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# Emotional Communication and Attachment Security in Infants At Risk for Autism Spectrum Disorders

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UNIVERSITY OF MIAMI

EMOTIONAL COMMUNICATION AND ATTACHMENT SECURITY IN INFANTS  
AT RISK FOR AUTISM SPECTRUM DISORDERS

By

John D. Haltigan

A DISSERTATION

Submitted to the Faculty  
of the University of Miami  
in partial fulfillment of the requirements for  
the degree of Doctor of Philosophy

Coral Gables, Florida

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Thirty-two infants and their parents were observed at 6 months in the Face-to-Face/Still-Face (FFSF) paradigm. Attachment security was assessed in the Strange Situation Paradigm (SSP) at 15 months. Eighteen of these infants had an older sibling with a clinically diagnosed ASD (ASD-siblings) and 14 had older siblings with no ASD (comparison-siblings). Results suggested that at fifteen months, before diagnostic outcomes are available, ASD-sibs are no more likely to evidence insecurity in attachment, or attachment disorganization, than are COMP-sibs. Additionally, 15-month secure and insecure infants differed with respect to 6-month gazing at their parent's face during the still-face (SF) and reunion (RE) episodes as well as the amount they were tickled by their parent in the RE episode. Parent tickling in the RE episode appeared to be differentially associated with later attachment security between ASD and COMP-sibs. For COMP-sibs insecurity in attachment at 15-months was associated with more parent tickling in the RE episode. For ASD-sibs it was not. Results suggest that infant and parent emotional behaviors at 6 months of age in a standardized emotion-eliciting paradigm provide a window into the processes of developing attachment security.

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## Chapter 1: Emotional Communication and Attachment Security in Infants at Risk for Autism Spectrum Disorders (ASDs)

Children with Autism Spectrum Disorders (ASDs) show higher levels of attachment insecurity and disorganization than children without ASDs (Rutgers et al., 2004; Van IJzendoorn et al., 2007; Naber et al., 2007). Further, the expected relationship between parental sensitivity and attachment security found in typically developing infants was not found in a recent study investigating attachment security in children with an ASD (Van IJzendoorn et al., 2007). This study compared rates of attachment security and disorganization between the infants of older siblings with an Autism Spectrum Disorder (ASD-sibs), who are at genetic risk for developing an ASD, and the infants of older siblings with typical development (COMP-sibs). This study also explored whether infant and parent communication behaviors at six months of age during the Face-to-Face/Still-Face procedure (FFSF; Tronick et al., 1978) had similar associations with later attachment security in ASD-sibs and COMP-sibs. Below, an overview is provided of attachment theory, the relevance of the FFSF paradigm for use in this project, and ASDs. This section concludes with a more specific description of the study's objectives and the relevant hypotheses.

### *Attachment Security*

Attachment Theory (Bowlby 1969, 1973, 1980) is rooted in the ethological notion that an infant will seek proximity to caregivers when separated from them, as well as under conditions of environmental stress (e.g., danger and predation), and that this proximity-seeking behavior is naturally selected. According to Bowlby (1969, 1973, 1980), attachment provides a secure base from which the child can explore the environment, a haven of safety to which the child can return when he or she is afraid or

frightened. The development of a secure attachment is a salient developmental task of infancy during the first year of life (Sroufe & Rutter, 1984).

Ainsworth first classified infants' attachment patterns empirically, based on a structured series of separations and reunions between the infant and caregiver, the Strange Situation Procedure (SSP; Ainsworth & Wittig, 1969; Ainsworth et al., 1978). Ainsworth originally identified three organized attachment patterns. Secure (B) infants readily greet and seek contact with the caregiver upon reunion, openly display emotional communication, and demonstrate engaged exploration and play in the presence of the caregiver. Resistant (C) infants are characterized by displays of ambivalence with the caregiver, particularly during reunion, often seeking contact and comfort from the caregiver while simultaneously demonstrating signs of resistance including squirming to get down (if held), angry crying, and generalized petulance. Avoidant (A) infants openly reject the caregiver upon reunion and show little or no distress during her absence. In normative, non-clinical samples about 65% of children are classified as securely attached, 20% receive a classification as insecure-avoidant, and 15% are classified as insecure-resistant (van IJzendoorn, Goldberg, Kroonenberg, & Frenkl, 1992) although cross-cultural distributions are slightly different (see van IJzendoorn & Sagi-Schwartz, 2008).

Crittenden and others (Crittenden, 1985; Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985) noted that some infants could not be readily classified into the ABC organized attachment patterns. This resulted in the development of the disorganized attachment classification by Main and Solomon (1990). The disorganized (D) pattern occurs with increased frequency in high risk and atypical samples, (Carlson, Cicchetti, Barnett, & Braunwald, 1989; van IJzendoorn et al., 1999) although approximately 14% of

infants in middle-class, non-clinical groups also receive a disorganized classification (van IJzendoorn et al., 1999). Disorganized infants are characterized by the lack of an organized behavioral strategy (i.e., security, resistance, or avoidance) to cope with the demands of the strange situation and display behaviors characterized by apprehension of the caregiver or disorganization and disorientation to the strange situation environment. For example, disorganized infants may lay prone on the floor while crying yet not approaching the parent, or they may approach the parent by backing towards them.

Secure parent-child attachments are typically predicted by high levels of parental sensitivity and responsiveness to the infant's bids for communication and contact (De Wolff & van IJzendoorn, 1997; Braungart-Rieker et al., 2001) although some studies (e.g., Seifer et al., 1996) have not found associations between parental sensitivity and attachment classification. Further, the association between parental sensitivity and attachment security is moderate ( $r = .24$ ; De Wolff & van IJzendoorn, 1997), suggesting that sensitivity is not the exclusive factor in the development of a secure attachment (see also Fuertes et al., 2006; Solomon & George, 2008) and that interactional approaches are also needed to explain attachment security (Schneider, Rosen, & Rothbaum, 1993; Jaffe et al., 2001). To evaluate the interactive contributions of infant and parent emotional communication variables to later attachment security, this project used the Face-to-Face/Still-Face (FFSF) procedure (Tronick et al., 1978) when the infant was 6 months of age.

*The Face-to-Face Still/Face Procedure (FFSF)*

The Face-to-Face/Still-Face (FFSF) procedure (Tronick et al., 1978) is a versatile interactive protocol useful for assessing both the positive and negative emotional expressivity of infants (Adamson & Frick, 2003; Cohn, Zlochower, Lien, & Kanade, 1999). Positive engagement declines and negative engagement increases when the parent ceases play and holds a still face (Tronick et al., 1978). The resumption of parental play in the reunion is characterized by moderate levels of both positive and negative infant expressivity (Weinberg & Tronick, 1996; Moore, Cohn, & Campbell, 2001). The FFSF allows for the dual opportunity to examine how an infant responds to the emotional unavailability of the parent during the still-face (SF) episode (Cohn et al., 1991) and the manner in which infant and parent re-establish social interaction in the reunion (RE) episode.

