

**Mother-Child Synchrony and Externalizing Behaviors in School-Aged
Children with and without Autism Spectrum Disorders**

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Abstract

Synchrony is a multi-faceted construct, defined here as the mutual warmth and responsiveness between a mother and her child. As children with Autism Spectrum Disorders (ASD) struggle to navigate various aspects of social life, we expected that impairments in synchrony would be seen, but that mothers would show adaptability. Twenty-five children (10 met ASD criteria on a gold standard autism assessment) completed a brief cognitive assessment and nine semi-structured play tasks with their mother, adapted from the Marschak Interaction Method. Synchrony was not found to moderate the relationship between ASD severity and externalizing behaviors, as hypothesized. ASD severity did predict externalizing behaviors. While children in the ASD group were more negative during the observed play tasks, there were no group differences on mother or dyad scores. Despite power limitations, our findings suggest important future directions for examination of mother and dyad mechanisms that better explain these differences.

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Chapter 1 - Introduction

Autism spectrum disorders (ASDs) are characterized by social and communication deficits, as well as stereotyped behaviors and/or restricted interests (American Psychiatric Association [APA], 2000). Additionally, children with ASD often lack joint attention and appropriate social eye contact, behaviors that typically developing (TD) children use to display interest in objects and social partners (Siller & Sigman, 2002; Mundy, Sigman, & Kasari, 1990). Children with ASD respond to and initiate joint attention less often than their TD peers, and have difficulties pointing, showing, and switching their gaze between an object and their partner's eyes. With less motivation to initiate and respond to social interactions, children with ASD often have difficulty effectively using social language (Trevvarthen & Daniel, 2005).

In the surveillance year of 2008, the Centers for Disease Control and Prevention (CDC) found that among 14 sites nationwide, 1 in every 88 children had a diagnosis on the autism spectrum (CDC, 2012). This statistic represented a 23% increase in prevalence from 2006 data taken from 11 sites nationwide, and a 78% increase from 2002 data from 13 sites (CDC, 2012). With such dramatic increases in the identification of autism, and the subsequent demand for intervention services, it continues to be important to understand the underlying processes that characterize this range of disorders.

The social development of children with ASD differs from that of TD children. With TD infants and toddlers, play is often initiated by the parent, such as the parent waving a rattle, handing the child a stuffed animal, or rolling a ball towards the child. Then, as the child develops, he or she controls more of the play, especially initiations, such as asking to be pushed on the swings, wanting to have a pretend tea party, or asking to play a board game. This developmental process demonstrates increased independence and greater responsibility on the part of the child to initiate and organize the social interaction (Bakeman & Adamson, 1984). Children with ASD often have difficulty initiating and responding to social interaction, including play, and are less likely to seek novelty and to share new discoveries and creations with their parents. As children with ASD often show greater engagement with objects than with people, play experiences may be less reciprocal and less exciting for parents of children with ASD (Freeman & Kasari, 2013). This social disengagement can be confusing or frustrating to parents, and may result in qualitatively less-satisfying interactions with their child with ASD.

In a longitudinal study of socioeconomically high-risk children, at ages 6, 24, and 42 months old, Pianta, Sroufe, and Egeland (1989) found that sources of stress that emanated from the environment or from child characteristics resulted in decreased maternal sensitivity during tasks, while positive social support increased maternal sensitivity.

1.1 - Defining Synchrony

Since lack of social orienting and responsiveness are hallmark characteristics of ASD, it follows that parent-child synchrony may also be impaired in individuals on the spectrum. Dyadic synchrony is defined in multiple ways, but can be generally conceptualized as positive reciprocal interactions between a parent and child. Siller and Sigman (2002, 2008) defined synchrony as a parent providing comments and engaging in behaviors with their child in an undemanding way, as their child plays and attends to objects. Deater-Deckard and Petrill (2004) defined “dyadic mutuality” based on four central concepts: parent responsiveness to child, child responsiveness to parent, dyad cooperativeness, and dyad behavioral and emotional reciprocity. Rothbaum and Weisz (1994) found the term “synchrony” to be more specific and useful than the broader term “responsiveness,” which included more emotionally-valenced constructs such as guidance and approval. Synchrony was conceptualized to overlap with “attunement, availability, empathy, involvement, openness, participation, and sensitivity” (Rothbaum and Weisz, 1994, p. 58).

Dyadic synchrony has also been related to the constructs of matching affective or behavioral states and behavioral harmony. For the purposes of the current study, dyadic or maternal synchrony can be best conceptualized as the reciprocal social interaction between a parent and child, including play, imitation, joint attention, point following, gaze shifting, and response to name. As these are traditional areas of weakness in individuals with autism, parent-child relationships lacking in warmth, responsiveness, and cooperation may be common as well.

In TD children, it has been found that a parent who verbally labels their child’s actions, or the objects to which their child is attending, may help build the child’s vocabulary and receptive and expressive language abilities (Bakeman & Adamson, 1984; Tomasello & Farrar, 1986). Pianta, Sroufe, and Egeland (1989) found that TD children who were part of dyads with high synchrony were more persistent in a problem-solving task, and showed higher self-control than peers in low synchrony dyads. Additionally, Mize and Pettit (1997) found that high synchrony was correlated with a preschool teacher’s positive rating of a child’s social

functioning. When controlling for symptom severity and IQ, low synchrony influenced functioning level in hyperactive/inattentive children; the mother-child interaction accounted for additional variance above and beyond individual mother and child factors (Healey, Gopin, Grossman, Campbell, & Halperin, 2010).

1.2 - Synchrony and Attachment

Synchrony and attachment have areas of obvious overlap. Bowlby (1988) noted that a positive, appropriate attachment to a caregiver provides a child with a “strong and pervasive feelings of security,” (p. 27), which encourages the child to continue and develop that relationship. The study at hand focuses on the behavioral expression of synchrony, which may have correlates among the behaviors of secure attachments. A relationship between synchrony and attachment as an attribute or disposition is not explored here.

The study of parent-child relationships has been nearly dominated by examination of attachment and individual/group differences on expressions of attachment, which may have resulted in underdeveloped ideas about other facets of the parent-child relationship (Dunn, 1993). However, attachment is only one part of the greater parent-child relationship. Dunn (1993) suggests three areas of adult relationships that have received attention, but have been less studied in early childhood: sharing feelings and experiences, sharing humor, and connectedness. Connectedness specifically has connotations for our study of synchrony. Although one way that connectedness is measured is in number of conversational turns, this would be confounded in a study of children with ASD, who, by definition, may have impaired communication. We posit that connectedness goes above and beyond the conversational; that synchrony includes a broader construct of warmth, approach, and engagement.

There may be group differences in the parenting styles of parents with and without children with developmental disorders. However, in the same way that TD children have different styles of attachment to their parents, we may find that mothers of children with ASD are able to adapt their parenting styles specific to that child’s disorder. Our overall expectation is that mothers are able to change their behavior according to the needs of their child, indicating an important amount of flexibility and creativity on the part of the mother. This may or may not be related to the child’s amount of engagement in the activity.

1.3 - Attachment in ASD

Relatedly, several researchers have used modified Strange Situation tasks to examine the attachment styles of children with ASD. Yirmiya and Sigman (2001) discuss several studies that have found similar results of children on the spectrum who are able to show secure attachment patterns with adults. For example, a study of 17 children with ASD, matched with 17 children with psychiatric diagnoses, found no significant differences between groups on behavioral ratings of a modified Strange Situation task (Rogers, Ozonoff, & Maslin-Cole, 1991). In a later study of 21 children with autism and 11 children with PDD, the same group found that 50% of the children had secure attachments, with no group differences (Rogers, Ozonoff, & Maslin-Cole, 1993). Others found that children with ASD looked and smiled at their mothers less frequently, and engaged in fewer showing and mutual play behaviors (Dissanayake & Crossley, 1996). However, there were no group differences between children with ASD, children with Down syndrome, and TD children for approach behaviors and physical contact.

The authors clarify that Strange Situation-type tasks may not assess how well the child with ASD relates him- or herself to their caregiver. Rather, attachment as it is measured in this task is relatively self-serving (i.e., to reduce distress), perhaps causing this measure to be less accurate in pinpointing true reciprocity within a caregiver-child relationship. However, these and other similar studies support the idea that there may be an underlying warmth and security to the relationship of a mother and her child with ASD, despite our limited ability to measure it well.

Dyadic synchrony helps a child regulate their behaviors, emotions, and cognitions in interactions with their parents, which may lead to improved self-regulation (Deater-Deckard, Atzaba-Poria, & Pike, 2004). In children with ASD, high parent-child synchrony may lead to better emotional regulation and fewer externalizing behaviors. Alternately, low synchrony may correlate with fewer pro-social behaviors. Improved self-regulation would be important to a child on the spectrum, potentially dispelling outbursts sooner and allowing the child to create better peer and adult relationships. These skills would be applicable in a variety of crucial settings, such as the home, school, and community.

The literature suggests that positive reciprocal interactions between a parent and a child are associated with better adjustment and fewer behavior problems (Healey et al., 2010). However, findings in regards to synchrony in children with ASD are still emerging. Therefore,

the relationship between synchrony and problem behaviors for children with ASD remains unexplored. Additionally, much of the synchrony literature focuses on infants, with toddler studies being less common, and even fewer studies with a focus on early childhood (Harrist & Waugh, 2002). This study seeks to explore mother-child synchrony as related to ASD severity and externalizing behaviors in school-aged children with and without ASD. Exploring the nature of synchrony in children with ASD may help improve care, especially for clinicians conducting parent training interventions. The results of this study could have specific implications for supporting positive parent-child relationships.

