ABSTRACT

Title of Thesis: THE EFFECTS OF MATERNAL DEPRESSION ON SPEECH TO PRE-SCHOOL CHILDREN: IMPLICATIONS FOR LANGUAGE DEVELOPMENT

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We examined whether a past history of maternal depression affects the manner in which mothers speak to their children, and whether any differences relate to child language development. To do this, we measured acoustic, temporal and content-based speech/language characteristics of 40 pre-school-aged children and mothers with and without a history of depression. Results indicated that children of mothers with a past history of depression exhibited significantly lower vocabulary scores than children of mothers unaffected by depression. However, no maternal speech/language variables appeared to account for this difference. Maternal pitch variability and number of negative utterances both were found to correlate with child vocabulary scores; however, neither variable was found to relate to prior depression status. We discuss possible explanations for these findings and implications for child language development.

THE EFFECTS OF MATERNAL DEPRESSION ON SPEECH TO PRE-SCHOOL
CHILDREN: IMPLICATIONS FOR LANGUAGE DEVELOPMENT

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

The effects of maternal depression on speech to pre-school children: Implications

for language development

Maternal depression is a major health concern (Hammen, 2009). Major depressive

disorder (MDD) has the highest lifetime prevalence of all DSM-IV disorders and women

are 70% more likely than men to experience depression at some point in their lives

(Kessler et al., 2005). The average age of onset for a major depressive episode is 32 years

old, around the time when many women are raising children (Kessler et al., 2005). The

children of depressed mothers are at risk for negative outcomes including behavioral

problems (Brennan et al., 2000), difficulties problem-solving (Nolen-Hoeksema,

Wolfson, Mumme, & Guskin, 1995), and lower receptive and expressive language

abilities (Brennan et al., 2000; Cox, Puckering, Pound, & Mills, 1987).

These adverse outcomes have been attributed to genetic (e.g., Milne et al., 2009),

biological (e.g., Dougherty, Klein, Olino, Dyson, & Rose, 2009), neurological (e.g.,

Dawson et al., 2003) and environmental (e.g., Frankel & Harmon, 1996) causes. The

present study seeks to further investigate one of the proposed environmental causes: the

ways in which depressed mothers interact with their children. Specifically, this study will

examine the child-directed speech of mothers with a history of depression, analyzing both

the linguistic (what the mother says) and non-linguistic (how she says it) aspects of the

mothers' speech.

Child-directed Speech

During parent-child interactions (PCIs), parents typically use a special kind of

speech known as infant-directed or child-directed speech (IDS or CDS, respectively).

Some characteristics of CDS include higher pitch (e.g., Jacobson, Boersma, Fields, &

Olson, 1983; Warren-Leubecker & Bohannon, 1984), exaggerated intonation patterns (Fernald & Simon, 1984), reduced complexity, and increased repetitiveness (e.g., Snow, 1972).

Babies as young as two days old demonstrate a preference for listening to IDS over adult-directed speech (ADS; Cooper & Aslin, 1994); and IDS has been thought to contain important input for children's development and mastery of language (Hoff-Ginsberg & Shatz, 1982). Fernald (1989) found that the intonation patterns of IDS play a significant role in conveying the meanings of words and sentences. Adult participants listened to IDS and ADS samples that had been low-pass filtered such that only the intonation patterns of the speech remained, but the linguistic content was not comprehensible. Participants were asked to choose which of five communicative intents best represented each sample. The communicative intents of samples spoken in IDS were more accurately identified than those spoken in ADS, suggesting that the prosodic cues of IDS may communicate meaningful information to the listener.

One benefit of IDS is that it may help increase the salience of new words and thus facilitate word-learning. Golinkoff and Alioto (1995) found that adults who learned Chinese words in IDS performed significantly above chance on a recognition memory test and significantly better than those adults who had learned the words in ADS. Mothers have been found to significantly increase their pitch when introducing new words to infants, indicating that mothers may be aware (either consciously or unconsciously) of the potential benefits of using IDS (e.g., Fernald & Mazzie, 1991). Likewise, Scheffel and Ingrisano (2000) found that mothers used slower speech, increased fundamental

frequency $(F_0)^1$, and increased amplitude to highlight specific segments while reading a book to their four-year-old children. Mothers of language-impaired children were found to employ these speech changes even more so than mothers of typically developing children, suggesting that mothers perceive these adjustments to be helpful in the language learning process.

Singh, Morgan, and Best (2002) examined how the affective quality of IDS impacted infants' attention. In a series of experiments, six-month-old infants listened to IDS and ADS samples varying in affective tone (happy, sad, or neutral). Results revealed that the infants attended for longer time periods to the more positive (i.e., happier) stimuli regardless of speech register (IDS vs. ADS). For example, the infants preferred to listen to happy ADS over neutral IDS. These results suggest that it is the "happy" quality to IDS that may be most important in capturing and maintaining an infants' attention.

Another speech register that has been shown to be beneficial for learning and comprehension is known as clear speech. Clear speech is the term used to describe the speech produced when a speaker wants to ensure that his or her message will be well understood by the listener. Clear speech shares many characteristics with CDS including a slower speaking rate and wider pitch range. Many groups of people benefit from the use of clear speech including children, listeners with a hearing impairment, and listeners in noisy environments. For each of these groups, the use of clear speech enhances the intelligibility of the signal (for a review, see Smiljanic & Bradlow, 2009). Because clear speech shares certain characteristics with CDS, it is likely that CDS provides a similar benefit.

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[1] Fundamental frequency refers to the rate of vocal cord vibration. The perceptual correlate of fundamental frequency is voice pitch (Yost, 2007).

Vocal Correlates of Depression

Eeyore from the *Winnie the Pooh* movies is often "down in the dumps". He speaks slowly, in a monotone voice, and always seems to have a negative outlook. Many of the characteristics of Eeyore's speech are, in fact, typical of individuals experiencing sadness or depression (Siegman, 1987). Depressed individuals tend to speak more slowly, include more pauses in their speech, pause for longer periods, and have less variability in their pitch than non-depressed individuals (Ellgring & Scherer, 1996; Mundt, Snyder, Cannizzaro, Chappie, & Geralts, 2007). Depressed individuals also demonstrate a reduced stress pattern (i.e., all words/syllables are given equal emphasis), have reduced vocal intensity, lack loudness variation, and tend to lose power over the course of an utterance (Alpert, 1983; Darby, Simmons, & Berger, 1984).

Breznitz (2001) examined the speech of a specific group of depressed individuals, depressed mothers. Depressed and non-depressed mothers were asked to discuss their own moods, their child's moods, and their husband's moods. The speech of the depressed mothers reflected greater feelings of sadness and anger than did that of the non-depressed mothers. Non-depressed mothers changed F_0 depending on which mood state was being discussed (happy sad, angry, or neutral), whereas depressed mothers' F_0 remained relatively constant throughout the various moods. Non-depressed mothers also displayed a higher average F_0 than depressed mothers and the depressed mothers took longer pauses and produced shorter vocalizations than did the non-depressed mothers. Currently depressed mothers or those with a history of depression have also been found to provide more negative content about their children when speaking about their infants (Barnes et

al., 2007), toddlers (Gravener et al., 2011), and school-aged children (Tompson et al., 2009).

Maternal Depression and CDS

Whereas the studies just mentioned examined depressed mothers' speech directed to an adult listener, many other studies have examined depressed mothers' speech while interacting with their children. Studies have examined both linguistic and non-linguistic aspects of maternal CDS in a variety of situations. The following is an overview of the findings of some of these studies.

Affect. Differences in the affective tone of PCIs have been found between depressed and non-depressed mothers, with depressed mothers displaying less sensitivity and more hostility in their interactions with their infant (e.g., Kaplan, Burgess, Sliter, & Moreno, 2009) as well as pre-school-aged children (e.g., Hwa-Froelich, Cook, & Flick, 2008). Murray, Kempron, Woolgar, and Hooper (1993) examined play interactions between two-month old infants and their mothers. Some of the mothers had experienced post-partum depression, some had experienced depression before their pregnancy (but not in the post-partum period), and some had no history of depression. Findings revealed that those mothers who had experienced post-partum depression expressed more negative emotions in their interactions than either of the other groups. Mothers who had experienced depression before their pregnancy did not differ from control mothers in the amount of negative emotions expressed. In another, similar play interaction (Stanley, Murray, & Stein, 2004), depressed mothers interacting with their three-month-old children were more negative and less positive in their responses to their children than were non-depressed mothers. Additionally, the depressed mothers were less attuned to

changes in the affective states of their infants. Field, Healy, Goldstein, and Guthertz (1990) found that depressed mothers matched their three-month-old infants' affective state more often when the infant was in a negative state (e.g., angry, disengaged) than when he/she was in a positive (e.g., play) state. Recently, these results have been extended to infants interacting with their depressed fathers (Sethna, Murray, & Ramchandani, 2012). Depressed fathers were found to produce more negative comments and fewer utterances related to their infant's psychological state than non-depressed fathers.

Herrera, Reissland, and Shepherd (2004) found that depressed mothers differed from non-depressed mothers in their use of affective speech directed to their 6-month-old and 10-month-old infants. Depressed and non-depressed mothers were observed playing with their infants and maternal speech was coded as either affect-salient or information-salient. Affect-salient speech involved expressive statements and included mimicking, laughing, and encouragement. Information-salient speech was fact-based and included direct statements and interpretations of the situation. Over the first year of a child's life, parents typically progress from an emphasis on affect-salient speech to an emphasis on information-salient speech (Bornstein et al., 1992). Whereas non-depressed mothers used more affective speech toward younger infants and less toward older infants, depressed mothers displayed the opposite pattern (Herrera et al., 2004). Herrera et al. (2004) concluded that these findings might be indicative of the fact that these mothers are unable to recognize their child's changing needs.

Although mothers increase the proportion of information-salient speech as children grow older, discussions about feelings and emotions remain important

throughout a child's life (Bretherton, Fritz, Zahn-Waxler, & Ridgeway, 1986). Depressed

mothers have been found to discuss emotions with their children in a way that differs

from that of non-depressed mothers. Zahn-Waxler, Ridgeway, Denham, Usher, and Cole

(1993) found that non-depressed mothers are more likely than depressed mothers to

provide their children with reasons why an emotion occurs, especially a positive emotion.

Depressed mothers, on the other hand, are more likely to emphasize negative emotions

without providing reasons for the emotion's occurrence (as cited in Free, Alechina, &

Zahn-Waxler, 1996, p. 784). Additionally, depressed mothers are less accurate in their

identification of and explanation about emotions. In a study by Free et al. (1996), mothers

with and without a history of depression were asked to look at pictures of various

emotions with their pre-school-aged children. Mothers with untreated past depression

were found to be significantly less accurate in their descriptions of the pictures than were

mothers undergoing treatment or those without a depression history.