The RE episode of the FFSF follows the SF episode in which the parent is instructed to maintain an expressionless face and refrain from all communication with their infant. The SF perturbation of social communication between infant and parent must then be resolved by the dyad in the RE episode, when play resumes and both mother and infant are confronted with the challenge of re-establishing interactive communication. The combined stressors of both the SF and RE for the infant, and parental responses in the RE may present a more meaningful context for examining how infant and parent communication variables shape later attachment security (cf., Kogan & Carter, 1996; McElwain & Booth-LaForce, 2006; Braungart-Rieker et al., 2001; Cohn, 2003). In particular, the infant must cope with the cessation and resumption of social responsivity from the parent, taxing their ability to self-regulate, while the parent is

typically placed in the position in the RE episode of having to respond sensitively to signals of infant stress, and often distress, which may be more difficult than responding sensitively to non-distress (McElwain & Booth-LaForce, 2006). How these tasks are met with by both the parent and infant may index the quality of early mother-infant interactive history and provide a window into the early development of the infant's implicit procedural model of self-other relationships.

Infant and parent behavior in the FFSF protocol has been used to examine later attachment security in children without ASD-risk (Cohn et al., 1991; Braungart-Rieker et al., 2001) as well as to explore potential subthreshold emotional impairments in ASD-sibs (Yirmiya et al, 2006; Cassel et al., 2007; Merin et al, 2007). A recent meta-analysis of the FFSF procedure (Mesman et al., 2009) identified eight studies that examined infant and/or parent behavior in the SFP and later attachment security. These studies suggest a modest link between infant behavior in the FFSF and later attachment security. In general, greater infant eliciting behavior and positive affect (e.g., smiling) during the SF episode is associated with later secure attachment as are higher levels of parental sensitivity (Braungart-Rieker et al., 2001) and greater levels of mother-initiated play bouts in the FF episode of the FFSF (Kiser et al., 1986). As discussed below, both infant (smiling, crying, gaze) emotion behaviors and parental sensitivity and modulation were investigated in this project.

### *Autism Spectrum Disorders (ASDs)*

Autism Spectrum Disorders (ASDs) are neurodevelopmental disorders in which impairments in social functioning and communication and the display of repetitive behaviors and/or stereotyped interests are distinguishing features (Landa et al., 2007;

Mundy & Hogan, 1994; Sigman & Ruskin, 1999). ASDs are typically not diagnosed until late toddlerhood or pre-school age. Parents, however, report that the mean age of ASD symptom onset is between 16 and 20 months (Chakrabarti & Fombonne, 2005; Ozand, Al Odaib, Merza, & Al Harbi, 2003; Short & Schopler, 1988; Spitzer & Siegel, 1990; Volkmar, Stier, & Cohen, 1985) and many parents report developmental deficits within the first year of life (Zwaigenbaum et al., 2005).

Unfortunately, little is known about ASD-related deficits in infancy. ASDs occur in approximately one in every 150-250 preschool-age children, making the disorder too rare to study prospectively in the general population (Bryson & Smith, 1998; Chakrabarti & Fombonne, 2005). The recurrence risk for ASD in younger siblings of children with ASD is estimated to be 6%-8% (Piven et al., 1997), and the prevalence of the broader autism phenotype in siblings has been reported to be as high as 20% (Bolton et al., 1994). However, recently published prospective studies of younger siblings have revealed substantially higher rates of ASD, ranging from 29% (19/65; Zwaigenbaum et al., 2005) to 37% (22/60; Landa & Garrett-Mayer, 2006). There is evidence that subclinical ASD-related deficits characterize the relatives of individuals diagnosed with ASDs (Constantino et al., 2006; Dawson et al., 2002; Bailey, Palferman, Heavey, & Le Couteur, 1998). In order to better understand these subclinical deficits and how ASDs develop across infancy and childhood, researchers have begun to implement infant sibling studies to examine potential early emotional differences between the infant siblings of older children with ASDs (ASD-sibs) and comparison groups of infant siblings of older children who have not been diagnosed with an ASD (COMP-sibs; Cassel et al., 2007; Merin et al., 2007; Yirmiya et al., 2006; Ibanez et al., 2008). Each of

the above studies has used the FFSF procedure as a methodological tool to study group differences in early emotional communication.

### *Attachment Security and ASDs*

No information exists regarding the development of attachment security in ASD-sibs. There are, however, disturbances in the affective processes of the first-degree relatives (i.e., both parents and siblings) of children with autism (Bolte & Poustka, 2003; Bolton, Pickles, Murphy, & Rutter, 1998; Murphy et al., 2000; Ibanez et al., 2008). Although early descriptions of autism (cf. Kanner, 1943; 1949) suggested that it was a developmental disorder with a failure to form affective contact, subsequent research has demonstrated that children with ASDs do, in fact, show attachment behaviors and form attachment bonds with their caregivers (see Yirmiya & Sigman, 2001 for a review).

The majority of the research on the development of attachment in children with ASDs has suggested that they both show a preference for directing attachment behaviors (e.g., proximity seeking) towards their parent and that they develop secure attachments to their parents, although the later finding is qualified by the level of cognitive development and degree of ASD impairment in the affected child (Dissanayake & Crossley, 1996; Shapiro et al., 1987; Sigman & Mundy, 1989; Rogers et al., 1991; Rogers et al., 1993; Capps et al., 1994; Rutgers et al., 2004; Naber et al., 2007). However, despite the fact that children with ASDs generally form secure attachments, they have also been shown to demonstrate higher levels of attachment insecurity and disorganization (Rutgers et al., 2004; van IJzendoorn et al., 2007; Naber et al., 2007) than children without ASDs. In addition, parents of children with ASDs do not differ in the amount of sensitivity and synchrony in interactions with their ASD children when compared to comparison

children, including those with developmental delay (van IJzendoorn et al., 2007; Siller & Sigman, 2002).

In their study of attachment in children with autism, Capps et al., (1994) noted that some autism-related behaviors which overlapped with markers of attachment disorganization, in particular behavioral stereotypies, were likely due to the child's neurological impairment and not a function of the parent-child relationship. There are a number of maladaptive antecedents and sequelae often associated with disorganized attachment (Carlson et al., 1989; Lyons-Ruth, 1996; Lyons-Ruth, Alpern, & Repacholi, 1993) and in particular disorganized attachment concomitant with mild mental lag (Lyons-Ruth, Easterbrooks, & Cibelli, 1997). Thus, it is important to determine whether potential increased levels of attachment disorganization in samples at-risk for neurodevelopmental impairment are due to the overlap of attachment disorganization indices with phenotypic behaviors associated with specific neurodevelopmental impairments.

To date, no research has examined the development of attachment in ASD-sibs, who might be expected to show higher rates of neurological impairment, given their genetic susceptibility to ASDs, and therefore also the phenotypic behavioral expression of this neurological impairment (e.g., milder variants of behavioral stereotypies, such as hand flapping or arm wringing). When attachment disorganization classifications are made in the context of likely neurological impairment using relevant coding criteria (cf. Pipp-Siegel et al., 1999; Barnett et al., 1999), the opportunity to better understand what is, and what is not, disorganization in the attachment relationship is made possible. Valid estimates of attachment classification rates, particularly the disorganized classification,



are imperative if researchers are to reliably disentangle neurological and relational disturbance in samples *at risk* for neurodevelopmental impairment (Green & Goldwyn, 2002).