1.4 - Hypotheses

It is proposed that synchrony moderates the relationship between ASD severity and externalizing behaviors, such that children with greater ASD severity who score high on measures of dyadic synchrony would have fewer externalizing behaviors than their low-synchrony counterparts. More specifically, it is expected that ASD (in terms of classification as well as continuous ASD severity) will be related to greater levels of negativity during the parent-child interaction task, as well as higher externalizing scores (i.e., main effects), though we do not expect ASD to be related to synchrony. Rather, we feel that mothers who have learned to adapt their style of play and engagement to their child's special needs will be able to uniquely connect with their child with ASD, and this mutual understanding may reduce outbursts and aggression. This relationship would reflect a unique flexibility and creativity on the part of the mother, above and beyond what is seen in mothers of TD children.

Chapter 2 - Method

2.1 - Participants

Data were collected from 28 children, aged 4 to 11 years old, from Southwest Virginia. Data were missing from seven participants due to technical difficulties; four of these seven families were able to repeat the protocol. Therefore, complete data from 25 children (64% males; $M = 7.24$ years, $SD = 2.1$ years) were used in all analyses (see Table 1 for complete demographic information for both groups and overall sample). There were no significant differences between groups on age, $F(1, 23) = 1.57, p > .05$. The children were 88% ($n = 22$) Caucasian and 8% ($n = 2$) Bi-racial; one mother did not report her child's ethnicity.

Children with concerns or diagnoses of ASD, as well as children without ASD diagnoses, were recruited. Twelve children had prior ASD diagnoses of Autistic Disorder, Asperger's Disorder, or Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) (83.3% males; $M = 6.58$ years, $SD = 2.1$ years). Of these children, eight (32%) had previous diagnoses of autism, three (12%) had previous diagnoses of Asperger's Disorder, and one had a previous diagnosis of PDD-NOS (4%). Thirteen children did not have prior ASD diagnoses (38.5% males, $M = 7.62$ years, $SD = 2.3$ years). One child whose mother initially had concerns of ASD did not meet criteria for ASD on the ADOS; this child was placed into the non-ASD group for analyses. While all 12 children with previous diagnoses met criteria either for Autism or the Autism Spectrum on the ADOS, the groups were re-characterized when ADOS scores were converted using newer algorithms from the Autism Diagnostic Observation Schedule, Second Edition (ADOS; Gotham, Risi, Pickles, & Lord, 2007). Two children who had previous diagnoses of autism were classified into the non-ASD group, based on their ADOS scores. Results remained unchanged when these two children were excluded from the regression analyses described below. Based on ADOS algorithms, 10 children met the cut-off for Autism or the Autism Spectrum (ASD group), and 15 did not (non-ASD group). These groups were used in data analyses.

Dyads were recruited at two locations, one in a rural town (56%) and the other in a small city (44%). Inclusion criteria were the ability to point and had participation of the child's biological mother or female guardian, who was also their primary caregiver. Participants were not excluded based on the length of time that the mother or guardian had been the child's

primary caregiver, nor based on if they had always been the primary caregiver for the child (e.g., adoptive mothers or stepmothers). Sixteen different mothers participated; seven of these mothers participated with two or three children. Sixteen of the 25 children were related to at least one other child in the study. Ninety-two percent of the children ($n = 23$) were accompanied by their biological mother, and 8% of children ($n = 2$) were accompanied by their adoptive mother. Both adopted children had previous ASD diagnoses.

Of the 16 mothers, 87.5% were Caucasian ($n = 14$), one mother was African-American, and one mother did not report her ethnicity. All mothers had some college education; 31.3% ($n = 5$) had a terminal college degree and 50% ($n = 8$) had a graduate degree. Six families (37.5%) earned \$39,000 or less per year, while four families (25%) earned \$100,00 per year or more. There were no significant differences between groups on income ($F(1, 23) = .08, p > .05$), maternal ethnicity ($F(1, 23) = 1.52, p > .05$), child ethnicity ($F(1, 23) = .06, p > .05$), or maternal education ($F(1, 23) = .07, p > .05$).

Based on scores from the Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2004), the Full Scale IQ (FSIQ) scores of the child participants ranged from 42 to 140 ($M = 104.4, SD = 20.9$). The KBIT-2 is standardized to have a mean of 100 and a standard deviation of 15; average scores are considered to be a standard deviation above and below the mean, or scores between 85 and 115. There was a significant difference in FSIQ between groups, $F(1, 23) = 11.29, p < .01$, with participants in the non-ASD group ($M = 114.00, SD = 12.78$) having significantly higher FSIQ scores than those in the ASD group ($M = 90.00, SD = 22.99$). A one-tailed group difference was also found on the SCQ, $F(1, 23) = 41.35, p < .001$, with those in the ASD group showing significantly higher scores of ASD symptoms ($M = 15.50, SD = 4.84$) than those in the non-ASD group ($M = 3.20, SD = 4.59$).

According to the Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition (DSM-IV-TR), four to five times as many males are diagnosed with autism than females (APA, 2000). A similar 4:1 ratio was expected in our ASD group. However, our ASD group was 100% male, while the non-ASD group contained 40% males. The gender difference between groups is a limitation of this study, which is discussed in further detail below. Significant gender differences were found on various measures, including the SCQ ($F(1, 23) = 5.66, p < .05$), the Prosocial scale of the SDQ ($F(1, 23) = 5.73, p < .05$), the total number of problem settings on the Home Situations Questionnaire, Pervasive Developmental Disorders version (HSQ-PDD;

Barkley, Edwards, & Robin, 1999; Research Units on Pediatric Psychopharmacology [RUPP], 2007, 2009; Johnson et al., 2009; $F(1, 23) = 5.94, p < .05$), the lethargy scale of the Aberrant Behavior Checklist (ABC; $F(1, 23) = 5.33, p < .05$), and ASD severity ($F(1, 23) = 10.53, p < .01$). A gender difference on the Hyperactivity scale of the ABC was trending towards significance, $F(1, 23) = 4.16, p = .053$. Therefore, gender is controlled for in all analyses.

2.2 - Data Analytic Plan

Due to a small sample size, primary analyses will explore correlations and group differences, while secondary analyses will examine moderational effects. Analyses will be one-tailed tests, reflecting directional hypotheses. All analyses will first be conducted while controlling only for gender, as the ASD group was 100% male.

Speech difficulties (as measured by the ABC Speech subscale) were negatively correlated with both Overall Child ($r = -.59, p < .01$) and Overall Dyadic scores ($r = -.59, p < .01$). A significant difference on FSIQ was found between the ASD and non-ASD groups. Therefore, analyses will be repeated with additional covariates of FSIQ and speech difficulties, in order to determine if the covariates functionally explain any of the findings.

2.3 - Power Analyses

Power analyses for correlations, ANOVAs, and linear regressions were calculated using G*Power 3 software (Faul, Erdfelder, Lang, & Buchner, 2007). Small, medium, and large effect sizes for each type of analysis were based off of Cohen's (1988) estimates. Power analyses for the ANOVAs and regressions were based on two-tailed tests; however, power would be higher in actuality, due to the use of directional tests in the analyses.

Correlations. An a priori power analysis of a one-tailed correlational analysis ($\alpha = .05$) showed that a sample size of 111 would be needed to demonstrate a medium effect size of .3, and a sample size of 34 would be needed to detect a large effect size of .5.

Group Differences. An a priori power analysis showed that, with $\alpha = .05$, a sample size of 84 would be needed to detect a large effect size of .40 with a one-way, two-group ANOVA. Under the same parameters, a sample size of 210 would be needed to detect a medium effect size of .25.

Main Effects. With $\alpha = .05$, an a priori power analysis demonstrated that main effects in a two-predictor linear regression would need a sample size of 48 to detect a large effect size of .35, and a sample size of 107 to detect a medium effect size of .15. The current sample is clearly underpowered for most parametric analyses, and results should be considered exploratory.

Moderation. A power analysis was conducted for a linear multiple regression with two predictors. To achieve adequate statistical power of .80 with $\alpha = .05$, a sample size of 35 would be needed to detect a medium effect size of .50. Aguinis, Beaty, Boik, and Pierce (2005) found that the average effect size found in moderational analyses was .009, leading Kenny (2011) to suggest that .025 may be a more accurate, if still “optimistic,” representation of a large effect size for moderational analyses. Under these guidelines, the sample size necessary to detect a large effect size with $\beta = .80$ and $\alpha = .05$ would be 389. The current sample size of 25 is obviously under-powered, which is exacerbated by the difficulty in finding significance in moderation (Holmbeck, 1997). The sample is too small for enough variance to be produced to show any significant results.

2.4 - Procedure

The university Institutional Review Board approved this study. Families were recruited through flyers and emails sent to local autism clinics, advocacy groups, parent support groups, schools, daycare centers, doctor’s offices, and at the local university. Nine children (2 ASD, 7 non-ASD) were recruited by phone through a child development database. Recruitment advertisements included the contact information of the researcher who collected all data. After contacting the researcher, a 2-hour session with the parent and child was scheduled. The examiner discussed a consent form with the mother, who then gave consent for participation. The examiner read age-appropriate information about the study to children over age 5 years, who then were given the opportunity to assent. No mother or child chose to leave the study early.

Data were collected at one time, except for one survey measure that is not discussed here. Another parent measure was completed by mothers, but was excluded from analyses due to invalid responding by the majority of mothers ($n = 21$; 84%).

The ADOS, KBIT-2, and mother-child interaction task were video-recorded. The mother completed the paper measures while seated in an observation room, while the examiner administered the ADOS and KBIT-2 with the child. As the measures were completed before the interaction task, it was not expected that the mother would be primed to rate her child a certain way on the survey measures. As compensation for their time, families received a small honorarium, as well as a non-diagnostic summary of their child’s assessments.

2.5 - Measures

The sample was characterized by the ADOS, KBIT-2, and Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003), as described below. The construct of externalizing behaviors was measured through use of the Total Difficulties score of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997, 1999), the HSQ-PDD, and the Irritability scale of the Aberrant Behavior Checklist (ABC; Aman et al., 1985a, 1985b).