The ability to correctly identify and discuss emotions, thoughts, and feelings may

be beneficial for a child's development. Ensor and Hughes (2008) examined maternal use

of mental state words and their relation to child outcomes. Findings revealed that children

whose mothers made more cognitive references demonstrated better social understanding

at ages two, three, and four. Cognitive references included terms such as *think*, *know*, and

forget.

Responsiveness. The PCIs of depressed mothers have frequently been categorized

into two interaction styles: intrusive and withdrawn (Field, Hernandez-Rief, & Diego,

2006). In intrusive interactions, the mother appears overly involved in the child's actions.

Cornish, McMahon, and Ungerer (2008) investigated mothers affected and unaffected by

depression interacting with their 15-month-old children. Although few differences were found among the mothers, both mothers with a history of depression and those with current depression were rated as more intrusive than mothers with no depression history. In withdrawn interactions, the mother often appears unresponsive to the child and disengaged from the task at hand. A meta-analysis by Lovejoy, Graczyk, O'Hare, and Neuman (2000) found a moderate association between maternal depression and disengaged interactional styles, which included ignoring the child and silence during gaze aversion. Similarly, Milgrom, Westley, and Gemmill (2004) found that depressed mothers were less sensitive in responding to their six-month-old infants' needs than were non-depressed mothers.

Maternal responsiveness has been found to impact children's language and social development (e.g., Ensor & Hughes, 2008; Tamis-LeMonda, Bornstein, & Baumwell, 2001). Tamis-LeMonda et al. (2001) observed mothers as they interacted with their 9- and 13-month-old children. The researchers examined six types of maternal verbal responses: affirmations, imitations of the child's vocalizations, descriptions, questions, play prompts, and exploratory prompts (e.g., "Look at this!"). Their findings revealed that each type of verbal response contributed to a child's expressive language abilities at some point in development. Similarly, Ensor and Hughes (2008) found that the more connected turns a mother took with her two-year-old child, the better the child's social understanding at age four. Maternal connected turns were defined as those in which the mother's utterance was semantically related to the child's previous utterance. Mothers suffering from depression have been found to be impaired in their ability to produce these types of contingent utterances (e.g., Downey & Coyne, 1990; Field et al., 1990).

Similarly, Katz (2009) found that depressed mothers interacting with their three-year-old children during a book-reading task produced fewer confirmatory utterances (e.g., "You're right.") than did non-depressed mothers.

Timing and Synchrony. While maternal contingency may refer to the relationship of the mother's speech content to that of her child's, it may also refer to the timing of the mother's response to her child's vocalizations. In other words, a contingent maternal response occurs at an expected point in the interaction (e.g., directly after the child verbalizes) and not during unexpected times (e.g., in the middle of the child's verbalization) (Watson, 1979). Depressed mothers tend to display less contingent timing than do non-depressed mothers (e.g., Breznitz, 1997). While interacting with their infants, depressed mothers have been found to have longer and more variable response latencies than non-depressed mothers (Bettes, 1988; Zlochower & Cohn, 1996). This demonstrates that depressed mothers are less able to synchronize with their children's vocalizations and thus less able to respond predictably.

Synchrony involves accommodating to the speaking style of one's conversational partner. Partners tend to synchronize on variables such as speech rate, response latency, and amplitude (Giles, Coupland, & Coupland, 1991). The ability to converge one's own speech with that of one's partner has been shown to be an advantageous skill for a speaker to possess. In studies with adults, individuals who converged their speech rate and response latencies with those of their speaking partner were rated more positively than those who did not converge (Buller & Aune, 1992; Putnam & Street, 1984).

Breznitz and Sherman (1987) measured amount of time spent speaking and average length of switching pauses during mothers' interactions with their three-year-old

children. Mother-child dyads were observed while the mother prepared lunch, while lunch was eaten, and while the parent and child prepared to be visited by a "doctor." The "doctor" scenario was meant to be mildly stressful. During the lunch scenarios, depressed women were found to speak significantly less to their children than were healthy mothers and, although not significant, there was a trend for depressed women to take longer than non-depressed women to respond to their children's vocalizations. In the stressful condition, depressed women significantly increased their amount of speech and although both depressed and non-depressed mothers decreased their response latencies, depressed mothers did so to a greater extent. These results demonstrate that depressed mothers typically speak less and with longer pauses than non-depressed mothers, but display the opposite pattern when faced with a mildly stressful scenario.

Further analysis by Breznitz (1997) examined the coordination in the vocal behaviors of the mother-child dyads. In other words, how well did the mothers and children accommodate to one another's speech rate and pause durations? Findings indicated that all of the non-depressed participants were able to successfully accommodate their speech, whereas only two of the ten depressed participants were able to accommodate. This provides further evidence of the difficulties depressed individuals may have in attuning to their speaking partners.

Pitch. Depressed mothers have also demonstrated differences in the pitch of their CDS. Bettes (1988) analyzed audio clips of mothers and their infants interacting at home to determine if depressed mothers' speech conformed to the typical exaggerated intonation patterns of IDS. Almost all utterances produced by non-depressed mothers did conform to these intonation patterns. A full quarter of the depressed mothers' utterances,

however, completely lacked an exaggerated intonation contour. The more depressed the mother (according to a self-report questionnaire), the less likely she was to use an exaggerated intonation pattern. This finding of a less exaggerated intonation contour in the IDS of depressed mothers has been replicated in other studies (Kaplan, Bachorowski, & Zarlengo-Strouse, 1999; Kaplan et al., 2009).

Reissland and Shepherd (2006) also found F_0 differences between depressed and non-depressed mothers. Mothers and infants played together with a Jack-in-the-box toy and the F_0 of the mothers' first vocalization of surprise was measured. Pitch is an important component in identifying moments of surprise and surprise vocalizations tend to contain a higher minimum pitch than most other types of vocalizations (Sauter, Eisner, Caulder, & Scott, 2010). Depressed mothers' surprise vocalizations were significantly lower in F_0 than the vocalizations of non-depressed mothers.

Breznitz (1997) replicated the findings that mothers with depression exhibit a lowered and less variable F_0 in a sample of mothers and their pre-school-aged children. Katz (2009) also analyzed mothers' F_0 in a pre-school-aged sample; however, no significant differences were obtained between depressed and non-depressed participants. Katz (2009), however, did not control for depression history and thus some mothers with a past history of depression may have been included in the control group, which may have impacted results. Further research is necessary to determine whether these pitch differences in the CDS of depressed and non-depressed mothers toward their infants can be extended to the CDS toward older children.

Impact on Children

Results of the above studies indicate that the CDS of mothers with depression and/or a depression history differs from that of non-depressed mothers. What impact, then, do these differences have on the children of depressed parents?

Children's language development is influenced, in part, by the input they receive (Huttenlocher, 1998) and mothers, as the typical primary caregivers, are often one of the main sources of a young child's verbal input. In a study by Hoff-Ginsberg (1986), it was found that certain structural (e.g., noun phrase usage) and functional (e.g., wh- questions) aspects of mothers' speech contributed to increased complexity in their two-year-old children's grammars. Similar results have been found for parents interacting with their four-year-old children (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002).

Because parental input is important to a child's language development, any alterations to this input may have negative consequences. The children of depressed mothers have demonstrated lower language scores than the children of non-depressed mothers at age one (Quevedo et al., 2011) and age three (Stein et al., 2008). Stein et al. (2008) found that maternal depression at child age 10 months was associated with poorer caregiving at child age 36 months, which was in turn associated with lower child language scores at age 36 months. Therefore, Stein et al. (2008) were able to pinpoint poor caregiving as the mechanism by which maternal depression influenced child language. The NICHD (1999) study found similar results in that currently depressed mothers and mothers with a history of depression tended to be rated as less sensitive than non-depressed mothers in their interactions with their children and that this lower sensitivity contributed to lower language outcomes at age three. La Paro, Justice, Skibbe,

and Pianta (2004) found a relationship between maternal depression and language outcomes in a group of children at risk for language problems. Children identified as having Specific Language Impairment at age three were more likely to persist with their language impairment at age 4.5 if their mothers were depressed and displayed less sensitive parenting. Mother-child affective synchrony during infancy has also been found to have an impact later in life. Children whose mothers were more attuned to their affective states during infancy displayed fewer behavioral problems, higher verbal scores, and greater empathy than did children whose mothers were less attuned to their affective states during infancy (Feldman, 2007).

Free et al. (1996) examined the impact of maternal depression on pre-school children's abilities to identify emotions. Results indicated that children of mothers with untreated depression were poorer at identifying negative emotions than were children of control mothers or mothers who had undergone psychotherapy for their depression. Children of treated mothers performed similarly to control mothers. It is important to note, however, that group assignment for this study was not randomized. Those mothers undergoing therapy had made the choice to do so previous to their enrollment in the study. Therefore, they may have differed from the untreated group in other ways (e.g., motivation for recovery).

In regard to the impact of the temporal variables of CDS on children, it has been found that mothers with depression talk less to their children, in part due to longer pausing and slower speech (Breznitz & Sherman, 1987; Rowe, Pan, & Ayoub, 2005). Children receiving less input from their mothers display slower vocabulary growth over time (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Breznitz and Sherman (1987)

found that not only did depressed mothers speak less to their children than did non-depressed mothers; there were also differences in the amount of speech produced by the children in each group. Children of depressed mothers produced less speech than did the children of non-depressed mothers.

As mentioned previously, depressed mothers often have trouble synchronizing with their children and do not respond with predictable pause intervals (Bettes, 1988; Zlochower & Cohn, 1996). Conversational participants who are able to adapt pause durations and speech rates similar to their partners' are viewed more positively than those who do not adapt (Putnam & Street, 1984). It is fair to assume, therefore, that mothers who are poorer at synchronizing may have more trouble relating to their children and/or their children may have more trouble relating to them.

Kaplan et al. (1999) investigated the effects of maternal pitch on the learning abilities of infants (2-6 month olds) using a conditioned attention paradigm. In the training phase, infants were presented six times with a short clip of IDS spoken by either a depressed or non-depressed mother followed by the presentation of a picture of a smiling face. During the test phase, infants were presented with a checkerboard image, which was paired with the same IDS clip heard during training for some trials and paired with silence during the others. Time spent looking at the checkerboard image was measured as the dependent variable. Results revealed that those infants who had listened to the IDS of mothers with more depression symptoms had a smaller mean looking time during the test phase than did infants who had listened to IDS of mothers with fewer symptoms of depression. Kaplan et al. (1999) interpreted this to mean that children

listening to non-depressed mothers' speech were better able to learn the association between the voice and a smiling face.