### *Current Study*

The primary aim of the current study was to explore whether ASD-sibs, who have genetic risk for developing an ASD, but who are not yet of diagnosable age, show similar rates of attachment insecurity and disorganization as infants who do not have this genetic risk (COMP-sibs). This project also assessed specific disorganization indices to explore whether ASD-sibs demonstrated a greater proportion of disorganized behavioral indicators that may potentially overlap with symptoms of neurological impairment (cf. Pipp-Siegel et al., 1999) and thus may not reflect attachment disorganization with respect to the caregiver.

We explored the developmental antecedents of attachment security in this project through the use of the face-to-face/still-face (FFSF) paradigm at 6 months of age to assess both infant and parent emotional and communicative characteristics. Specifically, this project examined whether parental sensitivity and modulation and infant crying, smiling, and gazing at the mother's face showed meaningful relations with later attachment security and explored whether patterns of prediction were similar for ASD-sibs and COMP-sibs. The utility of a novel parent variable—parent tickling of the infant in the FFSF procedure—in distinguishing later attachment patterns was also explored in the current project. In sum, the current study draws upon a developmental psychopathology framework by integrating the use of the FFSF in studies of both normative and atypical development. By examining the antecedents of attachment

security in the context of neurodevelopmental risk, it may be possible to better understand the early emerging social, communicative, and behavioral risk factors that place ASD-sibs on pathways towards later attachment insecurity and disorganization.

### *Hypotheses*

It was expected that ASD-sibs would evidence higher rates of insecure attachment than COMP-sibs. Importantly, it was thought that this increased insecurity would be expressed as an increase in disorganized classifications (cf; Naber et al., 2007; Rutgers et al., 2004). Related to this hypothesized increase in disorganized classifications among ASD-sibs, it was hypothesized, that given their genetic risk for subtle compromises in social and behavioral functioning (e.g., behavioral stereotypies) ASD-sibs would show a greater proportion of disorganized indices that overlap with potential symptoms of neurological impairment (cf. Pipp-Siegel et al., 1999) than COMP-sibs.

No hypotheses were offered with respect to group differences in infant communication behaviors between ASD-sibs and COMP-sibs as few differences have been reported in the literature. Parental sensitivity and modulation during the FF episode were not expected to differ between ASD-sib and COMP-sib groups. Conversely, in light of the fact that first degree relatives (i.e., parents) of individuals with autism carry a genetic risk for subtle impairments associated with ASDs (e.g., deficits in social functioning; Murphy et al., 2000) and to be socially less competent (van IJzendoorn et al., 2007; Folstein & Rutter, 1988), it was hypothesized that parents of ASD-sibs would be rated as less sensitive and as less able to effectively modulate their infant during the RE portion of the FFSF than parents of COMP-sib infants.

On the basis of previous research using the FFSF paradigm to predict later attachment (Braungart-Rieker et al., 2001; Kiser et al., 1996) as well as research showing no relation between sensitivity and attachment security in children with ASDs (van IJzendoorn et al., 2007) it was expected that parental sensitivity and modulation at 6 months would be associated with 15-month attachment security but only for the COMP-sibs. Drawing on the work of Cohn et al., (1991), Braungart and Stifter (1991) and Braungart-Rieker et al., (2001) regarding infant behaviors in the FFSF as indicators of later attachment security, infant smiling in the SF was expected to be related to later attachment security. Because there is limited information regarding infant crying and gaze behaviors in the FFSF procedure as predictive of later attachment, no hypotheses concerning these infant behaviors and later attachment were made. Nevertheless, this study explored how 15-month attachment groupings might differ with respect to these infant and parent communicative behaviors. Lastly, based on the idea that parent tickling might be experienced as intrusive or over-stimulating by the infant (cf., Malphurs et al., 1996; Field et al., 1986), it was hypothesized that parent tickling, particularly during the RE episode of the FFSF, would show an association with attachment insecurity.

## Chapter 2: Method

### *Participants*

This was a longitudinal study investigating the social and emotional development of the infant siblings of older children with an Autism Spectrum Disorders (ASD-sibs;  $N = 18$ ) and the infant siblings of older children with typical development (COMP-sibs;  $N = 14$ ). Infants were included in this sample if they were at least 36 weeks gestation at birth, and had a birthweight above 2500g. COMP-sibs were classified as such if their older siblings were not diagnosed with an ASD and there was no research evidence of heightened ASD symptomatology. ASD-sibs were so classified if at least one of their sibling(s) was diagnosed with Autism, Asperger's Disorder, or Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS). Independent community diagnoses for the older siblings with ASD were confirmed for this study via record review by a clinical psychologist and performance on the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999). The COMP-sibs were White/Caucasian (50%), Hispanic (29%), and African American/Other (21%). The ASD-sibs were White/Caucasian (44%), Hispanic (33%), and African American/Other (22%). Approximately 74% of the participants in this project were part of an investigation by Cassel et al. (2007) and approximately 71% were part of an investigation by Ibanez et al. (2008). Demographic data for the sample are presented in Table 1.

### *Face-to-Face/Still-Face Procedure (FFSFP)*

Appendix one provides a table of all measures used in this study and their underlying constructs. All infants participated with their parent in the Face-to-Face/Still-Face Protocol (FFSF; Tronick, Als, & Brazelton, 1978) at the six-month assessment. The

mean age of the infants was 6.12 months ( $SD = .33$ ; *range* 5.21 – 6.92). There was no age of FFSF administration difference between groups,  $p > .70$ . In the FFSF, parents (all mothers) were asked to play with their baby without toys for three minutes (Face-to-Face; FF), stop playing and maintain a still face with no emotional expression for two minutes (still-face; SF) and resume play for another three minutes (Reunion; RE). FFSF episodes were terminated if the infant cried for more than 20 seconds or if the parent elected to terminate the procedure. Two time-synched cameras were used to record the face and upper body of the infant and caregiver. Each segment of the FFSF footage (FF-SF-RE) for both infant and mother was then separately exported to a video file for coding of parent and infant emotional communication variables for later coding.

#### *Parental Sensitivity and Modulation*

Each 10 second segment of both the FF and RE episodes was coded for parental sensitivity and modulation. Ainsworth, Bell, and Stayton (1971) defined the constituent parts of maternal sensitivity as consisting of the mother's awareness of the signals, her ability to interpret them accurately, her tendency to respond appropriately, and the promptness (i.e., contingency) of her response (Malatesta, Culver, Tesman, and Shepard, 1989). The measure of parental sensitivity utilized in this project was chosen based on its theoretical relevance related to mother-infant interaction and attachment in previous studies. The sensitivity scale (Braungart-Rieker et al., 2001) used was developed in the spirit of the Ainsworth et al., 1971 tradition and is intended to reflect variation in parental sensitivity to infant social and emotional signals (i.e., sensitivity was defined as the parent's ability to perceive infant's signals accurately and vary his or her behavior appropriately). Coders rated sensitivity on a 5-point scale every 10 seconds with 0

representing no sensitivity or high intrusiveness and 4= high sensitivity, no intrusiveness. In addition, coders also applied a global sensitivity rating for each of the FF and RE episodes using Ainsworth's original sensitivity-insensitivity scale (Ainsworth et al., 1971). This global code was applied to the entire episode using a 9-point scale with 1 representing low sensitivity and 9 representing high sensitivity.

