ABSTRACT

Title of Thesis: THE BROAD AUTISM PHENOTYPE WITHIN MOTHER-

CHILD INTERACTIONS

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This study sought to identify features of the Broad Autism Phenotype (BAP) expressed by mothers during interactions with their infants to further understand how these features relate to early indicators of autism. Twelve mothers were selected who had an older child with autism, and the control group included twelve mothers who did not. Results demonstrated that the groups of mothers did not have significantly different responses on the BAP assessment, and they did not differ in any features of interactions, except that the experimental group used less inhibitory language. Children in the experimental group had lower language scores than the controls. When subjects were divided into groups based upon both child responsiveness and maternal BAP traits, subsequent patterns indicated four mother-child profiles, suggesting that a combination of maternal BAP characteristics and child behavior might influence interaction outcomes. Further research regarding BAP features as an early indicator for autism is discussed.

THE BROAD AUTISM PHENOTYPE WITHIN MOTHER-CHILD INTERACTIONS

By

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INTRODUCTION

Autism and Genetics

Autism is currently defined by the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-4)* as a pervasive developmental disorder. It is a spectrum encompassing a variety of impairments in the areas of social interactions, communication, and restricted or repetitive behaviors (American Psychiatric Association, 1994). There is a genetic component involved in autism, as shown through familial studies. In research involving monozygotic (MZ) twins, concordance rates for a diagnosis of autism are close to 36% (Bailey, Palferman, Heavey & Le Couteur, 1998; Folstein, & Rutter, 1977). The concordance rate between dizygotic (DZ) twins is much lower, around 10% (Bailey et al., 1998; Greenberg, Hodge, Sowinski, & Nicoll, 2001; Folstein, & Rutter, 1977). Sibling rates fall to between 2.8% and 7% (Smalley, Asarnow, & Spence, 1988), while parents of children with autism are observed to have higher rates of social deficits, repetitive behaviors, and communication impairment (Bolton, Pickles, Murphy, & Rutter, 1998; Piven, Palmer, Landa, Santangelo, Jacobi, & Childress, 1997).

Because of the high rates of affected siblings and family members, there has been interest in pinpointing traits amongst family members of individuals with autism, with the ultimate goal of establishing a genetic basis for the deficits in Autism Spectrum Disorders (ASD). As Kanner described autism in 1943, he also noted that the parents of these children were "highly intelligent" and displayed a "great deal of obsessiveness"; it seemed as if they were "preoccupied with abstractions of a

scientific, literary, or artistic nature, [with a] limited, genuine interest in people,"
(Kanner, 1943). He questioned if and how these personality types impacted the
children involved in the study. Ever since this first observation, there has been a
general interest in undiagnosed adults, leading Folstein and Rutter (1977) to describe
a Broad Autism Phenotype (BAP). The BAP was further defined as a set of social
deficits, communication impairments, and stereotyped behaviors that present in high
rates of parents and siblings of children with autism (Piven et al., 1997; Bolton et al.,
1994). Traits of the BAP are estimated to be present in up to 92% of MZ twins, and
10% of DZ twins (Bailey et al., 1998; Piven, Wzorek, Landa, Lainhart, Bolton, Chase,
& Folstein, 1994); there also are reports of higher rates in extended family relatives
such as aunts, uncles, and grandparents (Piven et al., 1994; Piven et al., 1997).

Description of the BAP

Individuals fitting the BAP profile tend to be aloof (Piven et al., 1994) and
under-communicative (Wolff, Narayan, & Moyes, 1988). They are described as less
tactful and less demonstrative (Piven et al., 1994; Piven et al., 1997). Parents of
children with ASD also appear to have increased tenseness, and can be considered
hypersensitive and highly conscientious (Piven et al., 1997). On scales of rigidity,
parents with BAP are often described as suspicious, anxious, and preoccupied with
specific details (Landa et al., 1992; Piven et al., 1997). Socially, adults are
considered withdrawn, as they have fewer close friendships or confiding relationships
(Piven et al., 1997) than those who do not have BAP traits. Individuals with the BAP
profile tend to be shy, less responsive, and more self-conscious in social situations
(Piven et al., 1994; Piven et al., 1997; Wolff et al., 1988). In addition, adults with

BAP traits are observed to be less interested in social engagement and less motivated to be in social environments (Duarte, Bordin, Yazigi, & Mooney, 2005; Landa et al., 1992). Finally, individuals fitting the BAP profile may also be more "difficult". They are described as irritable, aggressive, and have higher ratings of impulsivity (Murphy et al., 2000).

Given these observations of the mannerisms and personality characteristics of parents of children with autism, specific criteria to define the BAP were developed. The multitude of traits that seemed to present in individuals fitting the phenotype were compiled into the categories of 1) social personality, 2) rigidity, and 3) pragmatic language deficits (Hurley, Losh, Parlier, Reznick, & Piven, 2007; Piven et al., 1997). These categories are also reflective of the DSM-IV subcategories for a diagnosis of autism (American Psychological Association, 1994). When observing families of children with autism, it is more likely that a parent will have mannerisms and traits that fall under these categories, compared to parents of typical children or even to parents of children with other developmental disabilities.

Previous research has attempted to distinguish parents with an autism family history from parents of typical children, as it is unclear if some of these seemingly abnormal traits can be attributed to a BAP, rather than simply normal personality variation. Bishop, et al. (2004) compared parents of individuals with a clinical diagnosis of ASD or pervasive-developmental disorder (PDD) to parents of typical controls. The controls participating in the study were comparable in age, gender, family size, and socioeconomic status, and the experimental group shared similar autism symptoms (a screener was administered as an inclusionary criterion). The

study demonstrated that the areas of social skills and communication are more affected in parents of children with an ASD than in comparison parents. Hurley et al. (2007) compared parents of individuals recruited from an autism research project to parents of typically developing children, finding that the experimental group had higher scores of aloofness, pragmatic language difficulty, and rigidity on a phenotype measurement.

Other studies have compared adult relatives of children with autism with relatives of children from other cohorts to find differences in personality and social behavior. The cohorts were chosen based upon the idea that the BAP may not truly be a discrete diagnosis; it may reflect features of clinical personality disorders that emerge from the stressors placed on a family when a child has an ASD. Studies have used families of individuals with Down syndrome (DS) for comparison, with the idea that the groups would be matched to control for the general effect of having a child with a disability on family dynamics. Piven et al. (1997) supported the existence of a BAP by identifying traits observed in parents of children with autism compared to parents of children with DS; results showed a higher expression of rigidity, abnormal speech communication, and fewer friendships in the experimental group. Bolte, Knecht, & Poustka (2007) surveyed parents of subjects with autism, parents of children diagnosed with Obsessive-Compulsive Disorder (OCD), parents of children with early onset schizophrenia (EOS), as well as the parents of children with mental retardation (MR)/cognitive impairment. Differences among the parent groups were variable. Rates of psychopathy and personality styles related to the BAP in the adults from autism families were similar to those seen in families of children with MR,

although there were differences when they were compared to the families with OCD and EOS. Murphy et al. (2000) examined the personality traits of adult relatives of individuals with autism and DS. They demonstrated that tenseness and a "difficult" temperament are elevated in relatives of children with ASD. Traits of social withdrawal are also more frequent in this cohort.

Stress of Parenting a Child with Autism

As a variety of methods are used to evaluate the BAP, it is critical to take into account all of the variables that have the potential to affect assessment. As parents care for a child with an ASD, they experience different demands than does the family of a typically developing child (Koegel et al., 1992). Parents of children with ASD are constantly impacted by the burdens of prolonged care and with feelings of doubt, inadequacy, and helplessness. They also experience disappointments that parents of children with other developmental delays feel, as they watch their children's peers achieve the very same milestones that their children are having difficulty with. It would be reasonable to assume that having a child with autism causes stress; however, research has surveyed stress and mood disturbances in parents of individuals with autism in comparison to those of children with other disabilities, and it is clear that the difference between parents of children with autism and those of children with other disabilities exceeds that attributable to stress. This leads to the belief that there are personality and characteristic-related differences that affect the interactions between parents and children as well, (Koegel et al., 1992; Wolf, Noh, Fisman, & Speechley, 1989), such as depression, moodiness, feelings of social inadequacy, and self-isolation.

Depression and the BAP

The body of research that has examined characteristics of mothers with depression and their interactions with their children reveals some similarities and overlap with the concerns in mothers of children with ASD. Along with the stress of parenting a child with a disability, it is also reasonable for parents to experience depression. In fact, parents of children with ASD report higher rates of depression and a lower quality of life than the parents of children with DS and other developmental disabilities (Bolton et al., 1998; Ingersoll, Meyer, & Becker 2011). Mothers with BAP characteristics show a higher risk of mental health problems, possibly because of elevated profiles of hypersensitivity, cognitive deficits, and social difficulty (Ingersoll et al., 2011). They also demonstrate maladaptive coping strategies related to social withdrawal and negative self-esteem (Ingersoll et al., 2011). Bolte et al. (2007) did not observe significant differences in depression evaluation results from parents of autism families in comparison to families with a child with MR; however, differences were observed in comparison to typical families and families with OCD and EOS history (Bolte et al., 2007). Mothers of children with autism may be predisposed to social interpersonal problems due to depression (Duarte et al., 2005). They show a low level of social interest and experience more daily stress (Duarte et al., 2005). Whether depression is a trait of the BAP or depression is a secondary effect of the BAP, it is elevated in mothers of children with ASD.

Methods of Assessing the BAP

Many methods of assessment have been trialed to develop the most comprehensive measure of the BAP. A popular tool is the *Social Responsiveness*

Scale (SRS) (Constantino, Przybeck, Friesen, & Todd, 2000), a questionnaire yielding a score for social reciprocity. The SRS is typically completed by an adult to assess a child for symptoms; however, it also gathers information about restricted and repetitive behaviors that may be present in adults fitting the BAP profile (Dawson et al., 2006; Hurley et al., 2007). Another measure, the *Pragmatic Rating Scale (PRS)*, assesses pragmatic skills and conversational behaviors such as topic maintenance, provision of sufficient background details, and prosody range (Losh, Childress, Lam & Piven, 2007), but it only measures linguistic features of social interaction. The *Autism Family History Interview (AFHI)* was created to measure BAP traits in autism families, but provides general characteristics about the family constellation rather than specific traits of an individual family member (Piven et al., 1997). The *Autism-Spectrum Quotient (AQ)* (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) evaluates social skills, attention, communication skills, attention to detail and imagination, and can possibly be used to distinguish these traits in parents (Bishop et al., 2004; Hurley et al., 2007). The *Modified Personality Assessment Schedule (MPASR)* consists of an extensive interview to assess the presence of various traits related to the BAP, including a Friendship Interview, and a psychiatric interview (Losh et al., 2007; Piven et al., 1997). Personality traits are probed during the participants' descriptions of life experiences. The *MPASR* does seem to cover various aspects of the BAP including social aspects and personality traits, but it does not fully assess pragmatic or communication impairments in family members.

More recent measures have been able to combine some of the older measures into more comprehensive assessments. The *Broader Phenotype Autism Symptom*

Scale (BPASS) was developed to assess autism symptom-related personality traits across various ages and level of ability (Dawson et al., 2006). It measures social behaviors in terms of motivation and expressiveness, communicative behavior, and flexibility/range of interests. The *BPASS* is viewed as a relatively efficient method because it measures traits on a continuum, rather than scoring based on presence or absence of traits (Dawson et al., 2006). Similarly, Hurley and colleagues (2007) developed the *Broader Autism Phenotype Questionnaire (BAPQ)*, based on the *MPASR* and the *PRS*. It uses the subscales of an autism diagnosis as the targets of evaluation (social impairment, repetitive behaviors, and social language). The questionnaire seems to comprehensively measure the various areas of autism symptoms that are critical to the BAP and its subscales seem to have high content validity (Hurley, 2007). It is, therefore, used to measure the BAP of parents in the present study.

Naturalistic Observation of the BAP

Assessment of the BAP should encompass a variety of tasks. Appropriate measurements would examine the symptoms typically assessed in a diagnosis of autism through a questionnaire or an interview, but social interactions outside of an interview should also be taken into account. Most measures focus on social interactions with other typical adults, although it should be important to appraise interactions with children, affected or unaffected by autism. Communication with children requires a special form of speaker theory of mind in order to meet language-learners' needs. Additionally, any marked differences in parent-child interaction may exacerbate any co-occurring linguistic disorder that may accompany ASD in the child.

In this sense, analysis of mother-child interactions in families having children with ASD, or having children at risk for an ASD, can accomplish two goals: to further define what makes the phenotype distinct (Landa et al., 1992), and to identify any differences that may be informative to the identification and management of children with ASD.

To elaborate on this second goal of identifying differences between these mother-child interactions and those of typical families, one can observe families affected by autism in a naturalistic context. A child with autism, as previously established, has deficits in language, communication, and social behavior. Most mothers naturally adapt their language to children to facilitate comprehension and learning, so a mother of a child with autism might simplify her language to meet her child's needs. The mother will make these adjustments, using cues and feedback from her child; however, the situation may be different when a mother with BAP characteristics is involved. If she also has communication deficits in addition to abnormal social behaviors, it may be more difficult for her to adapt her language and interaction style.

Goals of the Present Study

Previous research on pragmatic features of mother-child interaction in ASD has used interview methods such as the *PRS* (Landa, Folstein & Isaacs, 1991) or analysis of narrative discourse samples (Landa et al., 1992), but few studies to date have used a play setting. Landa et al. (1991) were able to identify impaired language (shorter episodic recounts and poorer story qualities) in their group of parents of children with autism using narratives. They observed that autism parents produced

shorter, less structured narratives of poorer quality. A narrative elicitation procedure can be naturalistic, but observing parental behavior in a less restricted setting, without any defined task, is likely to yield more information about a mother's natural behaviors. An observation during a play setting will also allow researchers to see the reciprocal influence of a child's behavior on the mother's.

Parent-child interaction reflects many reciprocal features; it is important to depict the relationships involved in studying these communication exchanges. Figure 1 illustrates how a mother's behavior during dyadic play with her child is both affected by her own inherent personality traits as well as the child's behavior during a play session. For example, a mother may be more likely to restrict her child from banging on a toy because the child is likely to tantrum and/or because she has rigid tendencies. The child will act in a particular manner because of his or her personality traits and possible symptoms of autism. A child's behavior is also influenced by the exchanges and responses from his or her mother. Some aspects of the mother's personality traits may be genetically influenced, as previously discussed, which may be passed on to her child. What is observed within a parent-child interaction will be a compilation of all of these factors.

Figure 1. Mother-Child Interactions

Child's Behavior ⟵ C ⟶ **Mother's Behavior**

B ↑ D ↑

Child's Inherent Traits ⟵ A Mother's Inherent Traits
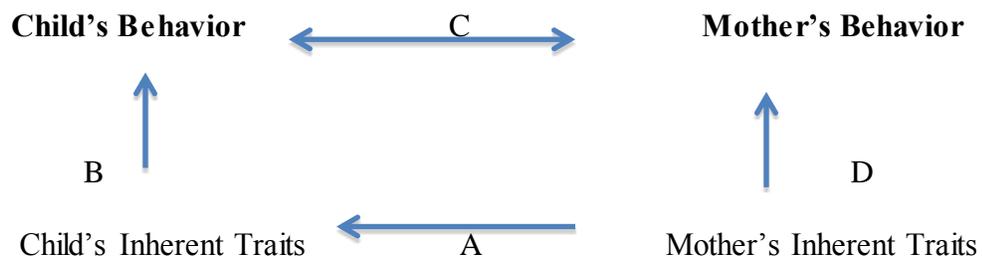
Figure 1 is especially important to the study of mother-child interactions with a family history of autism. According to previous research on the BAP, genetic links have been identified as risk factors for autism. A mother who possesses characteristics of the BAP has a higher chance of having a child who also has BAP traits, or autism (A). If a child has ASD, he or she will display the behaviors typically identified in an autism spectrum diagnosis, such as communication deficits, restricted or repetitive behaviors, and abnormal social behaviors (B). An affected child will present these behaviors in an interaction whether or not a mother also has BAP traits. An affected child may have a low rate of communication; he or she may not initiate social bids to the mother. Furthermore, because the child is repetitively "stuck" on particular items, he or she will not have high rates of social reciprocity. A typical mother is likely to react to her child by using speech that is attractive to children and language that is easy to comprehend (C). An affected mother, due to of inherent traits, may not have the same response to a child with autism symptoms, as this mother may find it difficult to tailor her language to her child and it is possible that she will not be able to vary her speaking style in the way that a typical mother is able to (D). This mother has a different style of communication, language, and social behavior, which will cause her to make behavior adaptations in her own way.