In this same study, as mentioned previously, Kaplan et al. (1999) found that depressed mothers were more likely to produce unmodulated utterances (the utterances lacked pitch changes), which were the least likely to facilitate learning. Kaplan et al. (2002) extended the findings from Kaplan et al. (1999) to show that children of depressed mothers were able to learn when listening to non-depressed mothers' speech, but not the speech of their own mothers. A more recent study (Kaplan et al., 2009), however, failed to find a significant relationship between less modulated F_0 and learning impairment. In this study, depressed mothers produced utterances with a smaller range of F_0 than did non-depressed mothers, and infants did not learn as well from the IDS of depressed mothers as they did from the IDS of non-depressed mothers; however, there was no direct relationship between F_0 and learning. What did influence infant learning, however, was maternal sensitivity, which was rated as lower in the depressed mothers.

Stanley et al. (2004) also found no effects of maternal depression on infant learning. Three-month-old infants of mothers with and without depression/depression history viewed an animated cartoon image on a screen that was activated if they moved their arms. Amount of arm movement was recorded as a measure of infant learning, but no differences were found among the depression groups. However, about 61% of the 124 participants did not complete this task, resulting in a significantly reduced sample size. Stanley et al. (2004) also conducted a still-face perturbation task in which the mothers were asked to engage with their infants as they would normally and then stop reacting to their infants for a short period of time (e.g., by maintaining a neutral expression and

refraining from touching/talking to the infant). Infants' attempts to re-engage the mother were measured and again, no differences were found among the groups. The fact that the mothers were asked to act for this part of the study may have been problematic, as it is possible that depressed and non-depressed mothers may differ in their ability to carry out this kind of task.

Murray, Marwick, and Arteche (2010) found that adolescent children of depressed mothers were more likely to have an affective disorder (e.g., depression) than were the children of non-depressed mothers. More important, however, is the fact that the researchers were able to identify maternal CDS during infancy as a unique contributor to the development of affective disorders. In other words, maternal CDS during infancy mediated the relationship between maternal depression and child mental health status during adolescence, with depressed mothers using more repeated falling intonation patterns than non-depressed mothers.

Summary

In general, the literature reviewed above provides a solid basis from which to further investigate the CDS of depressed mothers. There are, however, some important limitations that warrant discussion. Many of the earlier studies on this topic (e.g., Bettes, 1988; Breznitz & Sherman, 1987) used recording methods that pale in comparison to more recent technology. In fact, Breznitz (1997) had to discard about half the recordings when re-analyzing data from Breznitz & Sherman (1987) due to poor quality. In many of the studies that examined face-to-face interactions between mother and child, it is difficult to parse out the impact of speech over other communicative signals (e.g., body language, facial expression). Murray et al. (2010) note that facial expression may have

been a confounding variable in their study of mothers interacting with their 2- to 3-month olds. Definitions of depression varied from study to study with some relying on self-report measures (e.g., Bettes, 1988) to determine depression status and others relying on clinician expertise based on interviews with the mothers (e.g., Katz, 2009). Additionally, increased or decreased variability in the samples of some studies may have impacted results. Some researchers (e.g., Kaplan et al., 1999) included in their samples individuals suffering from other mood disorders, including Bipolar Disorder and Generalized Anxiety Disorder. Gravener et al. (2011) included individuals with a past history of depression, but did not account for the fact that some mothers may have also been depressed at the time of the study. Other studies included individuals selected from a more at-risk population. The sample in the study by Cornish et al. (2008) consisted of mothers recruited from facilities for parents of infants with severe difficulties settling and/or feeding. Maternal sensitivity for this group as a whole (both depressed and non-depressed mothers) was lower than what would be expected in a typical community sample and this may have been why few differences were found between the depressed and non-depressed groups.

Overall, previous research indicates that depressed mothers differ from non-depressed mothers in the ways they interact with their young children and there is evidence that these interactions may have negative consequences for the children. Further questions still remain, however, regarding the specific pathways through which mother-child interactions lead to these effects on the child: (1) What components of the interaction are most important for later child outcomes? Previous research has shown that depressed mothers exhibit a number of different speech characteristics from non-

depressed mothers in dimensions such as affective tone, responsiveness, speech rate, and pitch. Do these speech differences all have similar impacts on later child outcomes, or are some speech characteristics more important than others? (2) As children grow older, does maternal speech continue to differ between mothers affected by depression and those who are unaffected? The majority of the current literature investigates depressed mothers' speech toward infants and toddlers. Much less research has been done on the pre-school age group. (3) Finally, do any of the speech differences associated with depression continue to persist as depression remits or are mothers with a past history of depression similar to non-depressed mothers in their interactions with their children? The present study hopes to answer these questions and further the understanding of the impact of depression on mother-child interactions.

The Present Study

The present study seeks to examine the CDS of mothers with and without a history of depression as they speak to their three-year-old children during structured teaching tasks. The two tasks examined in this study involved the mother and child looking together at a wordless picture book and completing a categorical naming task in which the mother helped her child name as many items with wheels as he/she could. Shared picture book reading has been found to increase expressive language abilities (Whitehurst et al., 1988) and the quality of depressed mothers' shared book reading has been found to differ from that of non-depressed mothers (Reissland, Shepherd, & Herrera, 2003). During this task, the mother had to maintain the child's attention to keep him/her focused on the story. By using a book without words, the amount of reading was decreased, allowing for a greater amount of spontaneous maternal speech. The

categorical naming task also required the mother to keep her child engaged and allowed

for spontaneous conversation. Additionally, because this type of task can lead to

frustration from the child, the mother needed to be able to problem-solve this type of

reaction and encourage her child to continue. Mothers with a history of depression may

be less adept at handling these types of situations as they tend to respond more poorly in

PCIs than do non-depressed mothers (Field et al., 2006). Both PCI activities were

language-based tasks that allowed for spontaneous speech from both the mother and the

child, while still providing enough structure to confidently compare samples among the

mother-child dyads.

Six properties of maternal CDS will be examined in the present study: (1)

proportion of mental state words, (2) proportion of negative utterances, (3) amount of

contingent content, (4) total amount of speech produced, (5) speech rate, and (6)

variability of F_0. The first three variables examine the linguistic content of the mothers'

speech and the final three examine the non-linguistic aspects.

Maternal mental state words were chosen because of the importance of discussing

feelings and emotions with young children (Bretherton et al., 1986) and the relationship

of parental mental state word use to later child outcomes (Ensor & Hughes, 2008).

Depressed mothers' inability to adjust to their child's affective needs (Herrera et al.,

2004) and their difficulties identifying and explaining emotions to their children (Zahn-

Waxler et al., 1996) may impact their use of mental state words. Maternal use of negative

utterances was chosen because it has been shown to be a differentiating factor between

the CDS of depressed and non-depressed mothers interacting with their infants (e.g.,

Murray et al., 1993; Stanley et al., 2004). Maternal contingent content was chosen as a

measure of maternal responsiveness. As discussed, maternal responsiveness relates to later child language outcomes (e.g., Ensor & Hughes, 2008; Tamis-LeMonda et al., 2001) and depressed mothers' lack of responsiveness may negatively impact their children later in life (e.g., Milgrom et al., 2004).

Amount of overall speech produced by the mothers was chosen because previous studies have found differences in this variable between depressed and non-depressed mothers (e.g., Breznitz & Sherman, 1987; Rowe et al., 2005). Additionally, amount of maternal speech has been shown to impact child language development (Huttenlocher et al., 1991). The temporal variable of speech rate was chosen because of its importance in establishing conversational synchrony, which improves communicative interactions (Giles et al., 1991). Since speech rate is often affected by depressed mood (Ellgring & Scherer, 1996; Mundt et al., 2007), it is likely that the CDS of mothers with a history of depression will exhibit a slower rate than the CDS of non-depressed mothers. The variable F_0 variability was selected because it also appears to be affected by depressed mood (Breznitz, 2001; Ellgring & Scherer, 1996; Mundt et al., 2007), has been a significant factor in IDS studies (e.g., Reissland, 2003; Reissland & Shepherd, 2006), and may have an impact on child learning (Kaplan et al., 1999).

The present study seeks to further the current research in three ways:

(1) Although many studies have examined the CDS of depressed mothers speaking to their infants, fewer have examined maternal speech directed at pre-school-aged children. The pre-school years (ages three to five) are important for language development. It is during these years that children typically begin to understand grammar, increase their vocabulary, and improve their conversational skills (Hoff, 2001).

Although the characteristics of CDS (e.g., higher pitched, more repetitions) are not as exaggerated toward pre-school-aged children as they are toward infants, mothers still increase their mean pitch value (Warren-Leubecker & Bohannon, 1984) and pitch range (Garnica, 1977) when addressing children as old as five. While few studies have examined whether these pitch changes continue to benefit these older children, we take as our starting point the notion that typical speech patterns are likely to be beneficial to young children and that deviations from this norm are less likely to accrue the same benefits.

(2) The present study examines the speech of mothers with a history of depression, whereas previous research has focused mainly on mothers' current depressive symptoms (e.g., Bettes, 1988; Reissland et al., 2003). The occurrence of subsyndromal symptoms in patients with a history of depression is quite common (Boland & Keller, 2009), which is why it would not be unexpected to find differences in the CDS of mothers with a depression history. Those studies that have investigated maternal depression history have had mixed results. Stein et al. (2008) found that in a sample of three-year-old children and their mothers, maternal depression history was more predictive of poorer parenting and poorer child language scores than was current depression. Cornish et al. (2008) found that mothers with a history of depression were more intrusive in their interactions with their infants than were non-depressed mothers regardless of current depression status.

On the other hand, studies of depressed individuals have found changes in the linguistic and non-linguistic aspects of the individuals' speech from depression to recovery (e.g., Darby et al., 1984; Free et al., 1996; Mundt et al., 2007). It is possible,

therefore, that mothers with a history of depression may demonstrate different speech and language characteristics than those who are currently depressed. Additionally, Brennan et al. (2000) found that five-year-old children whose mothers had a past history of depression exhibited less negative outcomes than those children whose mothers were currently depressed. As these divergent findings illustrate, more research is necessary to investigate the effects of depression history on maternal CDS and child outcomes.

(3) Whereas most studies have examined only linguistic (e.g., Free et al., 1996) or non-linguistic (e.g., Bettes, 1988) effects of maternal depression on CDS, the present study seeks to examine aspects of both variables simultaneously. Additionally, this study investigates what impact these maternal CDS variables may have on children. Results of previous studies have shown that both linguistic (e.g., Feldman, 2007) and non-linguistic (e.g., Kaplan et al., 2009) differences in depressed mothers' speech may result in negative child outcomes.