In addition to parental sensitivity, parental modulation (Kiser et al., 1986) of the infants' affective reactions in the FFSF paradigm was coded in ten-second intervals. Low scores indicated less optimal performance in modulating the infant and high scores indicated optimal performance. Parental modulation was chosen based on its conceptual relevance to parent behaviors that are typically evoked by the infant during the FFSF procedure, particularly the reunion episode when infants are resuming social interaction with their parent following the stressful still-face episode.

Two coders, blind to infant risk status, separately and independently rated each 10-second segment of the FF and RE episodes of the FFSF procedure for both sensitivity and modulation and applied a global coding of sensitivity for each episode using Ainsworth's original sensitivity-insensitivity scale as noted above. The mean of these ratings (for those variables coded on a 10-second basis) was calculated for each rater's codes for each episode. Intraclass correlations for the sensitivity scale developed by Braungart-Rieker et al. (2001) were poor ( $\leq .58$ ) and therefore this scale was not used in subsequent analyses. Intraclass correlations for the Ainsworth sensitivity scale were also not adequate for either the FF (.60) or RE (.62). Thus, it was not possible to examine sensitivity in this project as originally intended. Intraclass correlations for parental

modulation were as follows: for FF modulation .82 and for RE modulation, .95. Total scores for modulation used in analyses were the average of both coders' assessments.

### *Parent Tickling*

Two independent coders coded parent tickling. Parent tickling of the infant began when the parent moved their fingers while touching their child and ended when the parent either removed their hands from their infant or stopped wiggling their fingers.

Approximately 16% of the video segments were double-coded with a mean agreement of 88% (mean  $kappa = .81$ ).

### *Infant smiling and crying and gaze behaviors*

The presence of infants' smiles and cry-faces in the FFSF were coded on a second-by-second basis by graduate students certified in the Facial Action Coding System (FACS; Ekman & Friesen, 1978) and trained in its application to infants, BabyFACS (Oster, 2000). In smiles, the lip corners are pulled diagonally upward by the zygomaticus major (AU12). In cry-faces, the lips are stretched laterally by the risorius muscle (AU20) and the brows are lowered by the corrugator muscle (AU4). Total durations of smiles and cry-faces proportionalized for segment length were obtained by dividing the duration of coded smiles or cry-faces by the subject's time spent in that episode. Approximately 31% of the total sample reported here were coded for reliability with a mean percent agreement of 86% (mean  $kappa = .68$ ). The main and reliability coders were not blind to infant risk status.

Infants were also coded as either gazing directly at the parent's face or not gazing at the parent's face on a second-by-second basis. Gaze was examined by calculating the average proportion of time in seconds that the infant spent gazing at the parent's face

within each episode. Approximately 44% of the video clips in the current sample were coded for reliability with a mean agreement of 90% (mean kappa = .75). The coders were blind to participant status.

#### *Strange Situation Procedure (SSP)*

Security of attachment was assessed using the traditional Strange Situation Procedure (SSP; Ainsworth and Wittig, 1963; Ainsworth et al., 1978). Infants completed the SSP at the 15-month assessment. The mean age of the infants at the 15-month SSP administration was 15.18 months ( $SD = .37$ ; *range* 14.49 – 16.03). There was no age of SSP administration difference between the two groups,  $p > .27$ . Classification of infants into attachment categories was determined using the standard Ainsworth et al., (1978) scoring system for the traditional classifications of secure (B) avoidant (A) and resistant (C) and their subcategories as well as Main and Solomon's (1990) scoring system for attachment disorganization (D).

This project also employed coding guidelines developed by Pipp-Siegel, Siegel, & Dean (1999) which distinguishes indices of disorganized attachment (Main & Solomon, 1990) as overlapping or not overlapping with symptoms of neurological disorder (see Pipp-Siegel et al., 1999); e.g., stereotypies such as hand flapping and other motor stereotypies which are often seen in children with ASDs), thus potentially permitting a potentially more valid classificatory estimate of 'true' disorganized infants. The implementation of this coding system was informed by the possibility that ASD-sibs may be more likely to show subtle behavioral impairments, such as motor stereotypies, than are children with no familial history of an ASD.



Strange situations were coded by an experienced coder (J.D.H.) who has satisfactorily passed the organized attachment reliability test (Minnesota tapes). Of the original 49 15-month Strange Situations, 41% (N = 20) were double-coded by an expert attachment coder. Twelve of those 20 (38%) cases comprise the current 15-month sample. Satisfactory intercoder agreement was reached on four-way attachment classifications (A, B, C, &D; 80%,  $\kappa = .63$ ). In addition, reliability was obtained when four-way organized attachment classifications with subclassifications were considered (i.e., A, B1-B2, B3-B4, C; 80%,  $\kappa = .71$ ). Intercoder agreement on the Richter's continuous measure of attachment security and the disorganization scale score were not adequate ( $r$ 's  $\leq .55$ ) and are not considered further.

### Chapter 3: Results

Results are presented in four sections. First, frequencies of attachment classifications and the proportion of disorganization indices overlapping with neurological impairment for both ASD-sibs and COMP-sib groups are presented. Next, information for infant-mother dyads during the 6-month FFSF procedure is presented for the ASD-sib and COMP-sib groups. Third, associations between infant and parent emotional communication variables across the FFSF are presented. Finally, the extent to which infant attachment patterns at 15 months differ on 6-month FFSF variables is examined.

#### *Attachment classifications for ASD-sibs and COMP-sibs*

Attachment classifications did not differ between ASD-sibs and COMP-sibs. Overall, 9 (28.1%) infants were classified as secure B1-B2, 13 (40.6%) as secure B3-B4, 7 (21.9%) as resistant, and 3 (9.4%) as avoidant (see Table 2). The frequencies of infants' four-way (i.e., A, B1-B2, B3-B4, C) attachment classifications did not differ by risk group (i.e., ASD-sib vs. COMP-sib),  $\chi^2(3, N=32) = 1.07, p = .78$ . The frequencies of ABC attachment classifications for each risk group also did not differ  $\chi^2(2, N=32) = .72, p = .70$  (see Table 3). The frequencies of ABC and D attachment classifications for ASD-sibs and COMP-sibs did not differ  $\chi^2(3, N=32) = 5.23, p = .16$  (see Table 4). Similarly, as can be seen in Table 5 the frequencies of secure and insecure categorizations for each risk group did not differ ( $p = .71$ , Fisher's exact test). Finally the frequencies of disorganized and not disorganized categorizations for each risk group did not differ ( $p = .27$ , Fisher's exact test; see Table 6). There were eight COMP-sibs and 13 ASD-sibs for which any behavioral disorganization was coded. An independent samples  $t$ -test revealed no significant difference between the ASD-sib and COMP-sib groups  $t$

(19) = .230,  $p = .47$  in the proportion of disorganization indices that overlapped with neurological impairment according to the Pipp-Siegel et al., (1999) guidelines.

In addition, infant gender was not associated with any of these attachment classification groups and was dropped from all further analyses involving attachment classifications.

### *Contrasts of ASD-sib and COMP-sib infant-mother dyads*

#### *Parent Modulation*

A 2 (ASD risk group) x 2 (Infant Gender) x 2 (FF/RE Episodes) repeated measures analysis of variance for parental modulation indicated no significant main or interaction effects for risk-group status, infant gender, or their interaction. There were also no main effects for FFSF episode or its interaction with infant gender or infant risk status.