Mother-child interactions are complex and involve the aspects of both mother and child inherent traits and behaviors. Using play sessions, this current study focused on the flexibility with which mothers who have children with autism are able to adapt the linguistic and social input towards their infants. Mothers can serve as windows into examining the communication and social development of children with

symptoms of autism. The goal of focusing on mothers' styles of behavior flexibility is to observe how mothers with traits of the BAP influence infants' sociolinguistic environment, and how this environment could impact a child who also has a genetic risk for autism.

At the present moment, there are many theories on the "cause" of ASD; however, research must also investigate the significance of early indicators. Identifying differences in interactions between mothers and children in families with BAP traits is essential to research on early indicators of autism characteristics. Gaining more information about what traits and features of interactions to look for during a diagnostic assessment is vital and an area of current need. The focus should not only be on the child's performance during an evaluation, but also the entire environment for development, including mother-child interactions. If the scientific and medical community can better identify characteristics of family interactions within affected families (those with a genetic predisposition to an autism diagnosis), it would be possible to further distinguish early indicators of autism. Earlier diagnoses translate to infants and children receiving therapeutic intervention sooner.

Variables of Interest

Most of the variables selected for analysis in the current study reflect findings from analysis of the speech of mothers with depression; as noted, there appear to be similarities in interactional style in women with depression and women who have children with ASD. Major variables of interest include quantity of child-addressed speech (e.g., total number of utterances and words), along with the mothers' Mean Length of Utterance (MLU), standard deviation of pitch, vocabulary diversity (VocD),

vocative use, presence of inhibitory words, use of terms of endearment, and rates of conversational contingency. These variables allow us to explore aspects of the three subcategories of the BAP. Language and communication behavior can be described through mothers' MLU, standard deviation of pitch, and contingency. Social behavior can be reflected in use of vocatives and terms of endearment. Finally, lexical diversity and restriction may be illustrated through vocabulary diversity and the use of inhibitory words; both measures may correlate with characteristics of the rigidity subcategory.

It is also expected that, in addition to the mothers participating in this study, the children participating will display a varying range of behaviors. Based on research on genetics, it is reasonable to assume that about 10-20% (or more) of child participants in the experimental group will have ASD. It is important to remember that all of the children in this group are at a higher risk because of their sibling with a diagnosis; however, the experimental group is likely to consist of some children with signs of autism and some children who are typically developing. Hypotheses concerning the children's behavior will be based upon the idea that although a mother's display of BAP traits may be independent of her child's, in a play session observation, the child's behavior must be taken into consideration. A child with autism or BAP characteristics will have an effect on a mother's behavior. Further justification of each variable chosen for observation follows.

MLU: MLU is a morphologic measure that calculates the average number of morphemes produced per utterance. It is considered a valid measure in assessing language complexity, as well as the diagnosis of language disorders

in conversational speech (Shipley & McAfee, 2008). BAP research has identified conversational style and expressiveness as areas of deficit in affected mothers. Mothers may be too detailed, over talkative, and disorganized (Piven et al., 1997); this predicts that mothers with BAP characteristics will have higher MLUs than unaffected mothers. Even when mothers produce less speech in conversation, individual MLU is positively correlated with increases in measured BAP traits (Breznitz & Sherman, 1987; Murray, Hipwell, Hooper, Stein, & Cooper, 1996). There is additional support for this hypothesis in studies of the child-directed speech of mothers with depression. Studies have shown that mothers with depression produce relatively longer utterances during interactions with their children than do non-depressed mothers (Bettes, 1988). It may seem counterintuitive that mothers would speak using longer utterances when they are depressed because it is typically thought that they would speak with fewer descriptors and less elaboration. Depressed mothers, however, do not appear to be as flexible in adjusting to the listener when they are suffering a depressive episode (Hwa-Froelich, Loveland, Cook, & Flick, 2008; Reissland, Shepherd, & Herrera, 2003). These mothers may have difficulty picking up social cues or subtle pragmatic features of an interaction because they are deeply impacted by the depression. Accordingly, when a child is developing language, he or she relies on the mother to make language simple and comprehensible (Sohr-Preston & Scaramella, 2006). Mothers who are depressed (or those with traits of the BAP) may not be using feedback from their communication partners to

make the appropriate conversational adjustments. It is hypothesized that mothers in families with a history of autism in this study will have MLU values that positively correlate with higher scores on a BAP assessment. These mothers are expected to have more difficulty adjusting their language to a child conversational partner, producing longer utterances than a group of mothers without a family history of autism.

Because, as displayed in Figure 1, a mother's behavior is also influenced by her child's, the hypothesis must also take into account the likely effect if an infant *does* show symptoms of autism. It is expected that a mother would make her language simpler if a child is showing signs of a language delay. Mothers whose children who appear to have communication deficits would be making their utterances short and direct, thus in a family with autism history, the combination of a mother's personality leading to an increased MLU and child behavior eliciting a decreased maternal MLU, it is also possible that there will be no significant effect observed because these two features will "cancel out". It is hypothesized that the mothers with high BAP scores who have children showing signs of ASD will have similar MLUs as the typical group.

Vocabulary Diversity: In previous research, mothers who are in high-stress situations increase verbalization rate, and decrease verbalizations in low-stress environments (Breznitz & Sherman, 1987). Mothers in autism families are more likely to be overly direct and show preoccupation with a more limited range of topics (Piven et al., 1997); this should lead to decreased lexical

diversity in their speech, as measured by VocD (Malvern, Richards, Chipere, & Purán, 2004). Mothers with depression also appear to lose some semantic quality in their speech patterns (Murray et al., 1996). However, Hwa-Froelich et al. (2008) observed that depressed mothers had similar type-token ratios (TTRs), another similar measure of types of words used by a speaker, as mothers who were not depressed. TTR is also a measure of vocabulary diversity, as it calculates the ratio of the total number types of words to the total number of words. Number of different words (NDW), sometimes referred to as "types", produces a value for the total number of word types in a speech/language sample. Both TTR and NDW are heavily influenced by the size of the sample; as the length of the sample increases, the NDW and TTR decreases. This is because, as a conversation goes on, many different words will be used initially, but the number of new word types available to use eventually decreases. VocD is a more appropriate measure because it mathematically plots a TTR versus token curve, using an average of 100 trials on random words chosen throughout the transcript, and then draws a line of best fit between the two lines. VocD yields a value, D, symbolizing lexical diversity (Hellman, 2011; McKee, Malvern, & Richards, 2000).

It was hypothesized that mothers of children with autism would demonstrate patterns of VocD that negatively correlated with their BAPQ scores. Because a subset of the BAP is restricted behaviors, affected mothers were not expected to have as much word variety in a conversation. The current study predicted that as these mothers' BAPQ scores increased, the D

values would decrease. If a child is showing early signs of autism, a mother would still likely use less lexical variety because she is attempting to use words repeatedly, to facilitate comprehension for her child.

Pitch: Mothers affected by the BAP are more likely than mothers of children without autism to have abnormal intonation (Piven et al., 1997). Depressed mothers tend to employ less infant-directed speech (IDS), sometimes referred to as "motherese" (Kaplan, Bachorowski, Smoski & Hudenko, 2002; Sohr-Preston & Scaramella, 2006). Because motherese often involves use of a high-pitch, exaggerated register, the hypothesis is that there will be less pitch variety for mothers with elevated BAPQ scores. These mothers are not expected to use pitch as a method to engage their infants as much as mothers without high BAPQ scores. The standard deviation of the mean pitch is an appropriate measure of this aspect of "motherese" because it will represent a speaker's pitch variation. Simply measuring the mean pitch would be heavily dependent on each mother's natural voice and fundamental frequency rather than the degree of adjustment she makes while using "motherese" features. We hypothesize that mothers with an autism family history will not vary their pitch as much as mothers in the control group, showing smaller standard deviations of mean pitch values during the play sessions with their children. When a child is at a higher risk for autism, a mother is predicted to have more pitch variation because she is trying to attract the attention of her infant to achieve joint attention. Thus, once more, in a family where both mother and

child show features of autism, these expected trends may cancel out, leading to similar pitch range as seen in typical dyads.

Vocatives: Vocatives are communicative tools used by speakers to draw attention from specified listeners and sustain social contact; they include addressees' names or terms of endearment (Jacobs & Griffin, 2010). The use of a vocative may reinforce children's communicative participation by stimulating interactions, so vocatives are often used in mothers' speech to children (Junefelt & Tulviste, 1997; Ferguson, 1982; Ochs, Solomon, & Sterponi, 2005). Mothers with depression tend to excessively direct the attention of their children (Hwa-Froelich et al., 2008). This could lead to a higher rate of vocative use. Piven and colleagues (1997) established that mothers of children with autism tended to be direct, which could lead them to call their children's names more and to want to immediately capture attention. Mothers with more traits of the BAP are proposed to use proportionately more vocative devices to control their children's activities during play. Additionally, if their younger children are at risk for ASD themselves, the children's play behaviors may lead mothers to use proportionally more vocatives to engage the child. Because of both the mother's characteristics and the child's characteristics, we expect that the experimental group will use a much higher rate of vocatives than the control group.

Inhibitory Words: Inhibitory language can be defined as the use of words that prevent or restrict the listener from an action. Children of depressed mothers are at an elevated risk for emotional and behavioral issues (Bettes,

1988); their mothers may need to use more inhibitory words to manage

deviant behavior. Parental stress is also correlated with a high frequency of

behavioral issues in children (Miceli et al., 2000), and it is clear that mothers

of children with autism often feel overwhelmed and anxious. Mothers with

high rates of BAP traits are expected to use more inhibitory language in their

interactions. This hypothesis presumes that use of inhibitory words would

relate to perceived problems in the child's behavior; however, it is also

possible that mothers with higher features of BAP would show atypical

reactions to their child's behavior, reflected in use of more inhibitory words

than a parent without BAP traits. If a child displays signs of autism, the

mothers, regardless of their own status of BAP traits, were expected to use

more inhibitory words. The mother would likely be using inhibitory language

to redirect attention or to reduce atypical play behaviors.

Terms of Endearment: Many conditions can decrease opportunities to

employ more positive features of interpersonal communication, such as terms

of endearment. For example, research has demonstrated that mothers with

depression are more likely to make critical and hostile comments. They may

also view their infants less intimately (Murray et al., 1996). Mothers with

postpartum depression are also less positive and more negative during

interactions (Sohr-Preston & Scaramella, 2006), and use fewer opportunities

to show affection towards children. Hwa-Froelich et al. (2008) noted that, as

children's activity levels increase, the number of comforting interchanges with

mothers decreases. The study hypothesized that the proportion of terms of

endearment in a mother's speech during play with her child would display a negative correlation with her BAPQ score: the higher the BAPQ score, the lower the frequency of endearments in her conversation. As with some of the other hypotheses, it was likely that children who seemed to be more at risk for an eventual diagnosis of ASD might demonstrate behaviors that result in the mother using more inhibitory words and fewer endearing vocalizations.

Contingency: Mothers who are depressed have been observed to be more constrained or reserved during conversation and communicative exchanges. They show fewer features of conversational contingency. Conversational contingency is defined as language that reflects feedback to the child's verbal and non-verbal behaviors during interaction (Bettes, 1988). Depressed mothers have trouble responding to their infants' needs (Hwa-Froelich et al., 2008; Sohr-Preston & Scaramella, 2006). Infants' behaviors are similarly contingent upon their mothers' behaviors; they interpret input by determining its affective meaning (Gergely & Watson, 1999). Infants determine that affect by using "social mirroring" to learn about others' emotions and cognitive dispositions; therefore, they rely on their mothers to establish social relationships by using various means of communication. In terms of conversational behavior, semantic contingency can be shown in recasting, expanding, or repeating the infant (Snow, 1986). Mothers in families with autism have been shown to use abnormal conversational timing, which may constitute a type of decreased reciprocity. Mothers in affected families have also demonstrated higher rates of failing to reciprocate than mothers of

children with DS, which is connected to less contingency exchanged between the mother and child (Piven et al., 1997). For this study, it was hypothesized that mothers with higher BAPQ scores would show lower levels of contingency, including a lower rate of response to their child's utterances during play. Because the children in the control group were not expected to be as responsive as the children in the experimental group, this should also decrease the amount of contingency terms used by the mother, as she will have fewer opportunities to engage. There would be a double effect from both the mother and child, creating a prediction of significantly lower rates of contingency in affected mother-child dyads.

Current Study

For this study, mother-child interactions were observed and analyzed to see whether features of the BAP are observable in the child-addressed speech of mothers having an older child with ASD. A control group served to represent typical interactions. Mothers (as opposed to fathers) were selected for analysis because they are usually the main caregivers for infants in most families. The play session format was preferred to create the most natural interactive environment possible.

The groups of participants were analyzed in various ways. First, the two groups of mothers were compared to observe any differences in play session behavior, as well as differences in BAPQ scores. The experimental group was expected to have higher scores on the subscales of the BAPQ (and total score). Mothers in the experimental group were also hypothesized to have higher MLUs, express less social contingency, have reduced pitch variation and vocabulary diversity, use more

inhibitory language and vocatives, and finally, use less endearing language than mothers the control group. Next, relationships were predicted between scores on the BAPQ and traits displayed by mothers during the play sessions. The hypotheses anticipated correlations between: the BAP Pragmatics/Language score and higher MLU, more restricted pitch variation (as measured by pitch standard deviation), and fewer proportional contingent terms; the BAP Aloof/Social subscale was predicted to show a negative correlation with proportional use of terms of endearment and vocatives; the BAP Rigidity subscale was hypothesized to correlate with lower VocD values and a higher proportion of inhibitory words. Finally, the last hypothesis predicted that child language ability would not be the primary influence on maternal behavior during the play sessions; child language scores and instances of the child failing to respond (FTR) would not be covariates of the findings of the previous hypotheses. Rather, the mothers' behaviors would be reflective of aspects of the BAP.

In addition, analyses measured child language ability to eliminate this variable as a main effect on the other variables of the study. Child language scores on a standardized test were incorporated to represent each child's linguistic level and to serve as an indicator of a language delay (characteristic of autism). The children participating in the interactions were hypothesized to show differences based on group (affected versus control groups) in the areas of language ability and responsiveness. Responsiveness was measured by the proportion of times that a child did not respond to bids of attention made by the adult. This was indicative of the child's engagement in the interactions, and helped to observe how children's behavior may be involved in the outcomes. For example, a mother may use an excessive

amount of inhibitory words, primarily because her child is not complying with her requests, not because she is displaying rigidity.

METHOD

Participants

Participants were 24 mother-infant dyads (12 experimental dyads, 12 control dyads) currently participating in a larger study at the University of Maryland. The larger study is focused on the social-cognitive language development of younger siblings of children with autism. Participants were recruited via public announcements and through an online university-maintained database of eligible participants. In the experimental group, all mothers had at least one older child who had been diagnosed with autism, or an older child who was showing symptoms of autism. The control group included mothers who did not have a child with autism. The infants participating in the study were all between nine and 14 months of age. The mean age of the experimental group of infants was one year, eleven days at the time of study, and the mean age of the control group of infants was one year, nine days. The mothers were matched for their children's gender, as each group contained seven male children and five female children. The mean age of the mothers in the control group was 34.167 years, and the mean age of the maternal experimental group was 34.083 years. The mean years of education (beyond a high school diploma) in the affected group was 3.8 years, and the mean years of education beyond high school in the control group was 5.7 years. These groups are considered to be statistically different ($p=0.007$); however, two participants in the affected group did not respond, which might have affected these results. All of the mothers indicated that the primary

language spoken in their homes is English, and each one indicated that she was a primary caregiver of the child. Additional information about the participants can be found in Table 1.