Hypotheses

The hypotheses for the present study are as follows:

(1) Mothers with a history of depression will differ from non-depressed mothers in their CDS. Specifically:

(a) Mothers with a history of depression will use fewer mental state words during CDS than will non-depressed mothers. This is predicted because depressed mothers have been found to be poorer at identifying and explaining emotions for their young children and less able to adjust to their children's emotional state (Free et al., 1996; Herrera et al., 2004).

(b) Mothers with a history of depression will produce more negative utterances during CDS than will non-depressed mothers, replicating previous studies of depressed and non-depressed mothers interacting with their infants (e.g., Murray et al., 1993; Stanley et al., 2004).

(c) Mothers with a history of depression will display less contingent content during CDS than will non-depressed mothers. Tamis LeMonda et al. (2001) found that maternal imitations and expansions became more important contributors to child language outcomes as the children in their sample aged. They explained these findings by positing that as children become communicators, they require more reinforcement of their language content (e.g., imitations) and elaborations from which to learn further language (e.g., expansions). Because depressed mothers have been found to provide less contingent responses to their children (e.g., Downey & Coyne, 1990, Field et al., 1990), it is likely that the CDS of mothers' with a depression history will contain less contingent content than will the CDS of non-depressed mothers.

(d) Mothers with a history of depression will produce less speech overall (as measured by number of words and number of utterances) during CDS than will non-depressed mothers, replicating previous findings (e.g., Breznitz & Sherman, 1987; Rowe et al., 2005).

(e) Mothers with a history of depression will exhibit slower rates of speech during CDS than will non-depressed mothers. This is predicted because slower speech rate has been found to correlate with depressed mood (Ellgring & Scherer, 1996; Mundt et al., 2007).

(f) Mothers with a history of depression will display a smaller F_0 range during

CDS than will non-depressed mothers. This is predicted because this result has

been found for depressed mothers' CDS toward their infant children (e.g., Bettes,

1988; Kaplan et al., 1999).

(2) The same mothers who are deviant on one variable will be more likely to be deviant

on the other variables. In other words, a mother who uses fewer mental state words than

control mothers, will also use more negative utterances, produce less contingent content,

produce less speech overall, speak more slowly, and have less F_0 variability.

(3) A history of maternal depression will be associated with poorer child language

outcomes. This is predicted based on previous findings showing maternal depression's

negative impact on child language abilities (e.g., Quevedo et al., 2011; Stein et al., 2008).

It is also predicted that CDS will mediate the relationship between maternal depression

and child language such that deviance in the CDS variables will negatively affect child

language outcomes, especially if the mother has a depression history.

As a whole, this study hopes to further the understanding of the effects of

maternal depression on CDS toward pre-school aged children and begins to explore how

these differences may impact children's language development.

Method

Participants

A subset of participants from a study of 173 three to five-year-old children and

their biological parents was used for analysis. The sub-sample included 20 mothers with a

history of Major Depressive Disorder (MDD) or Dysthymic Disorder (DD)[2] individually

matched to 20 mothers with no current or past depression. MDD and DD were assessed

using the Structured Clinical Interview for DSM-IV – Non-patient version (SCID-NP;

First, Gibbon, Spitzer, & Williams, 1996). Mothers were matched for child's gender and

age (within three months). Socioeconomic status (SES) was also controlled as this

variable has been found to impact CDS (Hoff, 2003). Maternal education level was used

as a measure of SES because it is a reliable measure of this variable in developmental

studies (Gottfried, Gottfried, Bathurst, Guerin, & Parramore, 2003). The maternal

education level of the MDD group was not significantly different from that of the control

group (t (38)=1.37, p>.05).

Twenty-three of the original 173 participants were not successfully recorded due

to technical difficulties or experimenter error. Of the remaining 150 participants, two

dropped out of the study, one was excluded because the father had a past history of

bipolar disorder, one was excluded due to an extremely low Peabody Picture Vocabulary

Test (PPVT; Dunn & Dunn, 1997) score, ten were excluded because the father

participated in the PCI instead of the mother, and nine were excluded because the mother

met criteria for depression during the month in which she participated in the study. This

resulted in a final sample of 127 participants. Although the entire sample of children

ranged in age from three to five years old, the present study will only examine those

within the ages of 36 to 48 months. This was decided because CDS has been shown to

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[2] Individuals with Major Depressive Disorder have experienced at least one major depressive episode, but no manic, hypomanic, or mixed episodes. Individuals with Dysthymic Disorder have experienced depression over a period of years, but only of moderate intensity. For a more comprehensive definition of each disorder, see the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV-TR; American Psychiatric Association, 1994).

vary depending on a child's age and is typically most pronounced during the younger years (Warren-Leubecker & Bohannon, 1984). Of those participants with a past history of depression, 20 were within the 36 to 48 month age range. The control group was formed by finding the best matches to the past depression group. If more than one participant presented as the best match, the match was chosen randomly.

The final sample consisted of 40 thirty-six to forty-eight month-old children (18 males; M age = 41.03 months, SD = 3.61) and their biological mothers (20 participants per group). Table 1 displays demographic information of the sample. None of the child participants had ever been diagnosed with mental retardation or a pervasive developmental disorder and no child had any current or past major physical health conditions. All children were of at least average cognitive ability as measured by the PPVT (M = 113, SD = 13.99). All mothers had at least 50% physical custody of their child and for all included families English was a primary language spoken in the home. Of the 20 mothers with a history of depression, thirteen (65%) had been depressed at some point during the child's life and the remaining seven were depressed prior to the child's birth. As part of the larger study, participants were given monetary compensation for completing all parts of the study. Additionally, the child participants were given various small prizes including a prize presented to them by their mothers at the end of the PCI.

A variety of recruitment methods were employed for this study. A purchased commercial mailing list (http://www.surveysampling.com) provided telephone numbers for families with three- to five-year-old children living within 20 contiguous miles from the University of Maryland, College Park campus. Undergraduate and graduate research

assistants telephoned these families to recruit for participation in the study. Print and

online newspaper advertisements were used to recruit from the Washington, DC

metropolitan area (i.e., Maryland, DC, Virginia). Additionally, flyers were distributed to

local schools, daycares, community centers, and health care providers (medical and

specialty clinics, pediatricians). Many of the flyers and advertisements were specifically

aimed at parents with a lifetime history of or current depression.

Table 1: Demographic Data for Each Group Within the Sample.

Demographic characteristics	Control	Past Depression
Mean maternal age (years)	33.95 (7.01)	34.55 (5.69)
Maternal education (%)		
High school degree	5	5
Some college (or 2 year degree)	40	25
4 year college degree	35	25
Master's degree	15	35
Doctoral degree	5	10
Children male (%)	45	45
Child's race (%)		
White	45	60
African-American	30	20
Asian	15	0
Other	10	20
% Hispanic	15	10
Child's birth order (%)		
Oldest	10	20
Youngest	45	35
Middle	15	15
Only child	30	30

Measures

  Demographic Information. Mothers completed a demographic questionnaire including information about age, socioeconomic status, education, and number of child's siblings. For the full questionnaire, see Appendix A.

  Parent-Child Interaction Tasks. Mothers and children engaged in a series of structured teaching tasks (Teaching Tasks; Egeland, Weinfield, Hiester, Lawrence, Pierce, & Chippendale, 1995). Although participants completed five tasks, only the *Book* and *Wheels* tasks were used in the present analysis. For a full list of the tasks, see Appendix B.

  Maternal Depression. The SCID-NP was used to assess lifetime history of depression in mothers. The SCID-NP has been demonstrated to have excellent reliability and validity (Williams et al., 1992). All SCID interviews were conducted over the telephone by a masters-level clinician. To determine inter-rater reliability of psychiatric diagnoses, a second interviewer made diagnoses based on listening to audiotapes of 10% of the interviews. Reliability for lifetime depressive disorder (MDD or DD) was excellent ($k = 1.00$). Interviews took about 60 - 90 minutes to complete. Additionally, all mothers completed the Diagnostic Inventory for Depression (DID; Zimmerman, Sheeran, & Young, 2004) to assess current depressive symptoms.

  Child Language Measures. Children were administered the PPVT as a measure of receptive language ability and to screen for gross cognitive impairment. The PPVT is a well-validated measure of verbal intelligence with strong psychometric properties (Dunn & Dunn, 1997). Children's mean length of utterance in words (MLU-W) and vocabulary diversity (VocD; McKee, Malvern, & Richards, 2000) were analyzed to examine the

length and complexity of their speech. Both of these measures were obtained using commands in the Computerized Language Analysis (CLAN) program developed by the Child Language Data Exchange System Project (CHILDES, MacWhinney, 2000).

Coding and Analysis

Mothers' CDS was audio recorded using a Tascam DR-07 Portable Digital Recorder connected to a Shure SCM262 stereo mixer and Shure Microflex cardioid microphone. The microphone was located on the ceiling of the room in which the CDS interactions took place. Recordings were transferred to a computer where they were transcribed and analyzed by the experimenter using software from the CHILDES project. Recordings were digitized at a 44.1-kHz sampling rate and 16-bit quantization rate. For transcription, utterances were defined by pauses greater than one second, structurally evident endings, and declinations in pitch. If two of these three criteria were present, an utterance boundary was inserted. Fifteen percent of the recordings (six total, three from each group) were transcribed twice (once by the experimenter and once by a research assistant) for reliability purposes. Intraclass correlation coefficients (ICCs) were used to compare the two coders on number of words and number of utterances spoken by the child and the mother for each episode. ICCs ranged from 0.86 to 0.99 ($p<.01$).

Linguistic Analyses. Mental state words were analyzed based on the coding system used in Ensor and Hughes (2008). Cognitive terms (e.g., *think*, *know*), terms about desires (e.g., *hope*, *want*), and terms about feelings (e.g., *happy*, *upset*) were included as mental state words. The specific words included were determined by taking an inventory of all words used by the mothers in the 80 transcripts (two groups of 20 subjects, two tasks per group). The experimenter then used that list to identify words related to a

mental state (as defined above). A second coder also selected mental state words. Only those words identified by both coders as mental state words were included in the final analysis. For a full list of the mental state words, see Appendix C. For words that have multiple meanings (e.g., like) context was considered in determining whether or not to count the word as mental state. The number of mental state words produced by each mother was divided by the total number of words produced by the mother to create a proportion of mental state words value.