#### *Infant Variables*

For the proportions of infant smiling, crying, and gaze behaviors across the FFSF procedure, separate 2 (ASD risk group) x 2 (Infant Gender) x 3 (FF/SF/RE Episodes) RMANOVAs were carried out. Group risk-status and infant gender served as between-subjects variables, and episode was the within subjects variable. For infant smiling there was a significant main effect of episode  $F(2, 56) = 31.19, p < .00, \eta^2 = .53$ . There were no other significant main or interaction effects. Difference contrasts revealed that infants spent a greater proportion of time smiling in the FF&RE episodes than the SF  $F(1, 28) = 7.55, p < .000, \eta^2 = .72$ . Similarly, for infant crying there was also only a significant main effect of episode  $F(2, 56) = 4.71, p < .00, \eta^2 = .14$ . There were no other main or interaction effects. Difference contrasts revealed that infants spent a greater proportion of time crying in the RE than in the FF episode  $F(1, 28) = 6.27, p < .05, \eta^2 = .18$ . The SF

versus FF&RE contrast however was not significant. The RMANOVA for infant gaze followed this same pattern with only a significant main effect of episode  $F(1, 28) = 25.2$ ,  $p < .000$ ,  $\eta^2 = .47$  with no other significant main or interaction effects. Difference contrasts revealed that infants spent a greater proportion of time gazing at the parents face during the SF than the composite of the FF & RE episodes  $F(1, 28) = 52.32$ ,  $p < .000$ ,  $\eta^2 = .65$ . The lack of a risk-group difference in the mean proportion of time infants spent gazing at their mother's face is consistent with Ibanez et al.'s (2008) report that ASD-sibs and COMP-sibs did not differ in the mean durations of gazes at their parents' faces during the FFSF procedure. Cumulatively, these results suggest no risk-group differences in infant expressivity as measured in this study.

#### *Associations among Mother-Infant Emotional Communication Variables*

Correlations among maternal modulation, infant smiling and crying, and infant gaze behaviors for relevant episodes of the FFSF procedure are presented in Table 7. As can be seen from the table, each infant emotional communication variable tended to be highly and significantly correlated with itself between episodes of the FFSF. Infant gaze in both the SF (.58) and RE (.57) was positively and significantly correlated with infant gaze in the FF. The same was true for infant crying. Infant smiling in the SF was positively and significantly associated with infant smiling in the FF while infant smiling in the RE was not. Correlations of each variable between the SF and the RE were also significant at the  $p < .05$  level with the exception of infant smiling: for gaze  $r = .51$ , for crying  $r = .81$ , and for smiling  $r = .26$ . Based on these SF-RE correlations, composite SF&RE scores for the infant communication variables were created. Following examination of these correlations, the composite influence of infant communication in the

SF and RE episodes on attachment was examined based on the theoretical and conceptual reasons outlined earlier. Similarly, only parent tickling in the RE episode was examined with respect to 15-month infant attachment security.

With respect to correlations between infant and parent emotional communication a strong negative association between parental modulation in the RE and infant crying in all three FFSF episodes (FF;  $r = -.58, p < .01$ ; SF;  $r = -.70, p < .01$ ; RE =  $-.83, p < .01$ ) suggested that the coding of parental modulation was potentially confounded with infant crying. Thus, parental modulation was not analyzed further.

#### *Secure-Insecure and Disorganized/Not-Disorganized Differences on 6-Month Infant and Parent Emotional Communication Variables*

In order to avoid low cell sizes in particular attachment groupings (e.g., 3 avoidant infants) and to maximize statistical power, attachment classification differences on 6-month parent and infant communication variables at the secure/insecure and disorganized/not-disorganized levels were examined. Collapsing infant insecure attachment classifications to increase statistical power is often done in attachment research (Malatesta et al., 1989; Fearon et al., in press). These specific dichotomous attachment outcomes were the most central to the objectives of this project.

#### *Secure-Insecure MANOVA*

A one-way MANOVA was performed on the data with the following infant and parent communication variables mentioned above which served as dependent variables: mean SF & RE infant smiling, crying, and gazing at the parent, and parental tickling in the RE. Attachment classification was the fixed factor (secure-insecure). The MANOVA was significant,  $F(4, 27) = 3.82, p = .01$ , partial  $\eta^2 = .36$ . Follow-up univariate ANOVAs were then carried out with both infant and parent variables. Of the

four possible ANOVAs, both the SF & RE mean proportion of time spent gazing at the parent  $F(1, 30) = 4.38, p < .05$ , partial  $\eta^2 = .13$  and parent tickling in the RE  $F(1, 30) = 5.65, p < .02$ , partial  $\eta^2 = .16$  were significant (see Table 9 for means, standard deviations, and observed power for analyses). Insecure infants showed greater mean durations of gazing at the parent during the SF & RE and were tickled more by their parents during the RE than secure infants.

We next evaluated potential risk group differences in attachment classification differences on 6-month infant SF & RE gazing at the parent and parent tickling in the RE. We did not find evidence of risk-group differences in attachment classification for the infant gaze at parent's face variable. However, separate risk-group ANOVAs for the parent tickling variable showed that parent tickling was associated with insecure attachment for the COMP-sibs,  $F(1, 11) = 5.25, p < .04$ , partial  $\eta^2 = .32$  and not ASD-sibs,  $F(1, 15) = .25, p = .63$ . This interaction is graphically presented in Figure 1.

#### *Disorganized/Not Disorganized MANOVA*

To evaluate potential differences in 6-month variables between infants classified as disorganized versus those classified as not disorganized, a one-way MANOVA was performed on the data with the following infant and parent communication variables mentioned above which served as dependent variables: mean SF & RE infant smiling, crying, and gazing at the parent, and parent tickling in the RE. The MANOVA was not significant  $F(4, 27) = .72, p = .59$ . No further analyses were conducted.

## Chapter 4: Discussion

This is the first project to examine the development of attachment security in ASD-sibs. We found no evidence for risk-group differences in either rates of attachment security or the expression of infant or parent emotional communication variables at 6-months of age. Considered overall, secure and insecure infants differed on a subset of 6-month infant and parent emotional communication variables. Specifically, future insecure infants gazed more at their mother's face during the SF & RE episodes and were tickled more by their mothers in the RE episode.

The findings of this project are discussed in three sections. First, attachment classification rates between the groups are examined. Next, the lack of risk-group differences on infant and parent emotional communication variables and their implications are discussed. Differences in 6-month infant and parent emotional communication variables between future secure and insecure infants are then discussed. Finally, future directions for attachment research in samples of children at risk for ASDs and other neurodevelopmental disorders are offered.

### *Rates of Attachment Security & Disorganization*

There were no differences between ASD-sibs and COMP-sibs on any of the attachment groupings. Overall, the attachment distribution patterns for infant attachment in both the COMP-sib and ASD-sib groups are comparable to those reported by others with middle-class, non-risk samples (e.g., Frodi & Thompson, 1985; Owen, Easterbrooks, Chase-Lansdale, & Goldberg, 1984). Importantly, these distributions also converge with findings from a meta-analysis by van IJzendoorn and colleagues (van IJzendoorn et al., 1992), which indicated that distributions of traditional organized

attachment classifications (i.e., A, B, & C) in infants with serious biological problems (prematurity, Down syndrome, autism, deafness, cystic fibrosis, congenital heart disease) were similar to those seen in non-clinical samples.