Table 1. Maternal Demographics

	AFFECTED	CONTROL
Mean age (years)	34.083	34.167
Education* (participants)		
Some college	3	0
4 year degree	6	3
Master's degree	0	8
Doctoral degree	1	1
Race (participants)		
White Non-Hispanic	8.5**	12
Black Non-Hispanic	3	0
Asian	0.5**	0

* = 2 nonresponders in affected group
** = 1 biracial responder (White and Asian)

Table 2. Child Demographics

	AFFECTED	CONTROL
Mean age (days)	376	374
Race (participants)		
White Non-Hispanic	7	10
Black Non-Hispanic	2	-
Biracial	2	1
Other/Not Specified	1	1
Birth Order (participants)		
Only	-	7

Second	6	3
Third	4	2
Fourth	2	-
Sibling Genders		
Female	4	7
Male	16	1
Sibling Diagnoses (participants)		
PDD-NOS	2	-
Autism	6	-
Autism Spectrum Disorder	1	-
Asperger's	3	-

Personality Styles and Preferences Questionnaire Administration

The *Personality Styles and Preferences Questionnaire (PSPQ)* is a version of the BAPQ (Hurley et al., 2007); the only modification that was made was a change in title (see Appendix A). The title was changed for the purpose of the study, as to not cue mothers that their personality traits were a focus of the study's design. The *PSPQ* consists of 36 statements, and the participant rates how well the statement applies to his or her life on a scale of 1 to 6 (1= very rarely, 2= rarely, 3= occasionally, 4= somewhat often, 5= often, 6= very often). Participants were asked to consider their typical social behavior as an adult, and they were advised to make ratings based upon relationships with people other than family members.

BAPQ Scoring

A total score for each subscale category of the BAPQ was computed based upon guidelines described by Hurley and colleagues (Hurley et al., 2007). The total

summary score (range 36-216) was also calculated. The higher the score, the more BAP qualities/characteristics the individual possesses. A lower score is considered characteristic of an individual with more typical language, typical social interaction, and a person with more flexible behavior.

Parent-Child Interactions

Semi-structured play sessions between the mothers and children took place in a laboratory setting at the University of Maryland. The dyads were provided with a standard set of age-appropriate toys to facilitate interaction, and mothers were told to play with their children as they typically would at home. All mothers and their children were given the same set of toys, and each mother was given the opportunity to accept or decline a toy with small pieces (Mr. Potato Head). The play sessions lasted approximately 15 minutes and they terminated at a naturally appropriate pause in the play sequence. Video and audio MOV recordings were made using a Kodak Zx1 camera, and all AVI recordings were made with a RCA EZ300HD camera. Each mother was aware that her speech and behaviors were being recorded (but were not told until after the session that their behaviors were a focus of the study).

Child Development Measures

In order to put the mothers' behaviors in context, it was necessary to appraise the children's relative linguistic and non-linguistic development. The *Mullen Scales of Early Learning* (Mullen, 1995) is a standardized test that measures the cognitive abilities of children from birth to 68 months. It consists of five subscales (Gross Motor, Fine Motor, Visual Reception, Expressive Language and Receptive Language) (Mullen, 1995). The children were given the entire test for the larger study at the

University of Maryland; however, only the Expressive Language and Receptive Language scales were applicable to the present study, in order to gauge each child's language level. Lower language ability can be indicative of lags in the child's development, which is important to understanding how the child will function within an interaction with the mother. Each child was administered the two language subtests on the same day that the play sessions were conducted. Because this cohort of children had not been evaluated for autism, these scores were used to measure the effects of child language level on behaviors witnessed in the interaction.

Data Collection

The audio recordings were recorded as uncompressed MOV or AVI files. Using the Computerized Language Analysis (CLAN) program (MacWhinney, 2009), the video files were linked to transcripts. Transcription and coding rules were established using the CHAT manual (MacWhinney, 2009), as well as rules made specific to the current study. For example, an additional code was added for the situation in which mothers made a gasping noise to direct her child's attention. Following a discussion with a second transcriber/coder, it was determined that these gasps were attention-getting devices, and added as vocatives. The utterance codes were marked on a subsequent line rather than on a main tier of transcription so that they were not counted as terms in analyses. A sample transcript and additional rules can be found in Appendices B and C.

Data Reduction and Analysis

The statements on the *BAPQ* (Hurley et al., 2007) are divided into categories representing the following areas of impairment related to the BAP: rigidity/flexibility,

language/communication/pragmatics, and social relationships/aloofness. The total

score in each subscale is a range from 12 to 72, and the raw score was used to study

the relationships with the corresponding variables. An example of a statement falling

under the rigidity/flexibility subscale is, "I am comfortable with unexpected changes

in plans." An example language/communication statement is, "My voice has a flat or

monotone sound to it." One of the social relationships/social behavior statements is,

"I look forward to situations where I can meet new people." These categories were

assigned to the variables described previously: rigidity/flexibility was correlated with

VocD and use of inhibitory words, language/communication was associated with

MLU, pitch variation, and contingency, and social relationships/social behavior was

correlated with use of terms of endearment and vocatives.

CLAN utilities (MacWhinney, 2011) were used to compute most of the

language variables of interest. The FREQ utility compiles a frequency count of all

the words spoken by a particular speaker within a transcript. When "freq + t*MOT"

is entered into the commands window, a list of the words with a frequency count of

each word is compiled. Using the list of all words found in the combined transcripts

of all 24 mothers, specific lists of inhibitory words, vocatives, and terms of

endearment were created. Examples of inhibitory words include "don't", "stop", and

"no"; the inclusion list is provided in the Appendix (see Appendix D). Vocatives

were compiled by obtaining a list of the first names of all participants, as well as pet

names such as "sweetie", "honey", or unique pet names (see Appendix E). Terms of

endearment (Appendix F) could include these same pet names, but they were

distinguished from vocatives when they were not used to get the attention of the child

by examining the utterance context in which they were found. For example, a vocative would be "Sweetie, come here"; however, a term of endearment would be "Yes, sweetie, that's a dog." Each list of terms was agreed upon by a second researcher to verify eligibility for word inclusion. The number of terms (i.e., vocatives, terms of endearment, inhibitory words, contingency acts) was divided by the total number of utterances by each mother, to obtain a proportion to be correlated with the respective BAPQ category.

As explained previously, the VoCD command is used to measure vocabulary diversity and minimizes the known effect of variations in sample size (which is unavoidable in a spontaneous play session) (Malvern et al., 2004). It also allows for the exclusion of selected tokens such as "um" or "uh" when an "exclude file" is created. By entering "vocd + t*MOT –s@excludefile" into the window, a vocabulary diversity score for each mother was determined. A higher VocD score indicated that a mother used a greater variety of words in her speech sample, while a lower VocD score represented a mother who used a more restricted range of vocabulary. A mother with a smaller VoCD value is likely to use a smaller set of words more often, showing a more limited vocabulary overall.

To analyze contingency, the *Inventory of Communicative Acts- Abridged (INCA-A)* system was utilized (Ninio, Snow, Pan, & Rollins, 1994). For the list of INCA-A codings used in this study, see Table 3.

Table 3. INCA-A Interchange Type Codes

Code	Function	Explanation
CMO	comforting	to comfort and express sympathy
DCA	discussing clarification of action	to discuss clarification of hearer's nonverbal communication
DHS	discussing hearer's sentiments	to hold a conversation about hearer's nonobservable thoughts and feelings
DJF	discussing a joint focus of attention	to hold a conversation about something that both participants are attending to, e.g., objects, persons, ongoing actions of hearer and speaker, ongoing events
NMA	negotiate mutual attention	to establish mutual attentiveness and proximity or withdrawal
DHA	directing hearer's attention	to achieve joint focus of attention by directing hearer's attention to objects, persons, and events
SAT	showing attentiveness	to demonstrate that speaker is paying attention to the hearer

CHAT Transcription Format (Ninio et al., 1994)

The following speech acts were analyzed in this sample: comforting (CMO), discussing clarification of action (DCA), directing the hearer's sentiments (DHS), discussing a joint focus of attention (DJF), negotiating mutual attention (NMA), directing the hearer's attention (DHA), and showing attentiveness (SAT). These variables were chosen because they reflect acts of reciprocal communication and responses in exchanges. Comforting is an example of a contingent act because a mother is reacting to her child's distress or unhappiness; her behavior is based upon what her child does. Discussing clarification of an action displays contingency because the mother has taken notice of an action performed by her child, and is commenting. In this study, typically, mothers rephrase what they believe their children would say, but they use more complex language. For example, a child may

take the hat off of Mr. Potato Head, and the mother would say, "I'm taking this off his head." Directing a hearer's sentiments is also contingent behavior, as it is similar to discussing clarification of actions; however, a mother says what a child may be thinking or feeling. A mother may say (in place of the child), "I don't want the hat on". She is inferring her child's thoughts. Discussing a joint focus of attention is especially important to this research because of the widely studied topic of joint attention in autism. In joint focus of attention, the mother discusses an object or action that both she and her child are attending to, and she shows a response to what her child is interested in. Negotiating mutual attention also requires a response because a mother must first become aware of her child's current focus of attention before she attempts to redirect it. Directing a hearer's attention is a contingent act, as a mother must establish a reference point by capturing the interest of her child. Finally, showing attentiveness is an example of contingency because a mother reacts to her child's behavior and she displays her own interest in the behavior. The entire *INCA-A* system was not used because some items were not appropriate to exchanges commonly found within an interaction with a child, or because they were not representative of a pragmatic language aspect demonstrating contingency with a communication partner. The total number of speech acts was measured as a proportion of each mother's utterance total. In addition, children were coded for failing to respond (FTR).

The standard deviation of the mean pitch was calculated for each mother. Ten utterances from the middle 50% of the transcript were randomly selected from each transcript, and exported to PRAAT (Boersma & Weenink, 2012). The software listed

out the pitch at each point in increments of .01 seconds. The program was set to a pitch range of 75 Hz to 500 Hz and the system used an autocorrelation method to generate pitch values. This method is typically used for intonation research rather than the cross-correlation method typically used for voice analysis (Boersma & Weenink, 2012). The pitch listing was imported into Microsoft Excel to calculate the standard deviation for each of the 10 utterances per participant. This standard deviation value represented each mother's pitch variation during the interactions.

Inter-rater Reliability

A second researcher using the same transcription rules and codes as the experimenter transcribed 8% of the transcripts (two total, one from each group). Percentage of agreement amongst the transcribers was calculated for total words, vocative codes, inhibitory codes, and speech act codes. Transcribers shared 91.6% word reliability, 62% vocative reliability, 85% reliability for inhibitory words, and 88.1% reliability for speech acts. Overall, these percentages are considered to be indicative of reliability ranging from "fair to good" (above 60%) to "excellent" (above 90%) (Fleiss, 1981).

RESULTS

Hypothesis 1: Group Differences in BAP Characteristics

The first hypothesis sought to find differences between the affected and control groups. One mother in the control group did not return the BAP questionnaire; consequently, her results are not included in the analyses involving BAPQ scores. The full chart of t-test results based on groups can be found in Appendix G.

The original hypotheses rested upon observing group differences in BAPQ scores of the mothers. Results of t-tests, in contrast to the hypotheses, showed no significant differences between the groups on scores for any subscale of the BAP; the mothers in the experimental group did not significantly differ from the control group in their responses on the BAPQ total score ($t(21)= -0.10$, $p=0.92$).

**Figure 2. Total BAPQ Scores by Group**
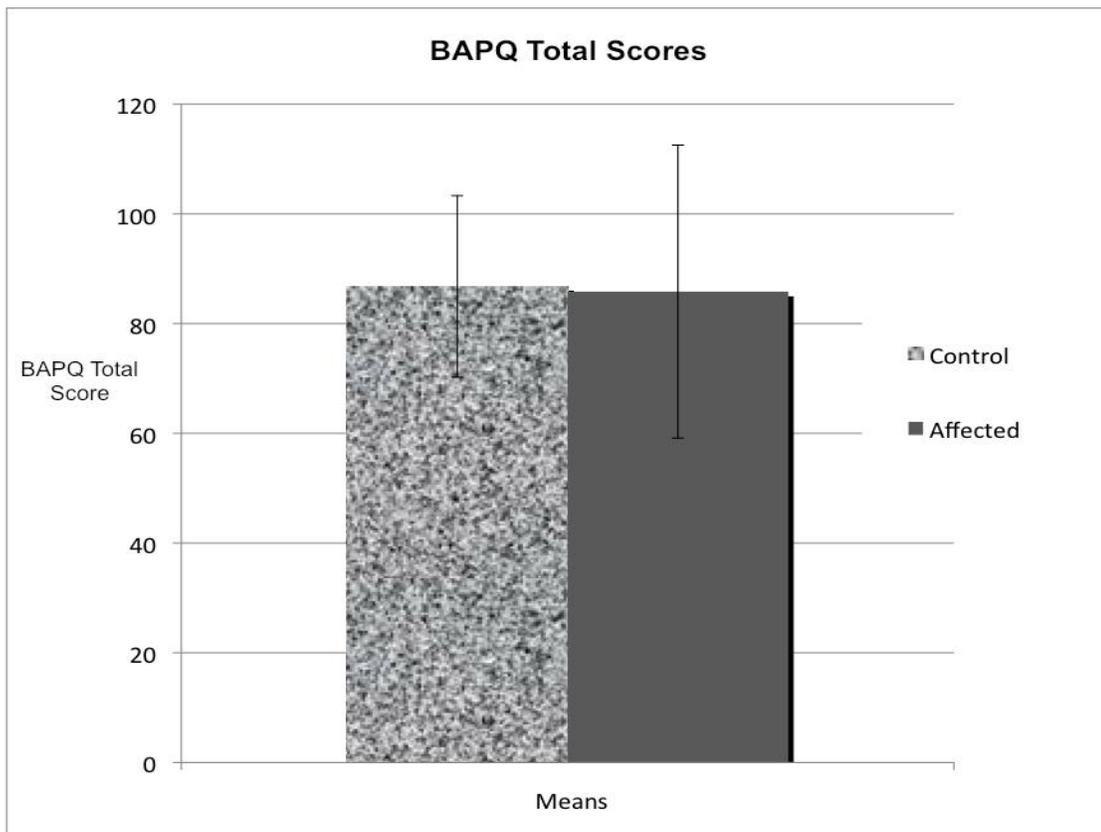
The following analyses examined differences between the groups on the list of variables present within the mother-child play sessions. The significance level was set at 0.05 for all of the following statistical analyses.

The mothers in the affected group were predicted to use longer utterances and use more complex language than mothers in the control group. Results of t-tests, however, were not significant at the 0.05 level ($t(22)= 0.64$, $p=0.53$). See Figure 3.

Figure 3. MLU by Group
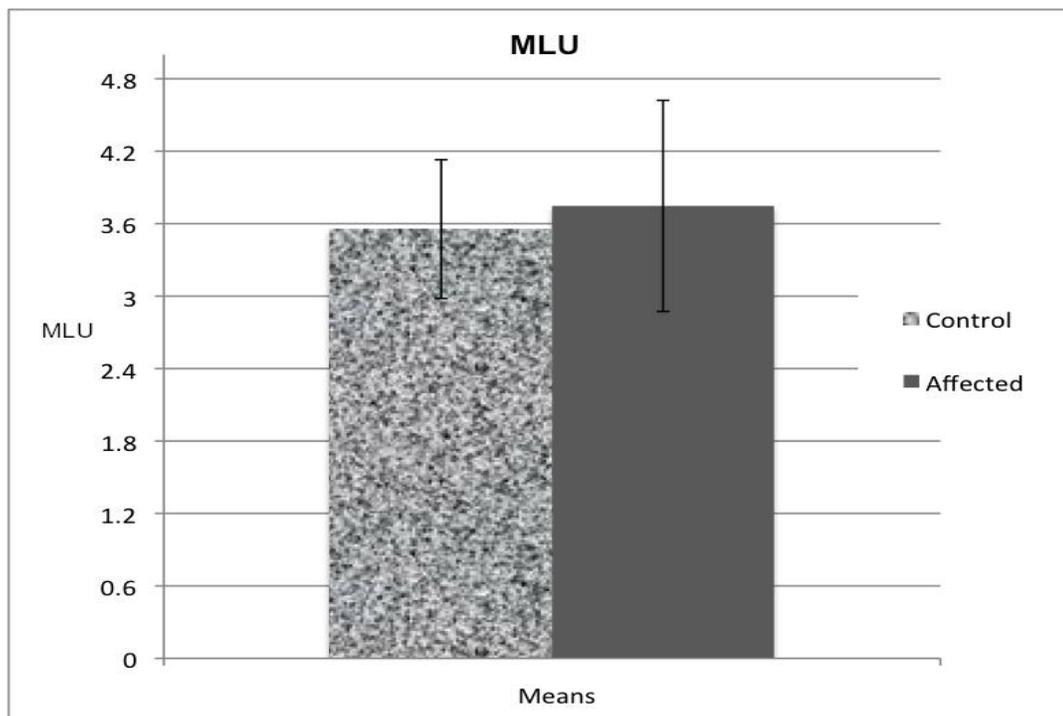
The next hypothesis predicted that mothers in the affected group would show lower VocD values; however, differences were not significant (t(22)=0.09, p=0.53).