Maternal negative utterances were determined in a similar way. The experimenter and a second coder both used the inventory of all words used by the mothers to select "negative" words. The definition of "negative" words was modeled after that used for "negative affect" in the study by Murray et al. (1993); however, adjustments to the definition were made to fit this older sample of children. In the present study, negative words were defined as those that would be found in a rejection (e.g., no, wrong), command (e.g., sit, wait), or a prohibition (e.g., stop, don't). Words that were rated by both raters as negative were included in the analysis. For a full list of negative words, see Appendix D. Once the negative words were determined, we used the KWAL command in the CLAN program (MacWhinney, 2000) to find the utterances in which these words were used. If the utterance was determined to be a rejection, command, or prohibition, the utterance was counted as negative. The number of negative utterances produced by each mother was divided by the total number of utterances produced by the mother to create a proportion of negative utterances value. As a measure of reliability, a second coder identified negative utterances for six participants ($k = 0.80$, $p<.001$).

Maternal contingent content was analyzed using the CHIP command in CLAN (Sokolov & MacWhinney, 1990). The CHIP command analyzes every line of the transcript to determine how often (and by what degree) each line overlaps with the preceding line. We used this command to determine the degree to which the mothers' responses overlapped in content with their children's previous utterances.

Non-linguistic Analyses. Amount of speech produced by the mothers was measured both in terms of number of words as well as number of utterances. Both of these measures were determined through the CLAN program (MacWhinney, 2000). The middle 40 utterances of each task were used for the temporal and acoustic analyses. Speech rate was calculated in terms of the average number of syllables per minute. Standard deviation of F_0 was used as a measure of F_0 variability. The pitch listing program in Praat took F_0 measures every .0375 seconds. Utterances with pauses of one second or longer, instances in which the mother and child spoke simultaneously, and utterances in which there was competing background noise were all excluded from analysis. A second rater determined speech rate for six participants for reliability purposes. The first ten utterances of each task were used for reliability. ICCs calculated between the two ratings revealed excellent reliability (ICC = 0.99, $p<.001$).

Statistical Analyses. Separate unpaired t-tests were used to compare the two groups on each of the dependent variables. Separate Pearson's correlations were used to determine if there was a relationship among the CDS variables as well as between each of the CDS variables and child language outcomes. For variables that were not normally distributed, an appropriate non-parametric test was used (i.e., Mann-Whitney U test or Spearman's correlation).

Procedure

       As mentioned previously, the present study was conducted as part of a larger study. Only procedures relevant to the present study will be discussed. Upon arrival in the laboratory, as part of the overall consent process, mothers were told they would be participating in a parent-child interaction, filling out questionnaires, and completing phone interviews at a later date about their psychological backgrounds. Mothers were then led to an observation room containing a one-way mirror to complete the questionnaires while their child engaged in a laboratory assessment battery.

       Following the child's laboratory assessment, the mother was given instructions about each of the teaching tasks and asked if she had any questions. Although the mothers knew the interactions were being recorded and coded, they did not know specifically that their speech was being analyzed. They were told only that the experimenters were interested in looking at the ways in which parents and children work together and to complete the tasks in any way they chose. During the *Book* task, the mother was instructed to tell her child a story using the picture book <u>*A Boy, A Dog, and A Frog*</u> by Mercer Mayer. During the *Wheels* task, the mother was asked to help her child name as many items that have wheels as he/she could. Mothers and their children were seated at a small table to complete the tasks. The entire PCI took about 30 minutes. Participants were given five to six minutes for the *Book* task and four minutes for the *Wheels* task.

       At the end of the teaching tasks, the experimenter administered the PPVT to the child. Meanwhile, the mothers were debriefed, thanked, paid, and told they would be contacted about completing the phone interview assessing their psychological history. An

attempt was made to complete all SCID interviews within a month of the laboratory visit; however, this was not always possible.

Results

Twenty mothers with a past history of depression and 20 mothers unaffected by depression were recorded speaking to their three-year-old children during two teaching tasks. Multiple linguistic and non-linguistic variables of the mothers' CDS were examined. Means and standard deviations for each maternal CDS variable are shown in Table 2. Since most of the findings for the variables did not differ between the two tasks, results are presented collapsed across tasks[3]. Cases in which the variables did differ between the two tasks will be noted.

Table 2. Means and Standard Deviations of the Maternal CDS Variables (Collapsed across tasks)

	Control	Past depression
Proportion mental state words	.04 (.01)	.04 (.01)
Proportion negative utterances	.04 (.04)	.03 (.03)
Degree of overlap	.22 (.07)	.23 (.08)
# of words	1069.95 (193.92)	1019.15 (185.79)
# of utterances	226.15 (39.89)*	202.30 (32.11)*
SR (syllables/min)	269.12 (35.94)	262.10 (27.97)
SD of F_0 (Hz)	72.67 (21.63)	70.04 (19.32)

Note. Degree of overlap = measure of contingent content, SR = speech rate, SD of F_0 = standard deviation of fundamental frequency, * = significant difference at .04 level

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[3] The variable "standard deviation of F_0" collapsed across tasks represents an average of the standard deviation of F_0 from the two tasks. For all other variables, a combined transcript was created and analyzed to determine the values collapsed across tasks.

Comparison of Groups on Each Maternal CDS Variable – Hypothesis One

Our first hypothesis predicted that mothers with a history of depression would differ in their CDS from non-depressed mothers on all of the variables examined. Separate independent samples t-tests were used to compare the two groups on most of the dependent variables. The variable "proportion of negative utterances" was not normally distributed and therefore a Mann-Whitney U test was used to compare the two groups on this variable. For the linguistic variables, we predicted that mothers with a history of depression would use fewer mental state words, more negative utterances, and less contingent content than control mothers. Results revealed no significant differences between the two groups on any of the linguistic variables: mental state words (t (38)=0.47, p>.05), negative utterances (z (38)=0.52, p>.05), or contingent content (t (38)=0.35, p>.05). As an exploratory analysis, we also examined the proportion of "feelings" words used (separate from all of the mental state words) by each group. There were no significant differences between the groups on this variable (t (38)=0.36, p>.05).

For the non-linguistic variables, we predicted that mothers with a history of depression would produce less speech, a slower rate of speech, and a smaller standard deviation of F_0 than control mothers. Amount of speech produced was measured using number of words as well as number of utterances. There was no difference between the two groups in number of words produced (t (38)=0.85, p>.05); however, control mothers produced more utterances than mothers with a history of depression (t (38)=2.08, p=.04). This difference was more evident in the *Wheels* task (t (38)=2.05, p=.05) than the *Book* task (t (38)=1.53, p=.13). However, because we investigated amount of speech input using two different measures, we applied a Bonferonni adjustment in order to avoid a

Type I error. Once we applied this adjustment, the difference between groups in number of utterances was no longer significant. There was also no difference between the groups in speech rate (t (38)=0.69, $p>.05$) or standard deviation of F_0 (t (38)=0.40, $p>.05$).

Intercorrelations Among Maternal CDS Variables – Hypothesis Two

Our second hypothesis predicted that mothers who were deviant on one CDS variable would be more likely to be deviant on the other CDS variables. This was investigated by conducting a series of correlations among all the maternal CDS variables. The results of the correlation matrix are presented in Table 3.

For the majority of the variables examined, no significant correlations were found. There were, however, a few significant correlations of note. There was a strong positive correlation between number of utterances and number of words. As the number of utterances spoken by the mothers increased, so did the number of words. This would be expected as both of these variables measured the overall amount of speech produced. Both of these variables (number of words and number of utterances) had a moderate positive correlation with speech rate. The more words and utterances the mothers produced, the faster their rates of speech. Finally, there was a moderate negative correlation between standard deviation of F_0 and proportion of negative utterances. The more negative utterances produced by the mothers, the smaller their standard deviations of F_0. Because multiple correlations were conducted during this analysis, it was necessary to use a Bonferonni adjustment, which would require a p-value of .007 for significance. After applying the Bonferonni adjustments, the only correlations that remained significant were between number of utterances and number of words and between standard deviation of F_0 and proportion of negative utterances.

Table 3. Intercorrelations Among CDS Variables (Collapsed across tasks)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Prop. mental state	1.0						
(2) Prop. negative	-0.19	1.0					
(3) Degree of overlap	0.05	-0.27	1.0				
(4) # of words	0.22	-0.03	-0.002	1.0			
(5) # of utterances	0.19	-0.03	-0.14	0.72***	1.0		
(6) SR	0.08	0.07	0.17	0.4**	0.31*	1.0	
(7) SD of F_0	0.29	-0.4***	0.18	0.12	0.24	-0.16	1.0

Note. Prop. = proportion, SR = speech rate, SD of F_0 = standard deviation of fundamental frequency, * = significant at .05 level, ** = significant at .01 level, *** = significant at <.001 level
Spearman correlations were used for correlations involving the variable "Prop. negative" because this variable was not normally distributed. For all other variables, Pearson correlations were used.

Child Language Variables – Hypothesis Three

Separate independent samples t-tests were used to compare the two groups on child language outcomes. Means and standard deviations for each child language variable are shown in Table 4. We predicted that children of mothers with a history of depression would demonstrate poorer language scores than children of unaffected mothers. Results revealed that the groups did not differ on VocD (t (38)=0.59, p>.05) or MLU-W (t (37[4])=1.36, p>.05), but did differ on PPVT scores (t (38)=2.04, p=.05). Children of mothers with a history of depression scored significantly lower on the PPVT than children of control mothers.

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[4] An outlier was removed from this data set, resulting in a degrees of freedom value of 37 rather than 38.

Table 4. Means and Standard Deviations of the Child Language Variables (Collapsed across tasks)

	Control	Past depression
VocD	45.38 (15.33)	48.56 (18.70)
MLU-W	2.25 (.45)	2.44 (.40)
PPVT scores	117.35 (12.75)*	108.65 (14.13)*

* = significant difference

Although the majority of maternal CDS variables did not differ between the two groups, we decided to examine how the maternal CDS variables related to child language outcomes. A series of correlations were conducted between each of the CDS variables and the child language variables. Results of these correlations are shown in Table 5. Figures 1 through 3 present scatter plots of the significant correlations.

There was a moderate positive correlation between child MLU-W and degree of overlap in the mother's speech. The more overlaps the mother produced, the longer her child's utterances. This correlation was mainly accounted for by the *Wheels* task (r (37)=0.38, p=.02).

PPVT scores correlated significantly with two maternal CDS variables. There was a small negative correlation between proportion of negative utterances and child PPVT scores and a moderate positive correlation between standard deviation of F_0 and child PPVT scores. The more negative utterances produced by the mothers, the lower their children's PPVT scores. The greater the standard deviation of F_0 produced by the mothers, the higher their children's PPVT scores. The relationship between proportion of negative utterances and PPVT score was mainly accounted for by the *Wheels* task. A

moderate negative correlation between proportion of negative utterances and child PPVT score was found for this task (r (38)=-0.27, p=.05).