Parent permission form (Appendix A). Mothers were mailed or emailed the parent permission form prior to their appointment. Before beginning data collection during their appointment, the Co-I reviewed the parent permission form, which described the general purpose of this study and explained the inclusion criteria. Participants were given an opportunity to ask questions. Children between the ages of 5 and 11 years old were read an Assent letter (Appendix B) to inform them about the project, to let them know that they would not be penalized for withdrawing from the study, and to answer any procedural questions they may have had.

Demographics form (Appendix C). The demographic measure is a standard form at this university's autism clinic, and collected information such as the mother's age, ethnicity, educational level, and income level, as well as child's gender, age, ethnicity, last grade completed in school, and previous ASD diagnosis. See Table 1 for demographic information for both groups.

Autism Diagnostic Observation Schedule, Second Edition (ADOS; Gotham et al., 2007). The ADOS is the gold-standard assessment for diagnosing ASD. It is a semi-structured assessment that evaluates an individual's social, communication, and play skills. The ADOS administrator also looks for examples of repetitive behaviors, stereotyped speech patterns, compulsive behaviors, and restricted interests.

There are four modules of the ADOS that can be administered depending on the participant's verbal language ability. Each module takes approximately 30 - 45 minutes to administer. Twenty-two (78.6%) of the child participants were administered Module 3 of the ADOS, suggesting that these children were verbally fluent and were able to play with toys and engage in conversation with the administrator. One child (3.6%) was administered Module 2 of the ADOS, which is for children with phrase speech or a few words of verbal language. Two children (7.1%) were administered Module 1 of the ADOS, indicating that they used little to no verbal language. Of the children administered Module 1, one child was primarily echolalic,

while the other was able to use a few manual signs. Both Module 1 and Module 2 are predominantly play-based assessments. The researcher was trained in administering the ADOS clinically and for research. ADOS scores allow classification of Autistic Disorder, Autism Spectrum Disorder, or no Autism Spectrum Disorder. Children in the non-ASD group were administered the ADOS to rule-out classification in the ASD domain.

Social Affect and Restricted-Repetitive Behaviors scores from the ADOS were converted into ASD severity scores, which account for ASD symptom severity based on the child's age, level of verbal language, and ADOS score (Gotham et al., 2007). ASD severity as measured by the ADOS was used as a predictor in the moderation analyses below.

Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2004). The KBIT-2 is an abbreviated measure of general intelligence abilities. The KBIT-2 provides scores of Verbal and Non-Verbal Intelligence, as well as a composite Intelligence Quotient score and percentile ranks by age. The KBIT-2 is appropriate for ages 4 to 90 years old, and can be completed in 15 - 20 minutes. As described above, 50% of children are expected to have FSIQ scores below 100, and 50% have FSIQ scores above 100. Average scores are considered to be 1 standard deviation above and below the mean, or scores between 85 and 115.

Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003). The SCQ is a parent-report measure that examines ASD symptomatology. The SCQ (Current form) consists of 40 yes/no questions regarding a child's social behaviors within the past 3 months, and should take approximately 10 minutes to complete. The SCQ was designed as a companion screening assessment to the Autism Diagnostic Interview - Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003). The ADI-R is the gold-standard structured interview for autism diagnosis, and elicits a comprehensive developmental history from the caregiver of a child with a suspected ASD. The four domains of the ADI-R (social interactions, communication, abnormal language, and stereotyped behaviors) are examined in the SCQ. In addition to the ADI-R, the SCQ is also related to the ADOS (Lord, et al., 2000; Gotham et al., 2007). Across 213 individuals who were verbally fluent, broken into four groups by age, internal consistency for the SCQ on diagnostic classification ranged from .84 to .93, with consistency increasing with age. The SCQ was valid with the ADI-R across the domains of Reciprocal Social Interaction ($r = .92$), Communication ($r = .73$), and Restricted, Repetitive, and Stereotyped Patterns of Behavior ($r = .89$). Outcomes on the SCQ classify an individual into a category of Autism Spectrum Disorder or no Autism

Spectrum Disorder. As expected, significant differences were found between the ASD and non-ASD groups, $F(1, 23) = 41.35$, $p < .001$, with the ASD group having significantly higher SCQ scores. Internal reliability for the current sample was .56 when listwise deletion was used. Three cases with missing items were excluded for the calculation of alpha.

Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997, 1999). The SDQ is the primary outcome measure of the current study. The SDQ is a measure of psychological adjustment in children and adolescents, and has both clinical and research uses (Goodman, 2001). While parent, self, and teacher forms of the SDQ are available, only the parent version was used here. Each of the five scales (Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems, and Prosocial [reverse-scored]) is comprised of five questions. Questions are answered on a 3-point Likert scale, ranging from 0 (not true) to 2 (certainly true). Both positively- and negatively-phrased questions are used. The sum of the first four scales, not including Prosocial, results in a Total Difficulties score. A Total Impact score is also calculated. Additionally, ranges are provided to classify each of the five scales, as well as the Total Difficulties score, into the range of “Normal,” “Borderline,” or “Abnormal.”

In a nation-wide sample of 9,998 British parents, reliability coefficients (α) for the five subscales of the parent version of the SDQ ranged from .57 to .77, while the Total Difficulties score had a reliability of .82, and Total Impact score had a reliability of .85 (Goodman, 2001). In the current sample, Cronbach’s alpha for the five subscales combined (including the reverse-scored Prosocial items) was comparable, with $\alpha = .83$, while the reliability coefficient for the Total Difficulties scale (excluding the Prosocial subscale) was .77.

A study investigating the predictive validity of the SDQ excluded children with ASD, as the SDQ is not meant to predict pervasive developmental disorders (Goodman, Renfrew, & Mullick, 2000). Rather, the SDQ is a screening tool used to capture variance in community and clinical samples. In one study of social and psychological difficulties children with ASD were included; as would be expected, children with ASD had significantly higher scores on all scales except for the Prosocial scale, where they had significantly lower scales (Allik, Larsson, & Smedje, 2006).

In the current study, 24 children (96%) received the SDQ for children ages 4-10, including the three 4-year-olds in the sample. The 11-year-old in the sample received the SDQ for children ages 11-17.

Home Situations Questionnaire - Pervasive Developmental Disorders Version (HSQ-PDD; Barkley, Edwards, & Robin, 1999; Research Units on Pediatric Psychopharmacology [RUPP], 2007, 2009; Johnson et al., 2009). The HSQ measures child non-compliance in everyday settings, such as at home, in school, and in the community. The standard version of this parent-report measure lists 20 situations and asks the parent to indicate whether or not their child engages in non-compliant behaviors in that setting. If the parent indicates affirmatively, they are asked to indicate the severity of the child's behavior in that setting, given a 9-point Likert scale of 1 (mild) to 9 (severe). The sum of the severity scores and the number of settings endorsed are used to calculate an average severity score, with higher scores indicating greater non-compliance.

Five questions were added to the original version of the HSQ to make it more specific to the ASD population, for a total of 25 items (HSQ-PDD; see RUPP, 2007, 2009; Johnson et al., 2009). For example, questions about a child's reaction when a repetitive behavior is interrupted or when a routine is changed are included in the HSQ-PDD. This modified version was used in the current study. Early work showed $\alpha = .92$, indicating high internal reliability (RUPP, 2009).

Exploratory factor analysis by the RUPP team found an appropriate fit with a two-factor model of "Socially Inflexible" and "Demand-Specific" items (Chowdhury et al., 2010). Additionally, a small positive correlation was found between Total HSQ-PDD score and the Daily Living subscale of the Vineland Adaptive Behavior Scales (Sparrow, Balla, Cichetti, & Doll, 1984), as well as moderate positive correlations between Total HSQ-PDD score and the Irritability and Hyperactivity/non-compliance scales of the Aberrant Behavior Checklist (Aman et al., 1985a, 1985b), the Children's Yale-Brown Obsessive Compulsive Scale - PDD version (CY-BOCS-PDD; Scahill et al., 1997) Total score, and the ADHD and Autism subscales of the Child and Adolescent Symptom Inventory (CASI; Gadow & Sprafkin, 1994, 1997, 1998, 2002). A high Cronbach's alpha of .95 was found for this sample when examining the internal reliability of the number of problem settings. Internal reliability was also high for the severity of behaviors in these settings ($\alpha = .95$).

Aberrant Behavior Checklist (ABC; Aman et al., 1985a, 1985b). The Aberrant Behavior Checklist is a 58-question survey measure used to assess a variety of negative behaviors in children. The current study utilized only the parent version of the ABC, although a teacher version is also available. Five subscales are calculated: Irritability ($\alpha = .93$), Lethargy (α

= .89), Sterotypy ($\alpha = .93$), Hyperactivity ($\alpha = .97$), and Inappropriate Speech ($\alpha = .85$). A 4-point Likert scale was used to answer each question, with 0 indicating that the behavior is “not at all a problem” and 3 indicating that “the problem is severe in degree.” No items are reverse-scored. In the current study, internal reliability was moderate with a Cronbach’s alpha of .83. There were no missing items.

Mother-child semi-structured play tasks, adapted from the Marschak Interaction Method, Pre-School and School Age Edition (MIM; The Theraplay Institute, 2005). Nine semi-structured play tasks were adapted from the Marschak Interaction Method (MIM), an observational technique used to characterize parent-child relationships. Tasks were chosen to be roughly appropriate for children ages 4 to 11 years old, with and without ASD. These nine tasks were adapted from the MIM’s recommended list of tasks for children aged 3 years or older. Each MIM task is designed to elicit behavior in one of four dimensions: Structure, Engagement, Nurture, and Challenge (The Theraplay Institute, 2005). These dimensions are developed from Marianne Marschak’s original four dimensions, formed in the 1960’s, and are intended to describe characteristics of a healthy parent-child relationship. These characteristics include providing security and setting appropriate boundaries (Structure), providing empathy and emotional attunement (Engagement), being a comforting and calming presence (Nurture), and challenging the child in a way that stimulates growth and independence (Challenge). The 9 tasks used in this study were drawn from all four dimensions, as noted below. There are two tasks each in the domains of Engagement and Nurture, and three tasks each in Structure and Challenge, as the 7th task lies in overlapping domains.