Figure 4. VocD by Group
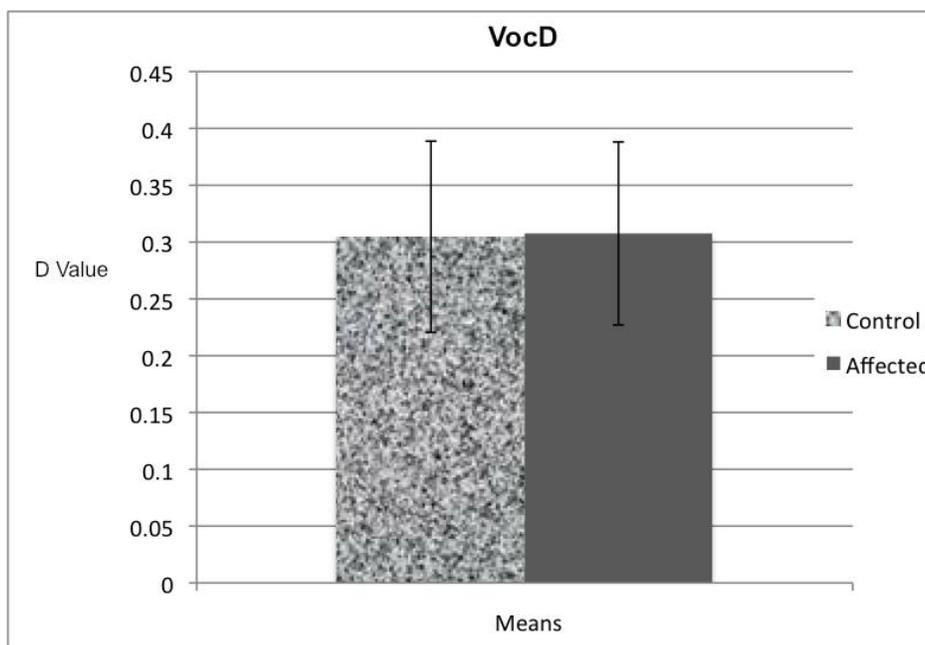
The mothers in the affected group were expected to have less variation in their pitch as the control group; the results did not meet criterion for significance (t(22)= -0.07, p=0.93).

Figure 5. Standard Deviation of Pitch by Group
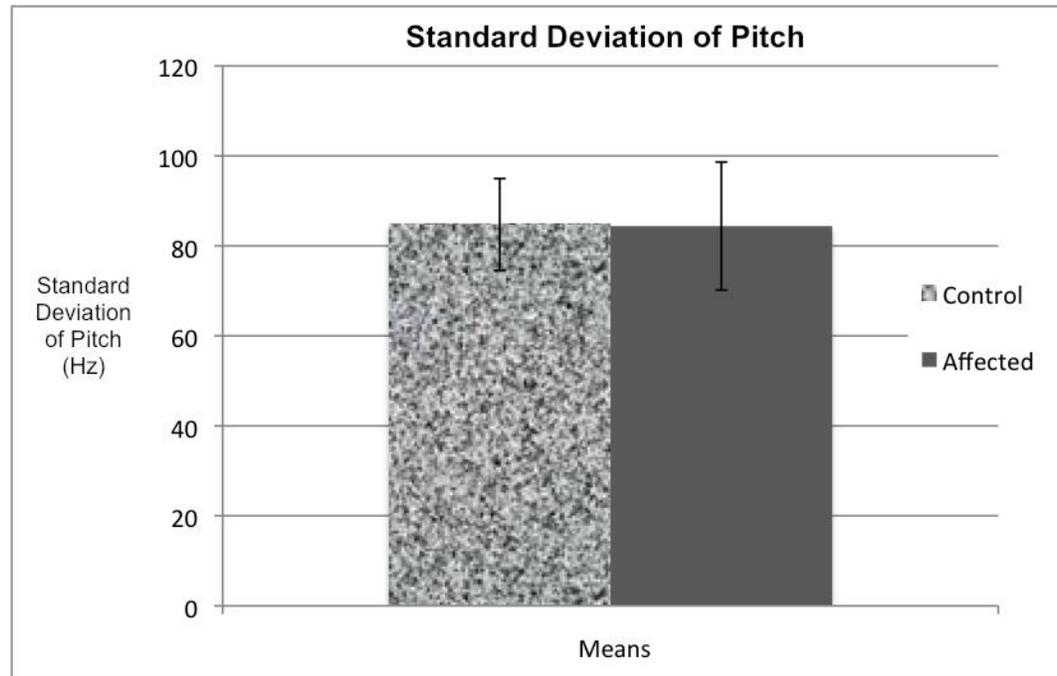
Mothers in the affected group were expected to use more vocatives and more inhibitory words than the control group. Results were not significant for vocatives, (t(22)=-0.03, p=0.97); however, proportion of inhibitory words did reveal a difference between the two groups (t(22)= -2.60, p=0.02). Mothers in the control group used proportionally more inhibitory words than mothers in the experimental group, which does not support the original hypothesis.

Figure 6. Proportion of Inhibitory Words by Group
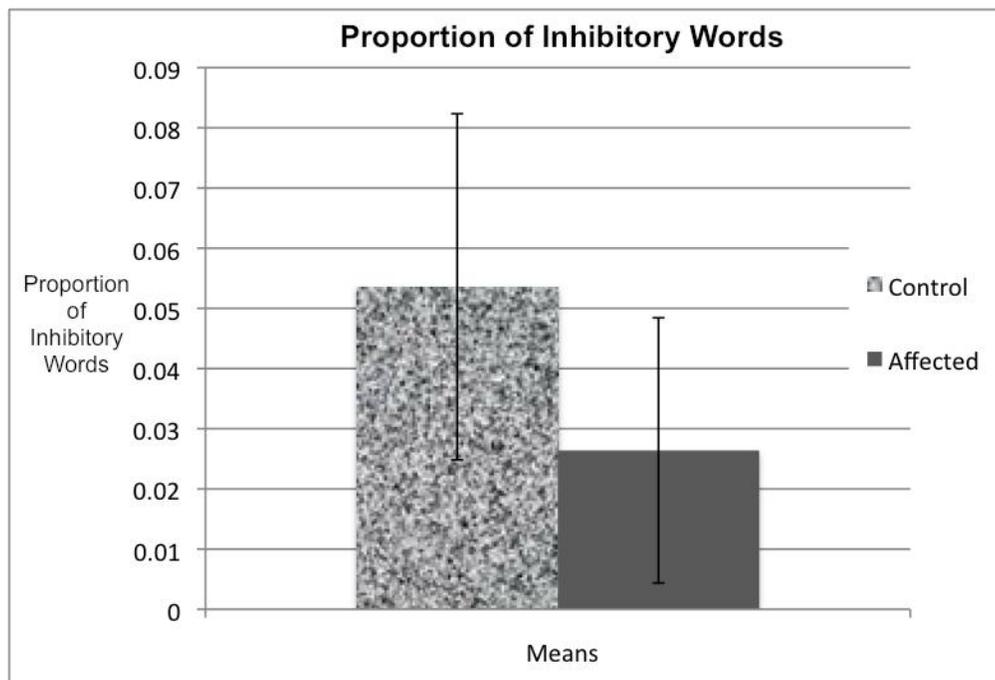
Figure 7. Proportion of Vocatives by Group
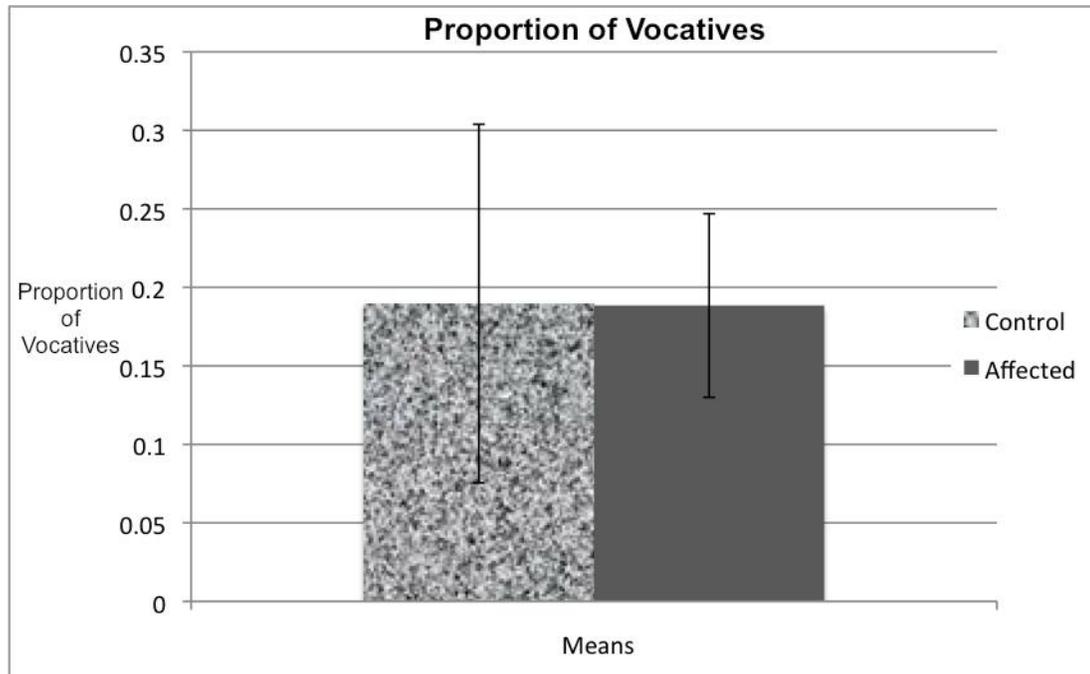
The affected mothers were also hypothesized to use fewer terms of endearment because of their impairments in social engagement and intimacy. Differences between the groups were not significant for this analysis (t(22)= 0.67, p=0.51).

Figure 8. Proportions of Terms of Endearment by Group
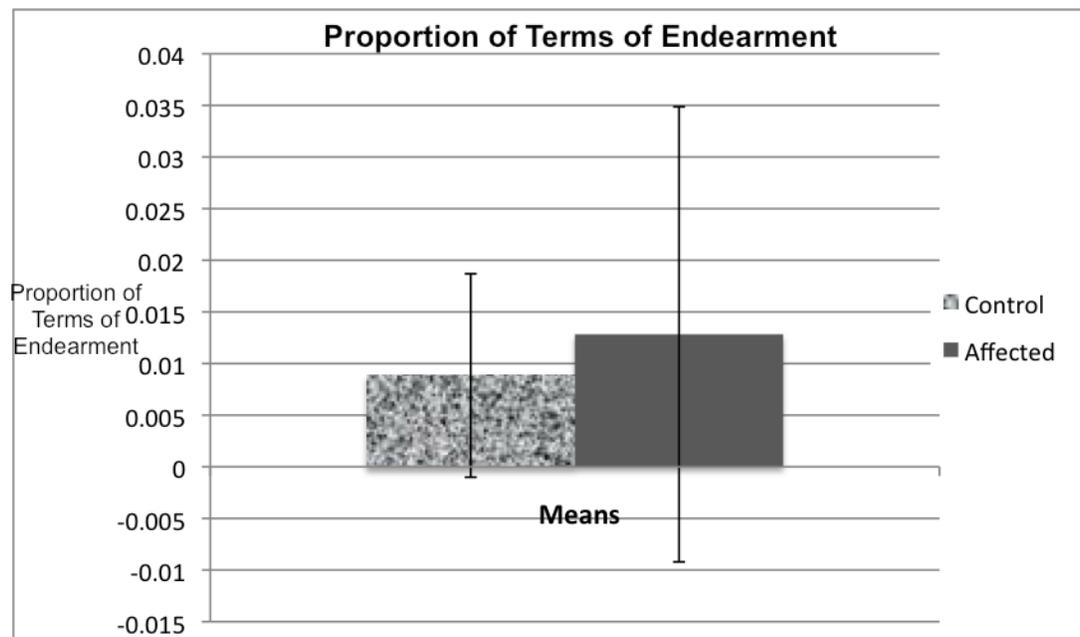
Finally, the mothers in the experimental group were predicted to use fewer instances of contingency than the control group; however, differences were not significant (t(22)=-1.71, p=0.10).

Figure 9. Proportion of Contingency Terms by Group
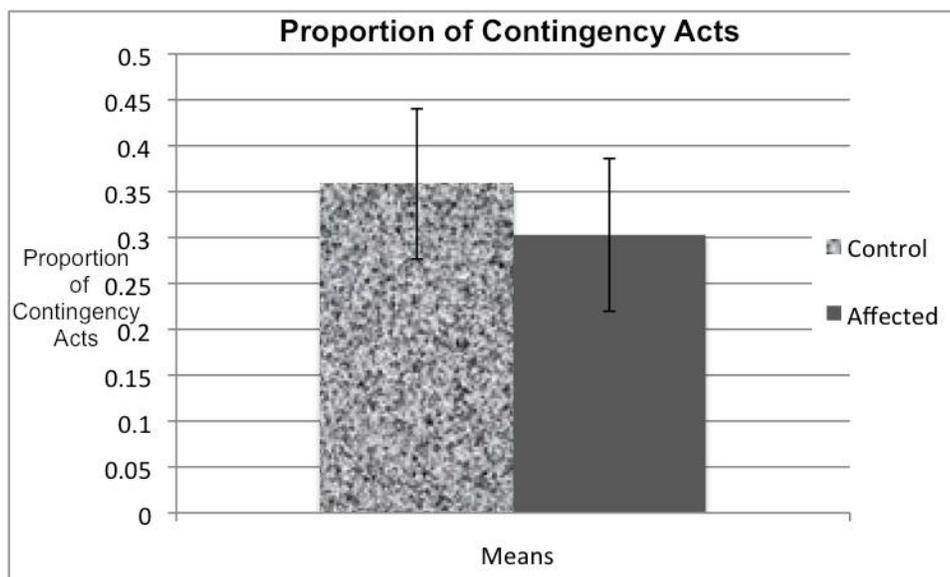
Additional variables such as number of words, word types, and number of utterances were also calculated in order to determine MLU and VocD. Using independent sample t-tests to compare the affected group to the control group, no significant differences were found for word count ($t(22)= 0.38$, $p=0.71$) or total utterances ($t(22)=0.55$, $p=0.59$).