This study utilized the Pipp-Siegel et al. (1999) guidelines, which consider specific disorganized behaviors as potentially attributable to neurological impairment, when coding attachment disorganization. We did not find any differences in classification rates for the disorganized category between risk groups. Additionally, there was no significant difference between the risk groups in the proportion of D indices using the Pipp-Siegel et al., (1999), guidelines to coding attachment disorganization. However, it should be noted that of two infants who have reached appropriate diagnostic age in the current sample and who have been diagnosed with an ASD, one (diagnosed with autism) was classified as disorganized at 15 months. This child's behavioral indices were almost all considered attributable to neurological impairments according to the Pipp-Siegel et al. (1999) guidelines. This study, suggests that children at-risk for ASDs are not any more likely to be disorganized than COMP-sibs. However, prior or concurrent disorganized attachment may be more likely for children in which clinical symptoms later emerge.

These findings should be placed in the context of those of Van IJzendoorn et al. (2007) and Naber et al. (2007), who found greater rates of insecurity and disorganization in children with ASDs. In both studies, attachment security was ascertained in clinically diagnosed children at 2 years and 42 months respectively. This study, in contrast, is the first to measure attachment security in children at-risk for ASDs at 15 months. The results from this study support the notion that at 15 months of age, infants at-risk for ASDs are not more or less likely to be securely attached than typically developing



children. It may be that those children who will be later clinically diagnosed with an ASD will be less likely to be securely attached at 15 months than children who will not be diagnosed with an ASD. However, until the current sample reaches appropriate diagnostic age, this remains unknown.

*Risk Group differences in Infant and Parent Emotional Communication Variables*  
*Infants*

We found no significant differences between risk groups on any of the infant emotional communication variables. We also did not find any risk-group by gender interactions on these variables. These null effects are consistent with other studies comparing ASD-sibs and COMP-sibs in the FFSF at four (Yirmiya et al., 2006) and six (Cassel et al., 2007; Ibanez et al., 2008) months of age, which have generally found either no differences or subtle differences between the sib groups, depending on the emotional communication variable examined. For example, Yirmiya et al. (2006) found that four month old ASD-sibs showed more neutral affect than TD-sibs in response to a maternal SF. In addition, her group found a trend for fewer ASD-sibs than TD-sibs to engage in negative affect over the course of the SF, (Yirmiya et al., 2006). Similarly, Cassel et al. (2007) found a tendency for 6-month old ASD-sibs to smile for a lower proportion of the overall FFSF than COMP-sibs, although the significance of this finding differed by the analytical approach used. We did not find even a tendency towards differences with respect to infant smiling or crying during the FFSF. Both Merin et al. (2007) and Ibanez et al. (2008) found that 6-month-old ASD-sibs did not differ from controls in the proportion of time they spent gazing at their parents' faces versus away during the FFSF. Thus, our null findings are consistent with the lack of mean proportional differences in ASD-sibs and COMP-sibs gazing at or away from their mother during the FFSF. It

should be noted that the samples in both the Cassel et al. (2007) investigation (74%) as well as the Ibanez et al. (2008) investigation (71%) overlapped with the current sample. Thus, these results increase confidence in the lack of significant risk-group findings for infant smiling and overall gazing at the parent's face found in these studies.

### *Parents*

This study did not find differences between risk groups in parental modulation of infants during the FF & RE episodes of the FFSF procedure. These null effects are consistent with prior literature comparing mothers of children with ASDs with mothers of children with typical development. In these studies (van IJzendoorn et al., 2007; Siller & Sigman, 2002), mothers of children with ASDs showed levels of both sensitivity and a broadly defined synchrony measure with their children comparable to those shown by mothers of typical developing children. Kasari et al. (1988) also found a lack of difference between parenting of children with autism and children with either mental retardation or typical development. What these findings have in common is that, despite their genetic liability (as first-degree relatives of children with ASDs) to impairments in social interactive abilities and communication (Cantwell & Baker, 1984; Bolton et al., 1998), these parents do not seem to show these deficits at least with respect to the constructs measured in these studies which are more molar ratings of sensitivity and broadly defined synchrony (i.e., appropriately reciprocal interaction with their child). Perhaps more sensitive, time-based measurements of ongoing responsiveness to the child's signals may reveal latent strains of the social impairments that characterize the first-degree relatives of children with autism. On the other hand, it may well be that, whatever the risk for social impairments these parents have, they do not manifest them in

interactions with their children, at least not in a seven-minute videotaped laboratory procedure in which task demands for parental sensitivity are likely apparent.

*Infant and Parent Emotional Communication Variables and Later Attachment Security*

The present investigation examined the extent to which attachment classifications at 15-months differed with respect to parent and infant emotional communication variables measured during the FFSF at 6 months. Both infant gaze at the mother during the SF & RE and, independently, parent tickling during the RE differed by 15-month attachment groupings. Differences in early infant smiling and crying as a function of 15-month attachment security were not found.

At six-months of age, future insecure infants gazed longer at the mother's face during the SF & RE episodes than secure infants. The few studies to date that have examined FFSF behaviors of infants as predictive of later attachment security (Cohn et al., 1991; Braungart-Rieker et al., 2001; Kiser et al., 1986) have either not directly measured infant gaze patterns or have not found relationships between infant gazing at the parent and later attachment insecurity. Braungart-Rieker et al. (2001) found that infant gazing at mother's face during a 4-month still-face did not differentiate 12-month attachment classifications. One possible explanation for the discrepancy between these null findings and those reported here is that this study utilized a 6-month FFSF assessment. It may be that at 4 months infant attachment behaviors, such as gazing, have not yet achieved meaningful organization in the service of the attachment behavioral system.

It was hypothesized that increased gaze at the mother's face during the SF and RE episodes, would be associated with later attachment insecurity (Malatesta et al., 1989).

This hypothesis was proposed based on the idea that increased--rather than decreased--gazing at the mother's face in both the SF episode when she is emotionally unavailable, and the RE episode when social communication is re-established, reflects an underlying infant preoccupation with respect to the mother's capacity to be emotionally available and sensitively responsive to the infant's bids for attention. The idea of excessively monitoring the whereabouts of the mother during the SSP is particularly consistent with insecure-resistant (C) infants, who demonstrate preoccupation with the mother's whereabouts (often in pre-separation episodes) and a failure to use her as secure base from which to explore (see Cassidy and Berlin, 1994). Although the findings reported here await replication, the functionally similar infant behavior observed in this study during the FFSF and SSP of insecure infants may suggest a developmental canalization of organized infant responses to early interactions with caregivers.