Mothers were instructed to take three to five minutes to complete each task together with their child, following the instructions that were attached to each plastic bag or manila envelope.

The nine tasks were:

1. Ask your child to complete an 8- or 12-piece puzzle. (Challenge)
2. Each of you take a figurine; make them play together. (Engagement)
3. Play a familiar game together with your child. (Engagement)
4. Ask your child to draw your house. (Structure)
5. Each of you take a pencil and a piece of paper. Draw a quick picture and ask your child to copy it. (Structure)
6. Teach your child something he or she does not know. (Challenge)

7. Take a set of 8 or 12 blocks; hand the other set of 8 or 12 blocks to your child. Build a structure with your blocks and then ask your child to build one just like yours. (Structure and Challenge)
8. Tell your child about when he or she was a baby, beginning with the words, “When you were a little baby...” (Nurture)
9. Share a snack with your child. (Nurture; adapted from “Feed each other a snack.”)

Tasks were videotaped and coded, using the Coding System for Mother-Child Interactions (CSMCI), as done by Healey and colleagues (2010). Coding is described in more detail below and in Table 2.

Coding. Coding was completed through the use of the CSMCI, which was created by Healey et al. (2010), and combined multiple coding approaches (i.e., NICHD Study of Early Child Care Research Network, 1999, 2003, 2006; Campbell, Pierce, March, Ewing, & Szumowski, 1994; Eyberg, Bessmer, Newcomb, Edwards, & Robinson, 1994). These systems have been found to be reliable and valid.

The CSMCI consists of three *Child Codes*, four *Parent Codes*, and four *Dyadic Codes*. Child codes consisted of: 1) how quickly and cheerfully the child listened to his/her mother (Cooperation-Compliance), 2) how much the child approached the tasks with enthusiasm or restraint (Enthusiasm), and 3) how demanding or rejecting the child was towards his/her mother and/or her ideas (Negativity and Hostility; reverse-scored). Parent codes, hereafter referred to as Maternal codes, included: 1) the quality of the mother’s positive regard, warmth, praise, and emotional support towards her child (Emotionally Supportive Presence), 2) how much the mother acted in a way that validated her child’s individuality and ability to make his/her own choices (Respect for Child’s Autonomy), 3) the amount of structure and support the parent provided, based on child’s understanding of the task (Quality of Assistance), and 4) the amount of anger or rejection the parent displayed (Negative Affect). Negative Affect is considered to be the opposite of the Emotionally Supportive Presence scale, and is reverse-scored. There was a significant negative correlation in this sample between Emotionally Supportive Presence and Negative Affect ($r = -.66, p < .001$). Finally, the Dyadic Codes included: 1) the flow of positive emotions and personal exchanges between mother and child, including eye contact (Affective Mutuality/Felt Security), 2) how much the mother and child seemed to enjoy the tasks and each

other's company (Mutual Enjoyment), and 3) how much the interaction was characterized by reciprocal behavioral and verbal responsiveness and engagement (Reciprocal Interactions).

These scores are constructed on a 5-point Likert scale, with 1 being a very low presence of that descriptor and 5 being a very high presence. Each individual score was summed to produce the composite Child, Maternal, and Dyadic codes. Overall Dyadic score was used as the primary measure of synchrony. Although this may be an oversimplification of the synchrony construct, the Overall Dyadic score seems to be our best assessment of the reciprocal mother-child relationship, as compared to either the Overall Maternal or Child scores, which likely measure more individualized concepts of either mother or child behaviors. The Overall Dyadic score was analyzed with SDQ Total Difficulties score, number of problem settings on the HSQ-PDD, and the Irritability scale of the ABC as dependent variables in exploratory regression analyses.

Coders were two undergraduate research assistants who were blind to ASD diagnosis. Coders were trained by the assessor, based on instructions received from an author of the CSMCI. Raters coded tapes separately and then met to form consensus ratings, which were used in data analyses. Inter-rater reliability of 62% was achieved; there were no significant differences in reliability between groups.

Chapter 3 – Results

As discussed above, descriptive analyses were conducted to characterize the sample; refer to Table 3 for the descriptive characteristics of each measure, separated by ASD vs. non-ASD classification. See Table 4 for descriptive statistics of the measures as separated by gender. Due to the small sample size employed here, correlational analyses and group differences were considered primary analyses, while multiple regression and moderational analyses were considered secondary.

3.1 - Correlational Analyses

One-tailed correlational analyses were conducted, controlling for gender, due to a significant gender difference between groups. Correlations for the main outcome measures are given in Table 5.

CSMCI scores. Correlations were used to explore the relationships between the individual (i.e., Maternal, Child, and Dyadic) and Overall scores of the CSMCI (Table 6). While Overall Maternal score and Overall Child score were each positively correlated with Overall Dyadic score ($r = .62, p < .01$ and $r = .64, p < .001$, respectively), the relationship between overall Maternal score and overall Child score was not significant ($r = -.06, p > .05$). When also controlling for FSIQ and speech difficulties, both correlations remained significant (Maternal: $r = .71, p < .001$ and Child: $r = .44, p < .05$).

SDQ scores. When controlling for gender, SDQ Total Difficulties score was negatively correlated with both Overall Child ($r = -.35, p < .05$) and Overall Dyadic scores ($r = -.38, p < .05$). Correlations were found between Overall Child score and the hyperactivity ($r = -.43, p < .05$), peer problems ($r = -.47, p < .05$), and prosocial behaviors (reverse-scored; $r = -.35, p < .05$) subscales of the SDQ. No relationship was found between the Overall Maternal score and the Total Difficulties score ($r = .03, p > .05$), or any of the subscale scores. Correlations were found between Overall Dyadic score and the hyperactivity ($r = -.58, p < .01$) and peer problems ($r = -.40, p < .05$) subscales.

When the additional covariates (FSIQ and speech difficulties) were added, the relationships between SDQ Total Difficulties and the Overall Child and Dyadic scores were no longer significant ($r = .17, p > .05$ and $r = .02, p > .05$, respectively). Regarding the subscales, new correlations were seen between Overall Child score and the emotional symptoms ($r = .52, p <$

.01) and conduct problems ($r = .42, p < .05$) subscales. While the relationship between Overall Dyadic score and hyperactivity remained significant ($r = -.39, p < .05$), a new relationship was found between Overall Dyadic score and emotional problems ($r = .62, p < .01$).

ABC scores. When only gender was controlled for, correlations were found between Overall Child score and the irritability ($r = -.38, p < .05$), lethargy ($r = -.42, p < .05$), and speech difficulties ($r = -.61, p < .01$) scales of the ABC. Overall Dyadic score was significantly related to the irritability ($r = -.39, p < .05$), lethargy ($r = -.40, p < .05$), hyperactivity ($r = -.35, p < .05$), and speech difficulties ($r = -.60, p < .01$) subscales.

When FSIQ was added as a covariate, the relationship between Child Overall score and speech difficulties remained significant ($r = -.59, p < .01$). The relationships between Overall Dyadic score and the irritability ($r = -.36, p < .05$), lethargy ($r = -.37, p < .05$), and speech difficulties ($r = -.59, p < .01$) subscales remained. No significant correlations between Overall Maternal score and any of the ABC subscales were found for either set of covariates.

HSQ-PDD scores. As expected, the total number of problem settings and the mean severity score on the HSQ-PDD were positively correlated ($r = .55, p < .01$). The total number of problem settings on the HSQ-PDD was negatively correlated with the Overall Child score on the CSMCI ($r = -.39, p < .05$) and the Overall Dyadic score ($r = -.58, p < .01$), but not the Overall Maternal score ($r = -.23, p > .05$). Additionally, the mean severity score was negatively correlated with the Overall Dyadic score ($r = -.36, p < .05$).

When covariates of FSIQ and speech difficulties were added, the total number of problem settings and the mean severity score on the HSQ-PDD were still correlated ($r = .41, p < .05$), and the total number of problem settings remained inversely correlated with the Overall Dyadic score ($r = -.38, p < .05$). However, Overall Child score was no longer related to the total number of problem settings ($r = -.05, p > .05$), and the mean severity score was no longer related to the Overall Dyadic score ($r = -.13, p > .05$).

ASD severity and SCQ scores. When controlling only for gender, ASD severity was positively related to SCQ score ($r = .77, p < .001$) and total number of problem settings on the HSQ-PDD ($r = .57, p < .01$). ASD severity was also negatively related to Overall Child score ($r = -.35, p < .05$), with no relationship to Overall Maternal ($r = -.04, p > .01$) or Overall Dyadic score ($r = -.30, p > .05$). SCQ score was negatively related to both Overall Child ($r = -.56, p < .01$) and overall Dyadic ($r = -.52, p < .01$) scores. When additional covariates of FSIQ and

speech difficulties were included, relationships were no longer seen between Overall Child score and ASD severity ($r = .09, p > .05$) or SCQ score ($r = -.21, p > .05$), nor between SCQ score and Overall Dyadic score ($r = -.28, p > .05$). The relationship between SCQ score and ASD severity remained ($r = .60, p < .01$), as did the relationship between ASD severity and total number of problem settings on the HSQ-PDD ($r = .43, p < .05$). The relationships between ASD severity and Overall Maternal and Overall Dyadic scores remained non-significant ($r = -.01, p > .05$ and $r = -.00, p > .05$, respectively).