During the transcription and coding of the videos, the experimenters were able to observe a range of behaviors across the groups, that potentially influenced results. For example, within the experimental group, there was a dyad in which the mother frequently attempted to both initiate joint attention on toys and to encourage her child's participation in play scenarios. She followed her child's lead by taking notice of what he *was* interested in (which was often electrical sockets or small parts of toys) and tried to talk about the objects to incorporate language into play. Moreover, the mother also attempted to redirect her child to a more functional toy by using sound effects and an excited tone of voice. Despite his mother's efforts, the child still had

difficulty responding to his mother's social bids and often got "stuck" on the objects instead of engaging in the exchange. Conversely, in this same group of experimental dyads, there was a mother who appeared to have more trouble with adapting her behavior to engage her child. The child was interested in playing alongside his mother and occasionally vocalized. The mother responded to him, but she seemed to find it difficult to maintain the communication, as there were frequent blocks of silence while playing with toys. There was also a dyad in which the child did not vocalize or attempt to bring his mother "in" to the interaction. He participated in some joint play; however, his mother also did not appear to be as expressive as other mothers. Therefore, both interaction participants were most likely influenced by one another, yielding an atypical sociolinguistic environment. Both the experimental and control groups also consisted of pairs in which both mother and child shared reciprocal, communicative interactions. One of the dyads included a mother who used engaging, simple language, with varied pitch to gain the child's attention, and she even sang songs related to the toys. Her child eagerly sang some words with her, displaying his developing language and interest in the social interaction.

Although the groups of participants did not appear to have many differences when compared statistically with group means, additional analyses were performed to further investigate the behaviors across the groups. Scattergrams were created to plot maternal BAP traits as a function of child responsiveness (Child's FTR proportion vs. Mother's total BAPQ score). The mothers' BAPQ scores were chosen for comparison because this variable is the most representative and comprehensive measure of features of the BAP. Child FTR proportion was chosen because this variable was

indicative of both social and linguistic participation in interactions. The figure below shows the distribution of the participants in the study.

Descriptive Analyses

Figure 10. Maternal BAPQ Score as a Function of Child FTR Proportion
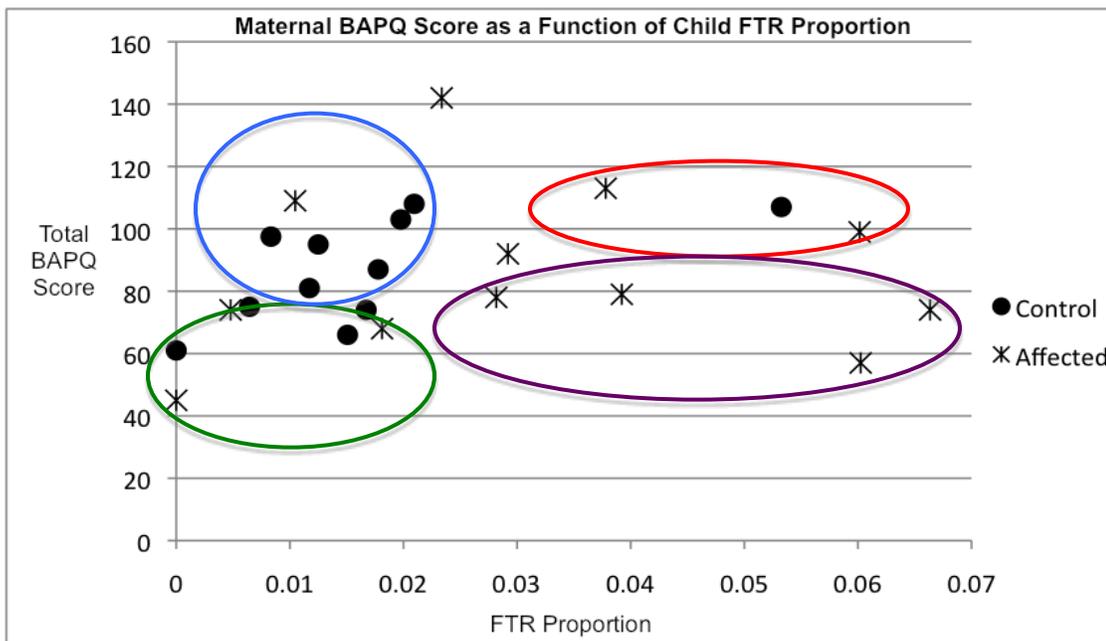
When presented in this visual format, the graph illustrates a range in distribution of the participants. First, it is important to note that the original affected group of participants revealed a wider range of FTR proportions than the original control group. This suggests that the group of subjects was not as homogenous as the mean statistics (substantiated on the play session/questionnaire data) lead one to believe. It is also possible to identify some informal clusters, as identified by the colored outlines on the plot. The green cluster represents children who have lower FTR ratios and mothers with lower BAPQ scores, signifying a typical environment. The blue circle highlights children who have lower FTR ratios with mothers indicating more BAP traits on the questionnaire. The children seem to be functioning

within normal range, but the mothers may report some atypical features. The purple circle includes dyads in which the child has a higher FTR ratio, yet the mother has a lower BAPQ score; i.e., the child is showing signs of atypical behavior but the mother is not.

Finally, the red circle would be considered the group with the most atypical behavior because the children have higher FTR proportions and the mother displays more BAP traits. Recognition of these clusters suggested a *post hoc* analysis, which divided the participants into groups based on the child FTR and maternal BAPQ score.

Participants were divided into four groups based on total BAPQ scores and FTR proportions. The participants were arranged in order from lowest to highest in terms of both BAPQ total score and FTR proportion to determine cut-off scores. The cut-off total score (to separate lower versus higher) for the mothers' BAPQ scores was 81, and the cut-off proportion for child FTR was .02. The groups consisted of the following criteria: 1) Mother with a higher BAPQ score and a child with a higher FTR proportion (Mother+, Child+); 2) Mother with a higher BAPQ score and a child with a lower FTR proportion (Mother+, Child-); 3) Mother with a lower BAPQ score and a child with a higher FTR proportion (Mother-, Child+); and 4) Mother with a lower BAPQ score and a child with a lower FTR proportion (Mother-, Child-). It should be noted that the group considered to be "typical" would be group 4 (Mother-, Child-). The group considered to be most at risk would be group 1 (Mother BAP+, Child FTR+).

The four groups were compared against the original variables of the study. A chart with the means for each variable divided based on group can be found in

Appendix I. The four groups appeared to have similar MLU and similar pitch variation profiles, displayed in Figure 11.

Figure 11. MLU (4 Groups)
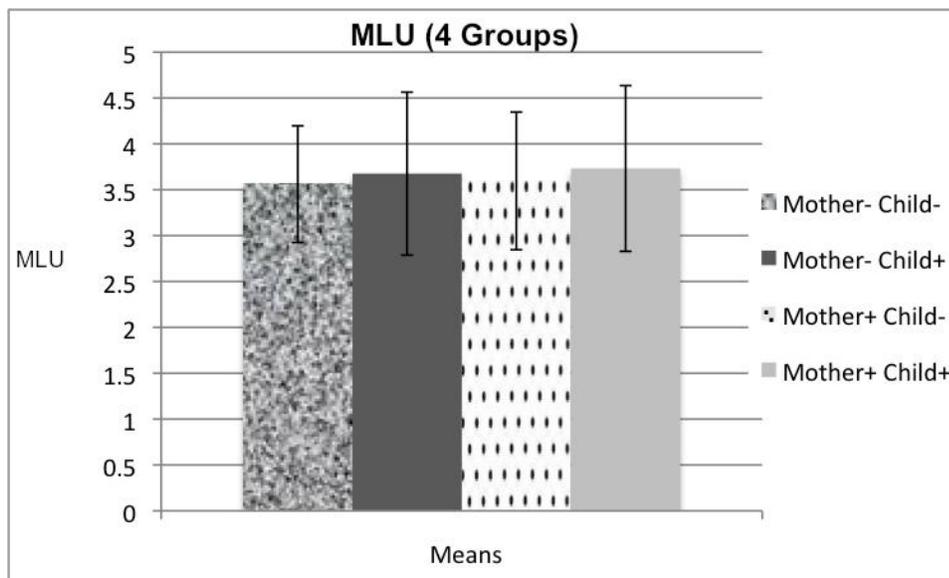
Figure 12. Standard Deviation of Pitch (4 Groups)
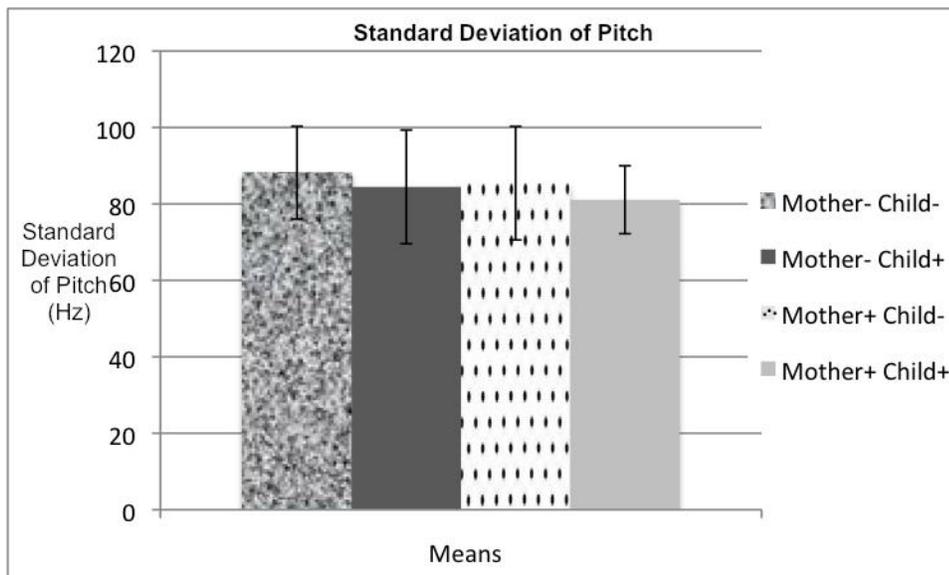
When looking at contingency (Figure 13), two of the groups seemed to use a higher proportion of contingent terms than the others. The Mother-,Child- group

(mothers with lower BAPQ scores and more responsive children) and Mother+,

Child- (mothers with higher BAPQ scores and more responsive children) had higher

means of proportional contingency than the other two groups. This finding is logical

because it supports a cyclical relationship between responsiveness and contingency.

Mothers are likely to respond and expand language of children who, in turn, also

respond to their bids for attention.

Figure 13. Proportion of Contingency (4 Groups)
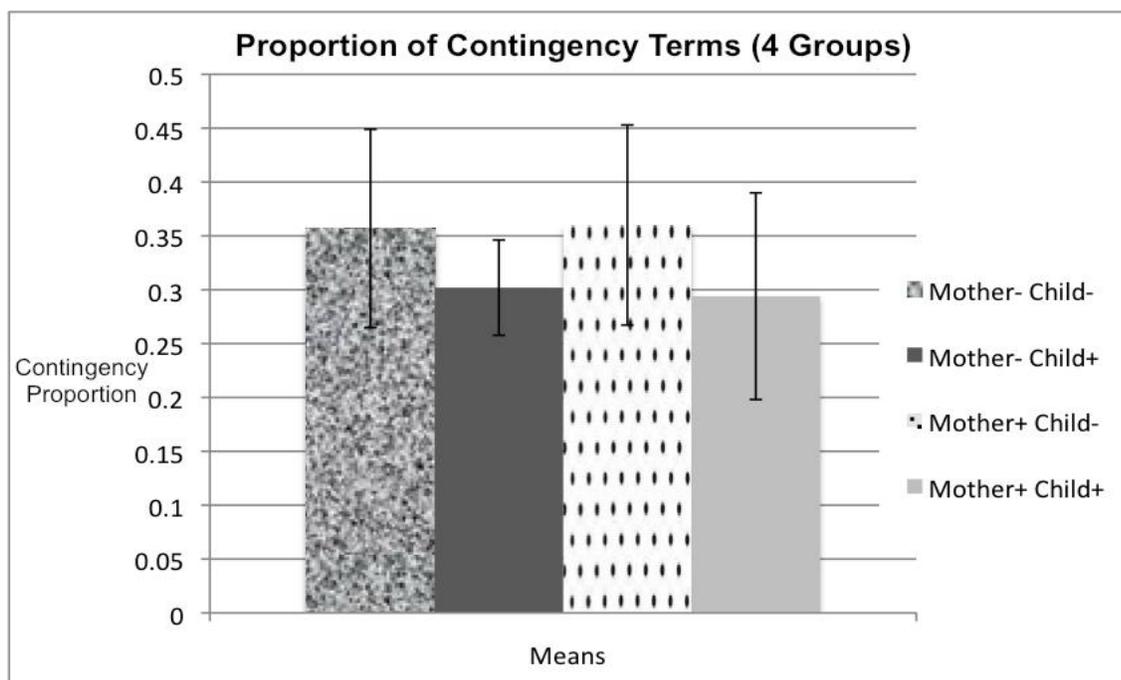
In regards to the D value representing vocabulary diversity, the group with the

highest mean D value was Mother+, Child- (mothers with more BAP traits and

children who are more responsive). The group with the lowest D value mean was

Mother -, Child+ (mothers with fewer BAP traits and children who are less

responsive). These findings are interesting because the group of mothers with higher

BAPQ scores would not be expected to have vocabularies more diverse than those

with lower BAPQ scores, but it appears as though vocabulary choices can be affected

by the attention of the child. The mothers with children who had lower rates of FTR were possibly able to incorporate more variety into their child-directed language because they were seeing growth in their children's receptive vocabulary and felt that using different words would be beneficial.

Figure 14. VocD (4 Groups)
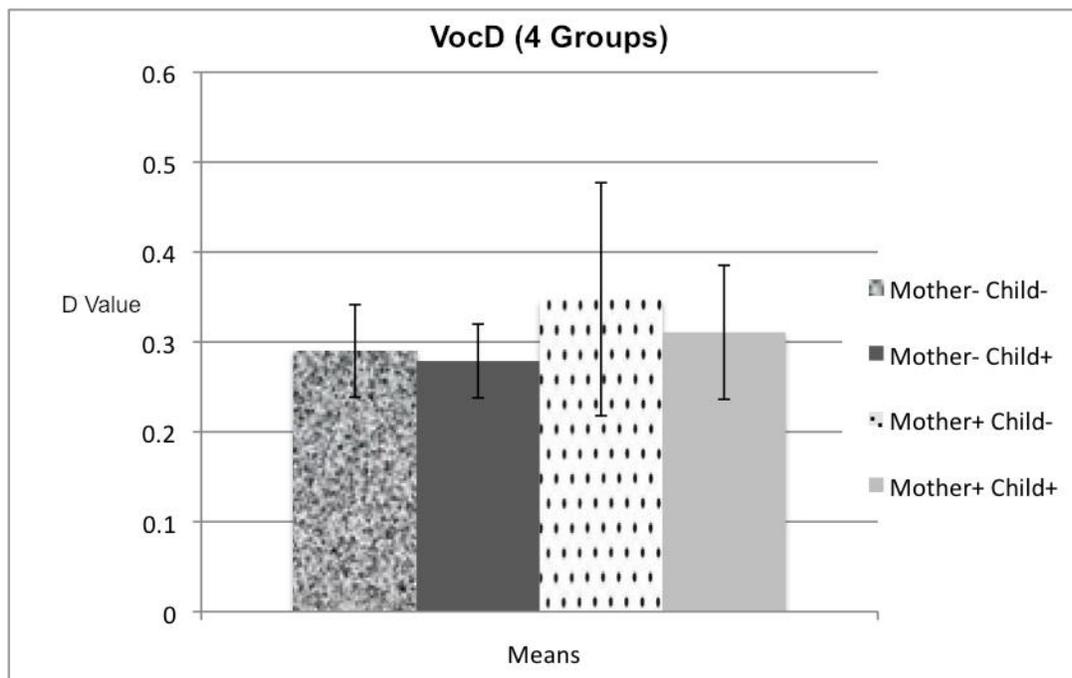
For proportion of inhibitory words, the group that seemed to use the most inhibitory language was Mother+, Child- (mothers with higher BAPQ scores and more responsive children). The group with the lowest mean was Mother+, Child+ (mothers with higher BAPQ scores and less responsive children). It is difficult to fully tease out the implications of these findings, because the higher mean suggests that mothers with more BAP traits are likely to use more inhibitory words, but the reverse argument does not seem to be true, as mothers with more BAP traits also yielded the lowest mean.