No research has directly examined parent tickling during the FFSF procedure as it relates to later attachment outcome. Parent tickling in the RE episode significantly distinguished secure and insecure COMP-sibs, but not secure and insecure ASD-sibs. Tickling has a mock aggressive quality ('I'm gonna get you') which may contextualize the experience for the infant as one of intrusion and interference on the part of the parent, particularly during the RE episode when infants are often distressed. The link between intrusiveness or over-stimulation and later attachment insecurity is based on the notion that the infant learns that negative affective states are not effectively modulated or 'soothed' by the parent. This then may lead to organized conditional strategies (Main, 1990) of self-reliance to modulate distress (i.e., the avoidant infant) or a maladaptive pattern of maximizing attachment behaviors towards the parent which interferes with

exploratory competence (i.e., the resistant infant). Lastly, the tickle finding could be conceptualized as the inverse of van IJzendoorn et al.'s (2007) finding that parental sensitivity did not predict security of attachment in children with ASDs. That is, in this study, parental behaviors which appeared as interfering—specifically tickling during the RE episode—did not predict insecure (avoidant) attachment in ASD-sibs. It may be that ASD-sibs have a different sensory threshold for parental tactile behaviors such as tickling, at least at six months of age, which may reflect a more general subclinical phenomenon associated with ASDs.

This study did not find an association between infant smiling in the SF and RE and future secure attachment. Some studies have found a relationship between infant positive affect in the FFSF (e.g., Cohn et al., 1991; Fuertes et al., 2006) and future attachment security and others have not (Bingen, 2001; see also Mesman et al., 2009 for a review). The lack of consistency in these findings may be explained by the use of different expert coding instruments to index infant positive affect in the literature. The use of non-expert 'intuitive' ratings of infant positive affect (Baker et al., submitted), which circumvent reliance on investigator-specific coding systems, may be well suited to more comprehensively examine the nature of the relationship between infant positive affect during the FFSF and later attachment security.

#### *Limitations & Future Directions*

Due to the small sample size of this project, and the further reductions in cell sizes when the risk and attachment groups were assessed separately, there was inadequate power to find significant between-group differences on many of the 6-month variables examined. For nonsignificant results, observed power ranged from .14 - .18; for

significant results, observed power ranged from .53-.63 (see Table 8). In spite of this, significant attachment group differences in 6-month infant gazing at the mother's face during the SF & RE and parent tickling of the infant in the RE of the FFSF procedure were found. Future research should seek to further explore the questions asked in this project with larger sample sizes to determine the interactive processes that contribute to the development of attachment security in ASD-sibs and whether they are similar to those observed in COMP-sibs. Similarly, it will be revealing for researchers to retrospectively examine group differences on these same variables between children who develop a clinically diagnosed ASD and those who do not. Such an approach may yield valuable insights into early identification of impairments associated with ASDs.

The FFSF procedure is a tool for capturing meaningful individual differences in parent and infant emotional communication (Mesman et al., 2009). Our use of the FFSF procedure with which to measure both infant and parent emotional communication variables and their impact on later attachment security is not without precedent (Braungart-Rieker et al., 2001; Hill & Braungart-Rieker, 2002; Cohn et al, 1991; Koulomzin et al., 2002; Kogan & Carter, 1996). However, studies which have attempted to predict later attachment from FFSF interactions are relatively few compared to the number of studies on the prediction of attachment from variables measured in other contexts during the infant's first year (i.e., infant-parent interactions observed in the home; Ainsworth et al., 1978; Seifer et al., 1996). One potential is that, because the FFSF is a highly structured procedure (without toys) in which the mother's attention is focused entirely on the infant, only the most conspicuous differences in parental behavior tend to be observed, yielding little variation in parental behavior. In contrast, when

parents' are observed in an unstructured setting where they must attend to both the child and other tasks, the more subtle and important aspects of parent behaviors directed toward the infant may be more observable (Pederson et al., 1990). The challenge remains on how best to measure these individual differences and whether the emotional communication behaviors observed during the FFSF are associated with later attachment security. It may be that researchers need to operationalize constructs such as sensitivity at the molecular level, examining moment-to-moment changes in the mother's responsiveness to the infant (Peck, 2003) in conjunction with applying molar ratings of sensitivity overall. Such moment-to-moment parameters of the dyadic interchange may show more predictive relation to attachment security. Nevertheless, the utility of subjective scales for predicting to differing aspects of the mother-infant relationship has proved fruitful in developmental research and should be retained in future studies, perhaps as a way to enhance understanding gleaned from microanalytic measurements (Kiser et al., 1986).

In sum, this study found no evidence that ASD-sibs and their parents show different patterns of emotional communication during the FFSF procedure than COMP-sibs and their parents, nor that ASD-sibs show divergent rates of attachment classifications at 15 months of age than COMP-sibs. However, this study did find evidence of attachment group differences for 6-month infant gazing at the parent's face during the SF & RE and for mother tickling of the infant during the RE episode of the FFSF. Research on the development of attachment security in ASD-sibs is a valuable enterprise and will inform our understanding of the manner in which heightened risk for an ASD influences the development of attachment security.

## Chapter 5: References

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Chapter 6: Tables and Figures

Table 1

Infant Ethnicity, Gender, and Risk Status

		Infant Risk Status					
		<i>COMP-sibs</i>			<i>ASD-sibs</i>		
Infant Ethnicity		Male	Female	Total	Male	Female	Total
White		2	5	7	6	2	8
Hispanic		3	1	4	5	1	6
Black/Other		1	2	3	3	1	4
Totals		6	8	14	14	4	18

Table 2

Frequencies of A, B1-B2, B3-B4, and C Infant Attachment Classifications by Risk Group

15-Month Attachment Group	ASD-sibs (N=18)	COMP-sibs (N=14)	Totals (N=32)
A	1 (5.6%)	2 (14.3%)	3 (9.4%)
B1-B2	6 (33.3%)	3 (21.4%)	9 (28.1%)
B3-B4	7 (38.9%)	6 (42.9%)	13 (40.6%)
C	4 (22.2%)	2 (21.4%)	6 (21.9%)

Table 3

Frequencies of Major A, B, & C Infant Attachment Classifications by Risk Group

15-Month Attachment Group	ASD-sibs (N=18)	COMP-sibs (N=14)	Totals (N=32)
A	1 (5.6%)	2 (14.3%)	3 (9.4%)
B	13 (72.2%)	9 (64.3%)	22 (68.8%)
C	4 (22.2%)	3 (21.4%)	7 (21.9%)

*Note.* Infants in Table 2 who are classified as B1-B2 or B3-B4 are collapsed into B (secure) infants above.

Table 4

Frequencies of A, B, C, &amp; D Infant Attachment Classifications by Risk Group

15-Month Attachment Group	ASD-sibs (N=18)	COMP-sibs (N=14)	Totals (N=32)
A	0 (0%)	2 (14.3%)	2 (6.3%)
B	11 (61.1%)	5 (35.7%)	16 (50.0%)
C	3 (16.7%)	1 (7.1%)	4 (12.5%)
D	4 (22.2%)	6 (42.9%)	10 (31.3%)

*Note.* Of the 6 disorganized COMP-sibs, 4 were secure and 2 were resistant in the ABC (non-disorganized) classification. Thus, 4 COMP-sibs were D/secure and 2 were D/resistant. Of the 4 Disorganized ASD-sibs, 2 were secure and 2 were resistant in the ABC (non-disorganized) classification. Thus 2 ASD-sibs were D/secure and 2 were D/resistant.