A Bonferonni adjustment was used on the VocD and MLU-W measures since these are both measures of children's spontaneous language abilities. The findings for MLU-W remained significant even at the .025 level. Because the PPVT is a standardized test of language ability and VocD and MLU-W are not, it was deemed unnecessary to use a Bonferonni adjustment for the PPVT correlations.

Table 5. Correlations Between CDS Variables and Child Language Variables (Collapsed across tasks)

	VocD	MLU-W	PPVT
Prop. mental state	-0.23	-0.01	0.04
Prop. negative	-0.16	0.12	-0.2*
Degree of overlap	0.05	0.4**	0.04
# of words	-0.16	-0.05	0.04
# of utterances	-0.12	-0.11	0.03
SR	-0.2	0.008	-0.14
SD of F_0	0.05	0.15	0.44*

Note. Prop. = proportion, SR = speech rate, SD of F_0 = standard deviation of fundamental frequency, * = significant at .05 level, ** = significant at .01 level
Spearman correlations were used for correlations involving the variable "Prop. negative" because this variable was not normally distributed. For all other variables, Pearson correlations were used.

Impact of Current Depressive Symptoms

Since past studies (e.g., Bettes, 1988) have demonstrated correlations between depression severity and maternal CDS variables, we decided to conduct an exploratory analysis of the severity of current depressive symptoms among our participants. The DID

scores for the entire sample ranged from 0 to 21 (M=6.76, SD = 6.32). An independent

samples t-test was performed to test whether there was a significant difference in DID

scores for the mothers with a history of depression (M=6.80, SD=6.11) as compared to

the control mothers (M=6.72, SD=6.68). The difference was not significant (t (38)=0.04,

p>.05). A series of correlations were conducted to determine whether DID scores related

to any of the maternal CDS or child language variables, but no significant results were

found.

In the present study, the CDS of mothers with a history of depression was found

to be quite similar to that of mothers unaffected by depression. The groups, however, did

differ on child vocabulary scores. Children of unaffected mothers performed significantly

better on the PPVT than children of mothers with a history of depression. Small to

moderate correlations were found between some of the maternal CDS variables and child

language scores, indicating potential mechanisms through which CDS impacts language

development.

Discussion

We examined whether the speech-language characteristics of mothers with a

history of depression differed from that of mothers unaffected by depression as they

interacted with their pre-school-aged children. We also investigated the language

characteristics of the children to determine whether any potential CDS differences

impacted child language outcomes. Although no significant CDS differences were found

between the two groups of mothers, the groups did differ in regard to child language

scores. Additionally, results revealed some potential mechanisms through which maternal

CDS may impact child language. In this section, we will discuss these findings in greater

detail, mention limitations of the study, put forth ideas for future research, and discuss implications for interventions.

We hypothesized that the CDS of the two groups of mothers would differ on a number of linguistic and non-linguistic variables. These were: proportion of mental state words, proportion of negative utterances, amount of contingent speech, total number of words/utterances, speech rate, and standard deviation of F_0. No significant differences were found between the two groups on these variables. Although these results were not predicted, they are not completely unexpected. Depressed individuals have demonstrated changes in their speech and language as they move from periods of depression to periods of recovery. Mundt et al. (2007) found that depressed patients who responded to treatment increased their pitch variability, displayed a decrease in pause time and number of pauses, and increased their speaking rates. Patients who did not respond to treatment did not display these same changes. Free et al. (1996) found that mothers undergoing treatment for depression performed similarly to control mothers when identifying emotions for their young children. Currently depressed mothers performed significantly worse. Results from the present study replicate these findings. The fact that few differences were found between the mothers with a history of depression and control mothers implies that recovery from depression may alleviate the speech and language symptoms associated with the disorder.

Although the occurrence of subsyndromal symptoms in patients with a history of depression is quite common (Boland & Keller, 2009), this did not appear true of the participants in the present study. Mothers with a history of depression had DID scores comparable to those of the control mothers. This validates the fact that participants in the

past depression group truly were in a "recovery" phase and were exhibiting few, if any, symptoms of current depression.

Although not a significant finding, there was a trend toward mothers with a history of depression producing fewer utterances than control mothers. This coincides with previous findings (e.g., Breznitz & Sherman, 1987; Rowe et al., 2005) that depressed mothers produce less speech overall than non-depressed mothers. In the present study, there was no relationship between the amount of speech produced by the mothers and child language outcomes. Previous studies, however, have found that the less speech input a child receives, the weaker his/her vocabulary skills (e.g., Huttenlocher et al., 1991). Therefore, this variable may be important to investigate further in future studies, especially to see if it has an impact on the language development of pre-school children of currently depressed mothers.

In regard to our second hypothesis, there were very few intercorrelations found among the CDS variables. The strong positive correlation between number of words and number of utterances is not surprising considering these were both measures of overall speech output. Two moderate correlations between number of words and speech rate and number of utterances and speech rate were found to approach significance. Again, these correlations are not surprising given that the faster one speaks, the more he/she is able to say.

The final significant CDS intercorrelation was found between negative utterances and standard deviation of F_0. The moderate negative correlation indicates that mothers who exhibit many pitch changes throughout their CDS are less likely to direct negative comments toward their children. This finding is especially noteworthy when considered

with the fact that both proportion of negative utterances and standard deviation of F_0 were found to correlate with child PPVT score. Fewer negative utterances and a greater variation in pitch related to higher PPVT scores. In other words, the more engaging the mother's speech (more variability in pitch, less negativity), the higher her child's language score. These findings converge with previous research that has found that wide pitch ranges used in CDS may help focus children's attention and facilitate learning (e.g., Fernald & Mazzie, 1991; Kaplan et al., 1999; Scheffel & Ingrisano, 2000), that children prefer "happy" speech (Singh et al., 2002), and that less sensitive parenting is linked to lower child language outcomes (e.g., La Paro et al., 2004; NICHD, 1999).

When we consider that, in the present study, children of mothers with a history of depression scored significantly lower on the PPVT than children of control mothers, the above finding becomes even more important. Mothers with a history of depression did not differ significantly from the control mothers on the variables examined, but their children's PPVT scores did differ. This could mean that there is a CDS variable accounting for this difference that was not examined in the present study, or it could mean that the lower PPVT scores of the past depression group are a result of past (i.e., when the mothers were depressed) CDS differences. Since negative utterances and standard deviation of F_0 were found to relate to PPVT scores and previous studies have shown currently depressed mothers to exhibit differences on these variables (e.g., Breznitz, 1997; Stanley et al., 2004), these may be two of the most important mechanisms through which maternal depression leads to poorer child language outcomes.

The degree of overlap in the mother's speech correlated moderately with child's MLU-W such that the more overlap the mother produced, the greater the child's MLU-

W. This finding presents another potential mechanism through which mother's CDS affects child language. As Tamis-LeMonda et al. (2001) explain, reinforcement of children's language content through imitations and elaborations may help promote child language development.

It was somewhat surprising that degree of overlap was the only CDS variable to impact children's spontaneous speech measures (i.e., VocD and MLU-W), especially considering that negative utterances and standard deviation of F_0 correlated with the standardized language measure. It was also somewhat unexpected that the spontaneous language measures did not differ between the groups even though the standardized language measure did. One possible explanation for the lack of findings related to spontaneous child language is that the tasks examined in the present study were predominately parent-directed. This allowed for a comprehensive corpus of maternal CDS, but may have resulted in the children not being able to produce enough speech to accurately measure their abilities in spontaneous language. Additionally, the spontaneous and standardized language measures examined different language skills (e.g., expressive versus receptive).

In examining the DID scores of the participants, we found no significant correlations between current depressive symptoms and CDS or child language variables. This may have been a result of the small sample size or the fact that none of our participants were currently depressed. A wider spread in DID scores may have yielded significant findings.

Limitations

There were several limitations to the present study. First, the PCIs did not take place in a naturalistic context. Although the laboratory setting provided the benefit of increased experimental control, it may have detracted from the ecological validity of the study. It is possible that the way the mothers interacted with their children in the laboratory was different from how they typically interacted with their children at home. Additionally, mothers with depression have been found to react differently than non-depressed mothers to mildly stressful scenarios (Breznitz & Sherman, 1985). Being in the laboratory setting may have caused some mothers to feel stressed.

Another limitation was that the sample size was relatively small. It is possible that with a larger sample size, more significant effects would have been found, and/or the effects that were found would have been more robust. In addition to a small sample size, there may have been participant factors in our sample that were not well controlled. Attempts were made to control participant variables such as gender, maternal age, and SES that may correlate with CDS variables or maternal depression. There are, however, other variables such as use of anti-depressants, the timing of the depression (before or after the child's birth), the duration of the depression, and the fathers' mental health that have been shown to impact maternal CDS and/or child language outcomes (e.g., Kaplan, Bachorowski, Smoski, & Zinser, 2001; Kaplan, Danko, Diaz, & Kalinka, 2011; Kaplan, Sliter, & Burgess, 2007; Murray et al., 1993; Sohr-Preston & Scaramella, 2006). In the present study, seven mothers (35%) in the past depression group were not depressed during the child's life. This may have affected results and would be an important factor to hold constant in future studies.

Finally, one major finding from the literature is that individuals with depression show differences in speech timing (e.g., speech rate, number of pauses, length of pauses) that may affect their ability to accommodate to the speech timing of their conversational partners (e.g., Breznitz, 1997). To examine this variable, we measured the speech rate of the mothers. Although depressed individuals have been shown to speak slower than non-depressed individuals (Ellgring & Scherer, 1996; Mundt et al., 2007), there are a couple of reasons why this may not have been the best measure to use for this study.

The first reason is that a main characteristic of CDS and clear speech is slow rate (e.g., Smiljanic & Bradlow, 2009). Slower speech has been found to increase intelligibility and thus may facilitate children's learning (Bradlow, Kraus, & Hayes, 2003). Therefore, mothers unaffected by depression may have been slowing down their speech because they were talking to their children during a teaching task. This may have masked any potential differences between the groups. The second reason why speech rate may not have been an appropriate measure of speech timing is that speech rate is not the same as speech rate accommodation. In mother-child interactions, depressed mothers have been shown to be poor at synchronizing their speech to that of their child's (Breznitz, 1997). The ability to converge one's speech with that of his/her speaking partner is important in conversational interactions (e.g., Putnam & Street, 1984). Depressed mothers have also been shown to be poor at accommodating to other types of child factors such as affective state (Herrera et al., 2004; Stanley et al., 2004). Because one of the main deficits for depressed mothers appears to be problems attuning to their child's needs and rhythms, analyzing the mother's speech rate as it related to the child's

speech rate may have been a better way of measuring differences in speech timing between the two participant groups.