Figure 15. Proportion of Inhibitory Words (4 Groups)
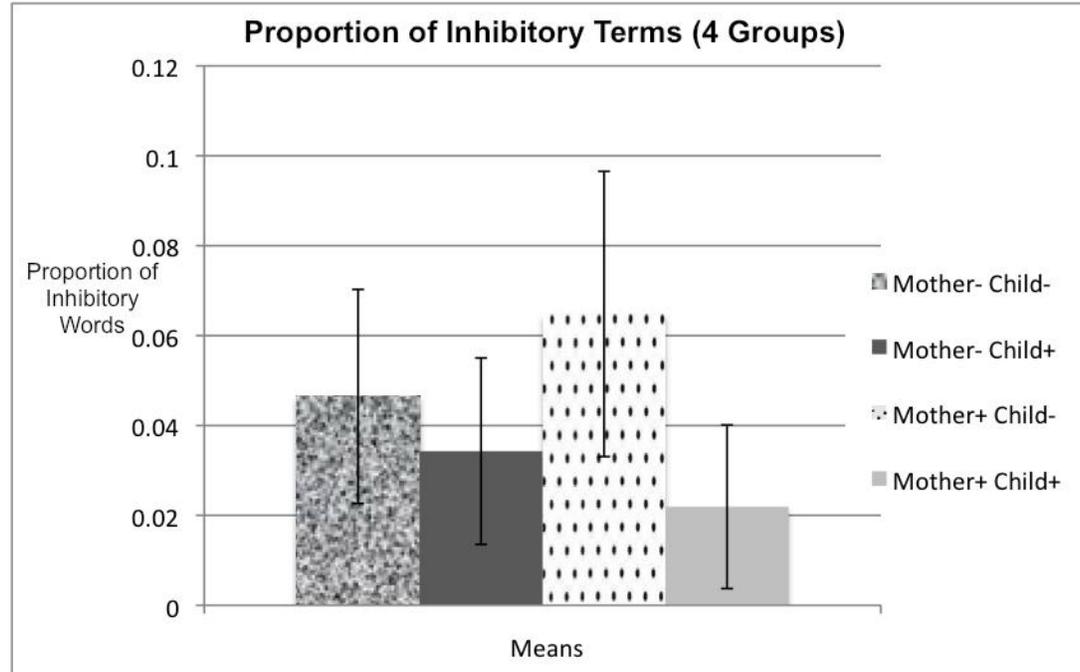
The group with the highest mean of vocative proportion was Mother-, Child+ (mothers with lower BAPQ scores and less responsive children). The finding suggests that even mothers who do not have many BAP traits are impacted by their children's responsiveness, because this group still called their children's names or used attention-getting words. The group with the lowest mean (Mother+, Child+) does not support this notion; however, it is important to note that the standard deviation in this group was high, meaning that the proportions of vocatives were more variable. This group that would typically be labeled "at risk" visually displayed a wider range of vocative proportions compared to other groups of subjects.

Figure 16. Proportion of Vocatives (4 Groups)
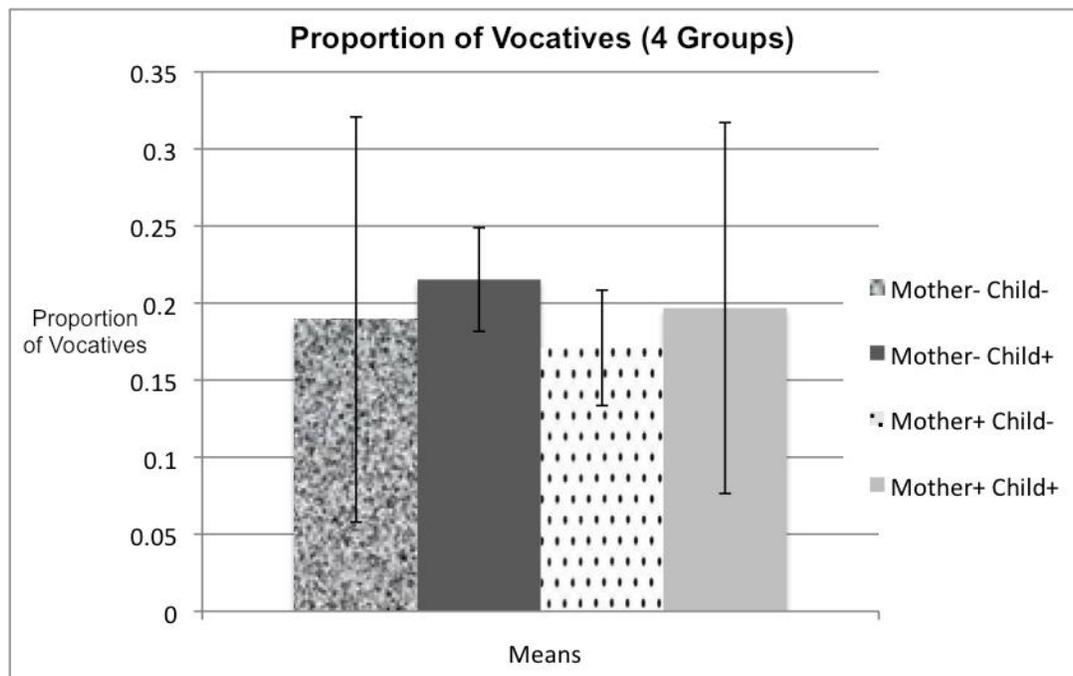
Overall, the proportions of terms of endearment produced standard deviation values similar to, or higher than, the means. The standard deviations were large, which resulted in standard error bars extending even into a negative value range. The group with the highest mean was Mother-, Child- (mothers with lower BAPQ scores and more responsive children). The group yielding the lowest mean of endearment terms was Mother+, Child+ (the inverse group). These results from the Mother+, Child+ group suggest that mothers with more traits of the BAP are less likely to use endearing language towards a child who is not responsive. It is not possible to determine whether the use of terms of endearment is more related to a mother's traits or to a child's behavior, especially considering the large ranges in each group.

Figure 17. Proportion of Terms of Endearment (4 Groups)
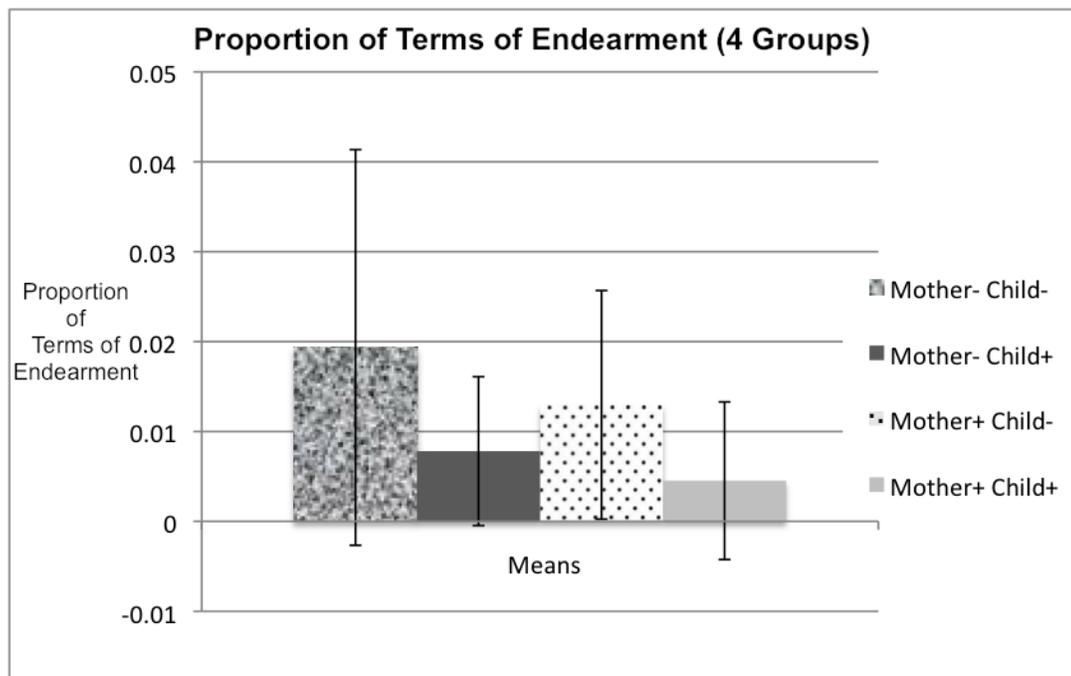
Hypothesis 2: Relationships between BAPQ and Mother-Child Interactions

The next analysis studied mothers' scores on the 3 subscales of the BAP to compare against selected features of the mother-child interactions using Spearman's Rank Order correlations. Spearman's Rank Order correlations are used with nonparametric data (data that do not have normal distribution) when measuring the strength of a relationship between two variables (Lund & Lund, 2012). Bonferroni adjustments were made due to the multiple analyses completed simultaneously. These adjustments decrease the probability level, thus reducing the chance of Type I error.

For hypotheses regarding the BAP Pragmatics score and its relationship with maternal MLU, pitch, and contingency, significance was set at $p=0.02$. It was hypothesized that the BAP subscale relating to language and pragmatics would show a positive correlation with mothers' MLU, a negative correlation with pitch variation,

and a negative correlation with contingency acts. Results demonstrated that BAP Pragmatic scores were not significantly correlated at the p=0.02 level with MLU (ρ(21)= -0.03, p=0.89), standard deviation of pitch (ρ(21)= -0.001, p=0.99), or contingency (ρ(21)=-0.17, p=0.44).

Figure 18. BAPQ Pragmatics Scatterplots

BAPQ Pragmatics Score vs. Proportion of Contingency Terms
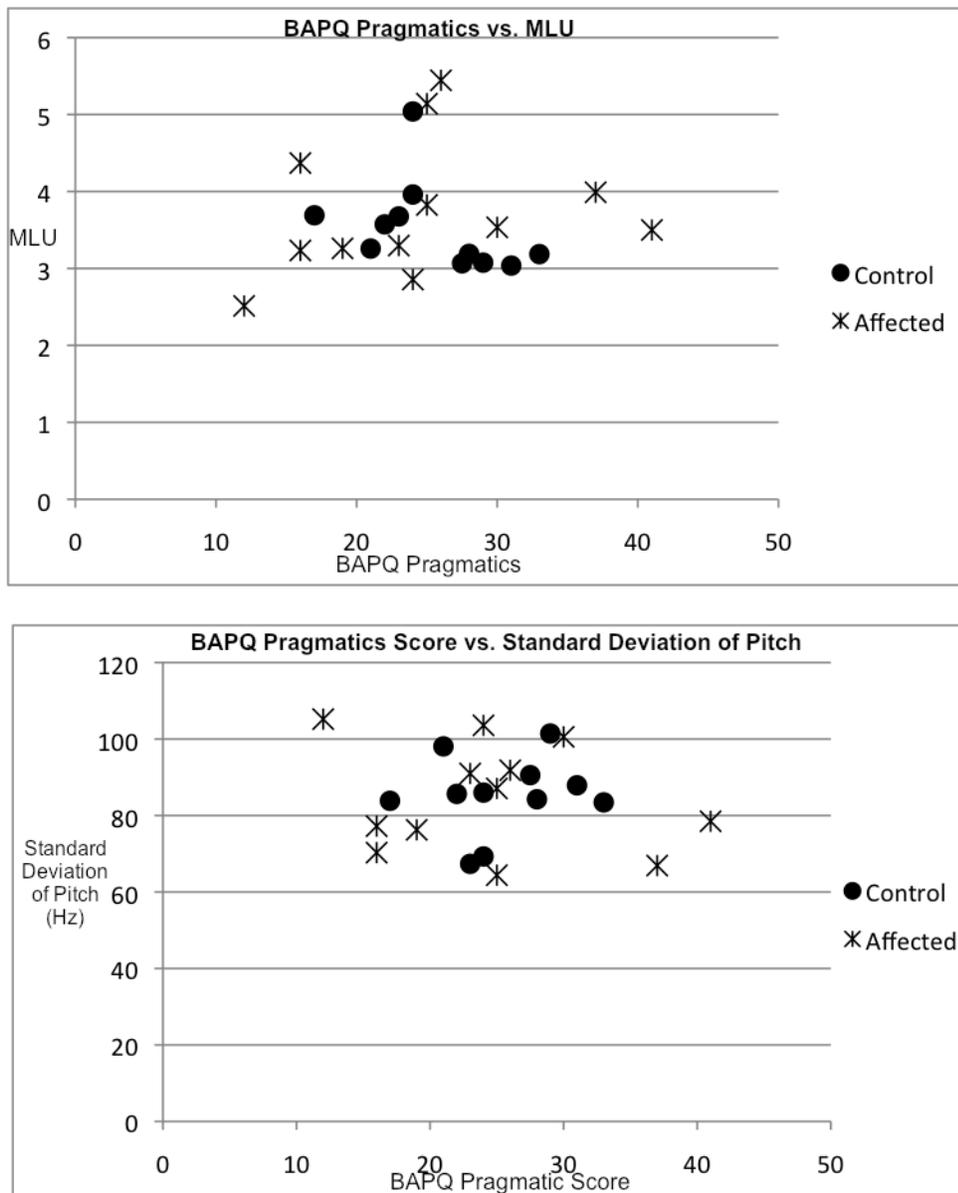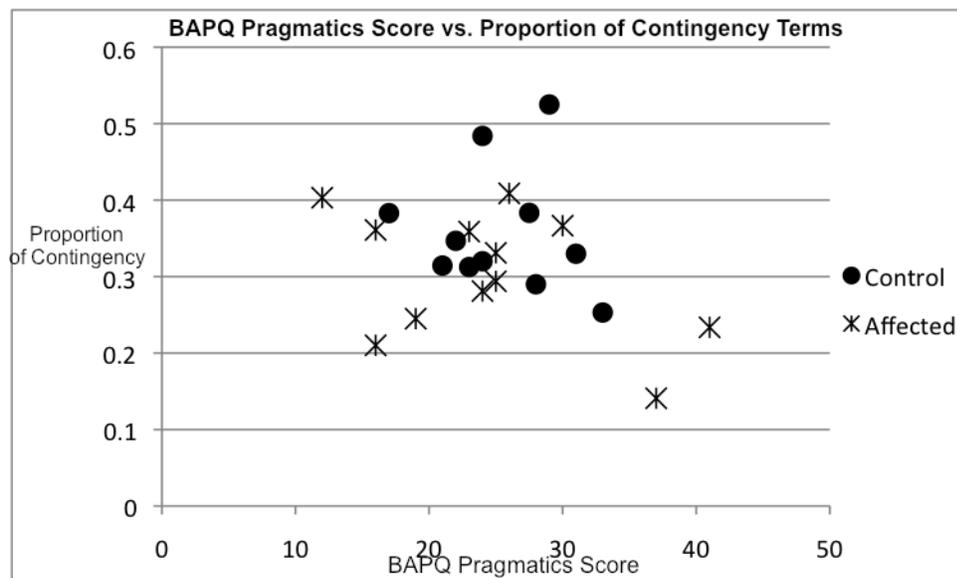
The BAPQ subscale for rigidity was predicted to positively correlate with VocD and negatively correlate with use of inhibitory words. For this hypothesis, significance was set at p=0.03. The correlation between BAP Rigidity and VocD was $\rho(21)=0.28$, p=0.21, and the BAP Rigidity and inhibitory word proportion correlation was $\rho(21)=-0.42$, p=0.05. BAP Rigidity scores and inhibitory word proportions approached significance, but due to the Bonferroni correction, the null hypothesis cannot be rejected.