Table 5

Frequencies of Secure & Insecure Infant Attachment Classifications by Risk Group

15-Month Attachment Group	ASD-sibs ( <i>N</i> =18)	COMP-sibs ( <i>N</i> =14)	Totals ( <i>N</i> =32)
Secure	13 (72.2%)	9 (64.3%)	22 (68.8%)
Insecure	5 (27.8%)	5 (35.7%)	10 (31.3%)

*Note.* A (avoidant) and C (resistant) groups are combined to form the insecure group above. B1-B4 are infants considered secure.

Table 6

Frequencies of Disorganized & Not Disorganized Infant Attachment Classifications by Risk Group

15-Month Attachment Group	ASD-sibs ( <i>N</i> =18)	COMP-sibs ( <i>N</i> =14)	Totals ( <i>N</i> =32)
Disorganized	4 (22.2%)	6 (42.9%)	10 (31.3%)
Not Disorganized	14 (77.8%)	8 (57.1%)	22 (68.8%)

Table 7

Correlations among Infant and Parent Emotional Communication Variables in the FFSF Procedure

	FF Mod	RE Mod	Smile FF	Smile SF	Smile RE	Cry FF	Cry SF	Cry RE	Gaze FF	Gaze SF	Gaze RE	Tickle FF	Tickle SF	Tickle RE
FF Mod		.35	.71	.30	.19	-.14	-.13	-.12	.68	.42	.38	.19	-.03	.20
RE Mod			.18	.20	.71	-.58	-.70	-.83	.22	-.08	.45	-.14	-.35	.11
Smile FF				.41	.42	-.10	.01	.01	.35	.12	.02	.28	-.04	.18
Smile SF					.26	-.10	-.18	-.09	.44	.42	.15	.56	-.04	.39
Smile RE						-.38	-.47	-.56	.06	-.23	.10	-.07	-.22	.02
Cry FF							.74	.69	-.18	.08	-.14	.11	.06	-.03
Cry SF								.81	-.20	.21	-.17	-.05	.27	-.12
Cry RE									-.13	.25	-.15	.23	.45	-.01
Gaze FF										.58	.57	.28	-.01	.24
Gaze SF											.51	.31	.02	.37
Gaze RE												-.04	-.05	.32
Tickle FF													-.07	.37
Tickle SF														-.11
Tickle RE														

*Note.* Correlations with absolute values  $>.351$  are significant at  $p < .05$  or less

Table 8

Means, Standard Deviations, and Follow-Up Tests of Significance for Infant and Parent Emotional Communication Variables for Infant-Mother Attachment Groups

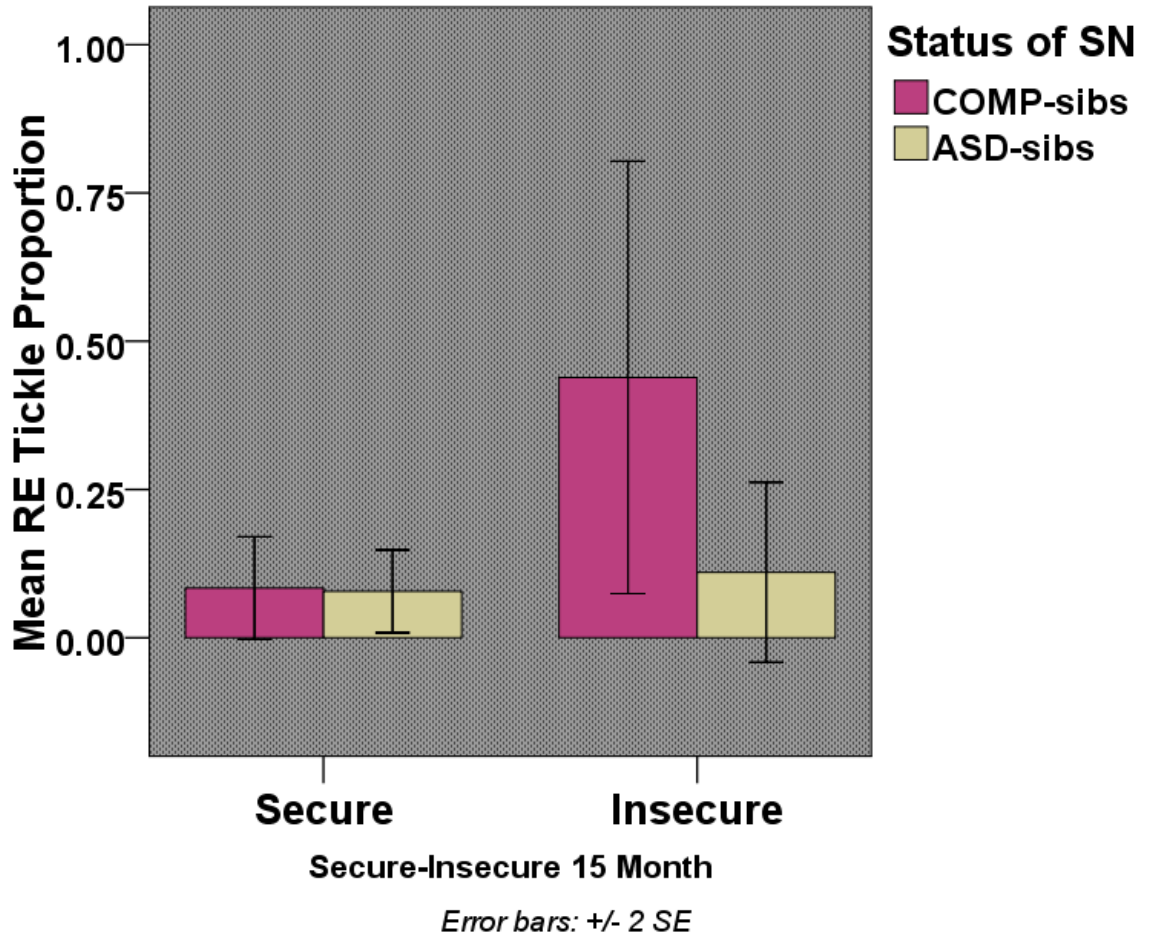
6-Month Variable	ANOVA F(1, 30)	Partial $\eta^2$	Obs. Power	Secure	Insecure
Infant Gaze SF&RE	4.38*	.13	.53	.32 (.17)	.45 (.15)
Parent Tickling RE	5.65*	.16	.63	.08 (.12)	.27 (.34)
Infant Smiling SF&RE	1.12	.04	.18	.14 (.11)	.10 (.07)
Infant Crying SF&RE	.80	.03	.14	.20 (.30)	.10 (.21)

Note. \*  $p < .05$



Figure 1

Mean Proportion of Time Spent Tickling the Infant in the RE Episode by Secure and Insecure Attachment Categories for ASD and COMP-sibs



Chapter 7: Appendix: Table of Measures and Underlying Constructs

Measure	Procedure	Construct
Infant Smiles & Cry-Faces	FFSF	Infant Positive and Negative Emotion
Infant Gaze	FFSF	Infant Visual Attention
Ainsworth Sensitivity vs. Insensitivity Scale	FFSF	Parental Sensitivity
Kiser Parental Modulation Scale	FFSF	Parental Modulation
Attachment Security	SSP	Attachment Security and Disorganization