Future Research

Future research should try to correct those limitations mentioned above by examining interactions in more naturalistic settings, using a larger sample size, and controlling for other potential participant variables such as medication use, depression timing, etc. Additionally, future research should try to examine speech rate accommodation (rather than speech rate). It also would be beneficial to investigate differences in pausing between mothers affected by depression and control mothers. Pausing, like speech rate, has an impact on speech accommodation and differences between depressed and non-depressed individuals in pausing and response latency are some of the more robust findings from previous studies (e.g., Bettes, 1988; Ellgring & Scherer, 1996; Zlochower & Cohn, 1996).

Another important consideration for future research would be to include a currently depressed group to compare to those with past depression and unaffected by depression. Including a group of currently depressed mothers and their children could potentially help determine the specific mechanisms through which depression affects child language. Additionally, including speech samples of ADS as well as CDS would be beneficial in future studies. Examining both CDS and ADS simultaneously would allow us to determine whether differences between depressed and non-depressed mothers' CDS are due to general differences in the way these groups speak (i.e., the same differences are found for CDS and ADS) or whether the differences are unique to CDS.

Conclusions

Overall, we found that mothers with a past history of depression exhibit CDS that is comparable to that of mothers unaffected by depression when speaking to their pre-school-aged children. This is a promising finding as it shows that there may be little to no speech-language effects following recovery from depression. There were, however, differences in the child language scores between children of mothers with past depression and children of mothers unaffected by depression with the latter performing better than the former. This finding replicates past studies that have found poorer language abilities in the children of mothers with a history of depression (NICHD, 1999; Stein et al., 2008). Two CDS variables, number of negative utterances and standard deviation of F_0, were found to correlate with language scores, but were unrelated to maternal depression. This shows that across all mothers, there may be certain interactional styles that are more beneficial to child language development than others. More engaging maternal speech (e.g., less negativity and greater pitch variability) may lead to better child language outcomes.

Mothers with depression may be more at risk for demonstrating less ideal interactional styles, but all mothers can benefit from learning what components of their speech and language may affect their child's development. By identifying negative utterances and standard deviation of F_0 as potential mechanisms through which maternal CDS impacts child language, we may better be able to focus interventions for mothers exhibiting less ideal interactional styles (including those mothers suffering from depression). Sohr-Preston and Scaramella (2006) present a review of some intervention programs that have been shown to be effective in improving the interactions between

depressed mothers and their children. These programs focused on warm, positive interactions between parents and children, but did not take into account maternal pitch. Adding a focus on pitch may further enhance interventions aimed at PCIs. Instituting such programs when children are young may help prevent some of the poorer language outcomes associated with maternal depression.

The results of the present study should be seen as a positive for those suffering from depression as well as professionals working with depressed individuals. A past history of depression does not necessarily indicate a poor interaction style. Additionally, although further research is necessary, this study provides a good first step into identifying those CDS variables that might be most important to focus on during interventions with depressed mothers.

Figure 1. Correlation Between Maternal Degree of Overlap and Child MLU-W

(collapsed across tasks)
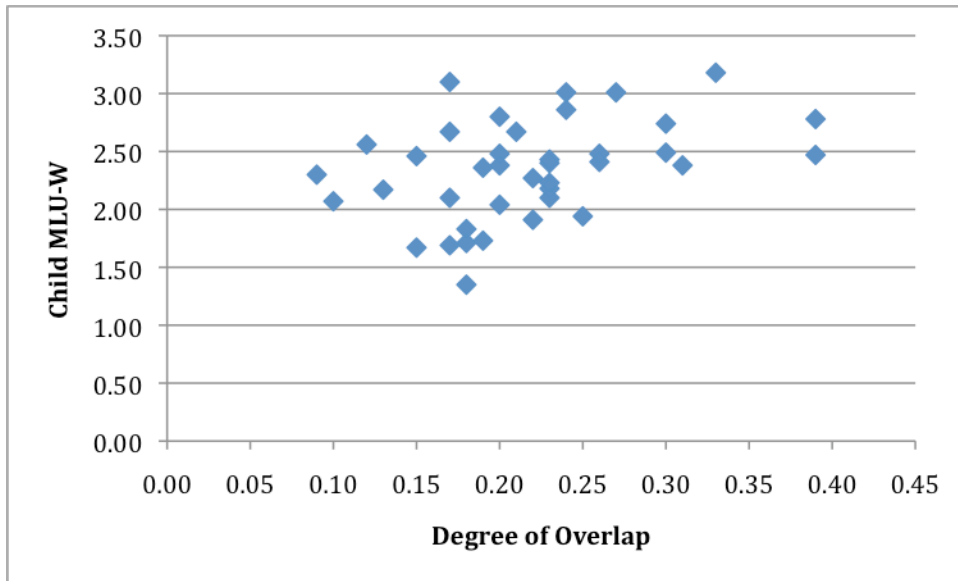
Moderate positive correlation between degree of overlap and child MLU-W (r (37)=0.40, p=.01)

Figure 2. Correlation Between Maternal Proportion of Negative Utterances and Child
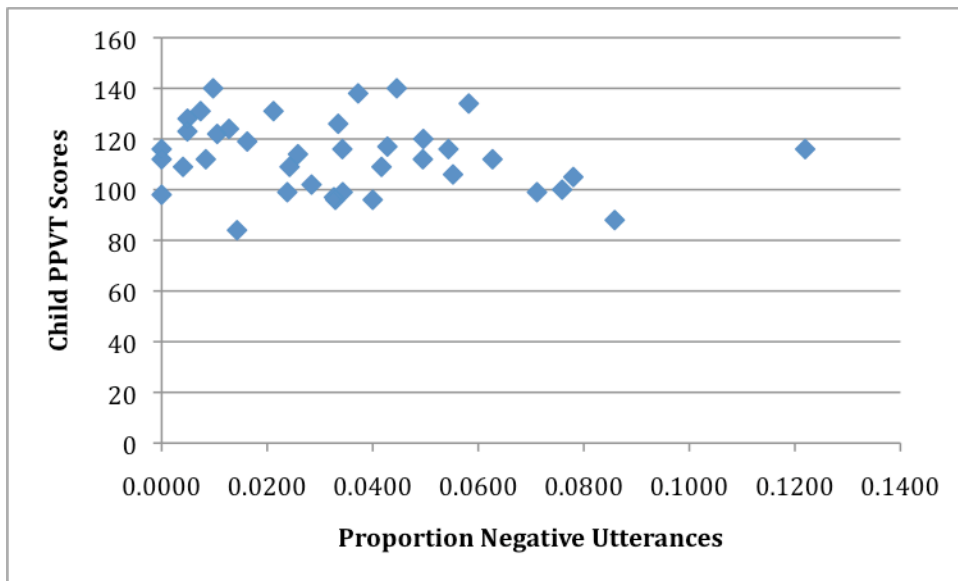
PPVT Scores (collapsed across tasks)

Small negative correlation between proportion of negative utterances and child PPVT scores (r (38)=-0.20, p=.05)

Figure 3. Correlation Between Maternal Standard Deviation of F_0 and Child PPVT
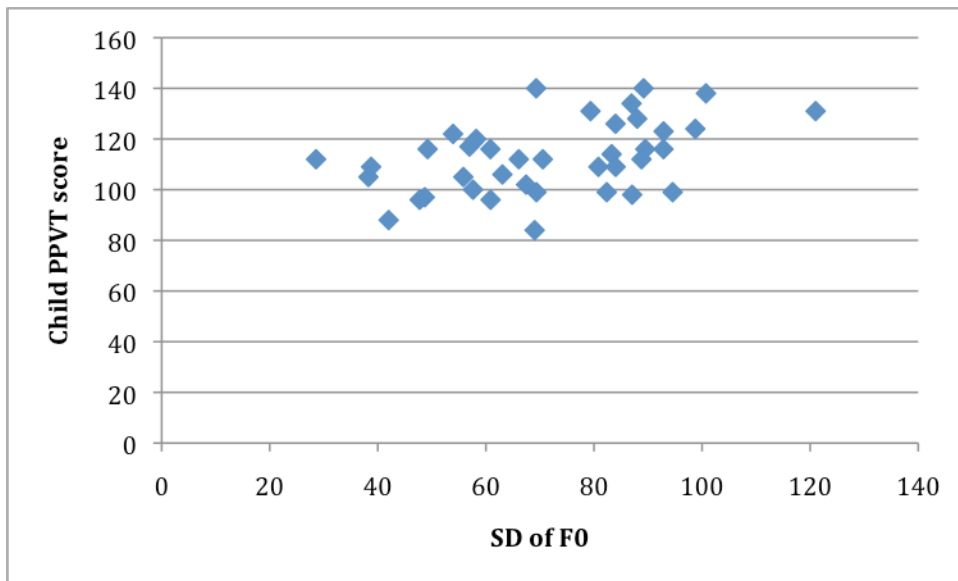
Scores (collapsed across tasks)

Moderate positive correlation between standard deviation of F_0 and child PPVT scores (r (38)=0.44, p=.01)

Appendix A. Demographic Questionnaire

Demographic Data

Child's Age: _____ years

Child's date of birth: _____MM/_____DD/_____YYYY

Your relationship to child: ○ Mother ○ Father ○ Other; Specify_____

Child's Ethnicity: ○ White ○ African American ○ Asian ○ Other

Is child of Hispanic descent? ○ Yes ○ No

With which adults does the child currently live? *(Check all that apply)*

○ Biological mother ○ Step-mother or father's companion

○ Biological father ○ Step-father or mother's companion

○ Adoptive mother ○ Other relative(s)

○ Adoptive father ○ Other non-relative(s)

Marital Status of child's biological parents:

○ Married ○ Separated

○ Living together ○ Divorced

○ Mother deceased ○ Never married

○ Father deceased ○ Mother remarried

○ Father remarried

Please list the child's siblings in order of birth. *(Please indicate first names)*

First Name	Sex	Age	Living at Home
	○ Male ○ Female		○ Yes ○ No
	○ Male ○ Female		○ Yes ○ No
	○ Male ○ Female		○ Yes ○ No
	○ Male ○ Female		○ Yes ○ No
	○ Male ○ Female		○ Yes ○ No
	○ Male ○ Female		○ Yes ○ No

PARENT INFORMATION: *(Please complete for biological parents if known)*

Mother: Age: _____   Mother's date of birth: _____MM/_____DD/_____YYYY

Mother's present occupation: _____

Father: Age: _____   Father's date of birth: _____MM/_____DD/_____YYYY

Father's present occupation: _____

Education of Mother: **Education of Father:**

○ 8th Grade or Less   ○ 8th Grade or Less

○ Some High School   ○ Some High School

○ High School Graduate (or GED)   ○ High School Graduate (or GED)