Figure 19. BAPQ Rigidity Scatterplots
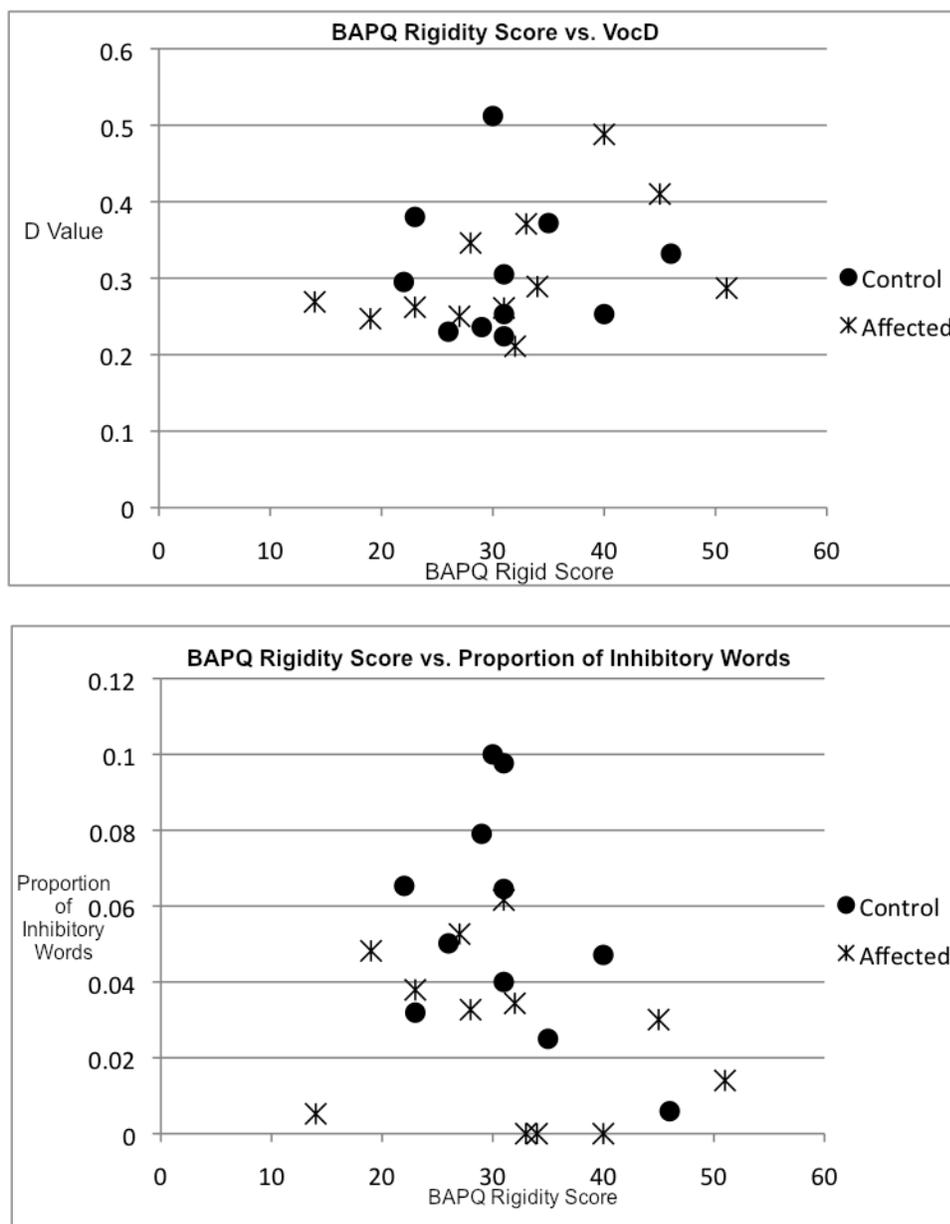
Finally, the social behavior scale of the BAP was predicted to show negative correlations with the use of terms of endearment and vocatives. Spearman's Rank Order correlations were performed on the relationships with proportion of terms of endearment and proportion of vocatives. The significance level was set at p=0.03 due to Bonferroni adjustments. Correlations were not significant between scores on the

BAP Aloof subscale and proportion of terms of endearment (ρ(21)=-0.18, p=0.41) or

between BAP Aloof and proportion of vocatives (ρ(21)= -0.23, p=0.29).

Figure 20. BAPQ Aloof Scatterplots
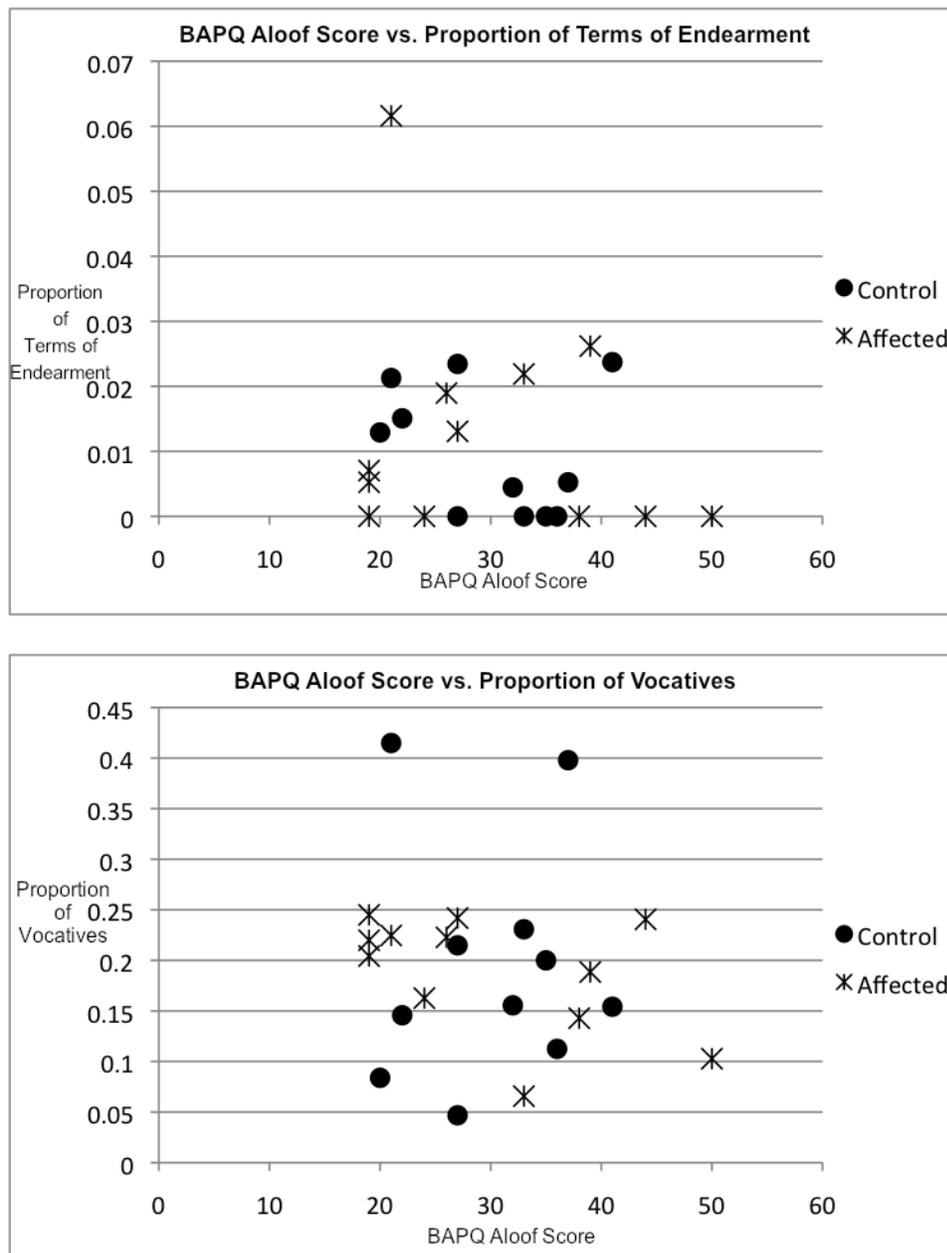
In summary, the majority of correlations derived from the BAP subscales and

the variables mentioned above were not significant, except for the hypothesis related

to use of inhibitory words. A list of full results can be found in Appendix H.

Hypothesis 3: Child Language Measures

The final hypothesis predicted that child language variables would not be a factors influencing maternal expression of BAP traits. Children's language and communication were analyzed through the Receptive and Expressive Language scores on the *Mullen* (Mullen, 1995)*,* and the mean number of turns when they failed to respond to their mothers during the play sessions.

Differences between receptive and expressive language scores in the two groups were significant, indicating that the children in the control group performed better than the children in the experimental group on both Receptive Language (t(22)= -2.53, p=0.02) and Expressive Language (t(22)= -2.1, p=0.04) portions of the language assessment. In addition, the relationship between the proportion of times that a child failed to respond (FTR) and Expressive Language scores showed a negative relationship (r= -0.39, n=24, p=0.06). This is considered a relationship of "moderate" strength (Choudhury, 2009). FTR showed a weak negative correlation with Receptive Language (r=-0.15, n=24, p=0.5). Additionally, the gender of the child did not impact any differences in receptive or expressive language scores (t(22)=0.59, p=0.57).

Additional analyses were performed to further explore the effect of child language level on the interactions. Analyses of covariance (ANCOVAs) were used to examine whether results for maternal MLU, proportion of vocatives, proportion of inhibitory words, and proportion of contingency acts hold true controlling for child expressive and receptive language ability, using a Bonferroni correction of p=0.01. ANCOVA results reveal that there were no statistically significant differences

between the groups on these variables when including for child language ability. The variable of child expressive language did not appear to be a significant covariate of maternal MLU ($F(1,21)= 0.10$, $p=0.75$), vocative proportion ($F(1,21)= 0.28$, $p=0.6$), inhibitory proportion ($F(1,21)= 0.3$, $p=0.59$), or contingency act proportion ($F(1,21)=0.26$, $p=0.62$). Child receptive language ability did not appear to be a significant covariate of MLU ($F(1,21)=1.75$, $p=0.20$), vocative proportion ($F(1,21)=3.01$, $p=0.10$), proportion of inhibitory words ($F(1,21)=0.46$, $p=0.50$), or contingency proportion ($F(1,21)=0.02$, $p=0.88$). Based upon these results, the control group used proportionally more inhibitory words than the experimental group.

DISCUSSION

This study examined the relationship between characteristics of mother-child interactions and the mothers' BAP profiles through play sessions and a questionnaire. There were some differences found between the two groups of control dyads and experimental dyads; however, most of the hypotheses were not supported by statistical analysis. The single conversational behavior that differentiated the two groups of mothers was use of inhibitory language. Mothers in the experimental group used proportionately less inhibitory language than did the mothers without a child having ASD, although BAPQ scores did not differ between the groups.

Because the children's language did significantly differ between the experimental and control groups, this finding suggests that the experimental group of children showed linguistic or non-linguistic behavior that impacted mothers' use of inhibitory language. A separate analysis examined the effect of child language

(receptive or expressive) as a covariate of the findings; however, these results were not significant.

When comparing the groups solely based on their current autism family history, the research did not produce many remarkable findings in terms of group differences; however, when the groups were examined in a different light, they did not appear to be homogenous. The children seemed to play a larger role in directing the interactions than the hypotheses originally anticipated. Most of the original hypotheses rested upon the idea that the interactions of the "affected" group and the control group would be drastically different mainly because of the mother's traits. Actually, four "typical" and "affected" combination groups emerged based upon a blend of maternal characteristics and child behavior.

After the groups were divided with respect to maternal BAPQ scores and child FTR proportions and compared on the same variables, certain patterns emerged. Children who had higher response rates (lower FTR proportions) in the interactions elicited a higher proportion of maternal contingency. Because these children responded back to their mothers' words and actions, mothers had more opportunities to respond as well. In these dyads, the overall environments might be more supportive of contingent acts. For example, when a child watches his mother answer a pretend telephone and then imitates this act, she is likely to follow with praise or continued expansion of the interaction.

This further division of groups also proposed the notion that children who are more responsive elicit higher maternal D values (more vocabulary diversity) in an interaction. It is possible that mothers take advantage of joint attention opportunities

to use more a wider variety of words. If a mother reading a book says, "Look at the children, " and her child does not seem to comprehend, she might repeat herself, "Look, the children." Another mother who has the attention of her child might go on to say, "They are outside," instead. The two sentences produce the same sample size in terms of tokens, but the second interaction has introduced new words. The fact that FTR proportion showed a negative correlation with child expressive language scores further supports this idea, as mothers are not expected to introduce new words to a child who is not responding, and a child who has not receptively mastered a word is not likely to use it expressively, either.

Finally, an interesting result was the high variability in proportion of terms of endearment. Although the group means across the four groups did not differ significantly in the use of terms of endearment, the standard deviations were very large. The standard deviations may suggest that this interaction behavior (using terms of endearment) is unpredictable, producing quite a few outliers.

Patterns of interaction between maternal BAP characteristics and potential child BAP characteristics may be clinically relevant. Clinicians, with additional supporting evidence, can use naturalistic interactions such as a play sessions to assess a number of factors. Play sessions can be additional components to observations and evaluations. They could be used in conjunction with, or even in place of, a speech/language sample, especially when working with very young children. With further research in this area, clinicians might be able to look at mothers themselves as early indicators for the detection of autism. Although not demonstrated in the current study, mothers are thought to adapt their language and social behavior based on what

they think their children need, and adaptations might not be as heavily dependent upon BAP characteristics as they are on child's responsiveness. In some cases, mothers with more BAP traits may find it challenging to make communication "repairs", such as using a vocative to establish the communicative exchange, using an exaggerated pitch register, or by selecting vocabulary appropriate to her child; however, this still does not mean that a mother is not making the efforts to do so. It may be a situation in which the mother makes attempts to have a back-and-forth exchange with her child during an activity, but her child is more interested in toy play and fixating on objects. If she does not have the same communicative flexibility as a mother with fewer BAP traits, she may struggle with redirecting an infant toward a functional way to communicate and play with toys.

If additional studies are able to identify some areas in which mothers with more BAP traits potentially have more difficulty in comparison to others, the clinical community would be able to cater therapeutic intervention towards this population. Clinicians can work with mothers who are considered "at risk" (either by virtue of having an older child with ASD or those mothers who have scored high on a BAP assessment) to help them with behavior management and sociolinguistic flexibility with their children. If research establishes child responsiveness as a key variable in the quality of mother-child interactions, clinicians can also teach mothers how to identify and problem solve when their children are not engaged with an activity, so that they might incorporate more "motherese" into interactions. Intervention could also include teaching activities that build routines, because not only do routines aid

children in mastering the predictability in language, but a mother with BAP traits may be more comfortable with routines rather than unstructured play.

*Limitation*s

The main limitation to this study was that the hypotheses rested upon the presumption that the control group and the affected group differ in BAP scores. We predicted that the mothers with an autism family history would have different scores on the BAP assessment than the mothers without an autism history, which would mean that they had higher rates of BAP traits. In turn, if the affected mothers reported more BAP traits, then this would lead to displaying different behaviors during the interactions. In the end, however, statistics could not show that one group of mothers displayed more BAP traits than the other. Therefore, it was difficult to examine relationships between the BAP and the various aspects of the interactions.

It is possible that we would have found more differences between the groups had we included the children's fathers as conversational partners as well. There is evidence that BAP characteristics occur more often in male relatives than female relatives, in particular, social withdrawal, deficits in communicative reciprocity, narrowed interests, and egocentricity (Wolff et al., 1988). This information, in conjunction with the overall higher prevalence of ASD in males than females, can lead us to believe that many of the relatives who have features of the BAP are fathers, or that fathers show more features of the BAP than mothers. This may have been the case for the families included in the experimental group of this study; the fathers could have displayed BAP traits in a play session more than the mothers did.

An additional factor that may have impacted the behaviors surveyed is the note on the BAPQ that specifies the relationships to consider when answering questions. The questionnaire asks mothers to respond thinking of, "casual interaction[s] with acquaintances, rather than special relationships such as with close friends and family members," (Hurley et al., 2007). Mothers did not answer the questions with their children in mind. Although the goal of the research was to draw from any relationships that were revealed between BAP characteristics and the characteristics' expression during mother-child interactions, it still must be noted that the results would probably be different if mothers had described familial interactions on the BAPQ. Taking all relationships into account might provide a better representation of inherent traits than just some relationships.

Finally, it should be taken into consideration that child language measures and responsiveness are not the only means studying early signs of autism. The child language assessment captures the area of communication/language abilities and the responsiveness measurement relates to social behavior, but a measure was not included that observed child rigidity and/or repetitive behaviors. Just as the results included differences in the affected versus control groups in terms of child language scores and then observable differences in the four groups based on FTR, an additional measurement of rigid behavior in the infants could also provide informative data.