Stereotypy scores on the ABC were positively correlated with SCQ Total score ($r = .54, p < .05$), but not ASD severity ($r = .17, p > .05$). Additionally, hyperactivity scores on the ABC were correlated with scores on the SDQ hyperactivity scale ($r = .72, p < .001$).

3.2 - Group Differences

Significant group differences ($p < .05 - .001$) were found on every composite and subscale score for each outcome measure (SDQ, ABC, and HSQ-PDD), except for the conduct problems subscale of the SDQ. No group differences were found for Overall Maternal or Dyadic scores on the CSMCI. A significant group difference on Overall Child score indicated lower scores in the ASD group ($M = 9.30, SD = 1.89$) relative to the non-ASD group ($M = 10.73, SD = .80$), $F(1, 23) = 6.91, p < .05$.

3.3 - Secondary Analyses

Multiple regression analyses were used to examine the potential moderation of synchrony (i.e., Overall Dyadic score) on the relationship between ASD severity on the ADOS and externalizing behaviors (i.e., SDQ Total Difficulties score). See Table 7 for analyses in tabular form. Although structural equation modeling (SEM) can also be used to determine moderation, Holmbeck (1997) recommends the use of multiple regression analyses for small samples in clinical-child and pediatric psychology, due to power limitations. Both the predictor (ASD severity) and the moderator (synchrony) were centered prior to analysis, to reduce multicollinearity (see Aiken & West, 1991). As above, regression analyses were first conducted with only gender as a covariate, and later with additional covariates of FSIQ and speech difficulties.

SDQ as Dependent Variable. The main effects were entered simultaneously, including the covariates of gender. Main effects for ASD severity were found in both Blocks 1 and 2 ($B = .20, t(22) = 4.32, p < .001$ and $B = .20, t(22) = 4.23, p < .001$, respectively). Main effects were

not found for synchrony in either Block 1 ($B = -.07, t(22) = -1.16, p > .05$) or Block 2 ($B = -.07, t(22) = -1.13, p > .05$). There was no significant interaction between synchrony and ASD severity ($B = -.01, t(22) = -.25, p > .05$).

When FSIQ and speech difficulties were added as covariates, in Block 1, main effects were found for speech difficulties and ASD severity, but not for synchrony ($B = .01, t(22) = .14, p > .05$). Speech difficulties predicted externalizing behaviors ($B = .13, t(22) = 2.13, p < .05$), as did ASD severity ($B = .16, t(22) = 3.03, p < .01$). In Block 2, the interaction variable (synchrony by severity) was non-significant ($B = .01, t(22) = .67, p > .05$). In sum, main effects were upheld for ASD severity ($B = .15, t(22) = 2.58, p < .05$), and there was a main effect for speech difficulties ($B = .15, t(22) = 2.18, p < .05$).

HSQ-PDD as Dependent Variable. In another multiple regression analysis, initial analyses again only controlled for gender. Main effects for ASD severity and synchrony were found in both Block 1 (ASD severity: $B = 1.22, t(22) = 2.74, p < .05$; Synchrony: $B = -1.67, t(22) = -2.84, p < .05$) and Block 2 (ASD severity: $B = 1.23, t(22) = 2.66, p < .05$; Synchrony: $B = -1.67, t(22) = -2.77, p < .05$). The interaction was non-significant ($B = -.01, t(22) = -.04, p > .05$).

When FSIQ and speech difficulties were added as covariates, the following results were found. In Block 1, the ASD severity coefficient was significant ($B = 1.29, t(22) = 2.25, p < .05$), but the synchrony coefficient was not (Block 1; $B = -1.45, t(22) = -2.01, p > .05$). No main effects were found for any term in Block 2. When the interaction term was added in Block 2 (synchrony by severity), the interaction coefficient was non-significant ($B = .02, t(22) = .09, p > .05$). In sum, the main effect of ASD severity remained significant, and the main effect for synchrony became non-significant.

Irritability Subscale of the ABC as Dependent Variable. A third multiple regression analysis was conducted with the same covariates as above. First, when only gender was controlled for, main effects for ASD severity were found in both Block 1 ($B = .157, t(22) = 3.60, p < .01$) and Block 2 ($B = 1.58, t(22) = 3.52, p < .01$). No other main effects were found; the interaction term was non-significant ($B = -.03, t(22) = -.19, p > .05$).

When FSIQ and speech difficulties were added as covariates, a main effect for ASD severity was found in Block 1 ($B = 1.14, t(22) = 2.14, p < .05$), but not for synchrony ($B = -.15, t(22) = -.23, p > .05$). In Block 2, no main effects were found and the interaction variable

(synchrony by severity) was not significant ($B = .12, t(22) = .60, p > .05$). Thus, in this set of analyses, only ASD severity emerged as a main effect.

Overall, these regression analyses indicated main effects of ASD severity on both irritability, problem settings, and overall difficulties on the SDQ, above and beyond the effects of IQ, gender, and speech difficulties. A main effect for speech difficulties was also found for Total SDQ score. No main effects for synchrony were found, nor were any significant interactions were found. However, when FSIQ and speech difficulties were *not* co-varied, both ASD severity and synchrony predicted the total number of problem settings indicated on the HSQ-PDD.

Chapter 4 – Discussion

The main purpose of this study was to test the notion that synchrony moderates the relationship between ASD severity and externalizing behaviors, such that children with greater ASD severity who score high on measures of dyadic synchrony would have fewer externalizing behaviors than their low-synchrony counterparts. In the primary analyses, we specifically predicted that ASD classification and ASD severity would be related to greater levels of negativity during the parent-child interaction task and higher externalizing scores, but we predicted that ASD would not be related to synchrony. Rather, in secondary analyses of moderation, we predicted that ASD would be related to externalizing behaviors only in the presence of low dyadic synchrony. Findings generally supported the primary hypotheses of increased negativity and externalizing behaviors in the ASD group, but moderation was not supported. These findings are further discussed below.

4.1 - Primary Analyses

As expected, significant group differences were found for how children behaved during the play tasks (Overall Child score). Children in the ASD group scored lower on this scale, which included ratings of their cooperation, compliance, enthusiasm for the tasks, and negative affect. However, despite significantly more negative child behaviors in the ASD group, group differences were not seen for mothers' behaviors or for overall dyadic synchrony.

The current findings showing no group differences on maternal behaviors or dyadic synchrony are consistent with previous research on attachment in children with ASD, which shows that these children are able to have positive, secure relationships with their mothers (see Yirmiya & Sigman, 2001). Although Dissanayake and Crossley (1996) found that children with ASD did not engage in as many mutual play behaviors with their mothers as compared to TD children and those with Down syndrome, the researchers found no group differences between the children on approach behaviors or physical contact with mothers. Although neither mother nor child enjoyment was directly assessed, our findings of no group differences on synchrony seem to indicate that mothers and children across both groups enjoyed themselves similarly. This contrasts Freeman and Kasari's (2013) suggestion that mothers of children with ASD may find play interactions to be frustrating and less satisfying than the mothers of non-ASD children.

Overall Maternal scores were consistently unrelated to assessments of child behavior, including all three outcome measures. This finding demonstrates a level of independence between mother-reports of child behavior and the mother's behavior during the play task.

Group differences were found on nearly every subscale of the SDQ, HSQ-PDD, and ABC, supporting the hypothesis that the ASD group would score higher on assessments of externalizing behavior than the non-ASD group. Additionally, main effects for ASD severity were consistently found throughout the regression analyses, indicating that ASD severity predicted externalizing behaviors. These findings are consistent with our conceptualization of children with ASD having significantly more behavior problems than those without ASD. Prior research has found that behavioral issues, such as aggression, differentiate children with ASD from their non-ASD peers, such that behavioral problems are considered in the diagnosis of ASDs (Gotham et al., 2009).

When controlling for FSIQ, gender, and speech difficulties, the Emotional Symptoms subscale of the SDQ was shown to be correlated positively with Overall Dyadic score and Overall Child score. It seems counter-intuitive that a child who shows more symptoms of emotional distress would also have higher dyadic synchrony with his/her mother and would have more positive behaviors within the play task. A potential explanation may be seen in the five items of the scale, which seems to be broadly defined. Three of the Emotional Symptoms items seem highly related to anxiety (e.g., often seems worried, nervous in new situations, many fears). High scores on these items, and consequently on this scale, may describe a child who has many internalizing behaviors, prefers to spend time with people he/she knows well, and does not seek out new situations. These symptoms do not seem to preclude a positive mother-child relationship, or any negative behaviors in a child who is playing privately with his/her mother with novel, enjoyable toys in a non-demanding environment.

Overall Child score was also positively correlated with the conduct problems subscale of the SDQ, when gender, FSIQ, and speech difficulties were controlled. This may indicate that children who have a need to act out and seek social attention were in an environment where they were able to appropriately receive that attention from their mother.

In part, our findings are similar to those of Healey and colleagues (2010), in that we found relationships between maternal and child variables with overall dyadic synchrony, but not with each other. This idea that synchrony is nested within the dyad, and that factors within the

interaction are responsible for the reciprocity or warmth, not any variable centered within a person. Within mother-child dyads with a child with ASD, we may find that mother variables are as important, or more important, than solely dyadic variables.

4.2 - Secondary Analyses

In regards to the secondary analyses, although consistent main effects of ASD severity were found on externalizing behaviors as measured by the SDQ, HSQ-PDD, and ABC, main effects were not found for synchrony on any of those measures with one exception. A main effect for synchrony was only found when the dependent variable was the total problem settings on the HSQ-PDD. Additionally, none of the interaction coefficients were significant. All of these findings remained the same after controlling for FSIQ and speech difficulties. Thus, synchrony was not found to be a moderator of the relationship between ASD severity and externalizing behaviors. Furthermore, although one analysis suggested a possible main effect of synchrony on problem settings, this finding did not replicate across the other measures and is likely spurious. In addition, even if a relationship may exist, it is likely that the small sample size of this study played a part in our non-significant findings. Future studies should further examine other mother or child variables that may influence the dyad, or better explain behavior within the interaction with a larger sample size.