○ Some College (or 2 Year Degree)   ○ Some College (or 2 Year Degree)

○ 4 Year College Degree   ○ 4 Year College Degree

○ Master's Degree   ○ Master's Degree

○ Doctoral Degree   ○ Doctoral Degree

Yearly Family Income:

○ <$20,000   ○ $20,001 - $40,000   ○ $40,001 - $70,000   ○ $70,001 - $100,000   ○ >
$100,000

COMPLETE THIS SECTION IF ADULT(S) CARING FOR CHILD IS/ARE NOT BIOLOGICAL PARENTS:

A. Relationship to child: ○ Adoptive parent   ○ Other relative   Age:
_____

                                         ○ Step parent   ○ Other non-relative

B. Relationship to child: ○ Adoptive parent   ○ Other Relative Age: _____
                                         ○ Step parent   ○ Other non-relative

Highest level of education for non-biological caretaker: *(See above)*

Caretaker A (above):   Caretaker B (above):
○ 8th Grade or Less   ○ 8th Grade or Less

○ Some High School   ○ Some High School

○ High School Graduate (or GED)   ○ High School Graduate (or GED)

○ Some College (or 2 Year Degree)   ○ Some College (or 2 Year Degree)

○ 4 Year College Degree   ○ 4 Year College Degree

○ Master's Degree   ○ Master's Degree

○ Doctoral Degree   ○ Doctoral Degree

Yearly family income of non-biological caretaker:

O <$20,000   O $20,001 - $40,000   O $40,001 - $70,000   O $70,001 - $100,000   O > $100,000

CHILD'S MEDICAL HISTORY:

Does child have any illnesses or disabilities (either physical or mental)?   O Yes   O No

If yes, please describe: _____

Please mark the circle next to any medical conditions your child has ever had.

O Epilepsy/seizures/convulsions

O Seizures with high temperatures

O Birth abnormalities

O Heart disease

O Asthma

O Food sensitivities

O Allergies (describe)
_____

O Chicken pox

O German measles

O Whooping cough

O Problems with vision

O Problems with hearing

O Serious accident (describe below)
_____

O Fever over 104, unknown cause

O Head injuries or lacerations leading to
     loss of consciousness

O Unconscious (other)

O Anemia

O Lead poisoning

O Meningitis

O Encephalitis

O Mumps

O Emergency room visit

O Poisoning, medicines

O Poisoning, cleaning agent

O Poisoning, non-food item

O Physical handicaps (describe below)
_____

O Other diseases (describe below)
_____

Is child taking medications for any conditions above?   O Yes   O No

Medication (specify) _____

Has your child ever been hospitalized for a medical problem?   O Yes   O No

If yes, please specify:

    a) Number of times _____

    b) Reason(s)? _____

CHILDHOOD HISTORY:

How many pregnancies did mother have before the pregnancy with this child?
(Including those not carried to term)

_____ # pregnancies

Check any of the following that occurred during the pregnancy with this child:
(Check all that apply)

O Severe nausea and vomiting   O Toxemia

O High blood pressure   O Rubella, Mumps

O Incompatible Rh factor   O Diabetes

O Anemia

O Bleeding 1st 3 months   O Bleeding 2nd 3 months   O Bleeding 3rd 3 months

Medications during pregnancy: O No   O Yes

Please specify medications (include antidepressants, name of drug, dosage, and duration of use)

(1)
_____

(2)
_____

(3)
_____

(4)
_____

(5)
_____

Check any of the following if they occurred at or following the delivery of the child:
(Check all that apply)

O Premature delivery   O Infant required oxygen
Specify weeks of gestation at birth: _____

O Cesarean section   O Infant required blood transfusion

O Breech delivery (feet or buttocks first)   O Infant was placed in an incubator

O Infant had cord around neck   O Infant was blue at birth

O Other problems (specify)
_____

Child's weight at birth: _____ pounds _____ ounces

Did your child stay in the hospital after mother left?   ○ Yes   ○ No

If yes, please specify number of days _____

During the first year of life, did your child have difficulties in any of the following areas? *(Check all that apply)*

○ Sleep problems   ○ Excessive crying

○ Feeding problems   ○ Difficult to comfort

○ Resisted being held   ○ Sluggish, nonresponsive

○ Overly active   ○ Fussy much of the time

○ Under active

Was child breast-fed?   ○ Yes   ○ No   **If yes, for how long?** _____months

Age child started walking without assistance: _____months

Age child spoke first words: _____months

Age child dressed without supervision: _____months

Did your child have difficulties with the development of speech? *(Check all that apply)*

○ No difficulties   ○ Did not use "I" or "me"

○ Delayed speech   ○ Often repeated other's words

○ Stammering   ○ Talked excessively about one topic

○ Hard to understand   ○ Other

Child's primary caregiver(s) are:
(check all that apply)

○ Mother   ○ Father   ○ Grandparent   ○ Live-in nanny/sitter   ○ Other_____

How many <u>hours per week</u> does your child spend in the following:

_____School   _____Daycare   _____Other childcare setting

Does mother work outside of the home?   ○ Yes   ○ No

If yes, how many hours per week? _____

Does father work outside of the home?   ○ Yes   ○ No

If yes, how many hours per week? _____

About how many close friends does your child have? (Do not include brothers and sisters)

O None   O 1   O 2 or 3   O 4 or more

About how many times a week does your child do things with any friends outside of regular school hours?
(Do not include brothers and sisters)

O Less than 1   O 1 or 2   O 3 or more

Compared to others of his/her age, how well does your child:

	Worse	Average	Better	
a) Get along with his/her brothers and sisters?	O	O	O	O Has no siblings
b) Get along with other kids?	O	O	O	
c) Behave with his/her parents?	O	O	O	
d) Play and work alone?	O	O	O	

Does your child receive special education or remedial services or attend a special class or special school?

O No   O Yes

If yes, please describe the kind of services, class or school
_____

_____
_____

Has your child repeated any grades?

O No   O Yes

If yes, please describe the grades and reasons
_____

_____
_____

Has your child had any academic or other problems in school?

O No   O Yes

If yes, please describe._____

_____
_____

Please describe the best things about the child:

_____
_____

_____
_____

Appendix B. Parent-Child Interaction Task Descriptions

Instructions to parent at start of visit:

Today, you'll be playing some games with (Child). I'll first explain them to you; then you'll explain them to (Child). It's important that you continue working with (Child) on each game until I bring you the next one. Each time, you'll get a reminder of how to play from the instructions on these cards (show cards). We chose these games because we wanted to see how parents & kids work together on games that may be new. You can work with (Child) in any way that you would like and give whatever help you think s/he needs to understand the games.

1. Book (6 minutes)

First, you'll be looking at a picture book with (Child). We'd like you to tell (Child) a story using this picture book.

2. Wheels (Stop after 4 minutes or stop if child hasn't named an object with wheels in 2 ½ minutes)

For this game, we want your child to understand that the goal is to name things with wheels. Please try to get (Child) to name as many different things that have wheels as s/he can. You can say or do anything you think might help him/her understand the goal of the game except for actually naming things yourself. Do you have any questions about this game?

3. Maze (5 minutes unless completed sooner)

Are you familiar with the etch-a-sketch? On this game, (Child) should use the knobs to make a line that goes from the starting point of the maze to the end point without crossing any of the lines. Again, you can give as much or as little help as you think your child needs to understand how to do it as long as s/he learns to do it him/herself. Any questions?

4. Story (6 minutes unless completed sooner)

In this game, we'd like (Child) to understand that the goal of the game is to put the story cards in the correct order & then tell a brief story about what is going on in each scene. There are a number of different picture sets (show parent cards & give example of putting 1 set in order, telling a story, then moving to next set). (Child) should do as many as s/he can. Remember that you can give whatever help you think s/he needs to understand the game. Any questions?

5. Tangoes (6 minutes unless child completes all puzzles sooner)

In this last game, we'd like you to help (Child) do some puzzles. Have him/her put the pieces together on top of the cards so that they make the shapes shown on these cards (show parent cards/pieces; tell parent that these are all the pieces that are needed, and all pieces are needed for each card; & give example). (Child) should try to do as many as s/he can. Again, you can give whatever help you think s/he needs to understand the game. Do the puzzle with the number labeled on the top right corner.

Appendix C. Mental State Words

1	angry
2	annoyed
3	able
4	behave
5	behaving
6	attention
7	awesome
8	amused
9	bad
10	bummed
11	busy
12	boring
13	bothering
14	cheeky
15	cheered
16	decide
17	decided
18	decides
19	concentrate
20	concerned
21	defeated
22	determined
23	cool
24	courage
25	distract
26	crazy
27	cross
28	cry
29	crying
30	enjoy
31	fine
32	excited
33	frowning
34	frustrated
35	frustrating
36	fun
37	funner
38	funniest
39	funny
40	fair
41	focus
42	feel
43	feeling
44	feelings

45	feels
46	forget
47	forgot
48	figure
49	figures
50	figuring
51	glad
52	glum
53	goal
54	hilarious
55	good
56	happily
57	happy
58	honest
59	hope
60	hopefully
61	hopes
62	great
63	grinned
64	grouchy
65	grumpy
66	guess
67	guessing
68	hurt
69	hurts
70	idea
71	ignoring
72	interesting
73	laughing
74	lonely
75	lonesome
76	love
77	mad
78	kind
79	like
80	liked
81	likes
82	knew
83	know
84	knows
85	listen
86	listening
87	mean
88	means
89	meant
90	need

91	needa
92	needed
93	needs
94	nervous
95	miss
96	missed
97	misses
98	missing
99	nice
100	patient
101	patiently
102	must
103	sad
104	sadly
105	scared
106	scary
107	realized
108	pretended
109	remember
110	silly
111	sorry
112	smart
113	smile
114	smiled
115	smiles
116	smiley
117	smiling
118	sneaky
119	tired
120	stubborn
121	surprise
122	surprised
123	think
124	thinking
125	thinks
126	thought
127	weird
128	wanna
129	want
130	wanta
131	wanted
132	wants
133	uncomfortable
134	understand
135	unhappy
136	upset

137 wishes
138 wonder
139 wondering
140 worried
141 worry

Appendix D. Negative Words

1	aren't
2	can't
3	don't
4	gimme
5	give
6	hunhunh
7	listen
8	no
9	nope
10	not
11	nuhuh
12	sit
13	stop
14	wait
15	wrong

<div style="text-align: center;">**References**</div>

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