Future Research

Future research in this area should attempt to address the limitations and concerns identified in this study. It would be beneficial to do this research on a larger scale, with a more demographically diverse population. The larger population would

likely gather a group of mothers who are distinctly unlike in terms of BAP traits. It could even be possible to create the groups based on BAPQ results, rather than basing groups on having a child with autism symptoms. In addition, to make the interaction more natural, future studies might attempt to go into the home setting. A natural home environment would allow the researchers to observe the settings in which young children are receiving the majority of their social and linguistic input. This information would also aid service providers in tailoring intervention to home environments, potentially increasing generalization of skills by both parents and children.

Forthcoming research should also include measurements not addressed in this study. A measurement to gather data on children's restricted behaviors such as repetitively performing the same play action or perseverating on an object/action would be beneficial. Observing male relatives during the play sessions and having the fathers' questionnaire outcomes incorporated into the results would be informative. The questionnaire directions could be changed so that responders answer thinking of all types of interactions, including those with children. A separate questionnaire could be developed specifically for familial interactions as well.

As a concluding comment, researchers should incorporate an observation of communication adaptability in future studies. Because the wider study from which this research began incorporates an interview with the experimenter following the play session, there are language samples available of the same mothers' interactions with an adult. It is possible to make comparisons on many of the same variables we analyzed to see if any differences are observable in adult-adult communicative

interchanges. This could also further investigate differences (or similarities) between the two groups of mothers. Finally, another aspect of communication adaptability could incorporate a retrospective analysis of the BAP in mother-child interactions. If the same groups are studied when the children are older, some of the children (in either group) may have a diagnosis of an ASD. It may be possible to identify differences that were present at this age, further contributing to the identification of early indicators of autism.

APPENDICES

Appendix A: Personality Styles and Preferences Questionnaire

Personality Styles and Preferences Questionnaire

Participant code: _____   Date: _____

Date of Birth (person completing): _____

Relationship to study participant (mother, father etc.): _____

Instructions

You are about to fill out a series of statements related to personality and lifestyle. For each question, circle that answer that best describes how often that statement applies to you. Many of these questions ask about your interactions with other people. Please think about the way you are with most people, rather than special relationships you may have with spouses or significant others, children, siblings, and parents. Everyone changes over time, which can make it hard to fill out questions about personality. Think about the way you have been the majority of your adult life, rather than the way you were as a teenager, or times you may have felt different than normal. You must answer each question, and give only one answer per question. If you are confused, please give it your best guess.

1---Very rarely	2---Rarely	3---Occasionally
4---Somewhat often	5---Often	6---Very often

Questions

1. I like being around other people   1 2 3 4 5 6

2. I find it hard to get my words out smoothly   1 2 3 4 5 6

3. I am comfortable with unexpected changes in plans   1 2 3 4 5 6

4. It's hard for me to avoid getting sidetracked in conversation   1 2 3 4 5 6

5. I would rather talk to people to get information than to socialize 1 2 3 4 5 6

6. People have to talk me into trying something new   1 2 3 4 5 6

7. I am "in-tune" with the other person during conversation***   1 2 3 4 5 6

8. I have to warm myself up to the idea of visiting an unfamiliar place 1 2 3 4 5 6

9. I enjoy being in social situations   1 2 3 4 5 6

10. My voice has a flat or monotone sound to it   1 2 3 4 5 6

***Casual interaction with acquaintances, rather than special relationships such as with close friends and family members.

11. I feel disconnected or "out of sync" in conversations with others***	1	2	3	4	5	6
12. People find it easy to approach me***	1	2	3	4	5	6
13. I feel a strong need for sameness from day to day	1	2	3	4	5	6
14. People ask me to repeat things I've said because they don't understand	1	2	3	4	5	6
15. I am flexible about how things should be done	1	2	3	4	5	6
16. I look forward to situations where I can meet new people	1	2	3	4	5	6
17. I have been told that I talk too much about certain topics	1	2	3	4	5	6
18. When I make conversation it is just to be polite***	1	2	3	4	5	6
19. I look forward to trying new things	1	2	3	4	5	6
20. I speak too loudly or softly	1	2	3	4	5	6
21. I can tell when someone is not interested in what I am saying***	1	2	3	4	5	6
22. I have a hard time dealing with changes in my routine	1	2	3	4	5	6
23. I am good at making small talk***	1	2	3	4	5	6
24. I act very set in my ways	1	2	3	4	5	6
25. I feel like I am really connecting with other people	1	2	3	4	5	6
26. People get frustrated by my unwillingness to bend	1	2	3	4	5	6
27. Conversation bores me***	1	2	3	4	5	6
28. I am warm and friendly in my interactions with others***	1	2	3	4	5	6
29. I leave long pauses in conversation	1	2	3	4	5	6
30. I alter my daily routine by trying something different	1	2	3	4	5	6
31. I prefer to be alone rather than with others	1	2	3	4	5	6
32. I lose track of my original point when talking to people	1	2	3	4	5	6
33. I like to closely follow a routine while working	1	2	3	4	5	6
34. I can tell when it is time to change topics in conversation***	1	2	3	4	5	6
35. I keep doing things the way I know, even if another way might be better	1	2	3	4	5	6
36. I enjoy chatting with people***	1	2	3	4	5	6

1---Very rarely	2---Rarely	3---Occasionally
4---Somewhat often	5---Often	6---Very often

***Casual interaction with acquaintances, rather than special relationships such as with close friends and family members.

Appendix B: Sample Transcript
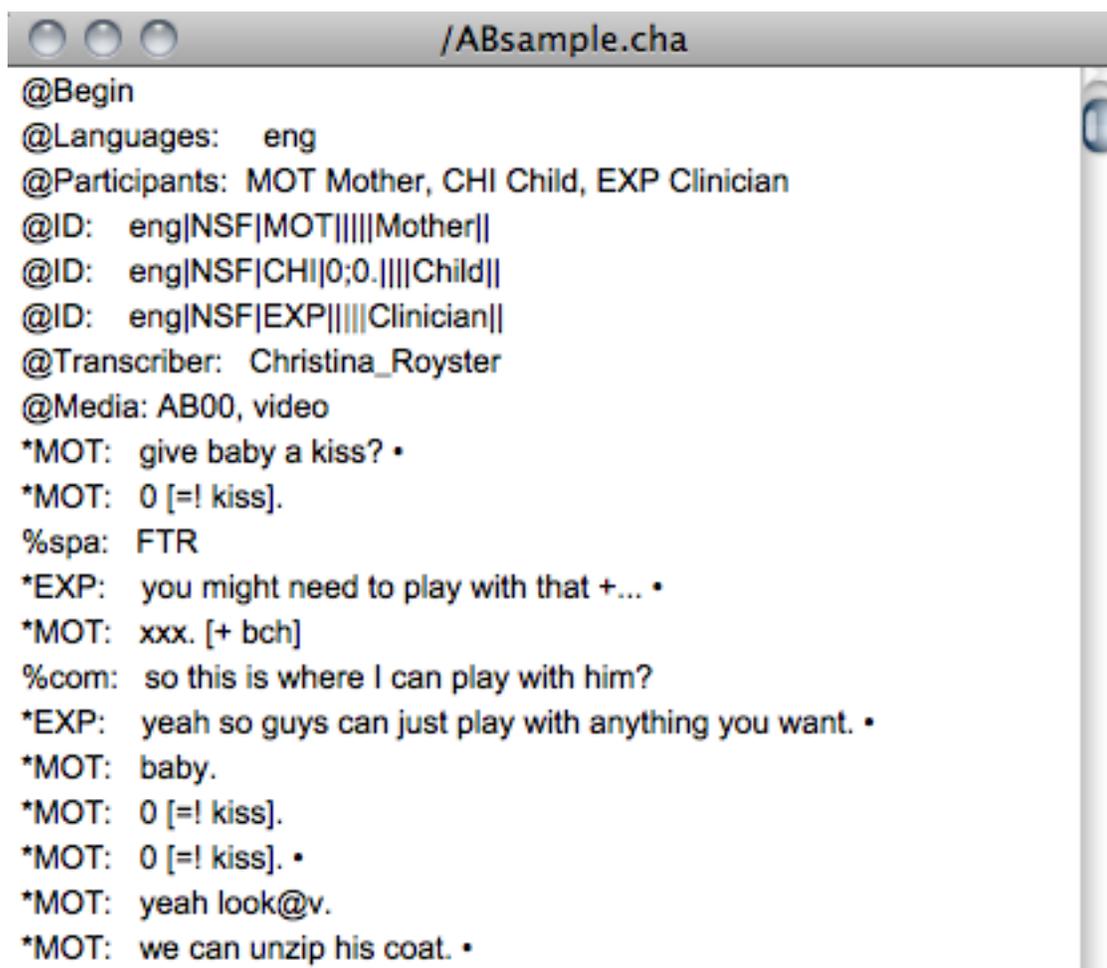
```
○ ○ ○                    /ABsample.cha
@Begin
@Languages:      eng
@Participants:  MOT Mother, CHI Child, EXP Clinician
@ID:    eng|NSF|MOT|||||Mother||
@ID:    eng|NSF|CHI|0;0.||||Child||
@ID:    eng|NSF|EXP|||||Clinician||
@Transcriber:  Christina_Royster
@Media: AB00, video
*MOT:   give baby a kiss? •
*MOT:   0 [=! kiss].
%spa:   FTR
*EXP:   you might need to play with that +... •
*MOT:   xxx. [+ bch]
%com:   so this is where I can play with him?
*EXP:   yeah so guys can just play with anything you want. •
*MOT:   baby.
*MOT:   0 [=! kiss].
*MOT:   0 [=! kiss]. •
*MOT:   yeah look@v.
*MOT:   we can unzip his coat. •
```

Appendix C: Additional Transcription Rules

<u>Vocatives @v:</u> All vocatives should be tagged with @v at the end of the word, except for a gasp is tagged with a comment line so that it is not counted as a word. Example below:

*MOT: 0 [=! gasp] look over there!

%com: gasp@v

In addition, only one vocative per utterance is coded.

<u>Inhibitory Words @i</u>*:* All inhibitory words are tagged with @i at the end of the word, example below. Only one inhibitory word per utterance is coded.

*MOT: no@i no stop Johnny@v!

<u>Terms of Endearment @t:</u> All terms of endearment are tagged with @t at the end of the word, example below. If a mother uses a nickname for the child all the time and never uses the child's full name, this is not considered a pet name.

*MOT: there you go sweetie@t.

If a term of endearment also serves as a vocative, it is coded as:

*MOT: sweetie@t@v come here!

<u>Contingency %spa:</u> Speech acts are coded on an additional tier line, example below. The abbreviations from the INCA-A codes should be used.

*MOT: it's okay honey@t you didn't fall too hard.

%spa: CMO

<u>Repetitive Words:</u> If another repeats a word more than twice in an utterance, it is written once and coded with the number of times it is used. If it is used twice, the word is written twice, examples below.

*MOT: dance [x 6].

*MOT: dance dance.

Appendix D: Inhibitory Words
    ahah@i
    can't@i
    careful@i
    chairs@i
    don't@i
    enough@i
    gentle@i
    get_away@i
    nah@i
    no@i
    not@i
    nope@i
    sit@i
    stop@i
    wait@i

Appendix E: Vocatives
    ay@v
    baba@t@v
    baby@t@v
    baby@v
    boo@t@v
    boo@v
    bud@t@v
    buddy@t
    buddy@t@v
    buddy@v
    babycakes@t@v
    babycakes@v
    bud@t@v
    citas@v
    citaswitas@t@v
    dude@t@v
    eyes@v
    kiddo@v
    gasp@v
    hello@v
    here@v
    hey@v
    hi@v
    honey@t@v
    honey@v
    kiddo@t@v
    kiddo@v
    lil_girl@t@v

lil_girl@v
look@v
lookie@v
lookit@v
mama@t@v
mama@v
oh@v
ooh@v
see@v
stickybutt@t@v
stickybutt@v
stinkygirl@t@v
sweetheart@t
sweetheart@t@v
sweetie@t@v
sweetie@v
watch@v
whistle@v

Note: Children's names are not included in this list to protect the identity of participants

Appendix F: Terms of Endearment
baba@t@v
baby@t
baby@t@v
babycakes@t@v
big_boy@t
boopers@t
boo@t
boo@t@v
boy@t
bub@t
bud@t@v
buddy@t
buddy@t@v
Citaswitas@t
dude@t
dude@t@v
girl@t
honey@t
honey@t@v
hun@t
love@t
kiddo@t
kiddo@t@v

Kitkat@t
lil_girl@t
lil_girl@t@v
mama@t
mama@t@v
stickybutt@t
sweetheart@t
sweetheart@t@v
sweetie@t
sweetie@t@v

Note: Children's nicknames are not included in this list to protect the identity of participants

Appendix G: Means and Standard Deviations of Group Differences

	AFFECTED		CONTROL	
	Mean	SD	Mean	SD
MLU	3.747	0.874	3.555	0.574
Utterances	199.750	53.128	186.167	66.897
Word Types	181.000	48.889	165.333	40.306
Words	632.833	247.835	595.167	240.254
VocD	0.308	0.081	0.305	0.084
Voc Prop	0.188	0.059	0.190	0.114
ToE Prop	0.013	0.018	0.009	0.003
Inhib Prop	0.026	0.022	0.054	0.008
Cot Prop	0.303	0.083	0.360	0.078
Pitch SD	84.392	14.222	84.745	9.892
R Lang	42.558	6.882	50.417	2.382
E Lang	47.667	9.948	57.750	3.631
BAP Total	85.833	26.707	86.773	16.543
BAP Aloof	29.917	10.681	30.091	7.120
BAP Prag	24.500	8.501	25.409	1.428
BAP Rigid	31.417	10.492	31.273	7.044
FTR Prop	0.031	0.022	0.016	0.013

Key:
Voc= Vocatives
ToE= Terms of endearment
Inhib= Inhibitory Words
Cot= Contingency
R Lang= Receptive Language
E Lang= Expressive Language
BAP Prag= BAP Pragmatic
FTR Prop= Failure to respond proportion

Appendix H: BAP Spearman Rank Order Correlation Matrices

BAP Pragmatic

Correlations

			BAPTotal	MLU
Spearman's rho	BAPPrag	Correlation Coefficient	.831**	-.031
		Sig. (2-tailed)	.000	.888
		N	23	23
	Pitch SD	Correlation Coefficient	-.105	-.564**
		Sig. (2-tailed)	.634	.004
		N	23	24
	Contingency Proportion	Correlation Coefficient	-.160	-.051
		Sig. (2-tailed)	.465	.812
		N	23	24
	BAPTotal	Correlation Coefficient	1.000	-.105
		Sig. (2-tailed)	.	.634
		N	23	23
	MLU	Correlation Coefficient	-.105	1.000
		Sig. (2-tailed)	.634	.
		N	23	24

BAP Rigidity

Correlations

			BAPRigid	VocD	Inhibitory Propportion
Spearman's rho	BAPRigid	Correlation Coefficient	1.000	.275	-.421*
		Sig. (2-tailed)	.	.205	.045
		N	23	23	23
	VocD	Correlation Coefficient	.275	1.000	-.432*
		Sig. (2-tailed)	.205	.	.035
		N	23	24	24
	Inhibitory Propportion	Correlation Coefficient	-.421*	-.432*	1.000
		Sig. (2-tailed)	.045	.035	.
		N	23	24	24

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

BAP Aloof

Correlations				Vocative Proportion
Spearman's rho	BAPAloof	Correlation Coefficient		-.230
		Sig. (2-tailed)		.291
		N		23
	Endearment Proportion	Correlation Coefficient		.160
		Sig. (2-tailed)		.454
		N		24
	Vocative Proportion	Correlation Coefficient		1.000
		Sig. (2-tailed)		.
		N		24

Appendix I. Mean Scores of Alternate Differentiation Analysis

	Mother-Child-	Mother-Child+	Mother+ Child-	Mother+ Child+
MLU	3.56	3.68	3.6	3.04
Pitch SD	88.17	84.45	85.43	87.89
Contingency Prop	0.36	0.31	0.36	0.29
D	0.29	0.28	0.35	0.31
Inhibitory Prop	0.05	0.03	0.06	0.02
Vocative Prop	0.19	0.22	0.17	0.2
Endearment Prop	0.02	0.01	0.01	0.005

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