Adding covariates of FSIQ and speech difficulties in the regression analyses did not change the pattern of relationships between the CSMCI scores, indicating that differences in IQ and speech ability were not primarily responsible for the observed group differences in externalizing behavior. However, the correlational analyses were impacted by the addition of these covariates. For example, child and dyadic scores were no longer related to SDQ Total Difficulties score when FSIQ and speech difficulties were controlled. Other, new correlations also became apparent with the addition of these two covariates, such as the relationship between Overall Dyadic score and the Emotional Symptoms subscale of the SDQ. These changes in the correlations suggest that speech difficulties and/or FSIQ may have been impacting the findings and should be explored as possible mediators in future research.

4.3 - Interpretation

We hypothesized that mothers of children with ASD would be able to adjust their own behaviors to support their child's unique needs. We proposed that these mothers would have spent more time focusing on their child's strengths and weaknesses due to their developmental

disorder, such as during therapy, individualized school plans, or psychological assessments, therefore leading to a higher level of attunement from the mother. These mothers may subsequently have learned how to anticipate their child's needs (e.g., "Will my child enjoy this task?"), enabling appropriate adjustment. However, our data do not, in fact, support significant differences in mother or dyad behaviors between groups, and evidence was not found to support this hypothesis. Yet, some mechanism might exist to account for the fact the children in the ASD group behaved more negatively overall during the play tasks, yet synchrony was not higher for the dyads in the non-ASD group. This finding could indicate that some part of the relationship was not fully captured within the design and/or measurement techniques of this study, and could be further explored in future work.

It remains to be seen whether these groups are similar on dyadic synchrony due to mothers of ASD children taking more responsibility for the interaction, or because there is unique variance captured in the construct of dyadic synchrony - the relationship between the mother and child. Without some type of additional effort on the part of the mother, considering that children in the ASD group showed more negativity than those in the non-ASD group during the play tasks, group differences on the Overall Dyadic scores would be expected. As this was not the case, it appears that more research into the mother variables that may moderate or mediate this relationship is needed, as well as the specific components of the dyadic relationship between a child with ASD and his/her mother. Alternative interpretations may exist for these findings, such as other moderator or mediator relationships, which were not testable given the power or design limitations of the study at hand.

In the current study, speech difficulties were found to predict externalizing behaviors on the SDQ, after controlling for FSIQ and gender. In a study of TD school-age twins and siblings, Levy and colleagues (1996) found that speech predicted Attention Deficit/Hyperactivity Disorder (ADHD), but not overall behavioral problems. It is possible that children who have delays in speech may be affected in other areas of development, such as reading and academics, which may lead to higher levels of frustration and acting out.

It is important to consider whether examination of the construct of synchrony is predicting additional variance in the mother-child relationship, above and beyond that which is described by individual behaviors of the mother or child. Findings here suggest that mother and

child behavior during play tasks are not directly related to each other, but that each is related to the higher-level synchrony construct. However, literature in the field has yet to show that there is significant, additional variance accounted for solely by synchrony.

4.4 - Limitations

Despite the positive factor of combining both parent-report and observation assessment measures to capture the construct of synchrony, a variety of limitations impact the generalizability of our results. It is likely that a self-selection bias exists among the mothers who responded to the research advertisements - these mothers may enjoy playing with their child more than others, for example. Four families completed the protocol twice, meaning that mothers or children may have changed their behavior to be more socially desirable during the second play observation, as they knew what types of tasks to expect. Additionally, family effects may be seen across the mothers who completed the study more than once, with different children. Four mothers had children in both groups, while two mothers had multiple children in the TD group and one mother had multiple children in the non-ASD group. This may limit generalizability, and should be explored in future analyses.

Statistically, we are hampered by a small sample size, which subsequently limits our power. There is also a significant gender difference across our groups, above and beyond what is expected within the ASD population. Inter-rater reliability was also lower than preferred in this study, and could have been improved with greater amounts of training and practice, as well as a training booster session mid-way through the study to prevent drift. An increased number of coders would also have increased reliability.

Finally, demographic information from the families may have been incomplete; informal differences were noted between families. Some mothers homeschooled their children, which may have led them to see the play tasks as teaching opportunities more than a mother who didn't homeschool her children. Additionally, some mothers were very educated about ASD, and some even had degrees in education or psychology. This type of specialized knowledge may have contributed to a mother having more appropriate developmental expectations for her child on the spectrum. Finally, the amount of therapy that a child or his/her family had participated in was not measured. Children and families who have been heavily involved with any type of intervention aimed at reducing their ASD symptomatology, especially parent training therapies, may have had

specific differences from families who had never participated in those types of treatments. These factors may have played a role in their engagement and play style with their child. Mothers' perceptions about their playing with their child were not measured.

4.5 - Future Research

In the future, further investigation of the mother and dyad variables that predict synchrony are warranted, especially within this specialized population. Examination of mother variables, such as profession, level of education, personality variables, and self-perception of enjoyment of play may hold interesting information regarding mother-child interactions. Future investigation of moderators of the dyadic relationship would also be warranted, as these moderators could play a role in treatment development. Additionally, the amount of time the mother spent with her child per week was not measured, and families where the father was the primary caregiver were not included in the study. Future studies may examine the differences between mother and father relationships with their children on the spectrum.

More subtle styles of synchrony could be explored and coded in the future. For example, informal observation noted that some parents appeared behaviorally less engaged with their children (e.g., being pre-occupied with taking phone calls or sending text messages). Multiple measures of parent or child engagement would add strength to any study of synchrony. Additionally, assessing the mothers' feelings about playing with their child prior to and after participating in the play task may have shown differences between mothers. For example, gathering ratings of the mother and child's enjoyment of the play task, or asking the mother to write a narrative after the play task (as in Hutman, Siller & Sigman, 2009), may have been informative.

Initial analyses of moderation were not supported, most likely due to small sample size. However, interesting findings were found, especially that groups differed on child behaviors, but not parent or dyadic behaviors, during play tasks. Additional potential factors in the synchrony relationship were discussed. The expression of synchrony in ASD continues to hold value for further investigation, especially in terms of understanding how synchrony is able to be maintained within the ASD mother-child relationship. More detailed measures of the synchrony construct will help illuminate the specific nature of the reciprocal interaction between a mother and her child. Future research into the adaptability and creativity of a mother of a child with ASD may have implications for treatment of play, family dynamics, and social skills in this population.

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Table 1

Demographic Characteristics of Sample

Mother and child characteristics	ASD Group (<i>n</i> = 10)	Non-ASD group (<i>n</i> = 15)	Total Sample (<i>n</i> = 25)
Child age in years (SD)	6.60 (2.01)	7.67 (2.13)	7.24 (2.11)
Child gender (male)	10	6	16
Ethnicity			
Caucasian	7	15	20
Bi-racial	2	0	2
Not reported	1	0	3
ADOS severity (SD)	7.70 (1.34)	1.47 (.83)	3.96 (3.29)
Children with prior ASD diagnosis	10	2	12
KBIT-2 score (SD)	90.00 (22.99)	114.00 (12.78)	104.40 (20.92)
Annual income			
Less than \$20,000	1	3	4
\$20,000 - \$39,000	3	1	4
\$40,000 - \$59,000	1	2	3
\$60,000 - \$79,000	2	2	4
\$80,000 - \$99,000	1	0	1
\$100,000 or greater	1	6	7
Not reported	1	1	2
Mother's highest level of education			
Some high school	0	0	0
High school degree	0	0	0
Some college education	2	2	4
College degree	3	5	8
Some graduate education	0	0	0
Graduate degree	5	8	13

Note. Total sample characteristics include data from all 25 reporters (16 different mothers). ADOS = Autism Diagnostic Observation Schedule, Second Edition. KBIT-2 = Kaufman Brief Intelligence Test, Second Edition.

Table 2

Detailed Descriptions of Coding System for Mother-Child Interactions (CSMCI)

Codes	Descriptions
Child Codes	
1. Cooperation-Compliance	How well does child obey his/her mother? Does child resist or delay? Does child go out of his/her way to be helpful?
2. Enthusiasm	Is child engaged and eager to complete a task? Is child hesitant or slow to warm up to the situation? Is child confident a task will go well?
3. Negativity and Hostility (R)	Does child show any negativity towards his/her mother, and if so, how often? Is child repeatedly overtly angry?
Parent Codes	
1. Emotionally Supportive Presence	Is the mother consistently supportive of her child, especially when child shows signs of needing help? Does the mother show warmth towards her child and faith in his/her ability? Does the mother reinforce her child's successes?
2. Respect for Child's Autonomy	Does the mother act in a way that validates the child's independence and individuality? Is the mother overly controlling or intrusive in the play situation? Does the mother provide opportunities for the child to make choices about the task?
3. Quality of Assistance	Is the mother able to tailor the amount of guidance and support she provides, based on her child's understanding of the task? Does the mother provide extra cognitive stimulation to encourage mastery of the task at a higher level?
4. Negative Affect (R)	Does the mother show exasperation, anger, or coldness towards her child? Is mother directly rejecting and hostile towards her child? Is teasing, such as mimicking, accompanied by humor and warmth? This subscale is the conceptual opposite of the Emotionally Supportive Presence subscale.
Dyadic Codes	
1. Affective Mutuality/Felt Security	Do moments of tension occur frequently? Are experiences and emotions, both positive and negative, shared by the dyad? When initiated by one member of the dyad, are behavior such as eye contact, smiling, physical approach behaviors, help-seeking, and reflection on the experience met with reciprocity and understanding?
2. Mutual Enjoyment	Does the dyad seem to generally enjoy the tasks and each other's company? Does one member of the dyad seem to be much more enthusiastic than the other (e.g., "cheerful child, bored mother" or "cheerleading mother and grumpy child")?
3. Reciprocal Interactions	Was the interaction characterized by reciprocal responsiveness and engagement, both behaviorally and verbally? Do the mother and child interrupt each other often, or are behavioral and verbal responses well-timed? Is the interaction characterized by turn-taking?

