comments made by the older sibling directed at the younger sibling that convey negativity, frustration, or discouragement. Do not include directive statements (i.e., I told you to place it here").

1 = complete absence of negative statements
2 = 1-2 instances of shared negative statements
3 = 3-5 instances of shared negative statements
4 = 6-8 instances of shared negative statements
5 = >8 instances of shared negative statements

In addition to coding global behaviors, the following behaviors will be a **frequency count** of behaviors calculated throughout the interaction**:**

Number of Positive Statements:

About Self: Older sibling's supportive statements about his/her ability to complete the task or help with the puzzle (i.e., Yes, I did it! I am so good at this)
About Sibling: Supportive statements made by older sibling toward younger sibling encouraging or stating how well the younger sibling performed (i.e., Nice job!)

Number of Negative Statements:

About Self: Statements made by older sibling negatively critiquing self (i.e., I can't do this, I suck at doing this puzzle)
About Sibling: Statements directed at younger sibling, negatively critiquing them (i.e., You're bad at this)

Coding for Teaching Task

Directions: Only the older sibling is coded for this segment. *Coding begins* once instructions have been read to older sibling and examiner has left. *Coding ends* once the model has been constructed by younger sibling.
The following behaviors are global codes based upon behaviors observed throughout the interaction:

Quality of Teaching: This is a global code looking at the overall ability of the older sibling to effectively use verbal directives in order to teach the younger sibling how to construct the model. Directives include telling the younger sibling where to put a piece or where not to put a piece of the model. Giving directive for each step and waiting to see if they did it after giving verbal directives constitutes high quality of teaching.

Note: Examples of a verbal directive include: "first you put this piece here."
"don't put that piece there."

1= Older sibling constructed object without showing/teaching younger sibling, or older sibling completes the majority of the building task for the younger sibling.
2= Older sibling rarely (1-2 times) uses verbal directives to teach younger sibling.
3= Older sibling uses few (3-4 times) verbal directives to teach younger sibling.
4= Older sibling uses some (5-6 times) verbal directions to teach younger sibling.
5= Older sibling uses verbal directives for the majority of the interaction (>50%) to successfully teach younger sibling how to construct the model.

In addition to coding global behaviors, the following behaviors will be a **frequency count** of behaviors calculated throughout the interaction**:**

Number of Rule Violations: The purpose of this code is to assess how well the older sibling was able to comprehend the instructions and inhibit the need to show his/her pictures or touch the other sibling's materials when trying to teach.

Number of Positive Statements:

About Self: Older sibling's supportive statements about his/her ability to complete the task or help with the puzzle (i.e., Yes, I did it! I am so good at this)
About Sibling: Supportive statements made by older sibling toward younger sibling encouraging or stating how well the younger sibling performed (i.e., Nice job!)

Number of Negative Statements:

About Self: Statements made by older sibling negatively critiquing self (i.e., I can't do this, I suck at doing this puzzle)
About Sibling: Statements directed at younger sibling, negatively critiquing them (i.e., You're bad at this)

Global Code of Positive Verbal Engagement: moments of shared positive affect include comments by the older sibling directed at the younger sibling that convey encouragement, success, or kindness. Do not include directive statements (i.e., place it here).

1 = complete absence of positive statements
2 = 1-2 instances of shared positive statements
3 = 3-5 instances of shared positive statements
4 = 6-8 instances of shared positive statements
5 = >8 instances of shared positive statements

Global Code of Negative Verbal Engagement moments of shared negative affect include comments made by the older sibling directed at the younger sibling that convey negativity, frustration, or discouragement. Do not include directive statements (i.e., I told you to place it here").

1 = complete absence of negative statements
2 = 1-2 instances of shared negative statements
3 = 3-5 instances of shared negative statements
4 = 6-8 instances of shared negative statements
5 = >8 instances of shared negative statements