Note: R = reverse-scored.

Table 3

Descriptive Characteristics for Measures by ASD Classification

Measure	ASD group	Non-ASD group	Group Difference
	Mean (SD)	Mean (SD)	
ADOS severity	7.70 (1.34)	1.47 (.83)	$F(1, 24) = 207.56^{***}$
KBIT-2 FSIQ score	90.00 (22.99)	114.00 (12.78)	$F(1, 24) = 11.29^{**}$
SDQ			
Total difficulties	2.50 (.71)	1.27 (.59)	$F(1, 24) = 22.25^{***}$
Emotional symptoms	1.50 (.85)	1.00 (.00)	$F(1, 24) = 5.31^*$
Conduct problems	1.60 (.97)	1.20 (.56)	$F(1, 24) = 1.73$
Hyperactivity	2.50 (.85)	1.73 (.88)	$F(1, 24) = 4.65^*$
Peer problems	2.50 (.71)	1.27 (.59)	$F(1, 24) = 22.25^{***}$
Prosocial behavior	2.20 (.92)	1.00 (.000)	$F(1, 24) = 26.15^{***}$
SCQ Total score	15.50 (4.84)	3.20 (4.59)	$F(1, 24) = 41.35^{***}$
ABC			
Irritability score	13.20 (5.96)	2.53 (4.94)	$F(1, 24) = 23.74^{**}$
Lethargy score	8.10 (6.23)	1.60 (3.42)	$F(1, 24) = 11.38^*$
Stereotypy score	4.90 (5.59)	1.20 (2.68)	$F(1, 24) = 4.96^*$
Hyperactivity score	22.70 (11.95)	6.93 (8.14)	$F(1, 24) = 15.52^*$
Speech difficulties score	3.50 (3.47)	.80 (1.08)	$F(1, 24) = 8.06^*$
HSQ-PDD			
Number of problem settings	17.70 (5.33)	6.27 (7.15)	$F(1, 24) = 18.58^{***}$
Severity across settings	4.09 (1.06)	2.27 (1.73)	$F(1, 24) = 8.77^{**}$
CSMCI Codes			
Child Overall score	10.90 (3.54)	13.67 (1.29)	$F(1, 24) = 7.75^*$
Maternal Overall score	16.80 (1.87)	16.27 (3.33)	$F(1, 24) = .21$
Dyadic Overall score	11.00 (2.16)	12.20 (1.94)	$F(1, 24) = 2.11$

Note. $*p < .05$, $**p < .01$, $***p < .001$. ADOS = Autism Diagnostic Observation Schedule, Second Edition. KBIT-2 = Kaufman Brief Intelligence Test, Second Edition. SDQ = Strengths and Difficulties Questionnaire. SCQ = Social Communication Questionnaire. ABC = Aberrant Behaviors Checklist. HSQ-PPD = Home Situations Questionnaire, Pervasive Developmental Disorders version. CSMCI = Coding System for Mother-Child Interactions.

Table 4

Descriptive Characteristics for Measures by Gender

Measure	Males	Females	Group Difference
	Mean (SD)	Mean (SD)	
ADOS severity	5.31 (3.38)	1.56 (.88)	$F(1, 24) = 10.53^{**}$
KBIT-2 FSIQ score	99.25 (23.48)	113.56 (11.46)	$F(1, 24) = 2.91$
SDQ			
Total difficulties	2.00 (.89)	1.33 (.71)	$F(1, 24) = 3.68$
Emotional symptoms	1.31 (.70)	1.00 (.00)	$F(1, 24) = 1.74$
Conduct problems	1.44 (.81)	1.22 (.67)	$F(1, 24) = .46$
Hyperactivity	2.19 (.91)	1.78 (.97)	$F(1, 24) = 1.11$
Peer problems	2.00 (.89)	1.33 (.71)	$F(1, 24) = 3.68$
Prosocial behavior	1.75 (.93)	1.00 (.00)	$F(1, 24) = 5.73^*$
SCQ Total score	10.63 (8.81)	3.67 (5.22)	$F(1, 24) = 5.66^*$
ABC			
Irritability score	3.89 (6.09)	3.89 (6.09)	$F(1, 24) = 2.24$
Lethargy score	1.00 (2.35)	1.00 (2.35)	$F(1, 24) = 5.33^*$
Stereotypy score	1.44 (3.13)	1.44 (3.13)	$F(1, 24) = 1.12$
Hyperactivity score	6.89 (9.32)	6.89 (9.32)	$F(1, 24) = 4.16$
Speech difficulties score	1.11 (.71)	1.11 (1.17)	$F(1, 24) = 1.19$
HSQ-PDD			
Number of problem settings	13.69 (8.05)	5.78 (7.27)	$F(1, 24) = 5.94^*$
Severity across settings	3.46 (1.33)	2.17 (2.12)	$F(1, 24) = 3.54$
CSMCI Codes			
Child Overall score	11.94 (3.15)	13.67 (1.41)	$F(1, 24) = 2.40$
Maternal Overall score	16.88 (2.31)	15.78 (3.56)	$F(1, 24) = .88$
Dyadic Overall score	11.69 (2.02)	11.78 (2.28)	$F(1, 24) = .01$

Note. $*p < .05$, $**p < .01$, $***p < .001$. ADOS = Autism Diagnostic Observation Schedule, Second Edition. KBIT-2 = Kaufman Brief Intelligence Test, Second Edition. SDQ = Strengths and Difficulties Questionnaire. SCQ = Social Communication Questionnaire. ABC = Aberrant Behaviors Checklist. HSQ-PPD = Home Situations Questionnaire, Pervasive Developmental Disorders version. CSMCI = Coding System for Mother-Child Interactions.

Table 5

Correlations Between Main Outcome Measures, Controlling for Gender, FSIQ, and Speech Difficulties

	1.	2.	3.	4.	5.	6.	7.
1. SDQ Total Difficulties score	---						
2. HSQ-PDD total number of problem settings	.62**	---					
3. HSQ-PDD mean severity score	.35	.41	---				
4. ABC Irritability subscale	.35	.63**	.49*	---			
5. CSMCI Overall Child score	.17	-.05	.06	.09	---		
6. CSMCI Overall Maternal score	-.04	-.21	-.08	-.04	-.14	---	
7. CSMCI Overall Dyadic score	.02	-.38	-.13	-.05	.44*	.71***	---

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. SDQ = Strengths and Difficulties Questionnaire. HSQ-PPD = Home Situations Questionnaire, Pervasive Developmental Disorders version. ABC = Aberrant Behaviors Checklist. CSMCI = Coding System for Mother-Child Interactions.

Table 6

Correlations Between Individual and Overall Scales of the CSMCI, Controlling for Gender, FSIQ, and Speech Difficulties

	Child Scores				Maternal Scores				Dyadic Scores				
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Child Overall Score	---												
2. Cooperation/Compliance	.91**	---											
3. Enthusiasm	.77**	.57*	---										
4. Negativity and Hostility (R)	.84**	.75**	-.39	---									
5. Maternal Overall Score	-.14	-.16	-.13	.07	---								
6. Emotionally Supportive Presence	-.24	-.22	-.15	.23	.88***	---							
7. Respect for Child's Autonomy	.03	-.05	.02	.04	.79***	.56**	---						
8. Quality of Assistance	-.08	-.12	-.15	-.06	.83***	.66**	.53*	---					
9. Negative Affect (R)	.12	.12	.15	-.04	-.85***	-.70***	-.63**	-.54*	---				
10. Dyadic Overall Score	.44*	.38	.40	-.33	.71***	.62**	.64**	.61**	-.50*	---			
11. Affective Mutuality/Felt Security	.43*	.41	.30	-.38	.70***	.58**	.56**	.63**	-.57**	.88***	---		
12. Mutual Enjoyment	.34	.26	.43*	-.18	.52*	.52*	.52*	.33	-.40	.83***	.59**	---	
13. Reciprocal Interactions	.31	.27	.24	-.27	.52*	.41	.50*	.56**	-.25	.75***	.57**	.37	---

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. R = reverse-scored.

Table 7
Multiple Regression Analyses, Entered Simultaneously, Controlling for FSIQ, Gender, and Speech Difficulties

Dependent Variable	Unstandardized Coefficient (B)	R Square	<i>p</i>
SDQ Total Difficulties, Block 1		0.60	
ADOS severity (C)	0.16		0.007
Overall Dyadic score (C)	0.01		0.894
SDQ Total Difficulties, Block 2		0.59	
ADOS severity (C)	0.15		0.019
Overall Dyadic score (C)	0.02		0.784
Severity X Synchrony	0.01		0.511
HSQ-PDD Number of Settings, Block 1		0.53	
ADOS severity (C)	1.29		0.036
Overall Dyadic score (C)	-1.45		0.059
HSQ-PDD Number of Settings, Block 2		0.50	
ADOS severity (C)	1.27		0.057
Overall Dyadic score (C)	-1.44		0.076
Severity X Synchrony	0.02		0.931
ABC Irritability Scale, Block 1		0.47	
ADOS severity (C)	1.14		0.046
Overall Dyadic score (C)	-0.15		0.823
ABC Irritability Scale, Block 2		0.45	
ADOS severity (C)	1.02		0.092
Overall Dyadic score (C)	-0.06		0.934
Severity X Synchrony	0.12		0.554

Note. C = centered. ADOS = Autism Diagnostic Observation Schedule, Second Edition. SDQ = Strengths and Difficulties Questionnaire. ABC = Aberrant Behaviors Checklist. HSQ-PPD = Home Situations Questionnaire, Pervasive Developmental Disorders version.

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Parental Permission Form for:

Mother-Child Interactions in Children with and without Autism Spectrum Disorders

I. Purpose of this Research Project

The purpose of this study is to investigate the group differences of mother-child interactions in children with and without Autism Spectrum Disorders (ASD). Since ASD are primarily characterized by difficulties with social interactions, we are exploring the underlying processes of these social deficits as experienced by many children with autism, manifested through family interactions. We are comparing children with and without ASD in order to inform our knowledge of family dynamics in both populations. For this study, we will be collecting data from up to 50 children, aged 4-11 years old, with or without an ASD diagnosis.

II. Procedures

This experimental session takes place at either the Virginia Tech Autism Clinic, the Roanoke Higher Education Center, or the Blue Ridge Autism & Achievement Center, and will last less than 2 hours. My child will be videotaped throughout the entire session. The procedure of the experimental session is as follows:

My signature on this permission document indicates my permission to enroll my child in the *Parent-Child Interactions in Children with Autism Spectrum Disorders* study. Then, I will be asked to complete some measures about my child's behaviors. At this point, I will be asked to step behind a one-way window, where I can watch the experimenter and my child interact throughout the entire session. My child will be given an autism diagnostic assessment, which consists of structured play tasks and will last approximately 45 minutes. My child will then be administered a brief measure of verbal and nonverbal cognitive ability, which will take 15 - 20 minutes. Finally, I will be asked to re-enter the room with my child. We will be asked complete a series of play tasks together.

III. Risks

There are no significant risks related to this study. All other aspects of the study should be familiar to my child and will hopefully be enjoyable.

IV. Benefits

A brief summary of the autism and cognitive assessments is available upon request. Additionally, there are societal benefits of understanding the particular social skills and deficits that children with ASD may have.

V. Extent of Anonymity and Confidentiality

All data related to me and my child will be de-identified with a participant identification number. All consent forms will be stored in a locked cabinet in the Virginia Tech Autism Clinic, separate from all other data. In addition, the video of my child and all other data will be labeled with his/her participant identification number and will be placed in a locked cabinet in the Virginia Tech Autism Clinic, separate from the consent form. The only individuals with access to this cabinet are the experimenter and one graduate student researcher. The video will be viewed by two trained undergraduate research assistants in order to code the play tasks that my child and I completed. Although an individual may still be identified directly through the videotape, the research team will not divulge any information to any individuals or any other entities. Video coders will be given no identifying information about my child, only my child's participant identification number. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. **If my child or I express any child abuse, or the intent to harm or kill myself or someone else, the researchers are legally obliged to inform an authority. In this case, I will be informed of the need to do so, and am encouraged to contact the Psychological Services Center at (540) 231-6914.**

VI. Compensation

Families will be compensated \$15 for their participation in this study. All participants who sign a consent form will be compensated, even if they withdraw from the study. Payment is not contingent on completion of study procedures.

VII. Freedom to Withdraw

This project has been explained to me and to my child, and we both have had the opportunity to ask any questions we have. I understand that my child and/or I do not have to fill out the questionnaires or respond to experimental situations and we will receive no penalty. My child and/or I can withdraw at any time, if we choose.

VIII. Parent (or Guardian)/Subject’s Responsibilities

I voluntarily agree for my child and me to participate in this study. My child and/or I have the following responsibilities: completing questionnaires, participating in an autism diagnostic assessment, participating in a measure of cognitive ability, and participating in a structured play situation.

IX. Parent/Guardian’s Permission

I am this child’s biological mother or legal female guardian, and his/her primary caregiver. I have read the Parental Permission Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for my child and I to participate in this study.

Parent/Guardian Signature: _____ Date: _____

Yes, I would like to receive a brief summary of my child’s autism and cognitive assessments.

No, I do not wish to receive a brief summary of my child’s autism and cognitive assessments.

X. VTAC Master List

If I participate in other studies affiliated with VTAC, my data will be given a code and potentially combined with my other coded data. A master list will be maintained in order to match my current data with previously collected data. My name from this master list will only be available to VTAC staff and will not be shared with others. I may be contacted for future studies if I give separate permission below.

Yes, I would like to be contacted for possible participation in future VTAC studies. I understand I would be under no obligation to participate in these studies if contacted. I can decide at that time if I would like to participate.

No, I do not wish to be contacted for possible participation in future VTAC studies.

Should I have any questions about the protection of human research participants regarding this study, I may contact:

Tyler Hassenfeldt, B.A.
Graduate Student
Department of Psychology
(540) 231-6914
thassen@vt.edu

Angela Scarpa, Ph.D.
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Dr. David Moore
Virginia Tech IRB for the
Protection of
Human Subjects
Office of Research Compliance
2000 Kraft Drive
Suite 2000 (0497)
Blacksburg, VA 24060
(540) 231-4991
moored@vt.edu

Invent the Future

Appendix B: Child Verbal Assent Script (ages 5-11)

“I am doing a project so that I can learn more about how parents and kids act together. You can choose to be part of this project, but you don’t have to be if you don’t want to. If you don’t want to be part of it, you will not get into trouble.

Let me tell you what you would do if you are part of the project. Your mom would fill out some forms while you and I do some things together, like talking and playing some games. She will sit behind the glass, where we can’t see her but she can see us. Then, I will ask you and your mom to do some things together, like drawing, talking together, and sharing a snack. We will be videotaping what goes on so that we can look at the videotape later on. Do you have any questions about what it would be like to be part of this project? [Take time to answer child’s questions.] Would you like to be part of this project?”

Appendix C: Demographic Questionnaire

GENERAL INFORMATION ABOUT THE PARENT

What relation are you to the child?

- Mother
- Father
- Stepmother
- Stepfather
- Adoptive Mother
- Adoptive Father
- Legal Guardian
- Other Relative (please specify): _____

What is your race/ethnicity? (optional)

- African American
- Asian
- Caucasian/European American
- Native American
- Latino, Hispanic, or Chicano
- Other (please specify): _____

What is your highest level of completed education? (optional)

- Some High School
- High School Graduate
- Some College
- College Degree
- Some Graduate Studies
- Graduate Degree

Which of the following is closest to your annual household income? (optional)

- Under \$20,000
- \$20,000 - \$39,999
- \$40,000 - \$59,999
- \$60,000 - \$79,999
- \$80,000 - \$99,999
- \$100,000 and above

GENERAL INFORMATION ABOUT THE CHILD

How old is your child?

____ Years

What is your child's gender?

____ Male ____ Female

What is your child's race/ethnicity? (optional)

- African American
- Asian
- Caucasian/European American
- Native American
- Latino, Hispanic, or Chicano
- Other (please specify): _____

What level of education has your child completed?

- None
- Preschool
- Kindergarten
- Elementary School

Specify last grade completed: _____

GENERAL INFORMATION ON DIAGNOSIS AND PROFESSIONAL SERVICES

What is your child's current Autism Spectrum Disorder diagnosis?

- Autism or Autistic Disorder
- Asperger's Disorder
- Childhood Disintegrative Disorder
- Rett's Syndrome
- Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS)
- Other (please specify): _____
- None of the above

How old was your child when he/she got this diagnosis?

____ Years ____ Months

Have any of the child's siblings been diagnosed with Autism Spectrum Disorder?

- Yes
- No

If Yes, please specify which disorder: _____

Does your child have any other symptoms or diagnoses? (check all that apply)

- Anxiety Disorder
- Attention Deficit Hyperactive Disorder
- Obsessive Compulsive Disorder
- Central Auditory Processing Disorder
- Depression
- Schizophrenia
- Hearing Impairment
- Vision Impairment
- 'Tunnel Vision Syndrome' (peripheral vision, vision perception impairment)
- Mental Retardation
- Seizures
- Dietary Allergies
- Digestive Problems (constipation, diarrhea, bloating, or abdominal pain)
- None
- Other (please specify): _____

If answered yes to dietary allergies, please specify: _____

What type of professional diagnosed your child with Autism Spectrum Disorder?

- Developmental Pediatrician
- Psychologist
- Neurologist
- Primary Care Physician
- Psychiatrist
- Other (please specify): _____

CURRENT SYMPTOMS DISPLAYED BY CHILD

Please check the symptoms currently exhibited by your child:

- Doesn't respond when called
- Self-injurious behaviors
- Destructive behaviors
- Receptive language delay
- Expressive language delay
- No verbal language
- Apraxia (oral motor, articulation problems)
- Absent or limited gestures
- Cognitive delay
- Strong visual learner
- Strong auditory learner
- Gross motor delay
- Fine motor delay
- Undersensitive to pain
- Oversensitive to pain
- Undersensitive to sound
- Oversensitive to sound
- Aggressive to others
- Has trouble joining a group
- Happier left alone
- Frustrated
- Gets angry easily
- Cries excessively
- Hums frequently
- Insists on sameness
- Agitated when routine is disrupted
- Insists on precision
- Poor eye contact
- Stomach Pain
- Constipation
- Diarrhea
- Eczema
- Thrush (white tongue yeast infection)
- Itchy penis/perineum/all
- Losing weight
- Gaining weight
- Fixation on objects or topics
- Unusual cravings for certain foods
- Has known food sensitivity
- Sustained odd play
- Echolalia (repeats the same phrase over and over)
- Does not require long sleep

- Requires longer than average sleep
- Does not stay asleep
- Wakes up at night and does not go back to sleep
- Takes a long nap daily
- Tantrums
- Anxiety
- Depression
- Hand flapping
- Toe walking
- Spinning self
- Likes to watch objects spin
- Rhythmic or rocking behaviors
- Other types of self-stimulatory behavior (please specify): _____

If answered yes to unusual cravings for certain foods, please specify:

If answered yes to known food sensitivity, please specify:
