ABSTRACT

Title of Document:	Talking Down to Toddlers: Comparing Maternal Language to Adults, Maternal Language Input to Toddlers, and Toddler Vocabulary Growth
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This study considers how differences between adult-directed-speech (ADS) and child-directed speech (CDS) at 11 and 24 months affect child vocabulary development. The effects on child vocabulary development of 1) the size and stability of simplification in MLU and VOCD between ADS and CDS, 2) proportions of rare words, 3) one-word utterances and 4) nouns in CDS on toddler vocabularies are considered. Mothers' MLU and *VOCD* in CDS were stable, but did not relate to children's vocabulary growth, while other input factors were related to child outcomes, but were not stable. Results provide no evidence of an upper limit to beneficial complexity in CDS and do not support replacing time-lagged with concurrent measures in research.

Talking Down to Toddlers?
Comparing Maternal Language to Adults, Maternal Language Input to Toddlers, and Toddler Vocabulary Growth

By

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Chapter 1: Introduction

Young children's vocabularies vary greatly. Bates, Dale & Thal (1995) report that two-year-olds have a mean expressive vocabulary of 312 words, but the 1.28 standard deviation range is from a low of 89 to a high of 534. Some children who are slow to acquire their first words achieve language scores in the normal range as children and adults, but other "late talkers" continue to display linguistic delays (Desmarais, Sylvestre, Meyer, Bairati, & Rouleau, 2008; Rescorla, Dahlsgaard, & Roberts, 2000; Rescorla, Roberts, & Dahlsgaard, 1997).

Successful establishment of larger vocabularies is also associated with syntactic development. Apart from certain clinical populations, such as children with Down syndrome, most children's syntactic development is strongly correlated with vocabulary size (Chapman, Schwartz, & Bird, 1991; McGregor, Sheng, & Smith, 2005). Furthermore, early vocabulary levels are associated with later language and literacy success. Researchers have long been aware of robust links between children's vocabulary levels at age three and later academic success through elementary school (Snow et al.,1998). More recent studies considering younger children show a similar pattern. In a study of over 1000 children, Lee (2011) found that children with higher total vocabulary as reported on the MacArthur-Bates Communicative Development Inventory (MCDI) (Fenson et al., 2007) at age 2 also had higher scores on many language and literacy measures throughout childhood (from age three to age eleven). Thus, vocabulary size at age two is an important foundation for future language development. Growing public awareness of the high stakes of early language development has resulted

in an increased focus on its promotion (Bercow, 2008; Parlakian, 2003). Identifying the factors associated with successful language development at age two is a key step in providing timely and effective educational and therapeutic approaches for young language learners and their families.

One factor that influences the rate of language development is the input that children receive from their caregivers. Hart and Risley, considering the differing language development of children of differing socio-economic status (SES), estimated that, by the age of three, children of higher economic status had heard 30 million more words than poor children (Hart & Risley, 1992). Studies by Hoff-Ginsberg and Huttenlocher and colleagues also reported significant differences in the quantity of language addressed to young children, as well as in the number of word children had learned(Hoff-Ginsberg, 1991; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Hart and Risley found that three-year-olds from high SES families had a mean vocabulary size of 1000 words, while three-year-olds from low SES families had a mean vocabulary size of 500 words. Huttenlocher et al. found significant relationships between exposure to varying quantities of language at sixteen months and subsequent rates of child vocabulary growth for individual children. Children of higher SES exposed to a greater quantity of language input based learned more vocabulary than those who heard fewer words in as little as ten weeks (Hoff-Ginsberg, 1991). Each of these research groups reported that children who heard more words, learned more words.

Furthermore, researchers identified salient differences in the quality of input. If this quantity of language promotes language development in part because of specific qualities or kinds of input within it, then identifying those factors that could be delivered

more efficiently both by caregivers and in educational and therapeutic settings is of obvious interest. Hart and Risley found that parents who used more words also used a greater variety of words, and presented these in utterances that were longer, compared to their children's own utterances. This led the authors to recommend investigation of "the extent to which positive child outcomes are associated with a speech style that, rather than simplifying to match the child's utterance length, maintains the integrity and complexity of adult speech" (page 1110, Hart & Risley, 1992) . In order to provide specific recommendations for promoting early language learning, it is necessary to consider the character of that input with care. Twenty years after Hart and Risley, researchers and clinicians in the field of child language still question whether simplification or complexity in different dimensions of CDS better promotes child language development.

Chapter 2: Child-directed speech: does simplified input promote language learning?

In most of the world's cultures, adult caregivers speak to young children very differently than they do to adults. This special register for addressing children, which was originally dubbed "motherese", is now studied as infant-directed or child-directed Speech (IDS or CDS). Researchers have identified particular acoustic, prosodic, lexical, and syntactic characteristics of speech directed towards young children. These include a high level of repetition, larger variations in pitch, and exaggerated affect (Fernald, 1989; for a recent review of research in IDS, see Soderstrom, 2007). CDS is also characterized by shorter, syntactically simpler utterances, and higher-frequency, and more concrete vocabulary (Phillips, 1973Snow, 1972).

Reported values of lexical diversity in CDS are, on average, lower than those used (Remick, 1976)in conversation between adults. Mean measurements of type-token ratio have found less lexical diversity, that is, fewer different word types, when compared to the total number of word tokens in infant- and child-directed speech have been found to be lower than in ADS(Henning, Striano & Lieven, 2005; Kaye; 1980, Phillips, 1973) . Phillips (1973) found type-token ratios of .34 at 18 months and .41 at 28 months, as opposed to .52 with adults. These published means may, however camouflage the range of diversity and complexity in CDS. Few studies have included measures of both ADS and CDS from the same parent. From measures such as these we can only glean a rough picture of CDS as having reduced lexical complexity compared to adult measures.

Infant- and child-directed speech is also syntactically simple. One study found maternal mean length of utterance (MLU) to one- and three-month old infants to be 3.6 and 4, values which language learning children typically achieve around age four (Henning, et al., 2005). Bornstein and colleagues found a mean maternal MLU of 4.03 addressed to 18-month-olds (Bornstein, Haynes, & Painter, 1998). Some researchers have hypothesized that the syntactic and lexical simplification of IDS, which are near language-universals, aid children in the task of learning language (Furrow, Nelson, & Benedict, 1979; Murray, Johnson, & Peters, 1990).

Other aspects of CDS, such as its acoustic properties, have been linked to the preferences, needs, and learning patterns in younger children. Young infants have been found to prefer IDS over adult-directed speech, and this preference seems to be driven primarily by the prosodic properties of the signal (Cooper, Abraham, Berman, & Staska, 1997; Fernald & Kuhl, 1987; Fernald & Mazzie, 1991; Fernald & Morikawa, 1993;

Newman & Hussain, 2006; Pegg, Werker, & McLeod, 1992; Werker & McLeod, 1989; Werker, Pegg, & McLeod, 1994). In experimental contexts, adults learn better when words are presented with the exaggerated pitch of IDS (Golinkoff & Alioto, 1995).

Many have theorized or developed clinical practices based on the theory that the simplification of vocabulary and syntax that characterizes IDS also has beneficial effects on language learning. A simplified lexicon could "reduce word-learning load" on language-learning infants (Soderstrom, 2007). When designing interventions for children who have language delays, therapists commonly adopt many of the simplifications found in IDS. For example, the highly regarded *It Takes Two to Talk* program from the Hanen Center in Ontario, Canada, trains therapists and parents to "say less", "go slow", and "stress". In other words, they recommend offering children language in simplified and especially salient forms which they will be able to understand and imitate more completely (Pepper et al., 2004). Therapists attempt to work in the "zone of proximal development", providing models of vocabulary items and simple syntactic combinations that are "one step up" from the child's language level (Vygotsky, 1978). In a recent review article, researchers considered whether telegraphic or grammatically correct utterances were preferable in therapy with young children with language delays. The benefits of simplification itself were taken as a given (van Kleeck et al., 2010).

Lexical diversity: more is more

Quantity of speech, and diversity of words used are not inevitably linked. It is possible to talk at great length using a restricted vocabulary. It is also possible to have varying degrees of lexical diversity in even small samples of speech. However, in

empirical investigations of child-directed speech, quantity and lexical diversity go hand-in-hand. Furthermore, diversity of words in CDS, along with quantity, is documented to be beneficial for toddler vocabulary development. In a study matching children of middle and high SES for vocabulary level and tracking their vocabulary growth, Hoff found that children 16 to 31 months whose mothers used language with more diverse vocabulary increased their vocabulary more than those whose maternal input was lexically less diverse in as little time as a month (Hoff, 2003). The difference in children's vocabulary growth that corresponded to differences in SES was completely accounted for by maternal language input factors. In further analysis from their longitudinal study, Huttenlocher and colleagues had similar results (Huttenlocher et al., 2010). Research with mothers of lower SES also finds that greater lexical diversity predicts greater vocabulary growth between fourteen and thirty-six months (Pan, Rowe, Singer, & Snow, 2005). Interestingly in this study, child vocabulary growth was not related to quantity of CDS. Whether quantity or diversity is has a greater effect, or for which children either one has a greater effect, is unresolved. Still, lexical simplification in the form of either less talk, or less diversity of the lexicon used has never been found to positively affect language-learning toddlers.

Reduced mean length of utterance (MLU) has also been hypothesized as a way that IDS could aid young children both in segmenting the speech stream, and in correctly attaching meaning to individual words. A single study has reported results linking lower linguistic complexity in maternal language input to larger vocabularies in children: children whose mothers addressed them with lower MLU at nine months showed greater language development at 18 months (Murray, et al., 1990). Other studies have not found

this to be the case. Often, the focus of research on the syntax of maternal language input considers its effects on toddler's syntactic development. However, higher MLU has also been linked with children's vocabulary growth.

In continuing work with Hoff's groups of higher and mid-SES, Hoff and Naigles focused on lexical input, but included MLU as an "index of the richness of the linguistic environment" (page 424, Hoff & Naigles, 2002). Although they had not predicted this result, MLU, rather than more strictly lexical measures of maternal input, was a significant predictor of child vocabulary measures. Hoff reported that, in her study of mothers of differing SES, mothers of high SES used significantly higher MLUs with children between 16 and 31 months. MLU accounted for 22% of the variance in child vocabulary development scores (Hoff, 2003). In contrast Huttenlocher and colleagues found that syntactic complexity, measured as constituent diversity and clausal diversity of parental language input, predicted syntactic, but not *lexical*, development in children (Huttenlocher et al., 2010). In both cases, syntactic complexity, not simplification, conferred an advantage on language-learning toddlers.

One possible source of conflict between these studies on the one hand, and Murray and colleagues and the clinical recommendations in favor of simplicity on the other, could be that children of different ages have different needs. The latest measures of maternal language input in the Murray et al. study were at 9 months. The Hanen programs are focused on the beginning stages of verbal language, which for typically developing children would be at eleven months or a year. Studies linking linguistically complex input to greater child development begin at fourteen months or beyond. Eleven-month-olds, such as the children at the first time point in the current study, hold a middle

ground. Whether they benefit from simplified or more complex language is still unknown.

Much of the research considering relative lexical diversity and syntactic complexity in CDS also considers the role of SES. In Huttenlocher's study, like Hoff's, higher SES was associated with greater lexical diversity and syntactic complexity in child-directed speech. Children of higher SES tend to have greater language skills, but this seems to be driven not by SES *per se*, but by differences in how high-SES and low-SES parents talk to their children. Those parents from high-SES families tend to use more diverse vocabulary and more complex syntax when talking to their children, and these aspects of CDS lead to more advanced language development. This is hardly surprising. The most-used measure of SES in children is maternal educational level, and most college degree programs both require and train facility with oral and written language. People of higher socio-economic status do use more sophisticated language in their everyday interactions with adults (Hoff-Ginsberg, 1991; Van den Broeck, 1977). For low-income mothers, as well, maternal language input factors are affected by maternal education. Rowe, Pan, and Ayoub (2005) found that more educated low-income mothers talked more and used greater lexical diversity than less educated mothers. It may then seem plausible that highly educated mothers are using the linguistic sophistication learned in college and graduate programs with their children. However, no study has found this to be the case. The *relatively* sophisticated language input that is correlated with larger toddler language growth remains substantially simplified vis-à-vis habitual adult speech (Hoff, 2006).

Chapter 3: Unpacking the paradox of "relatively complex simplification" in CDS

A key issue in unpacking the potential effects of CDS is to consider not only the general trend of simplification in group means, but the degree to which individual mothers alter their habitual adult speech when speaking to their children. Huttenlocher and colleagues (2007) documented consistent relationships between CDS at different time points in individual mothers (Huttenlocher, Vasilyeva, Waterfall, Vevea, & Hedges, 2007). In this study, the CDS of all participants increased steadily in lexical diversity and syntactic complexity as children matured, but participants retained their rank order in relation to one another. Huttenlocher and colleagues consider this to be evidence that caregivers "retain their individual speech patterns over time." If CDS levels are tied to habitual individual parental speech levels, then it would follow that a parent's particular level of CDS would, at least in part, be related to their particular level of ADS. If this were so, then the connection between SES and child language outcomes need not be explained by differences in CDS. Associations between SES and child language outcomes could be mediated by inherited language aptitudes (see Stromswold, 2001, for a review of heritability of language skills) . Specific levels of linguistic complexity in ADS and CDS could be byproducts, not mediators, of this relationship. Huttenlocher and colleagues recommend that measures of ADS be included in future studies.

However, few studies to date have compared ADS and CDS for individual speakers. Maternal vocabulary and language ability, as measured by formal testing, have been found to correlate with child language development at age two (Bornstein, et al., 1998; Rowe, 2008). Yet studies that incorporate direct measures of ADS have found equivocal results. In a 1991 study comparing the speech of working and upper-middle

class mothers to their toddlers (18-29 months), Hoff-Ginsberg compared ADS and CDS. She found working-class mothers used significantly lower numbers of different words (a measure of lexical diversity) than upper-middle-class mothers in speech to adults. But in this study, while upper-middle class mothers' CDS showed simplification, working class mothers used *greater* lexical diversity when interacting with their children than they did with an adult.

Research reporting simplification in CDS may not capture different behaviors in mothers of different classes. Reports of mean simplification, too, could camouflage very difference relationships between ADS and CDS for different mothers.

In a sample of 47 mothers of varying SES, Rowe (2008) measured lexical diversity in ADS and CDS. In this study, the number of word types in ADS was correlated with word types in CDS. The quantity and quality of CDS, including its lexical diversity as measured by *VOCD*, did relate to children's vocabulary growth. However, the level of sophistication of CDS was not related simply to the parents' ADS. Instead, it was predicted by a model including children's earlier language level, parental SES and parent knowledge of child development. Group tests (e.g., Hoff-Ginsburg, 1991) find that mothers of higher SES both use more linguistically sophisticated ADS and more linguistically sophisticated CDS and have children with more advanced language development at earlier ages. Rowe's results, however, allow room to question the precise nature of this association. It could be, following the work of Huttenlocher, Hoff-Ginsberg, Bornstein and colleagues, cited above, that mothers have their own "individual speech patterns" linking both ADS and CDS over time. However, it may be, as Rowe found (2008), that maternal ADS has a less consistent relationship with CDS. It

may be that parents approach the task of communication with language-learning children fundamentally differently. Some may simplify their speech drastically, while others do so slightly, if at all. As Rowe found, this leaves room for other mediating factors, such as knowledge of child development (Rowe 2008).

If all mothers simplify to similar degrees, but from different baselines, then parallel levels of complexity in CDS and ADS would confound the relationship of CDS and children's results. It would be impossible to know whether it was the content of maternal language input that affected children's language outcomes, or whether it mothers' general language abilities, reflected in their ADS, were a reflection of language aptitudes, which their children could genetically share. Documented differences in CDS would be a concomitant effect of maternal language styles rather than a source of differences in children's language growth. Understanding the specific relationships between ADS and CDS has the potential to separate the contribution of CDS to child language outcomes as distinct from maternal SES or language ability. It warrants further investigation, with an additional sample, to determine the size and consistency of syntactic and lexical simplification from ADS to CDS.

Chapter 4. Beyond simplification: some specific characteristic of CDS

Some aspects of CDS can be characterized as simplifications, and considering the differences between ADS and CDS in MLU and VOCD captures the degree of simplification used by individual mothers. However, some syntactic and lexical differences between CDS and ADS are less a matter of complexity, than of specific characteristics. As average measures, MLU and VOCD may fail to capture individual differences in providing specific forms of input that are particularly salient for word learning. Where these characteristics of CDS can be mapped to known qualities of children's early language development is potentially fruitful ground for uncovering maternal language input factors that affect child language outcomes. Three such factors are the relative use of core, common vocabulary and more rare words, the proportion of one-word utterances, and proportion of nouns in CDS.

Greater lexical diversity, measured variously as type-token ratio, number of different words, *VOCD* in CDS has been linked to greater children's vocabulary development. For older children, this makes intuitive sense: vocabularies cannot expand beyond the net variety of words that child has heard. Children will not acquire *navy* and *turquoise* and *canine* and *St. Bernard* if they only ever hear *blue* and *dog*. *VOCD*, does not distinguish between diversity within the most common words of English and diversity that extends to include rare words. Weizman and Snow (2001) specifically investigated the effect of this form of lexical diversity by calculating rare word type densities and rare word token densities for maternal CDS. They found that even very small amounts of exposure to rare words in CDS (on the order of two to four percent of words spoken) corresponded to measurable increases in children's vocabulary levels.

This begs the question of whether it all parents should be advised to use as much lexical diversity in conversation with their children as possible. Before any such recommendation could be made, it would be crucial to determine whether there is an upper limit beyond which additional syntactic complexity and lexical diversity in language input is either no longer helpful, or even actively detrimental.

Younger children, in particular may have a different response to "rare" vocabulary in input. One- and two-year-old children are still acquiring core vocabulary for the world around them. It may be possible for parents to use too much diversity, providing too few exposures to core vocabulary and a greater proportion of words which have little direct relation to toddlers' daily lives. If greater use of rare words were not useful, then we would expect to see a diminishing slope in the correlation of lexical diversity in CDS and toddler vocabulary development. If maternal use of rare words supplanted presentation of more common early vocabulary, then it could negatively impact vocabulary development. Specific consideration of lexical diversity construed as proportions of rare words with children in this specific age group to unpack the association of greater *VOCD* in CDS with greater vocabulary gains in warranted before any blanket recommendation of increased lexical diversity in CDS vocabulary be issued.

Another specific feature of CDS that could be related to children's vocabulary growth is the proportion of one-word utterances. Just as mean *VOCD* scores fail to capture the number of lexically rare items, so does MLU, fail to capture the proportion of one-word utterances. Many one-word utterances might depress MLU levels, but their presence could also be disguised, if other utterances are unusually long. One-word utterances may be of particular use for language-learning toddlers for several reasons.

First, spoken language, unlike written language, contains no spaces between words. When young children are beginning to map meanings to sequences of sounds, one primary task is parsing the speech stream into the sequences of sounds that are grouped as meaningful units. One-word utterances present a meaningful unit of speech with little room for doubt regarding which sounds constitute the name for the referent at hand. When a parent responds to the their eleven-month-old's excited pointing with "*cat*" rather than *look at that big cat go*, then the animal' s name cannot be misconstrued as "*bigcat"* or "*cat go"* or , with assimilation "*cak*". Furthermore, once a number of words have been learned in isolation, they provide word boundaries that can be used to separate further words from the speech stream, increasing a child's ability to glean new word forms longer utterances as well (Bortfeld, Morgan, Golinkoff, & Rathbun, 2005). Lastly, young children's first speech acts are one-word utterances. Maternal one-word utterances provide a model for an utterance that young children, with limited phonological repertoires, can more successfully imitate. One-word utterances in maternal language input between nine and twelve months have been found to predict children's expressive mastery of those specific lexical items at fourteen to fifteen months (Brent & Siskind, 2001).

Another characteristic of maternal language input that could have bearing on toddler language outcomes is the number of types and tokens of *nouns* used in CDS. VOCD does not distinguish between specific kinds of words, but the amount and diversity of noun use may be disproportionately useful to toddlers. Nouns in general, and concrete, image-able nouns in particular, figure prominently in early vocabularies (Fenson et al., 1994; Goldin-Meadow, Seligman, & Gelman, 1976). Parents who provide

more noun input to toddlers may cater to their children's propensity for noun learning. Like single word utterances, and use of common and rare words, this is more of a specific characteristic of CDS than a simplification. It too, is not captured by mean measures, of lexical diversity and syntactic complexity.

Chapter 5: Time-lagged and concurrent measures

Consideration of levels of simplification in ADS and CDS in mean measures of other specific CDS characteristics will reveal the degree of variation or consistency among mothers, and the variation or consistency, within mothers. Finding consistent patterns has repercussions for future research. If all mothers simplify from ADS to CDS to a similar degree, then measures of ADS would provide a proxy for CDS (although without shedding light on the degree to which mothers use the specific CDS characteristics described above). Verifying a stable relationship between CDS at different time points would facilitate research, because then maternal language input factors and child language outcome could be measured in a single laboratory visit, assuming that, CDS measured at that later point was related to earlier CDS. Current standard practice requires that maternal language input be measured at an earlier time point, while (presumably) resultant child progress is measured at a later time. Without this precaution, it is impossible to claim children's language development is based on the input given; it could be that adults calibrate their own speech, in order to respond to children's specific language levels (Richards, 1991). A further failsafe is to measure the amount of advancement in child language from Time 1 to Time 2, thereby isolating the language learning that occurred after language input was measured. As Hoff (2003) points out, this results in a conservative measure of language input effects, insofar as it can be assumed that input was also a factor in the language growth acquired prior to Time 1.

While the reasoning behind this caveat is sound, recent advances in understanding of parent language variables have shown that, while parent input changes as children

grow, it tends to remain on the same trajectory. Huttenlocher and colleagues showed that, while all parents changed their CDS as their children matured, they remained in a similar rank order of diversity and complexity (Huttenlocher, et al., 2007). If this is indeed true, it may be possible to consider CDS at twenty-four months, as it compares to child language development at the same age, assuming that this later input is systematically related to earlier CDS that affected the child's language development. For this study, measures of CDS were completed at both eleven and 24 months. This affords an opportunity to check whether concurrent measures provide similar results to time-lagged measures.

Chapter 6: Research questions

The present study is designed to address several questions raised by recent research about the relationship between language input factors and child language acquisition. The primary goals of this research were:

1) To examine the differences in syntactic complexity (MLU), and lexical diversity (*VOCD)* in ADS and CDS to eleven- and 24-month-old children for individual parents and to determine the relationship of those differences to child vocabulary outcomes.
2) To investigate the effect of maternal use of relatively more sophisticated lexical input, and whether it results in greater child vocabularies, or if greater maternal use of rare vocabulary is associated with diminishing returns.
3) To investigate the effect of proportions of one-word utterances in CDS to child vocabulary outcomes.
4) To determine whether higher proportions of nouns in CDS are associated with greater child vocabulary development.
5) To determine whether consistent relationships between CDS at different time points will allow studies of maternal input and child language outcomes to use concurrent, rather than time-lagged measures.

Chapter 7: Methods

Participants

Participants in this study consisted of thirty-four mother-child dyads selected from the families participating in an ongoing longitudinal study at the University of Maryland. This multi-part longitudinal study of infants' perceptual and linguistic abilities and maternal IDS is examining differences in maternal input parameters as their children develop their initial receptive and expressive language skills (from age seven months to two years). Children in this study were full-term infants and spoke English as their primary language (80% or more of their language exposure was reported to be English). Mother-child pairs visited the lab for play sessions and parent interviews at approximately eleven and twenty-four months. For the dyads selected for this study, transcriptions of the first visit had already been completed, leaving transcription of the two year old visit to complete the present data for each child. A single child participant was reported to use fewer than fifty words on the *MCDI: Words and Sentences* at age. (Interestingly, his mother's use of both lexical diversity and syntactic complexity were the most complex of any mother in this study at both eleven and twenty-four months). This dyad was excluded from the study, leaving 33 mother-child pairs. Only one child was excluded based on this criterion, but that does not mean that no other children in the study have clinical language impairments. Children who have achieved this milestone may still have clinical language impairments. Other children in the study received standard scores greater than one standard deviation below the mean on the EOWPVT. However toddler vocabulary development varies substantially. More "late talkers" at age two fall within the normal range for language development by elementary school than continue to present with language impairments of greater than one standard deviation

below the mean (Paul, 1993). Furthermore, norms on the EOWPVT-III for this age group are based on a sample size smaller than the number of participants in the present study. Preliminary examination from the longitudinal study suggests the EOWVPT-III may over-identify language impairment. Therefore, these children were not excluded from the study.

At the first time point, children were a mean age of eleven months (*SD* = 17 days, range = 9 months, 5 days to eleven months, 27 days). In the larger longitudinal study, children made two laboratory visits at approximately ten and eleven months. For this study, data were available from the second visit for all but three subjects, whose data from the first visit were used. This resulted in including two children who were somewhat younger than the next youngest participant (see Figure 1). Two-thirds of the child participants were reported to say one or no words, and only two said more than ten words.

Mothers in this study were native speakers of English. One mother had an associate degree. Most mothers had completed four years of college (n = 11) or received a master's or doctoral degree (n = 18, n = 4).

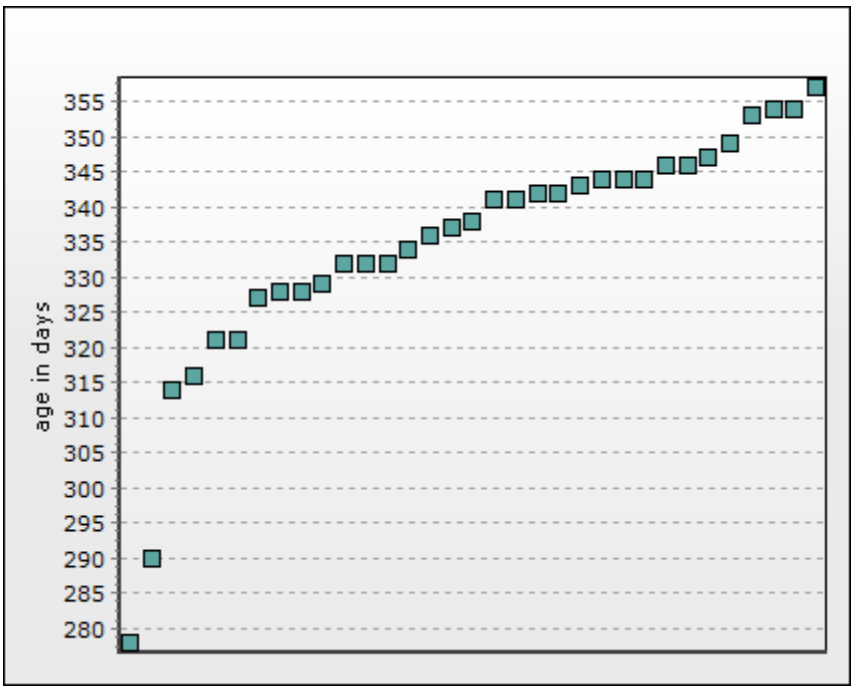

Figure 1. Age of children in days at first visit (n=33).

Data Sources

Data for the maternal language input measures were collected during mother-child visits to the University of Maryland Language Development Laboratory. For the play sessions, mothers and children were given a variety of age-appropriate toys and asked to play together as they would at home. For each visit, toys had been selected in order to elicit a variety of vowel productions from mothers. Incidentally, both sets of toys included opportunities for mothers to produce both very common (e.g., *baby*) and more exotic (e.g., *otter*) vocabulary items. Age-appropriate books were also included in each toy assortment. The choice to read them, or not, was left to the individual mothers. After the play session, each mother was interviewed about what the child had played with in the play session, what toys the child did and did not enjoy, and how the toys compared to toys or real objects that are part of the child's life at home. Parent–child dyads were

recorded using a clip-on Audio-Technica miniature cardioid condenser microphone (AT831b) and a Marantz portable solid state recorder (Model PMD660). Sixty-eight mother-child play sessions and sixty-eight parent interviews were transcribed and coded by the transcription team for the Language Development Laboratory at the University of Maryland, College Park, using the Codes for the Human Analysis of Transcripts (CHAT) transcription system of the Child Language Data Exchange System (CHILDES) (MacWhinney, 1995). The author verified the coding of all transcripts to ensure consistent transcription of concatenations and to mark backchannel utterances (instances where the mother addressed another adult in the play session, or her child during the parent interview), repetitions and filled pauses. The time allotted to play sessions and parent interviews was set at approximately fifteen minutes. Eleven-month play sessions were an average of 13.8 minutes long (*SD* = 2.2) and twenty-four month play sessions were an average of 16.3 minutes long (*SD* = 2.9). Mothers varied substantially in how much they spoke, both in the play sessions and parent interviews. Mothers used an average of 860 words (*SD* = 44) in the play sessions. Volubility is known to vary among parents and has been considered to be an authentic difference in language input to children (Hart & Risley, 1992; Hoff-Ginsberg, 1992). For measures of both maternal and child speech in the play session, sample sizes were allowed to float.

Each mother had provided two ADS speech measures in two parent interviews. Sample sizes varied. Some adult interviews were very short. In very small samples, atypically extreme utterances can have a substantial effect on measurements. To avoid this problem, we place a minimum utterance length on the size of the adult sample included in this study. When the first ADS interview contained at least 95 utterances, we

used that parent interview for our analysis. If the first ADS sample was smaller than 95 utterances, the second sample was used. The resulting adult samples had a mean of 758 words (*SD* = 300, range = 311-1875).

Measures of simplification in CDS

The level of syntactic complexity of maternal language was evaluated using mean length of utterance (MLU) in words. Classic mean length of utterance calculations were developed to assess children's syntactic development until approximately age four (Brown, 1973). Use of morphemes is a key development in this age range, so utterance length in morphemes is an appropriate metric. For the current study, a measure of the difference in syntactic complexity between ADS and speech addressed to eleven-month and two-year-old children was required. Children at age eleven months are preverbal, or just beginning to produce their first single word utterances. Since children at this stage are unlike to be aware of many sublexical morphemes, maternal mean length of utterance was measured as the mean length of utterance in words.

Determination of utterance breaks is central to any calculation of utterance lengths. In adult conversations, the end of an utterance is often the end of a communicative turn, after which the other person speaks. When young children serve as communicative partners, mothers often provide several utterances in a row. Utterance boundaries were placed where a sentence was complete, and in the case of coordinating conjunctions, when the following clause could stand as a complete sentence on its own. In addition, a new utterance was considered to have begun when pitch contours, pausing, and a shift in topic indicated a new utterance. When these indicators were inconsistent, the boundary was placed where two of the three criteria indicated.

Another transcription choice relevant to MLU involves assimilated forms common in spoken English. For this study, contractions of pronouns with the verb *be* and negations (e.g., *he's, can't*) were transcribed as contractions. All other assimilations were transcribed as standard word forms; *wanna* was transcribed as "want to" or "want a" as appropriate; *whyncha* became *why don't you.* Choice between an assimilation and a standard transcription is often dependent both on the ear of the transcriber and the quality of the audio equipment used for transcription. Furthermore, what is most important is not what specific choice is made for transcription, but that any choices are consistently applied, so that all language samples to be compared have been measured with the same metric. Choosing to transcribe standard grammatical English simplifies the task of ensuring that the same words will be transcribed the same way, preventing, for example, "*what are you*" from counting as different lexical items, depending on whether the transcriber chose *whatcha, whacha,* or *whadya*. Following CLAN conventions, false starts and repetitions were not considered in calculations of mean length of utterance. This prevents false starts and multiple attempts at a single phrase from inflating MLU. Onomatopoeic utterances were included in most measures, because they are a major component of early vocabularies. If they were made in a series without pauses or utterance-final prosodic changes they were counted as a single utterance, regardless of the number of repetitions. *Moo* and *moo moo moo* were both counted as one utterance, made up of one lexical item. In order to examine mothers' degree of simplification when speaking to their child, their MLU for CDS was subtracted from their MLU for ADS.

Lexical diversity was quantified using *VOCD*. Word type counts are affected both by the variety of words spoken and by quantity. Differences in quantity can be an

authentic reflection of differences in maternal language input, but they can also vary substantially based on sampling, particularly when language samples comprise a tiny fraction of maternal vocal behavior, as they do here. *VOCD* addresses the problem of finding lower lexical diversities when sample sizes are smaller, by mathematically correcting for the tendency of diversity measures to increase with increasing sample size (Duran, Malvern, Richards, & Chipere, 2004; Malvern & Richards, 1998). As discussed above *VOCD* allows for samples of varying lengths to be used in their entirety and directly compared to one another. Following CLAN convention, false starts and repetitions were included in this calculation, as both do contribute to the child's exposures to a particular lexical item. For each adult participant, *VOCD* in CDS was subtracted from *VOCD* in ADS to investigate the differences in degrees of lexical diversity used with adults and children.

Measures of specific characteristics of CDS

Additional measures were included to consider other structural aspects of maternal input that may provide a word-learning advantage for eleven-month-olds. These consider specific utterance types and lexical measures that are obscured in the mean calculations of syntactic and lexical sophistication offered by *VOCD* and MLU.

In order to examine how use of words beyond the most common vocabulary items affects child language development, it was necessary to determine which words, in the context of mother-child interactions at eleven months and two years, were common, and which were rare. Preliminary trials with the Chall-Dale word list used by Weizman and Snow with pre-school age child participants revealed that if this full list was defined as common, the number of rare words in our samples was vanishingly small, and provided

very little variability among participants. Moreover, on a theoretical level, a word that is common to a 4-year-old might well be quite atypical when speaking to a one-year-old child. Therefore, for this study, lists of common and uncommon words were generated based on their frequency in the corpus at hand. In the thirty-three play sessions at eleven months, mothers used a total of 1375 different word types, and 25,164 tokens. In the play sessions at twenty-four months, mothers used 1,546 difference word types, and 36,033 word tokens. Lists were compiled of all words used at least ten times in the corpus. These were considered "common" and excluded in order to measure mothers' rare word use. Some words that were common for an individual child, such as proper names, were excluded, as were non-word sounds. The resulting lists of common words are somewhat smaller than the Chall-Dale list but are more pertinent to parent-toddler interactions. What constitutes a common word is partly determined by general frequency (*you* is the most frequent) and partly by the context of the play session. *Woolly* is counted as common, because it occurs in one of the books included in the selection of toys. What constitutes a *rare* word here is simply one that is rare in this context. *"Man"* is included as a rare word.

Excluding lists of "common" words, non-words, and proper nouns, the child-directed speech files were run through the *freq* command in CLAN. This resulted in values for types and tokens of rare words. Following Weizman and Snow (2001), the numbers of tokens and types of less common words were then compared to the total numbers of types and tokens in each sample to yield measures of rare word type density and rare word token density. These provide an indication of how tightly mothers remain

within a limited vocabulary of the most common words used by mothers of children of the same age, in similar settings, with a set group of toys.

For children who are themselves at the one-word level of expressive language, one-word utterances may provide a particularly salient from of input for word learning. Using CLAN, one-word utterances were counted in CDS at each age for each adult participant. Meaningful, but non-word sounds such as *hmm* were excluded. Repetitions were excluded, so utterances that consisted of repetitions of a single word *("no no"* or "*woof woof"*) were included as single word utterances.

Looking at the proportion of nouns in parents' speech serves as a proxy for mothers' naming behavior, measured separately both from general lexical variety (which could stem from other parts of speech) and from single word utterances. Using the MOR line in CLAN, the total number of common nouns for each play session was calculated and divided by the total number of words in the transcript, to yield a measure of proportion of nouns in speech. Both the proportion of noun types in the total number of word types and the proportion of noun tokens out of the total number of word tokens were calculated.

Child language measures

Prior to each laboratory visit mothers were mailed age-appropriate versions of the MacArthur Communication Development Inventory (MCDI, Fenson et al., 2007) , a parent checklist of common early vocabulary. At the two-year-old visit, children completed the Peabody Picture Vocabulary Test (PPVT-III), a picture-pointing, receptive vocabulary assessment, and the Expressive One-Word Vocabulary Test (EOWPVT -III) a picture-naming expressive vocabulary assessment (Brownell, 2000;

Dunn & Dunn, 1997). While the EOWPVT-III is designed to be administered to children at age two and provides standard scores for that age, the PPVT-III does not. Thus raw scores were used in the current study. Children were judged to understand and tolerate both tests and anecdotal commentary from parents confirmed that answers were consistent with their impression of their children's vocabulary knowledge.

In addition, the number of different word types spoken by children during the play session was added as a direct measure of child language. This provides a measure of toddler's productive vocabularies: Most children did not provide a sample that was large enough for successful use of *VOCD*. Word types were chosen over word tokens, because a two-year-old who says *no* many times does not display the same language ability as one who uses a variety of words. No attempt was made to regulate sample size, so this measure of word types depends on the quantity, as well as the variety, of toddler's speech. Transcribers cannot always reliably identify all the words a toddler says. In CLAN, entire utterances judged to contain multiple words are transcribed as xxx. When it is possible to say how many words, but not to identify them, this is transcribed as xx. (e.g., "I xx xx"). Following CLAN conventions, this analysis included *xx* in the count of words used, but excluded *xxx*. Therefore, some portion of the diversity of word types in children's language samples could not be counted. Children's surface word forms were accepted as words, including contractions (*can't*), concatenative forms (*wanna*), and onomatopoeia (*woof*). Proper names and fillers (*um*) were excluded. One child participant whispered throughout the play session. This participant was excluded from all analyses involving word types used during the play session at age two. These analyses were performed with the remaining thirty-two participants.

Chapter 8: Results

The first research question concerned the differences in speech quantity, syntactic complexity (MLU) and lexical diversity (*VOCD*) between ADS and CDS to children at different ages. Mean values for these measures are reported in the Table 1. Mean values for the differences between ADS and CDS with eleven- and twenty-four-month-olds are reported in Table 2.

Table 1. Maternal language measures in CDS and ADS: descriptive statistics

Person addressed	Word tokens	MLU (words/utterance)	*VOCD*
11 month CDS	*M* = 669 *SD* = 285 Range = 147-1,131	*M* = 2.86 *SD* = .61 Range = 1.6-3.8	*M* = 59.08 *SD* = 16.47 Range = 29.2-96.7
24 month CDS	*M* = 1050 *SD* = 339 Range = 333-1893	*M* = 3.47 *SD* = .54 Range = 2.3-4.6	*M* = 66.25 *SD* = 11.0 Range = 38.8-91.8
ADS	*M* = 795 words *SD* = 315 Range = 317-1929	*M* = 5.97 *SD* = 1.1 Range = 3.5-7.9	*M* = 70.5 *SD* = 8.8 Range = 55.18-88.41

Table 2. Differences between ADS and CDS: descriptive statistics

Difference	MLU in words	*VOCD*
ADS and 11 month CDS	*M* = 3.11 *SD* = 1.18 Range = .29-6.32	*M* = 11.4 *SD* = 17.0 Range = -16-42
ADS and 24 month CDS	*M* = 2.50 *SD* = 1.2 Range = .35-5.0	*M* = 4.2 *SD* = 11.6 Range = -11.9-31.9

Mothers showed a larger and more consistent simplification of MLU at eleven months. No mother used a lower MLU in adult-directed-speech than with her child. (See Figure 6.). A paired samples, two-tailed t-test showed the differences between ADS and CDS at eleven and 24 months were significant. ($t(32) = 6.2$, $p<.001$). However, they were also strongly correlated. ($r(31) = .88$, $p < .001$. See Figure 7). The amount of adjustment mothers made in MLU for eleven-month-olds accounts for 77% of the variance in adjustments of MLU in CDS at twenty-four months.

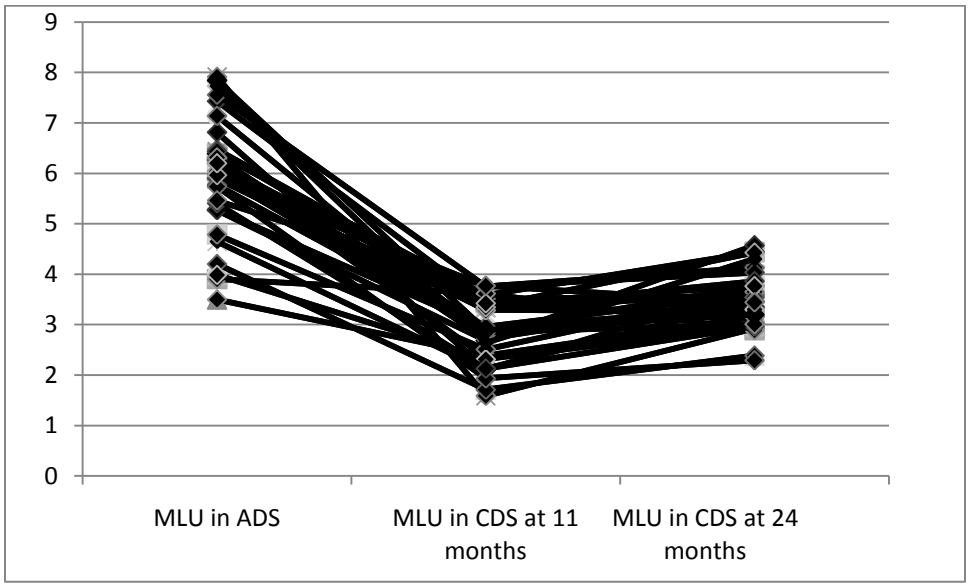

Figure 2. Differences in MLU in ADS and CDS at 11 and 24 months.

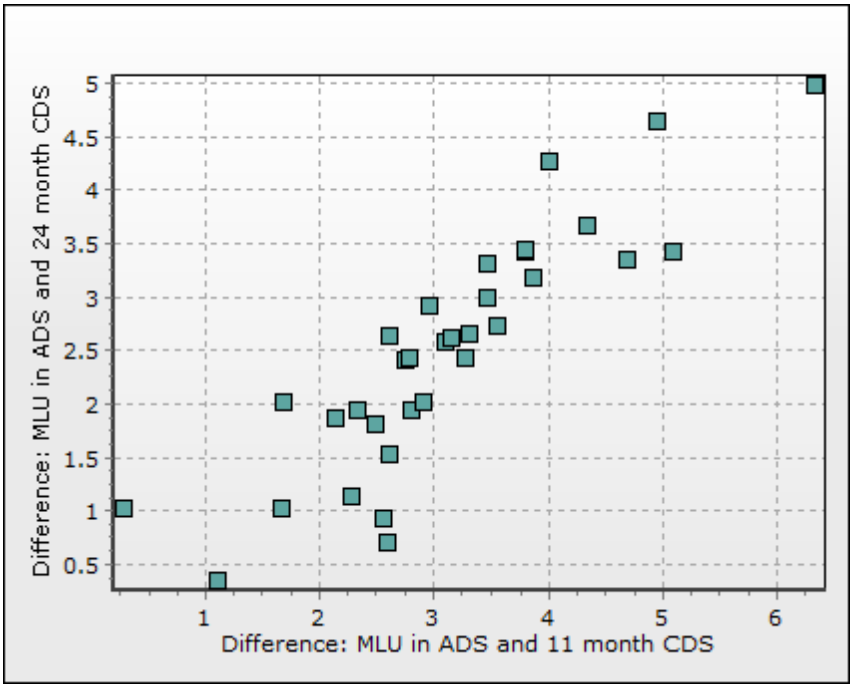

Figure 3. Correlation of differences in MLU in ADS and CDS at 11 and 24 months (r (31) = .88, p < .001).

Differences between ADS and CDS for *VOCD* show more variability (see Figure 7). Mean measures from ADS to 11 months decline from 70.5 to 59.08. But while twenty two mothers used less lexical variety with eleven-month-old children, eleven showed more. On average, mothers used more lexical diversity with adults than they did with two-year-olds. Twelve of thirty-three did use more, but twenty-one of thirty-three used less. There is a significant difference between the levels of simplification for eleven-month-olds and two-year-olds (t(32) = 2.6, p = .01). They are also correlated with one another (r(31) = .44, p = .01). As with MLU, there is an emerging picture of simplification for young children, followed by lexical diversity that increases gradually and steadily as children grow. However, differences in the level of reduction of lexical diversity for eleven-month-olds accounted for just 19% of the variance in levels of reduction of lexical diversity for two-year-olds.

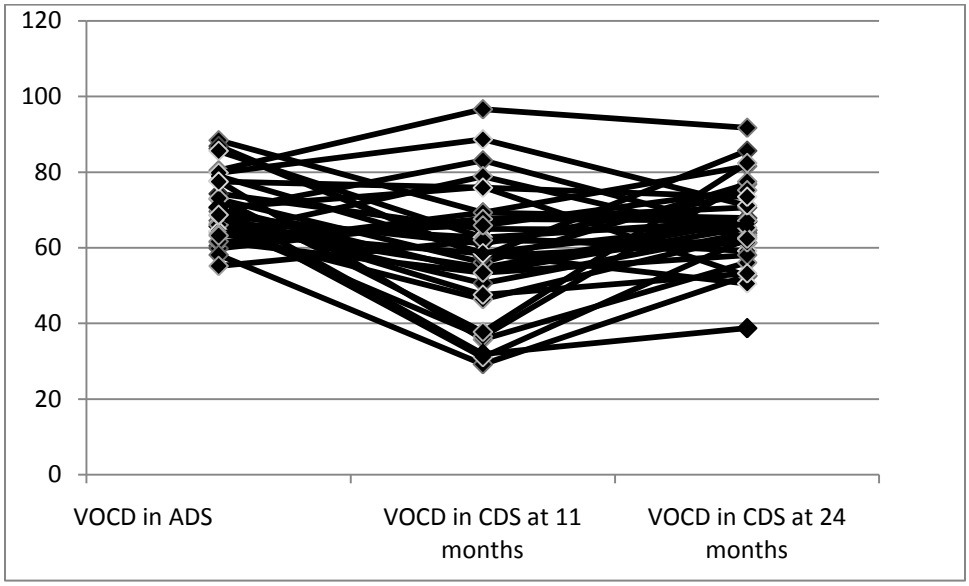

Figure 4. Differences in VOCD in ADS and CDS at 11 and 24 months.

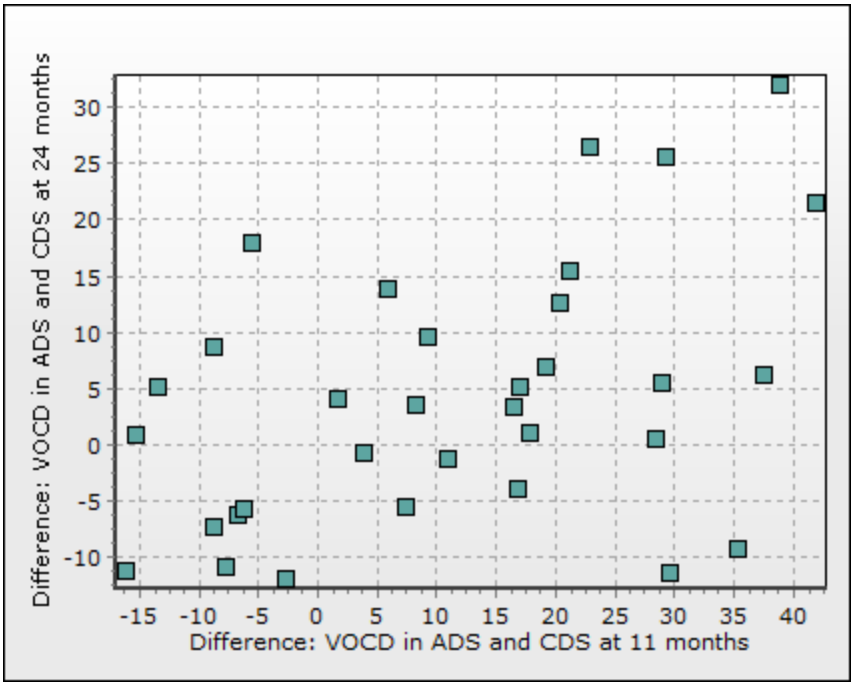

Figure 5. Differences in VOCD in ADS and CDS at 11 and 24 months ($r(31) = .44$, $p = .01$).

For mothers in this study, like those studied elsewhere (Huttenlocher, et al., 2007), patterns of relative sophistication within CDS are relatively consistent. That is,

mothers who used more words, higher MLU, and, to a lesser degree, greater lexical diversity with eleven-month-olds also did so with two-year-olds. Next, we turn to whether related levels of simplification in input have similar relationships to children's language outcomes.

Simplification from ADS to CDS and child language development outcomes

Children in this study, like most toddlers, displayed a wide range of levels of vocabulary development. Descriptive statistics for child language measures are presented in Table 3.

Table 3. Descriptive statistics for child language outcome measures.

	Mean	*SD*	Range
EOWPVT-III	98.7	13.5	59-118
PPVT	32.2	12.7	9-59
MCDI	335	142	24-600
Word types produced in play session (n=32)[1]	57	28	3-117

Considering child language development subsequent to the point at which factors influencing its development are measured is recommended in order to establish that characteristics of CDS are a source of, and not a response to, child language development (Hoff, 2003; Richards, 1991). Pearson's *r* correlations between degrees of simplification of MLU and VOCD at eleven months, and child language development measures at age

[1] One child whispered throughout the play session audibly, but unintelligibly. His data could not be included for statistics involving children's speech in the play session.

two are presented in Table 4, followed by scatterplots of these correlations (Figures 10-21). Greater differences between ADS and CDS at eleven months correspond to greater amounts of simplification. Therefore, negative correlations would indicate that less simplified, more complex input corresponded to better toddler outcomes. With Bonferroni correction for the four language outcome measures so that α is set to .01, there are no significant correlations between levels of simplification from ADS to CDS at eleven months and child language outcome measures. Only one relationship approaches significance: the negative correlation between changes in numbers of tokens used at eleven months and MCDI results at twenty-four months. This result would imply that smaller reductions in quantity of tokens used from ADS to CDS correspond to better toddler vocabularies at age 2. This is consistent with widely reported, robust effects of the increased quantity of maternal input on toddler language outcomes, More surprising is the fact that no language measure other than the MCDI was related to the number of words spoken by mothers. Furthermore, no other adjustment of ADS to CDS was related to any of the outcome measures. Reviewing the correlation factors (small), and p-values (large) in these correlations and visually considering the scatterplots show that the parameters of CDS to eleven-month-old infants have very different relationships with child language outcomes for individual mothers. Samples from some mothers showed simple language and better outcomes, but others used complex language, and their children did not do as well. These results differ from those with children at nine months, showing that more simplification of MLU at nine months correlated with greater language outcomes (Murray, et al., 1990). They also differ from the body of research showing that syntactically more complex and linguistic input promote language

development in older toddlers. Input for this study was measured at eleven months. It may be that eleven-month-old children's needs are in transition, and that the optimal kind of input, more simplified or more complex, is especially variable at this intermediate age.

Table 4. Degree of simplification in language input at 11 months and child language outcomes at two

Maternal language input and child language outcomes	Pearson's *r*
Tokens and EOWPVT-III	r (31) = -.24, p = .18
Tokens and PPVT-III	r (31) = -.19, p = .29
Tokens and MCDI	r (31) = -.37, p = .03 *
Tokens and children's word types at age two	r (30) = -.20, p = .28
MLU and EOWPVT-III	r (31) = -.05, p = .79
MLU and PPVT-III	r (31) = -.01, p = .96
MLU and MCDI	r (31) = .13, p = .48
MLU and size of children's word types at age two	r (30) = .26, p = .15
VOCD and EOWPVT-III	r (31) = -.19, p = .30
VOCD and PPVT-III	r (31) = -.25, p = .17
VOCD and MCDI	r (31) = -.10, p = .58
VOCD and children's word types at age two	r (30) = -.01, p = .96

**this result approaches, but not achieve significance, with α=.01*

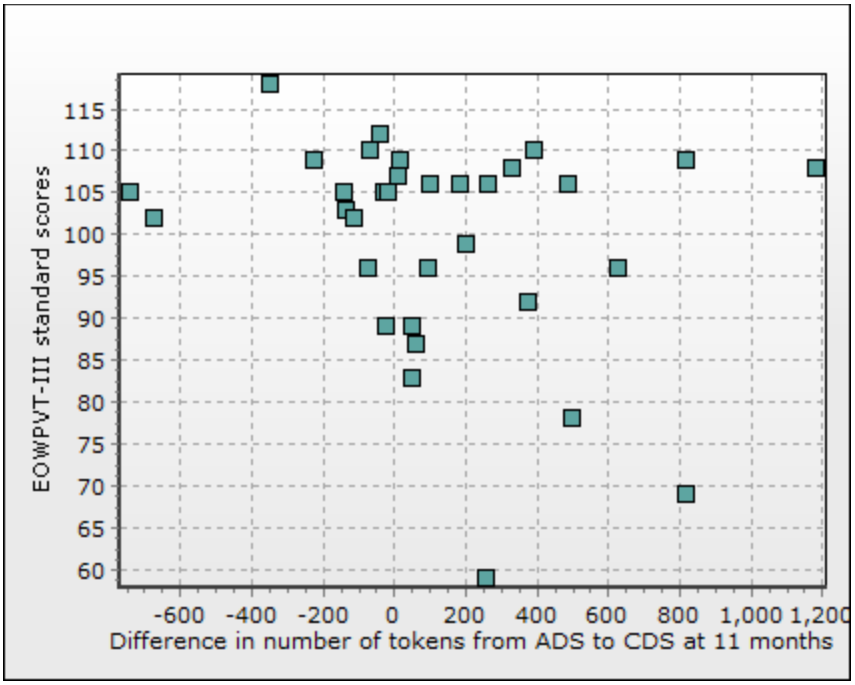

Figure 6. Difference in tokens from ADS to CDS at 11 months and EOWPVT-III standard scores (r (31) = -.24, p = .18).

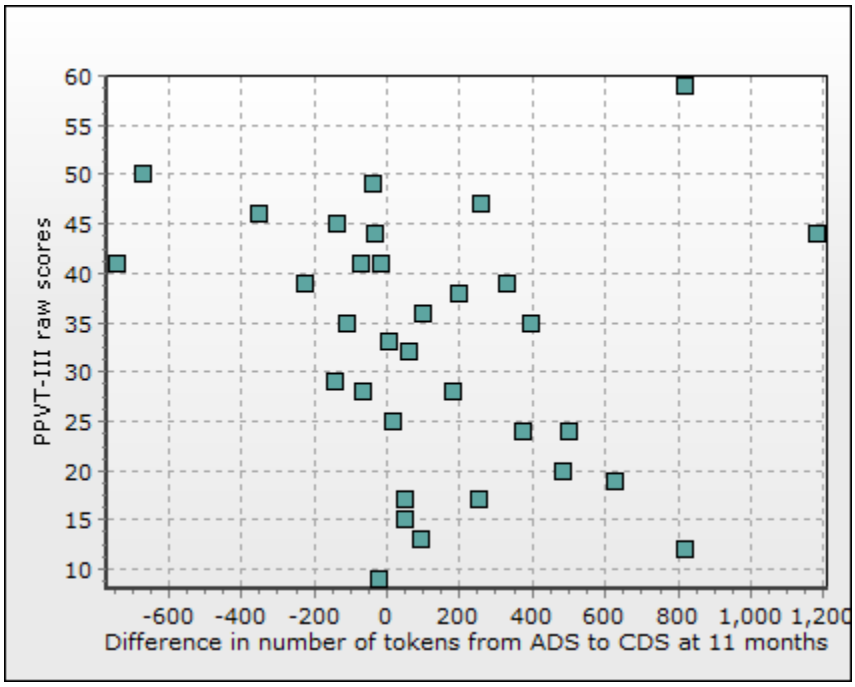

Figure 7. Difference in tokens from ADS to CDs at 11 months and PPVT raw scores (r (31) = -.19, p = .29).

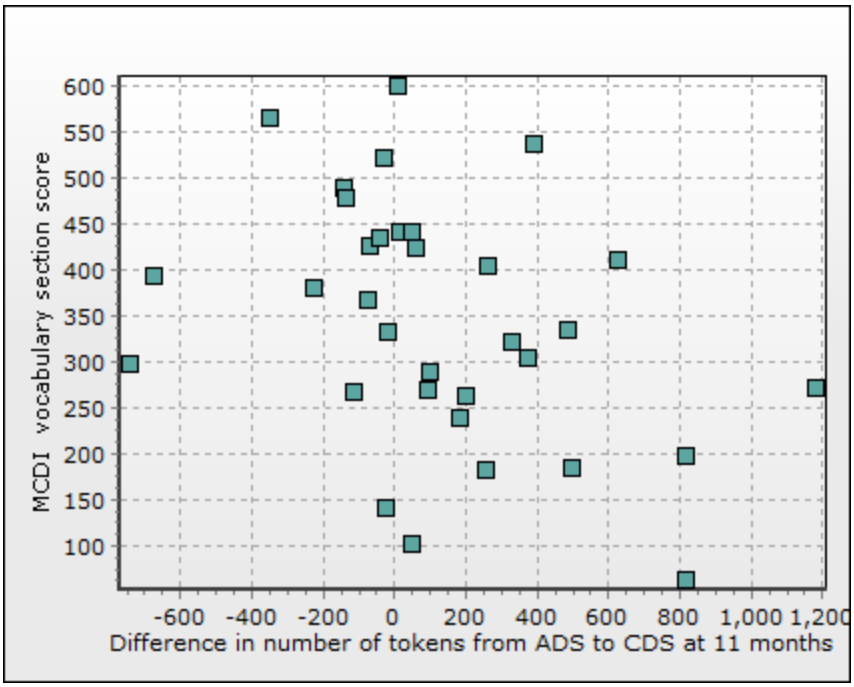

Figure 8. Difference in tokens from ADS to CDS at 11 months and MCDI vocabulary section scores (r (31) = -.37, p =.03). This correlation approaches, but does not achieve, significance.

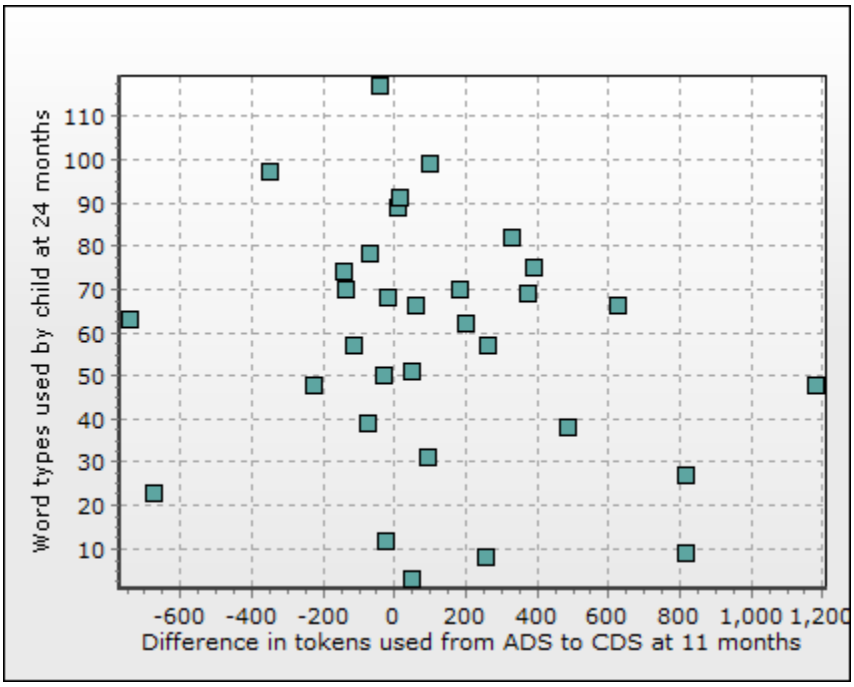

Figure 9. Difference in tokens from ADS to CDS at 11 months and word types used by child in play session at 24 months (r (30) = -.20, p = .28).

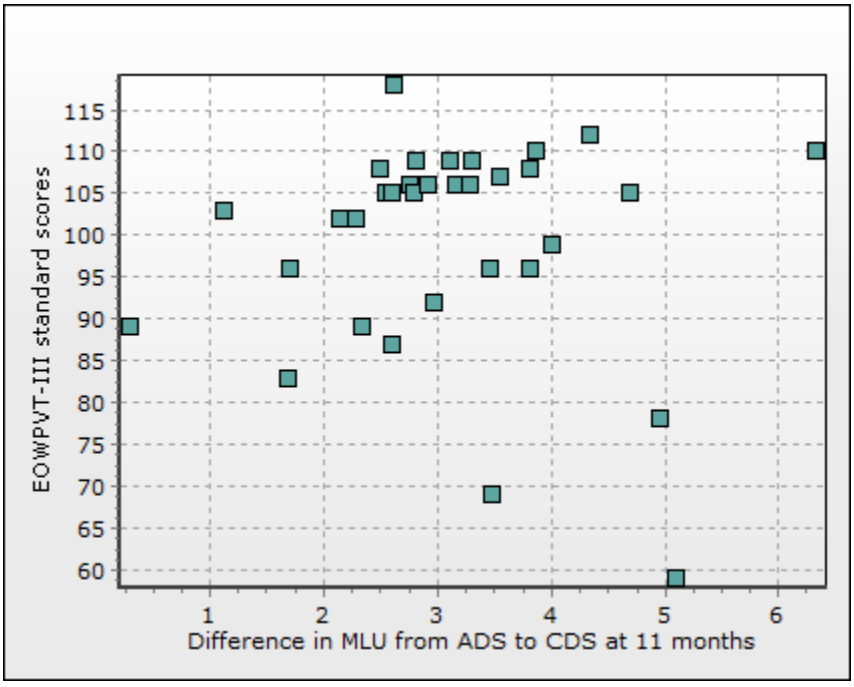

Figure 10. Difference in MLU from ADs to CDS at 11 months and EOWPVT-III standard scores (r (31) = -.05, p = .79).

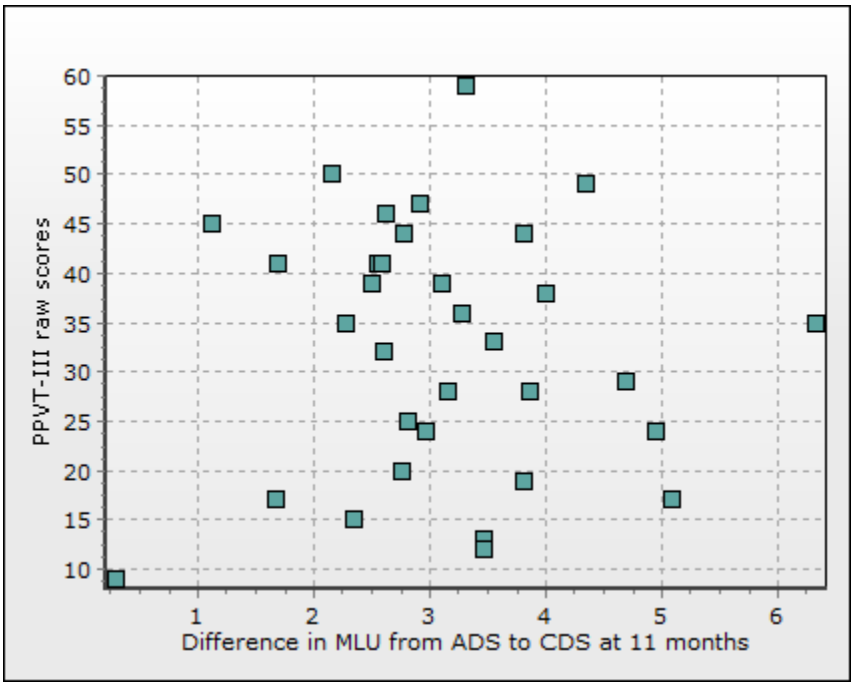

Figure 11. Difference in MLU from ADS to CDS at 11 months and PPVT-III raw scores (r (31) = -.01, p = .96).

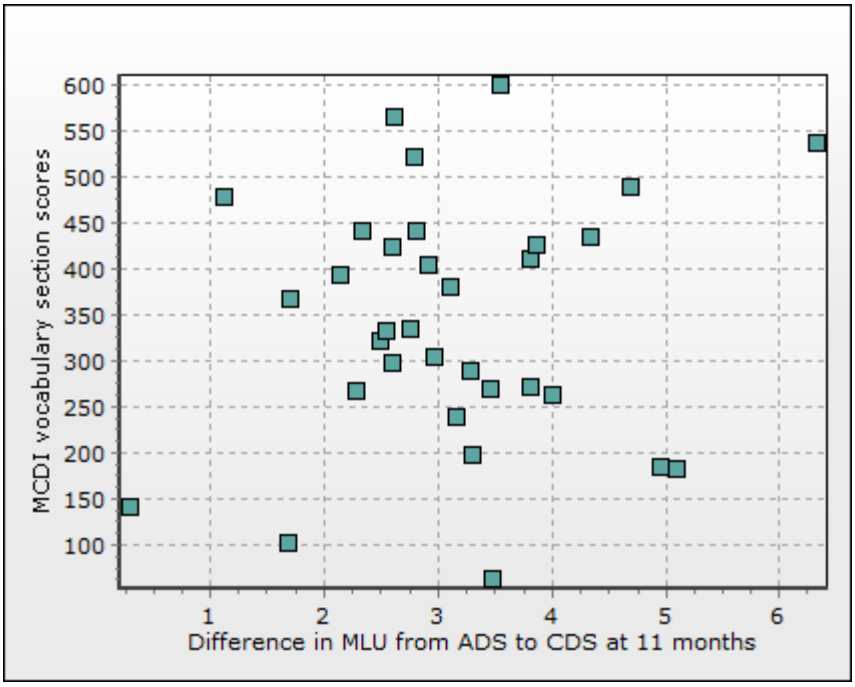

Figure 12. Difference in MLU from ADS to CDS at 11 months and MCDI vocabulary section scores (r (31) = .13, p = .48).

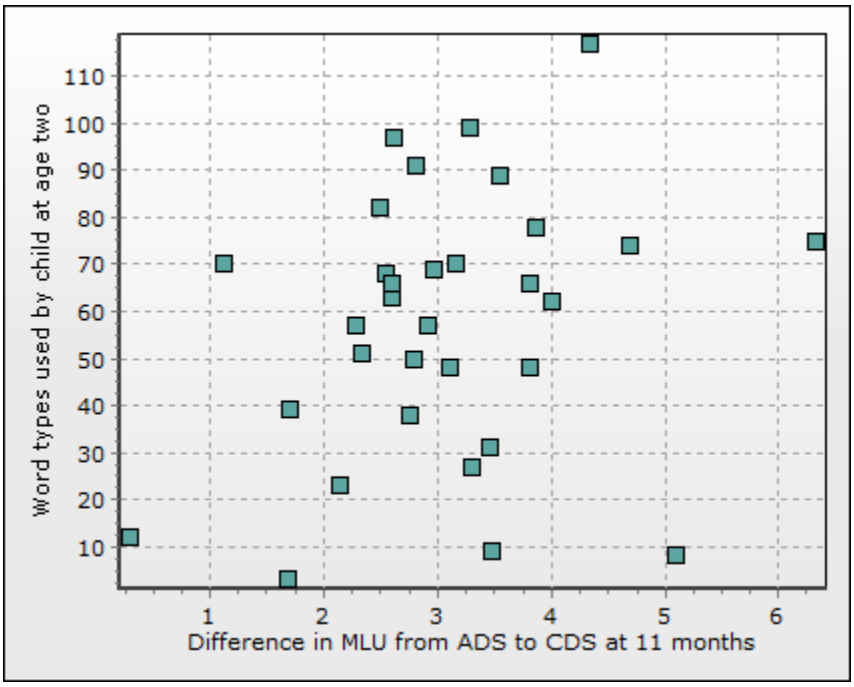

Figure 13. Difference in MLU from ADS to CDS at 11months and word types used by child at age two (r (30) = .26, p = .15).

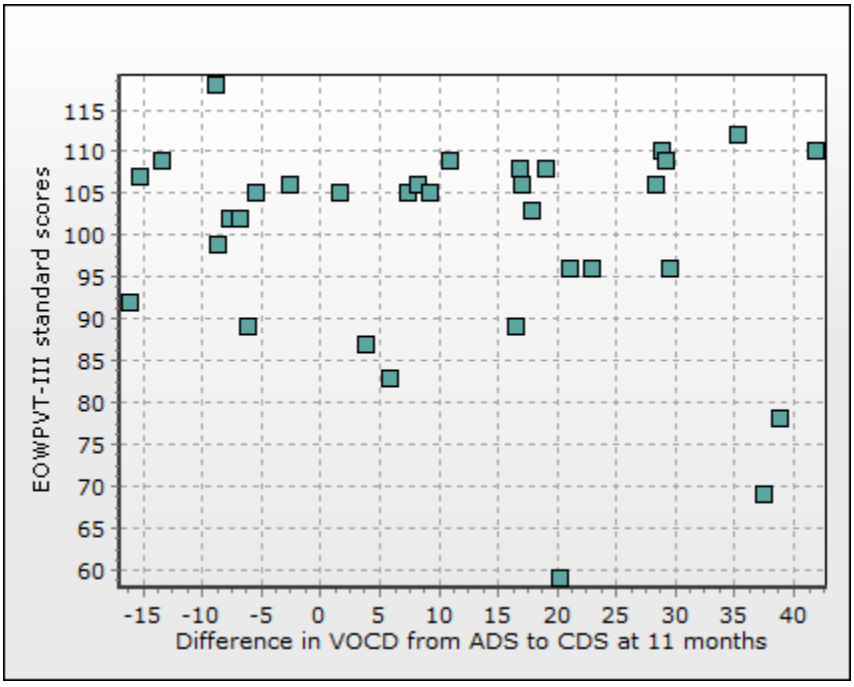

Figure 14. Difference in VOCD from ADS to CDS at 11 months and EOWPVT-III standard scores (r (31) = -.19, p = .30).

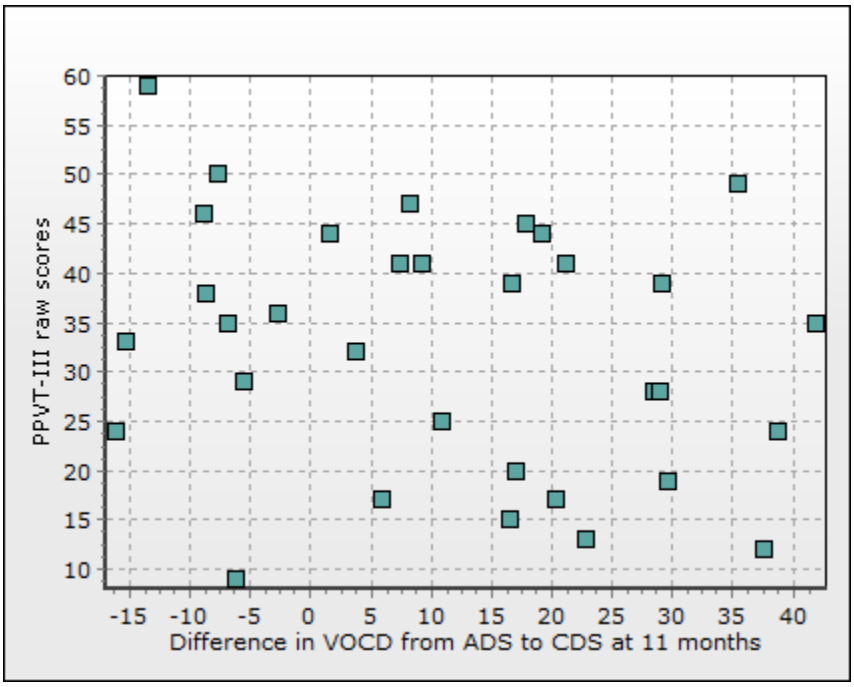

Figure 15. Difference in VOCD from ADS to CDS at 11 months and PPVT-III raw scores (r (31) = -.25, p = .17).

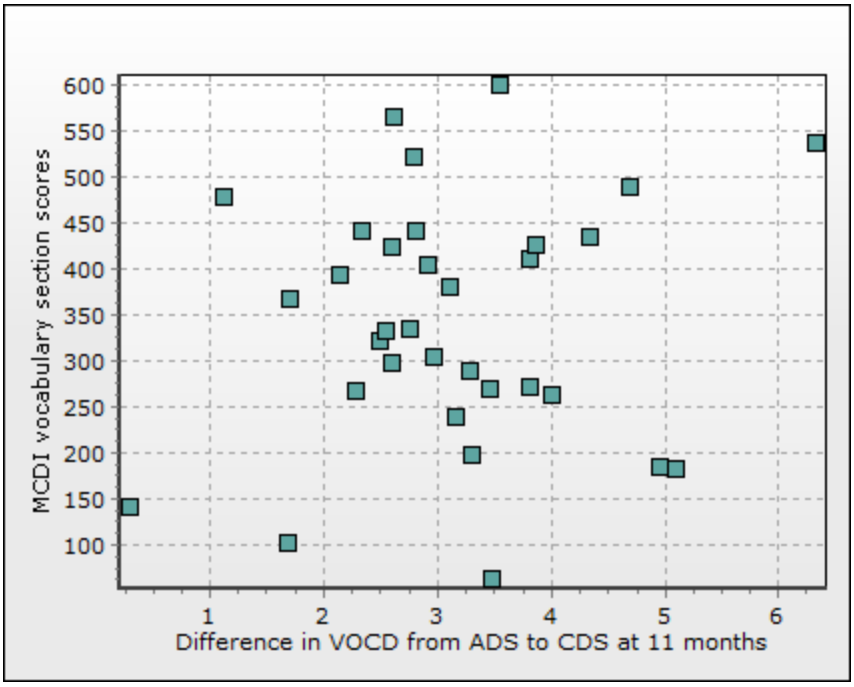

Figure 16. Difference in VOCD from ADS to CDS at 11 months and MCDI vocabulary section scores (r (31) = -.10, p = .58).

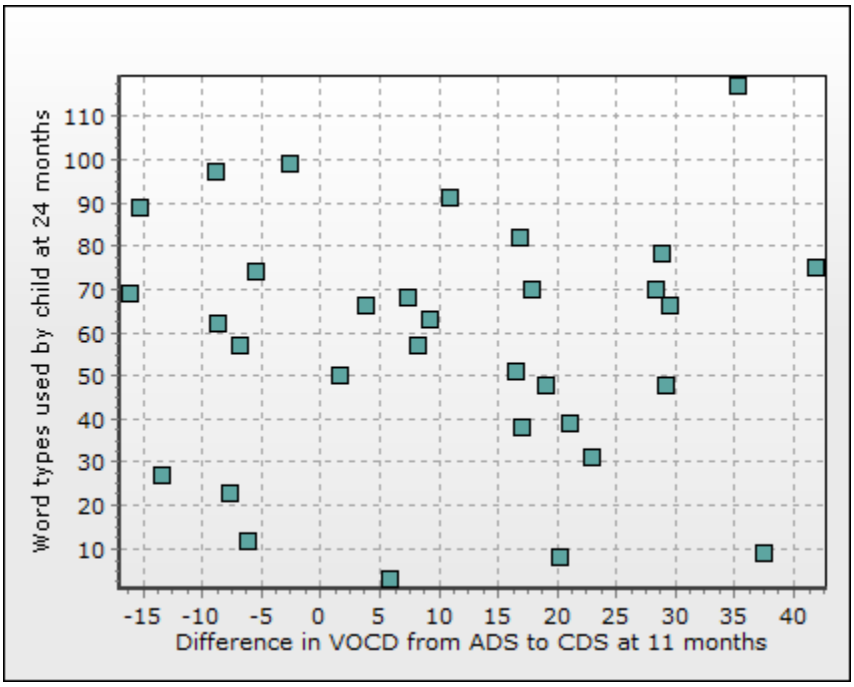

Figure 17. Difference in VOCD from ADS to CDS at 11 months and word types used by child at 24 months (r (30) = -.01, p = .96).

Maternal language input factors were also sampled at twenty-four months. Recall from Hoff (2003), that this is considered a less stringent test of the effect of CDS on child language development, because it allows for the possibility that parent "input" factors are actually responses to, rather than antecedents of, a child's level of language development.

Pearson's r correlations were performed to evaluate the relationship between these measures and child language development scores at the same age (see Table 5 and Figures 21-32). Again, alpha was set to .01, and again, no correlation achieved statistical significance. Two results approached significance, although not strongly. The first parallels the result from the analysis of adjustments to eleven-month input: the smaller the degree of reduction of quantity of words spoken in CDS to two-year-olds, the better two year olds performed. Although it is suspect to argue from null results, it is worth noting that despite characterization of time-lagged measurements as more stringent, the

effect is smaller, and the significance is weaker, in the concurrent measures. The second was the negative correlation between *VOCD* and the number of types used by toddlers. In other words, the more variety mothers used in speaking with their children in the play session, the greater the variety of words used by the toddler. The direction of this effect cannot be known. Both mothers and toddlers frequently repeat one another's utterances, so increased lexical diversity on the part of either could be echoed by the other.

Table 5. Difference of 24 month CDS from ADS and child language outcome measures at 24 months

Maternal language input and child language outcomes	Pearson's *r*
MLU and EOWPVT-III	$r(31) = -.15$, $p = .39$
MLU and PPVT-III	$r(31) = -.13$, $p = .48$
MLU and MCDI	$r(31) = .02$, $p = .93$
MLU and size of child's speech sample at age two.	$r(30) = .12$, $p = .50$
VOCD and EOWPVT-III	$r(31) = -.18$, $p = .31$
VOCD and PPVT-III	$r(31) = -.02$, $p = .35$
VOCD and MCDI	$r(31) = -.06$, $p = .75$
VOCD and size of child's speech sample at age two.	$r\ (30) = -.31$, $p = .08$ *

**approaches, but does achieve, significance.*

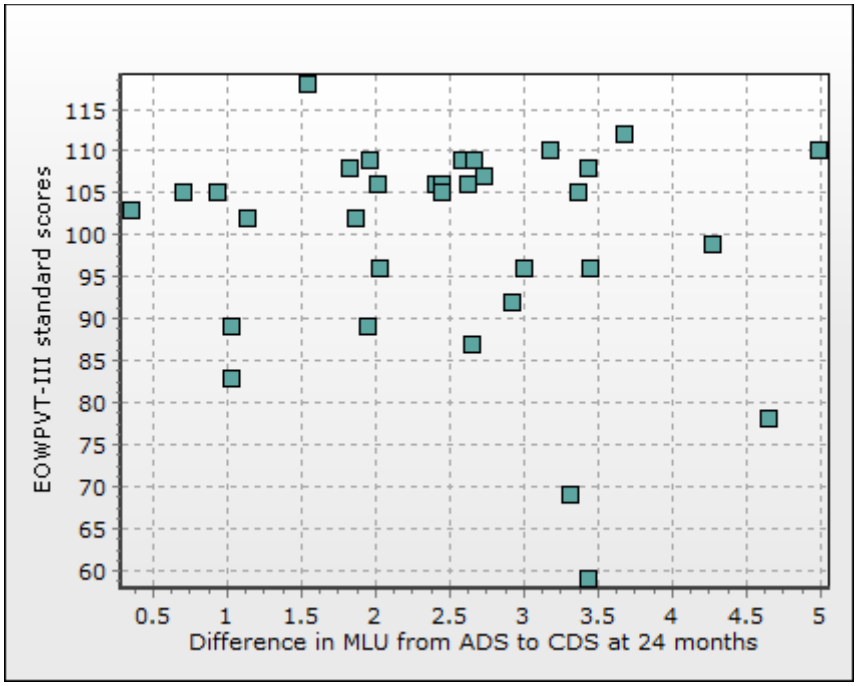

Figure 18. Difference in MLU from ADS to CDS at 24 months and EOWPVT-III standard scores ($r\ (31) = -.15$, $p = .39$).

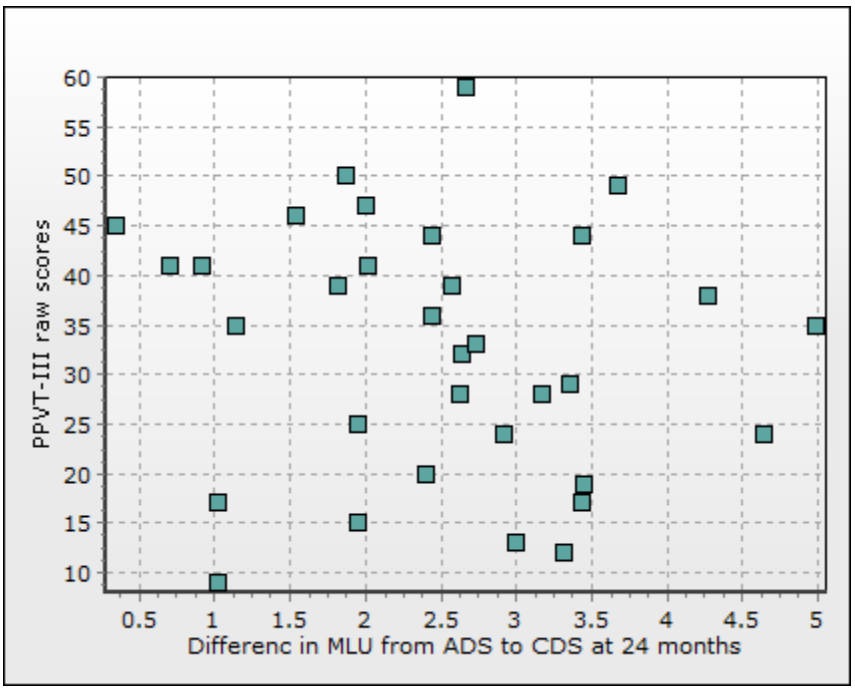

Figure 19. Difference in MLU from ADS to CDS at 24 months and PPVT-III raw scores (r (31) = -.13, p = .48).

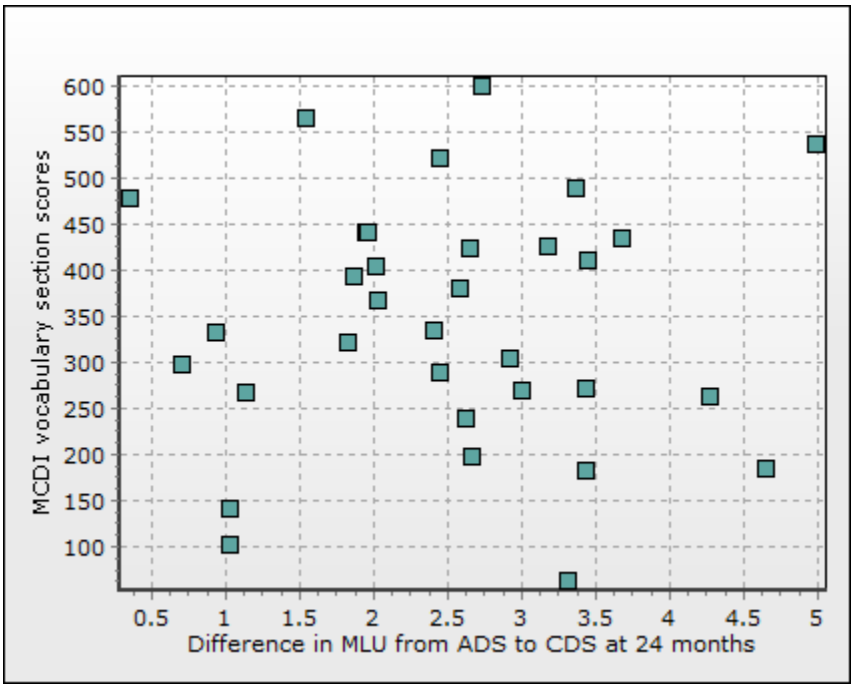

Figure 20. Difference in MLU from ADS to CDS at 24 month and MCDI vocabulary section scores (r (31) = .02, p = .93).

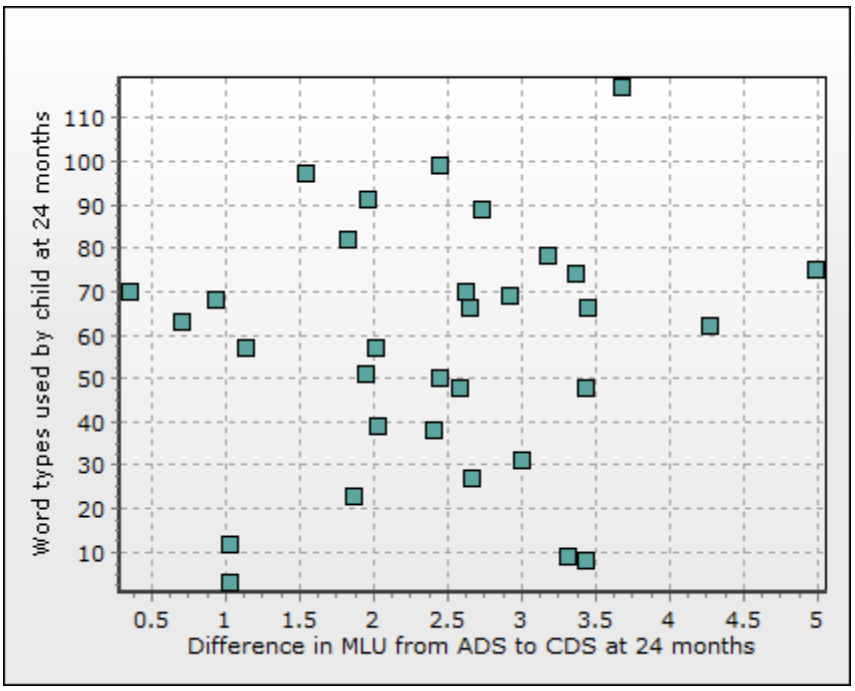

Figure 21. Differences in MLU from ADS to CDS at 24 months and word types used by child at 24 months (r (30) = .12, p = .50).

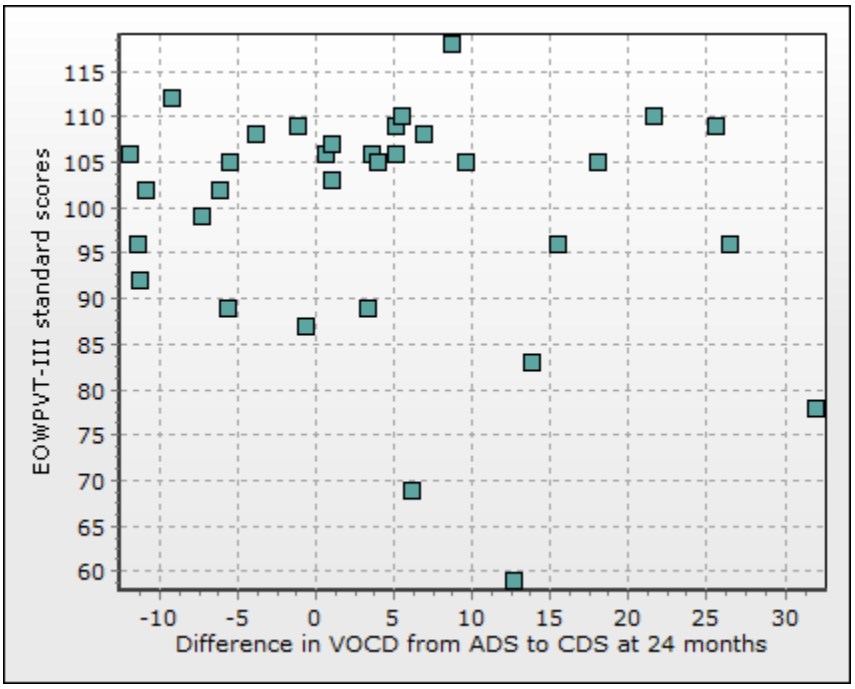

Figure 22. Difference in VOCD from ADS to CDS at 24 months and EOWPVT-III standard scores (r (31) = -.18, p = .31).

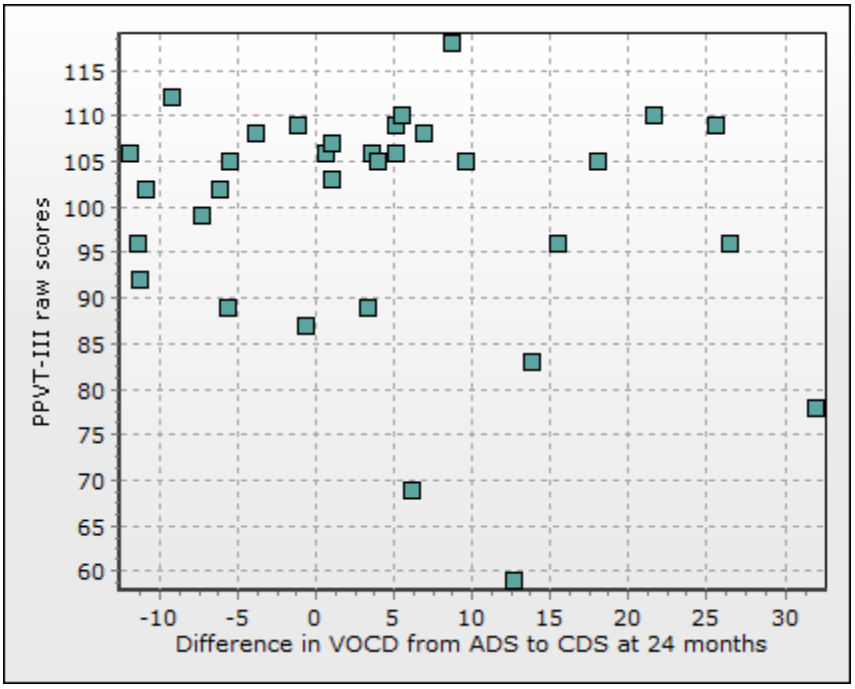

Figure 23. Difference in VOCD from ADS to CDS at 24 months and PPVT-III raw scores (r (31) = -.02, p = .35).

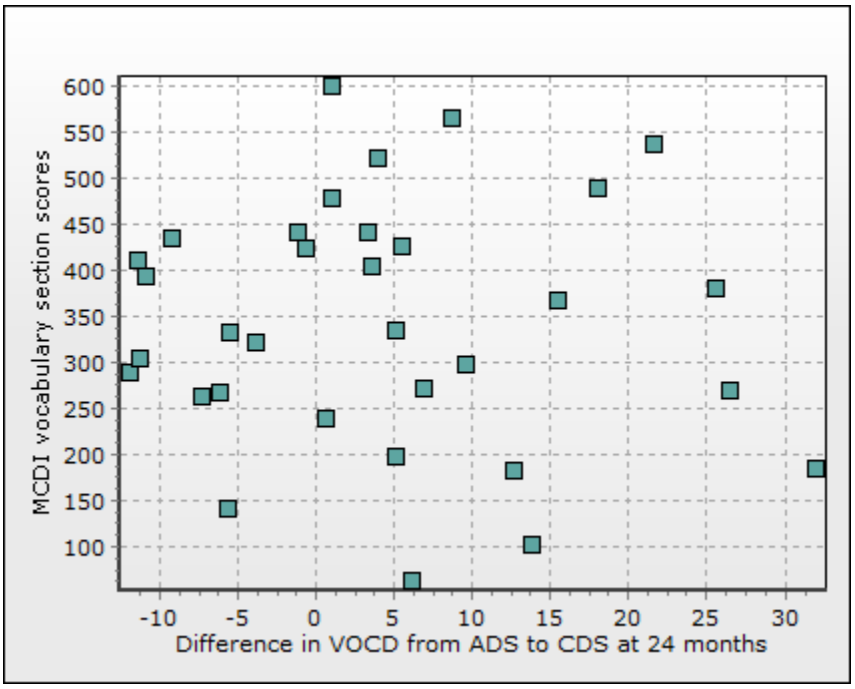

Figure 24. Difference in VOCD from ADS to CDS at 24 months and MCDI vocabulary section scores (r (31) = -.06, p = .75).

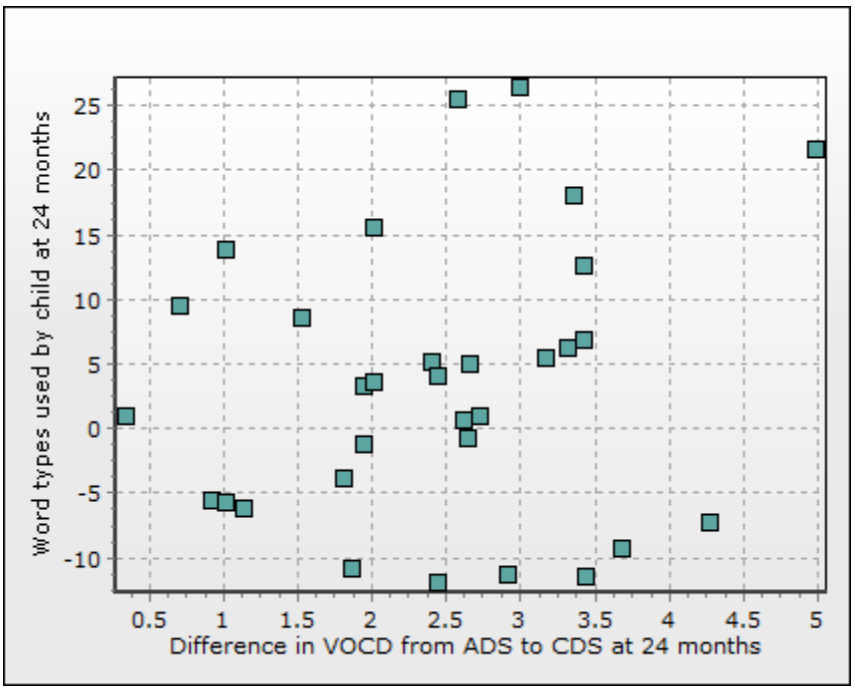

Figure 25. Difference in VOCD from ADS to CDS at 24 months and word types used by child in play session at 24 months (r (30) = -.31, p = .08). This correlation approaches, but does not achieve, significance.

The persisting lack of significant results remains to be explained. Many studies of maternal language input factors have included two-year-olds, and have found that increased syntactic complexity and lexical diversity have corresponded with larger toddler vocabularies. It could be that these effects are more readily found as group differences, or with more sophisticated statistical techniques. Alternately, it could be that more stringent criteria should have been used to eliminate children with potential language impairment, who may respond differently to levels complexity in maternal language input (i.e., they may a group that performs better with simplified language).

A last possibility is that changes in mean measures of complexity did not prove effective predictors of children's vocabulary development because these means mask other, more specific qualities of child-directed-speech. The following section considers three of these in turn: 1) the degree to which mothers stray from the most common

words, 2) the proportion of one-word utterances 3) and the proportion of nouns used in CDS.

Rare word type density and rare word token density in CDS and child language outcomes

In an adaptation of rare word type density and rare word token density for younger children, common words were defined as those used at least ten times by mothers in the eleven-month play sessions for this study. Proper names and non-word sounds were also not considered to be "rare". Mean values for rare word type density and rare word token density are reported in Table 6. According to this measure, rare words made up 26 percent of word types used, but eleven percent of word tokens used. These results differ from those of Weizman and Snow, who did not find a mean of more than four percent rare words types or two percent rare word tokens in any setting (Weizman & Snow, 2001). This measure is, however concerned with a different age group of children, and asks a different question. Where Weizman and Snow looked for the *benefit* from even infrequent exposures to rare words, the aim here is to investigate whether diversity could negatively impact word-learning at the beginning of language development when very few words are known. Rare word type densities did correlate with one another across time points (r (31) = .37, p = .04, see Figure 32), while rare word token densities did not (r (31) = .19, p = .28, see Figure 33).

Table 6. Frequency of rare words in CDS at 11 and 24 months

Type of maternal speech	Rare word type density	Rare word token density
CDS at 11 months	*M* = .24 *SD* = .07 range = .11-.39	*M* = .09 *SD* = .03 range = .03-.18
CDS at 24 months	*M* = .26 *SD* = .06 range = .14-.38	*M* = .09 *SD* = .02 range = .04-.15

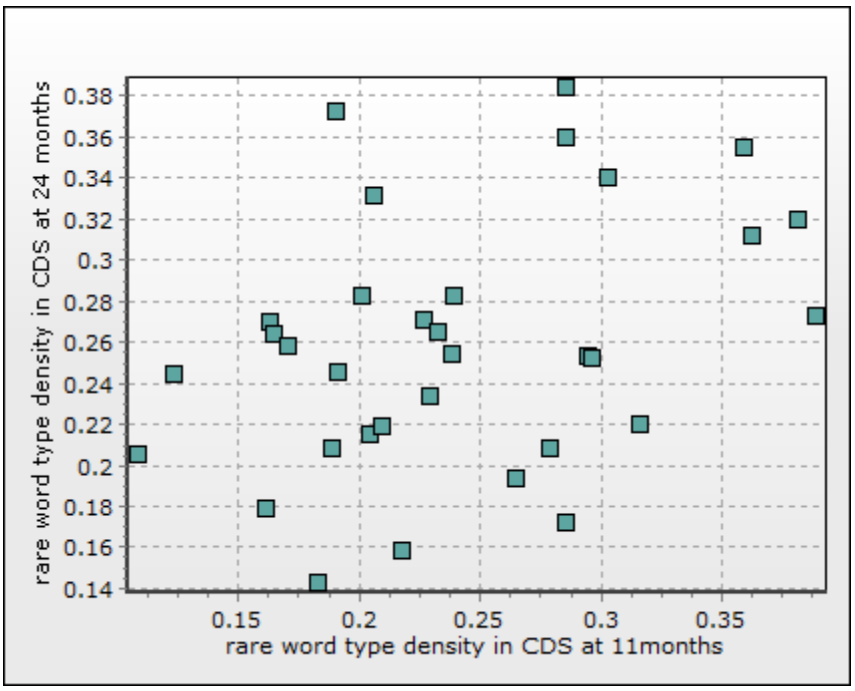

Figure 26. Rare word type densities at 11 and 24 months (r (31) = .37, p = .04).

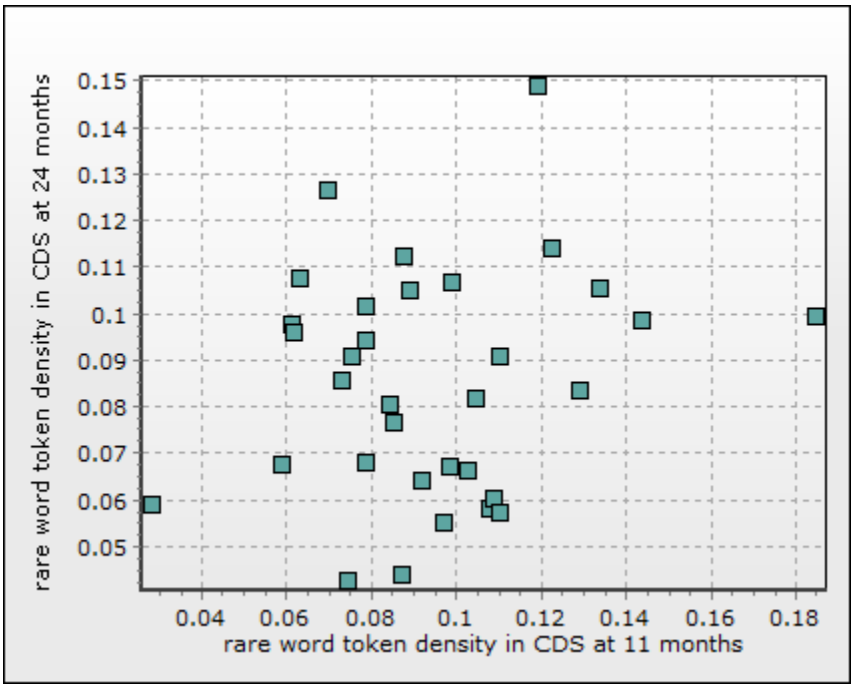

Figure 27. Rare word token densities at 11 and 24 months (r (31) = .19, p = .28).

A series of correlations were performed to examine whether rare word density measures had an effect on child language outcomes (see Tables 7 and 8 and Figures 35 –

50). Neither rare word density measure at either time point had an effect on EOWPVT or MCDI scores or word types used by two-year-olds in the play session. However, rare word type density, measured at eleven months, did have a significant effect on PPVT-III scores ($r(31)=.45$, $p = .008$, see Figure 39). This correlation achieved significance even with a Bonferroni correction, such that $\alpha = .01$. Differences in rare word type density at eleven months are responsible for twenty percent of the variance in PPVT-III scores at age two. The relationship between rare word token density at eleven months and PPVT-III scores at age two approached, but did not achieve, significance at this level ($r(31) = .42$, $p = .02$, See Figure 43). Two aspects of this result are of particular interest: the relationship between this particular input measures and the PPVT-III, and the relationship of time-lagged and concurrent results.

All four of the measures of toddler language outcomes are attempts to capture the same thing. Therefore, it is to be expected that factors that impact scores on any one should have an effect on the others. However, the measures are not identical, and more subtle effects may be better captured by one vocabulary assessment over another, depending on their specific foci. Of the three, only PPVT-III is a receptive language task. The positive association between a greater proportion of less common vocabulary in CDS and greater receptive language gains may be a reflection of broader exposure resulting in partial knowledge of more vocabulary items. For the PPVT-III, children are asked to choose the appropriate picture from a field of four. This requires only that a phonological form be recognized, not accurately produced, and that it be associated, in any way, with the correct picture, more than with the other three picture choices. For children in this study, exposure to a greater number of words provided this benefit, without also granting

greater productive vocabulary. Further research would be required to see whether, as children's word-learning accelerates and their articulation improves, they would also show effects of exposure to a greater range of vocabulary in all language measures.

The second aspect of these results that is of interest here is that, while time-lagged and concurrent measures show a similar pattern, the effect is stronger for the time-lagged measures.

Table 7. Maternal rare word type and token densities at 11 months and child language outcome measures at 24 months.

Child language outcome measures 24m.	Rare word type density	Rare word token density
EOWPVT-III	$r(31) = -.17$, $p = .34$	$r(31) = .13$, $p = .48$
PPVT-III	$r(31) = .45$, $p = .008$ *	$r(31) = .42$, $p = .02$ **
MCDI	$r(31) = .17$, $p = .34$	$r(31) = .11$, $p = .54$
Word types used by child in play session	$r(30) = -.10$, $p = .60$	$r(30) = -.10$, $p = .5$ **significant at α=.01* ***approaches significance*

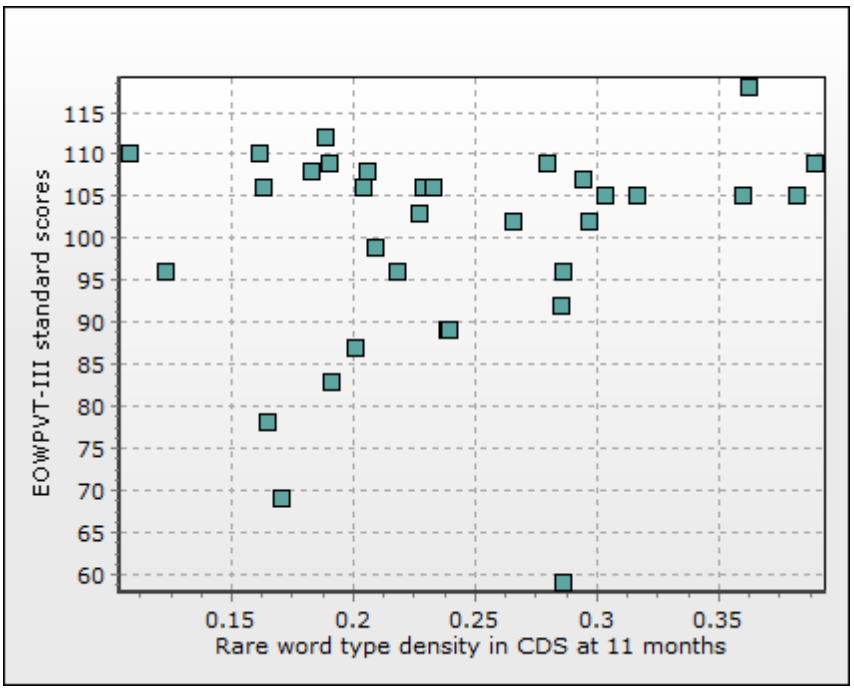

Figure 28. Rare word type density in CDS at 11 months and EOWPVT standard scores (r (31) = -.17, p = .34).

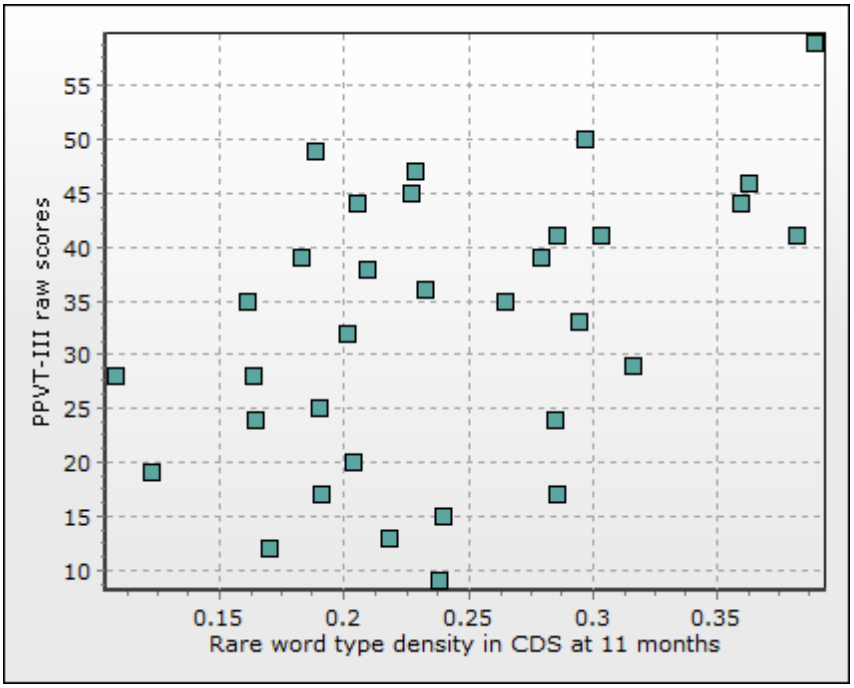

Figure 29. Rare word type density in CDS at 11 months and PPVT-III scores (r (31) = .45, p = .008). This correlation achieves statistical significance.

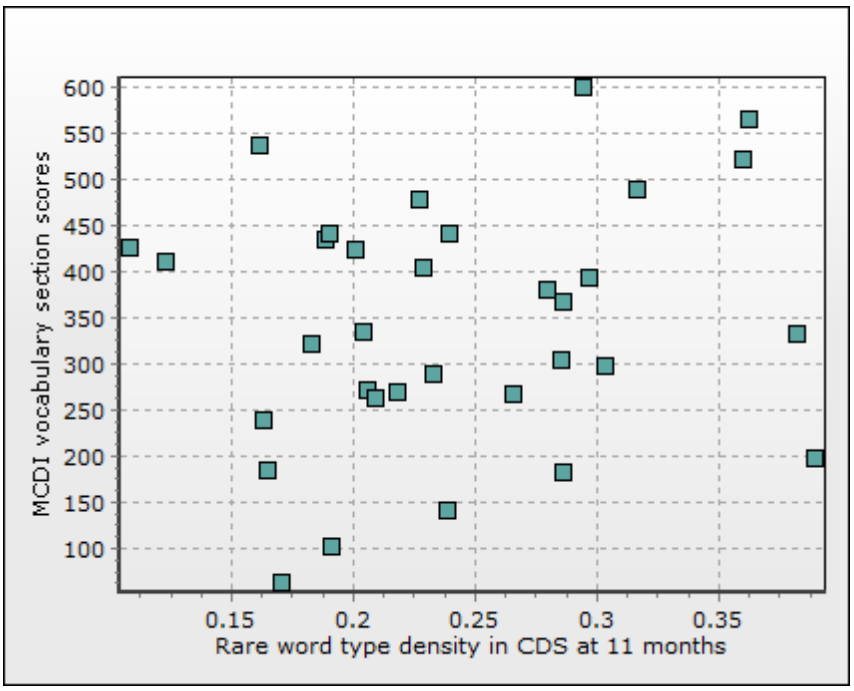

Figure 30. Rare word type density in CDS at 11 months and MCDI vocabulary section scores r (31) = .17, p = .34).

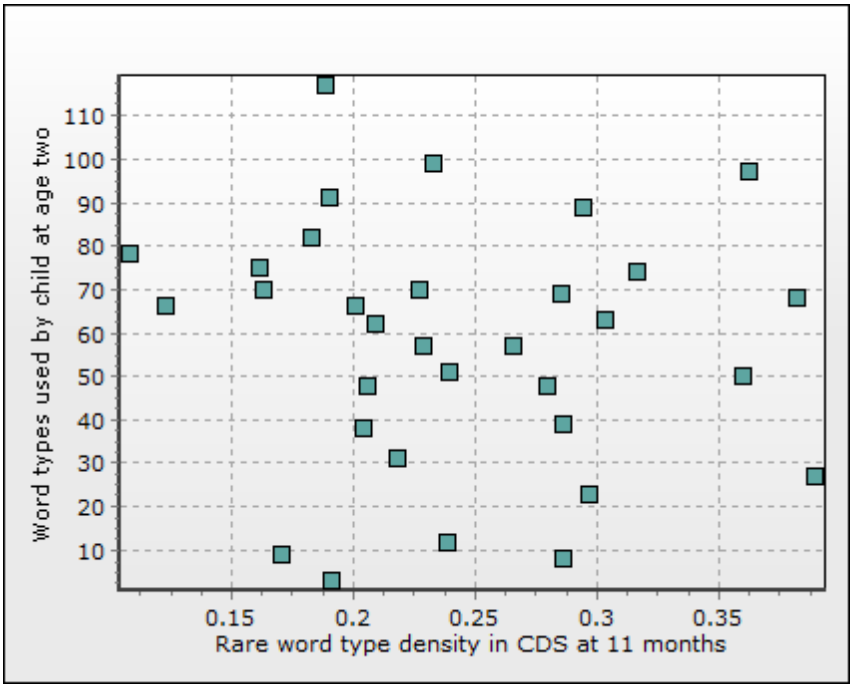

Figure 31. Rare word type density in CDS at 11 months and word types used by child at age two (r (30) = -.10, p = .60).

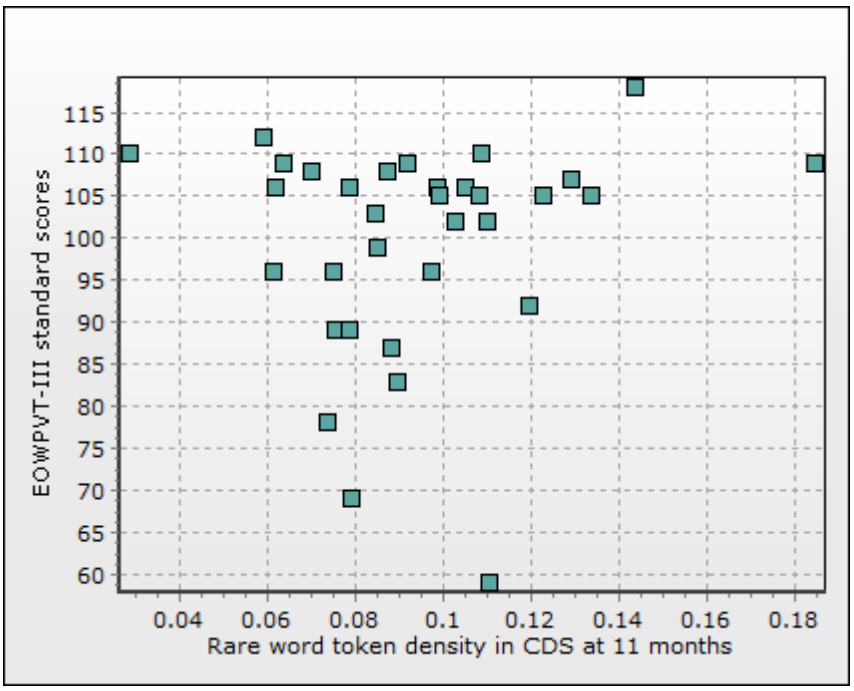

Figure 32. Rare word token density in CDS at 11 months and EOWPVT-III standard scores (r (31) = .13, p = .48).

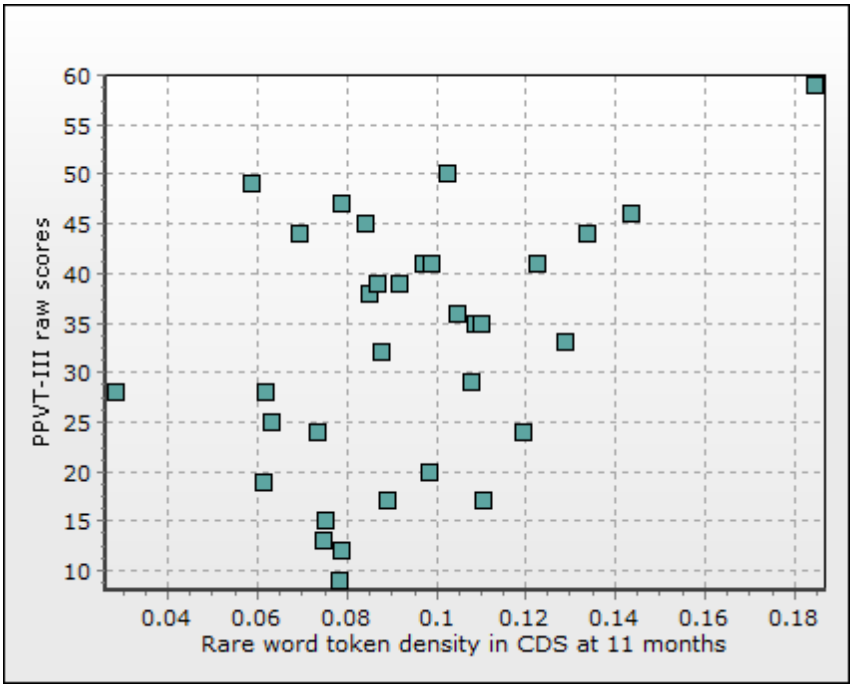

Figure 33. Rare word token density in CDS at 11 months and PPVT-III raw scores (r (31) = .42, p = .02). This result approaches, but does not achieve, significance.

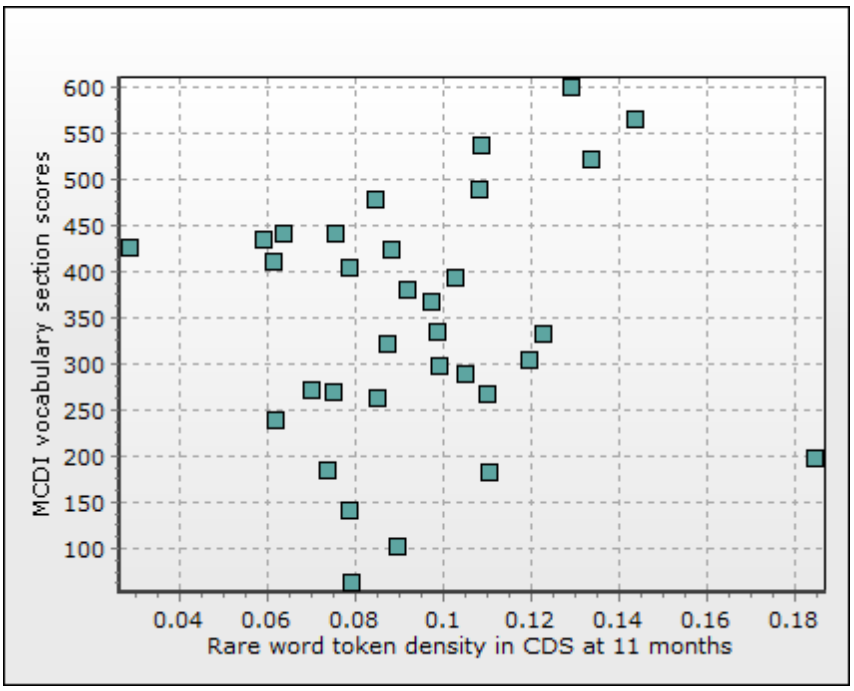

Figure 34. Rare word token density in CDS at 11 months and MCDI vocabulary section scores (r (31) = .11, p= .54).

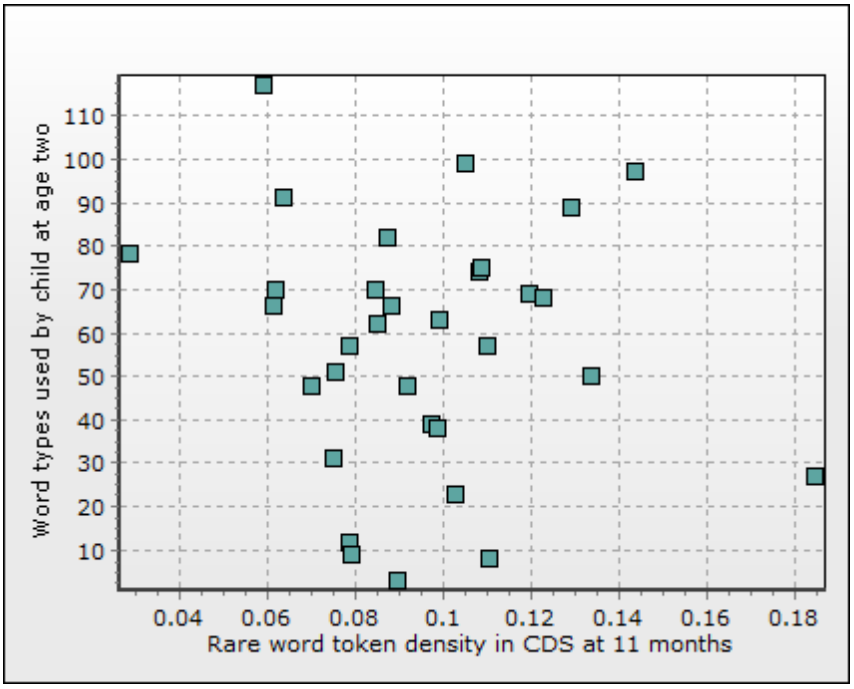

Figure 35. Rare word token density in CDS at 11 months and word types used by child at age two (r (30) = -.10, p = .5).

Table 8. Maternal rare word type and token densities at 24 months and child language outcomes at 24 months.

Child language outcome measures 24m.	Rare word type density	Rare word token density
EOWPVT-III	$r(31) = -.19$ $p = .29$	$r(31) = -.23$, $p = .21$
PPVT-III	$r(31) = .003$ $p = .99$	$r(31) = -.08$, $p = .66$
MCDI	$r(31) = -.02$, $p = .91$	$r(31) = .19$, $p = .30$
Word types used by child in play session	$r(30) = -.01$, $p = .96$	$r(30) = -.07$, $p = .70$

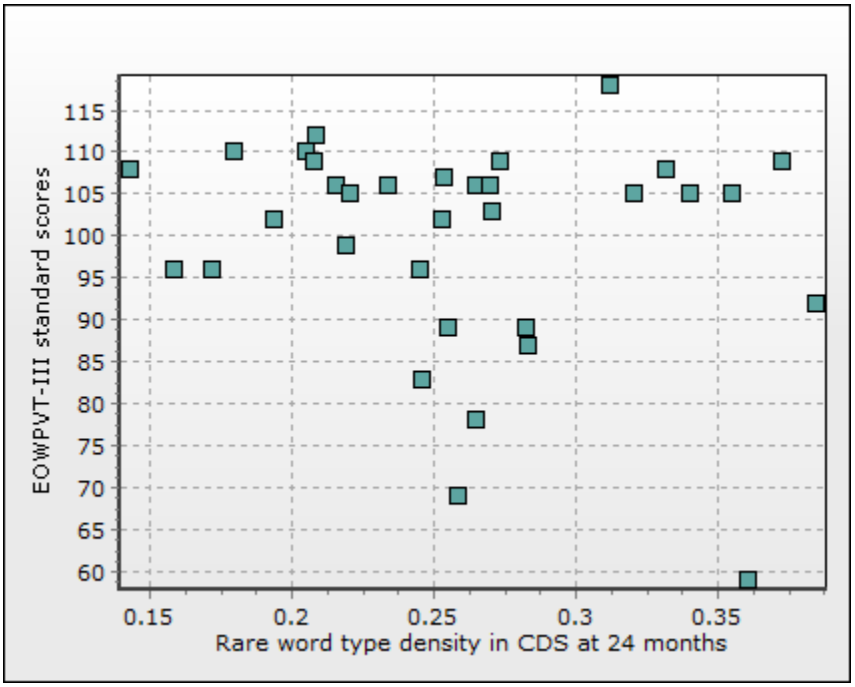

Figure 36. Rare word type density in CDS at 24 months and EOWPVT-III scores (r (31) = -.19, p = .29).

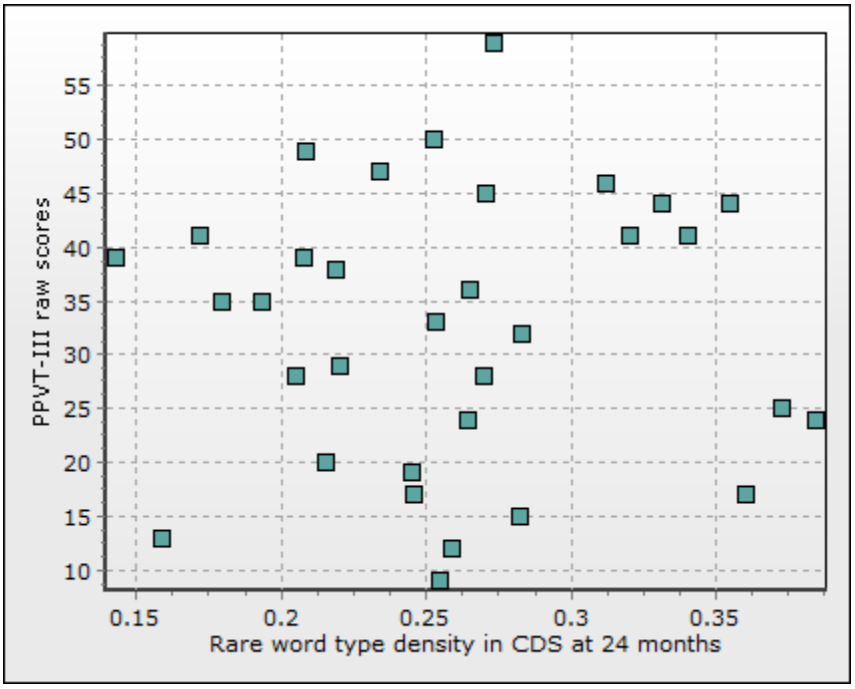

Figure 37. Rare word type density in CDS at 24 months and PPVT-III scores (r (31) = .003, p = .99).

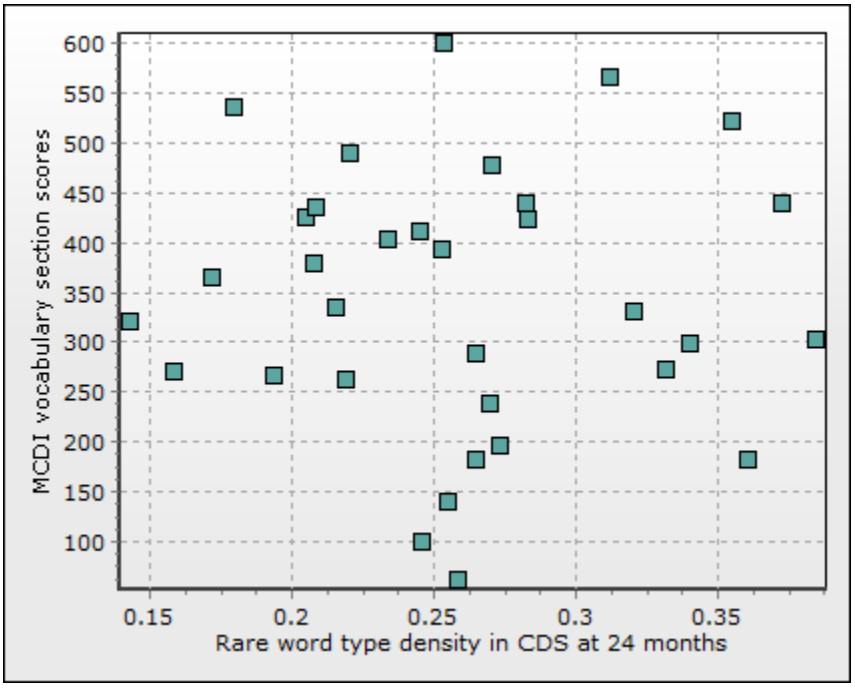

Figure 38. Rare word type density in CDS at 24 months and MCDI vocabulary section scores (r (31) = -.02, p = .91).

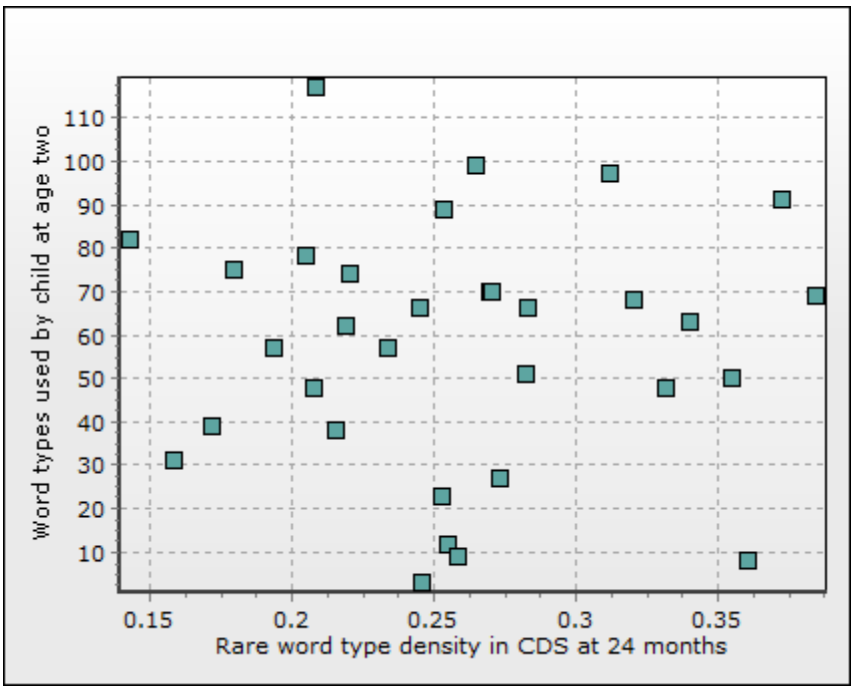

Figure 39. Rare word type density in CDS at 24 months and word types used by child at age two ($r(30) = -.01$, $p = .96$).

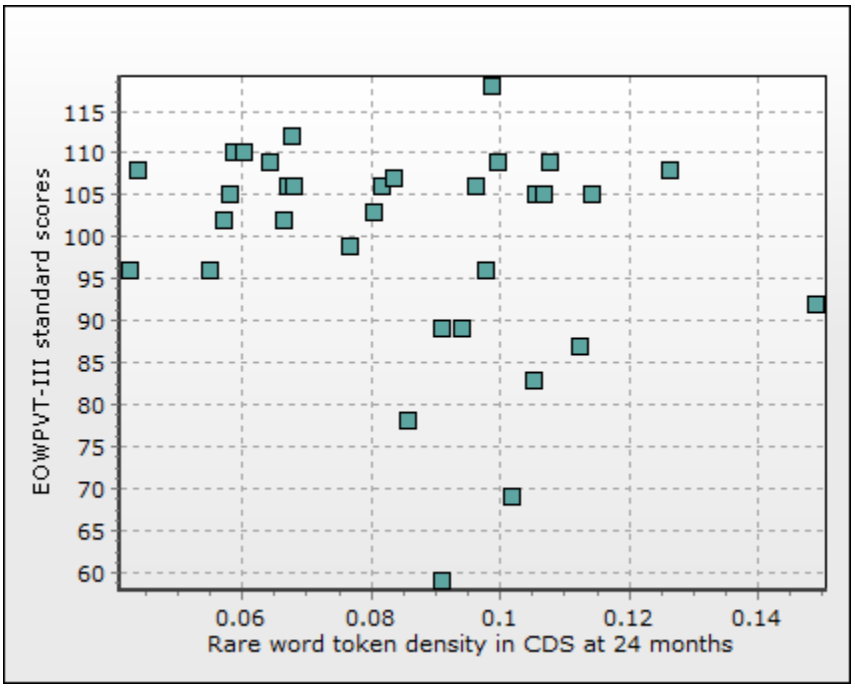

Figure 40. Rare word token density in CDS at 24 months and EOWPVT-III scores (r (31) = -.23, $p = .21$).

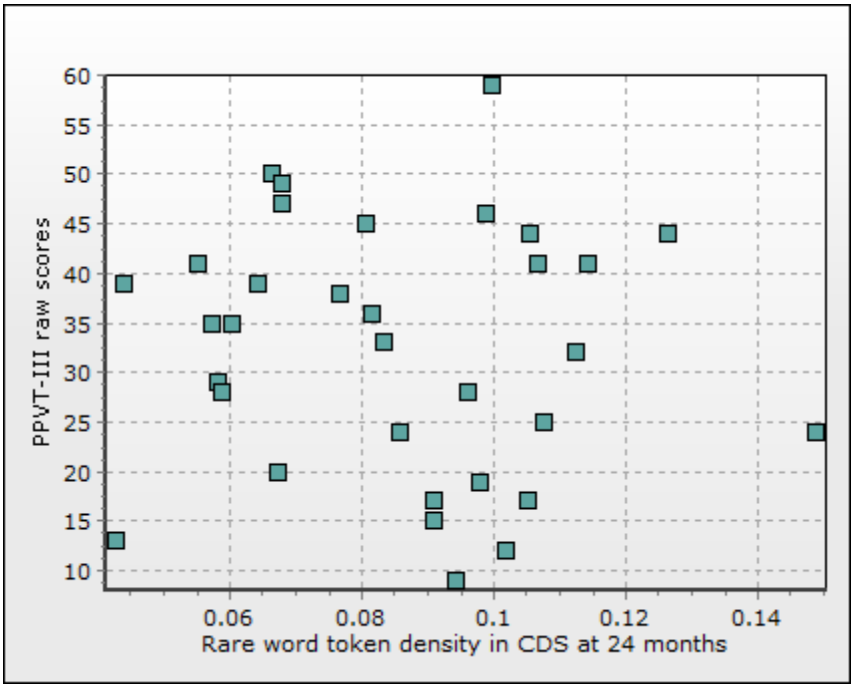

Figure 41. Rare word token density in CDS at 24 months and PPVT-III scores *(r* (31) = -.08, *p* = .66).

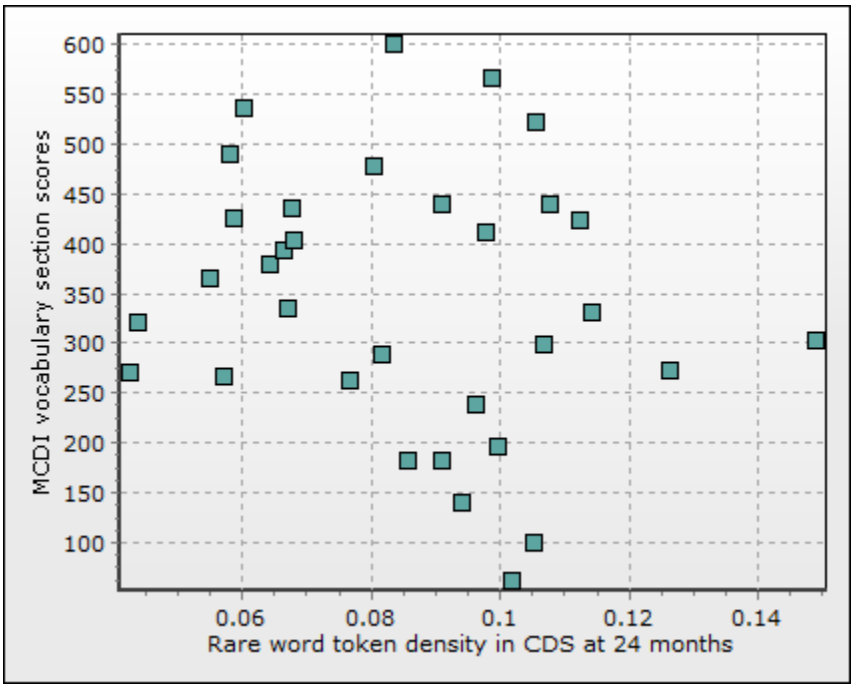

Figure 42. Rare word token density in CDS at 24 months and MCDI vocabulary section scores (*r* (31) = .19, *p* = .30).

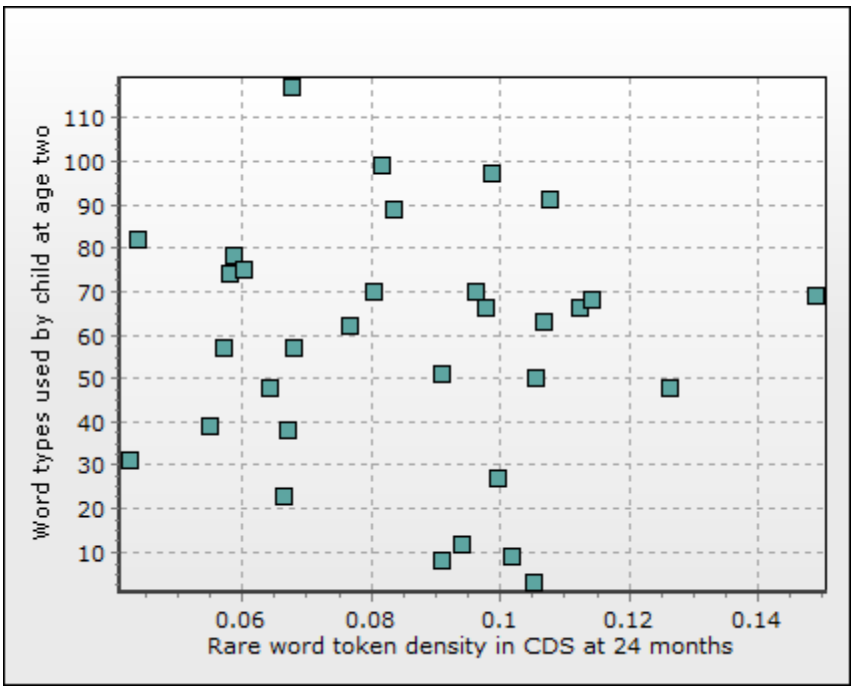

Figure 43. Rare word token density in CDS at 24 months and word types used by child at age two (r (30) = -.07, p = .70).

Proportion of one-word utterances in CDS and child language outcomes

While rare word type density and rare word token density are measures of a specific form of lexical diversity, measures of the proportion of one-word utterances focus on a specific kind of syntactic simplification. As discussed above, one-word-utterances present language-learning children with meaningful word forms without requiring that they parse the speech stream themselves. There is no ambiguity regarding what portion of the phonological sequence is the target word. One-word utterances may subsequently help language-learning children extract meaningful units from continuous speech by using known word boundaries to infer other word boundaries. Eleven-month-old children have relatively small receptive vocabularies. The largest receptive vocabulary reported for any child in this study at eleven months was 137 words. Children at this early stage of language learning should still need the benefits one-word

utterances provide. One-word-utterances were extracted from maternal CDS using CLAN. The number of one-word utterances was divided by the total number of utterances to arrive at proportions of one-word utterances for each play session. Mean values are reported in Table 9. Mothers used a significantly higher proportion of one-word utterances with 11-month-olds than with two-year-olds (r (33) = 3.6, p <.001). Fifteen percent of all utterances were single words with eleven-month-olds, while ten percent of all utterances were single words with two-year-olds. Individual results are shown in Figure 51. The majority of the mothers the general pattern (n=25, vs. n=8 who showed the reverse). Mothers who used more one-word utterances when their children were eleven-months-old did not also use more at twenty-four months old, so proportion of one-word utterances is not a consistent quality in individual mothers' CDS (r (31) = .13, p = .47, See Figure 52).

Table 9. Proportion of one-word utterances in CDS: descriptive statistics.

Type of maternal speech	Proportion of one-word utterances
CDS at 11 months	*M* =.15 *SD* = .07 range = .07-.44
CDS at 24 months	*M* = .10 *SD* = .04 range = .04-.21

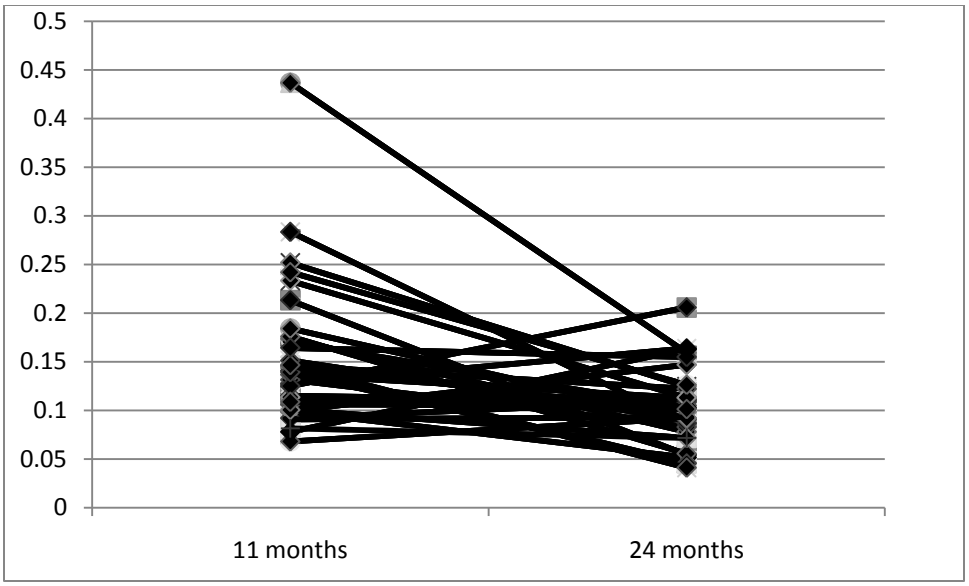

Figure 44. Proportion of one-word utterances in CDS at 11 and 24 months.

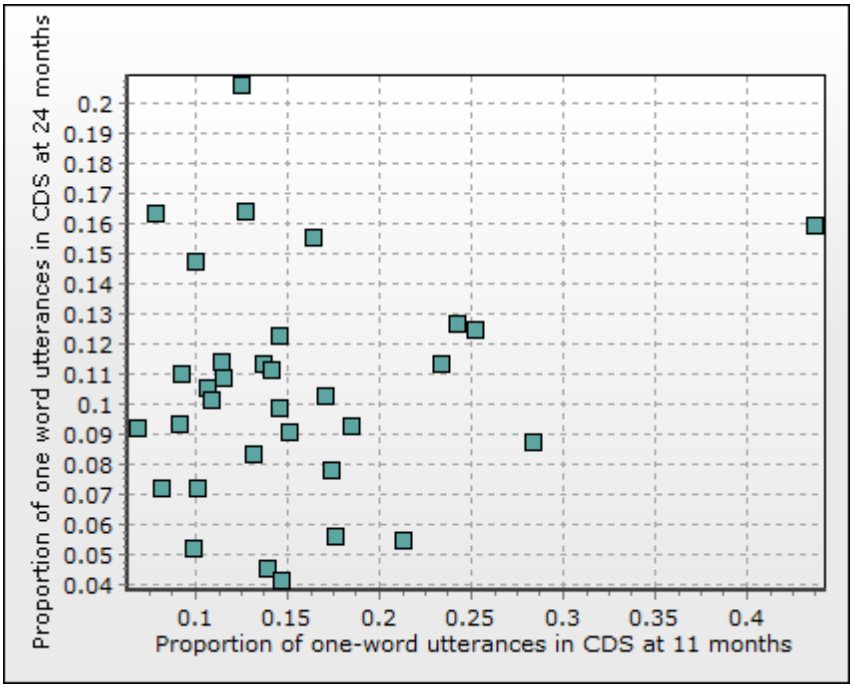

Figure 45. Proportions of one-word utterances in CDS at 11 and 24 months(r (31) = .13, p = .47).

Visual inspection of Figure 51 reveals one mother for whom over forty percent of utterances to her child at 11 months were single words. This represents an increase of

over 10 percent over the mother with the next highest proportion of single word utterances. This child also displayed strong language development with scores on both the EOWPVT and MCDI in the top three of participants in the current study. For this one child, a larger number of one-word utterances at 11 months did seem to accompany better language development at age two. However, including this outlying data point could create the illusion of correlations, when there is none. Therefore, Pearson's *r* correlations were performed without this subject for proportion of one-word utterances and toddler language outcomes at eleven months, to see whether they were associated even without this outlying value. With α corrected to .01 because of the four outcome measures, there is no significant effect of proportions of one-word utterances at either eleven or twenty-four months on child language outcomes at age two (See Table 10 and Figures 52-59). However, the correlation of the proportion of one-word utterances at eleven months with the EOWPVT-III *approaches* significance (r (30) = .37, p = .04), as do the correlations with the MCDI vocabulary scores (r (30) = 32, p = .07) and with the number of word types used by the child in the play session at age two (r (29) = .37, p = .04). All three of these language outcome measures gauge expressive vocabulary. They measure a child's ability to accurately recall and intelligibly produce words. It is plausible that hearing words in isolation, without the effects of co-articulation across word boundaries, allows for better perception of their phonological form. In cases where the referent is clear, single word utterances remove any ambiguity regarding which sound sequence constitutes the name for the item or quality at hand. Alternately, it may be that mothers who use one-word utterances also share another quality. For example, one-word

utterances may often be repetitions of children's utterances, and it could be repetition, rather than exposure in isolation, that produces the potential effect.

The proportion of one-word utterances in CDS at age two fails to approach significance with any language outcome measure. However, there was no correlation of proportions of one-word utterances in CDS at eleven and twenty-four months. This, combined with the reduction of one-word utterances for most mothers supports a tentative conclusion that what is helpful about one-word utterances for children at eleven months is no longer as important when children are more practiced word learners at age two.

Table 10. Proportions of one-word utterances in CDS and child language outcome measures.

Child language outcome measures	Proportion one-word utterances in CDS at 11 months	Proportion one-word utterances in CDS at 24 months
EOWPVT-III	$r(30) = .37$, $p = .04$	$r(31) = -.04$, $p = .83$
PPVT-III	$r(30) = .19$, $p = .30$	$r(31) = .05$, $p = .77$
MCDI	$r(30) = 32$, $p = .07$	$r(31) = -.03$, $p = .88$
Word types used by child in play session	$r(29) = .37$, $p = .04$	$r(30) = .083$, $p = .65$

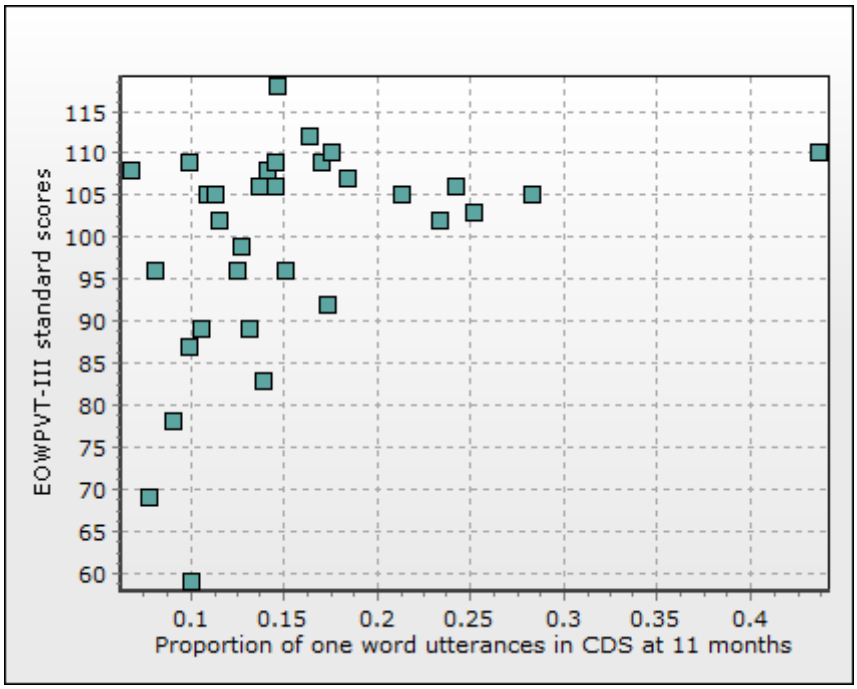

Figure 46. Proportion of one-word utterances in CDS at 11 months and EOWPVT-III scores (r (30) = .37, p = .04).

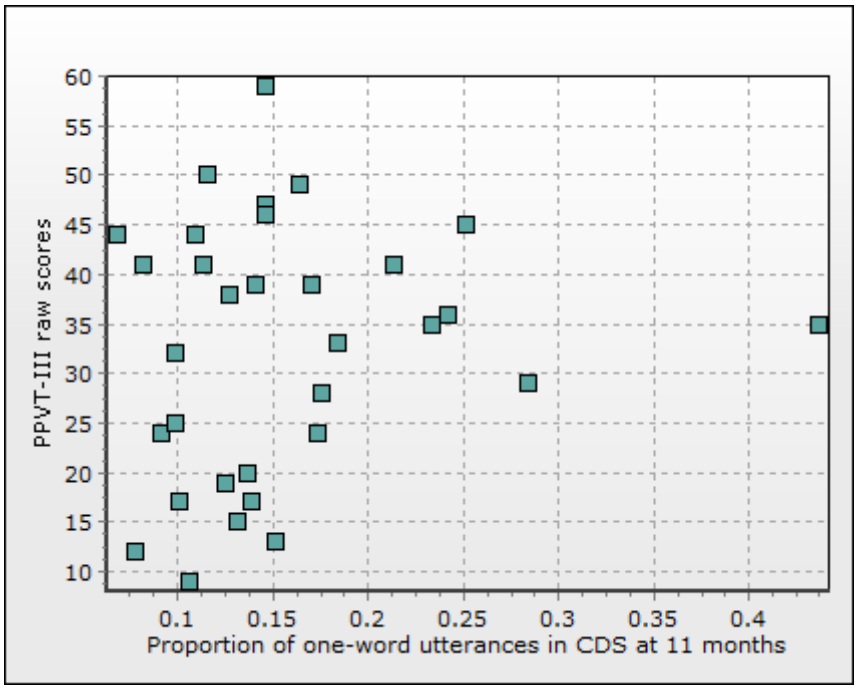

Figure 47. Proportion of one-word utterances in CDS at 11 months and PPVT-III raw scores *(r* (30) = .19, p = .30).

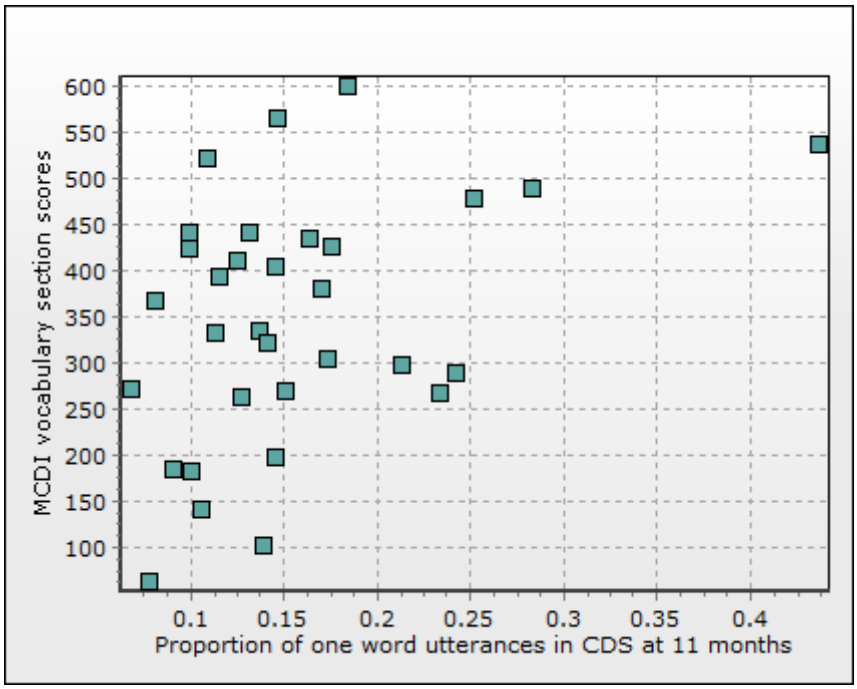

Figure 48. Proportion of one-word utterances at 11 months and MCDI vocabulary scores (r (30) = 32, p = .07).

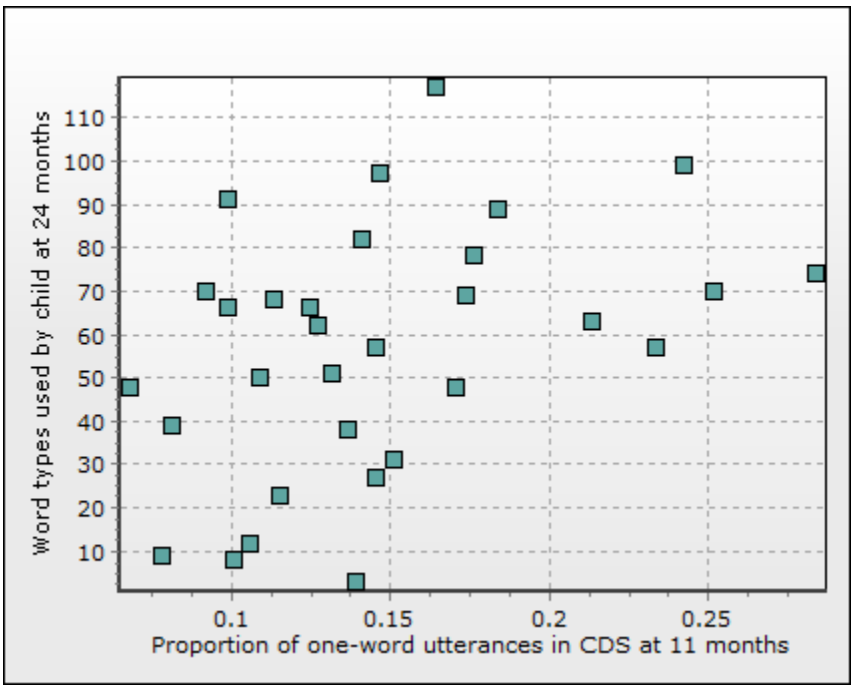

Figure 49. Proportion of one-word utterances at 11 months and word types used by child at 24 months (r (29) = .37, p = .04).

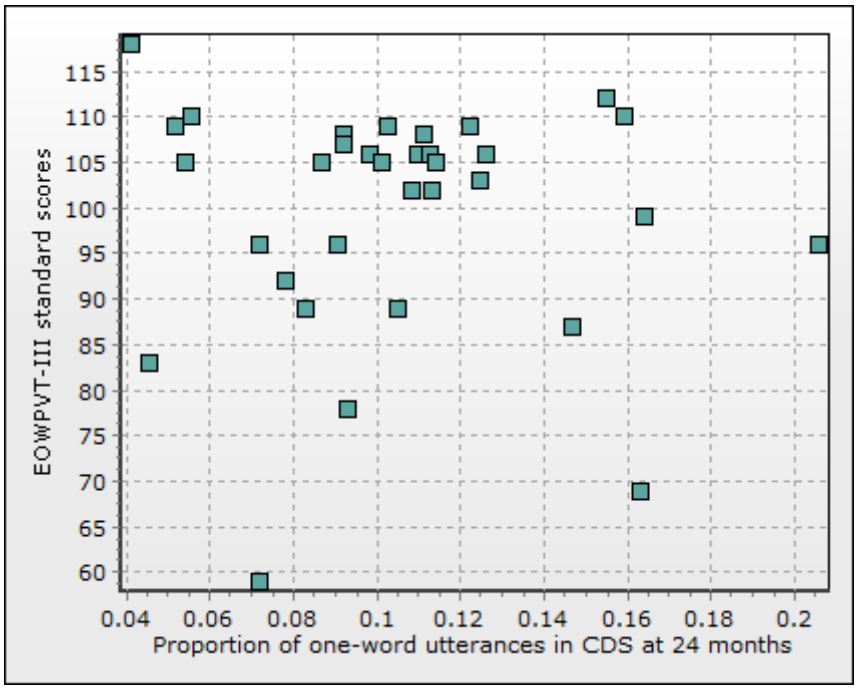

Figure 50. Proportion of one-word utterances in CDS at 24 months and EOWPVT-III scores(r (31) = -.04, p = .83).

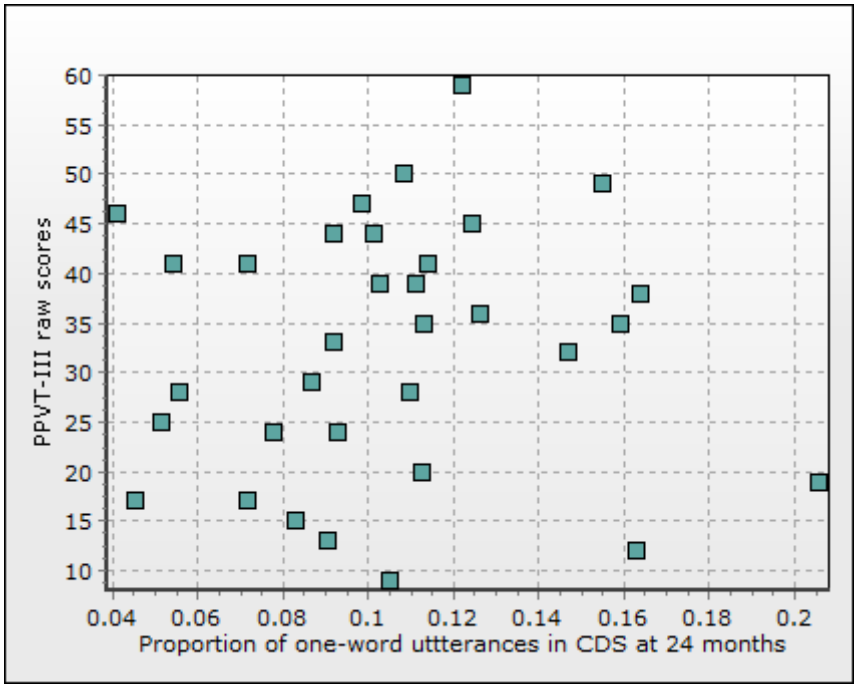

Figure 51. Proportion of one-word utterances in CDS at 24 months and PPVT-III scores (r (31) = .05, p = .77).

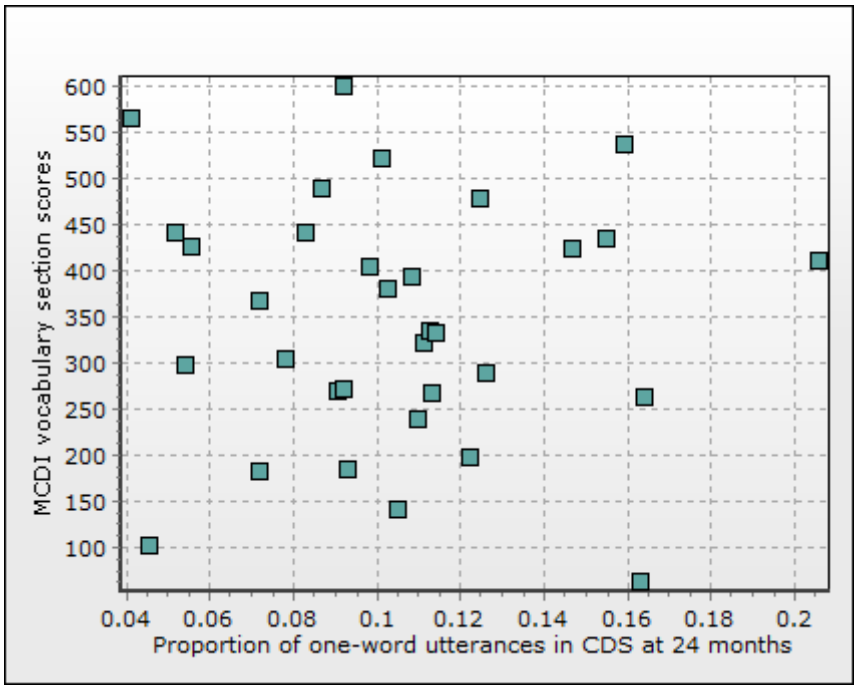

Figure 52. Proportion of one-word utterances in CDS at 24 months and MCDI vocabulary scores (r (31) = -.03, p = .88).

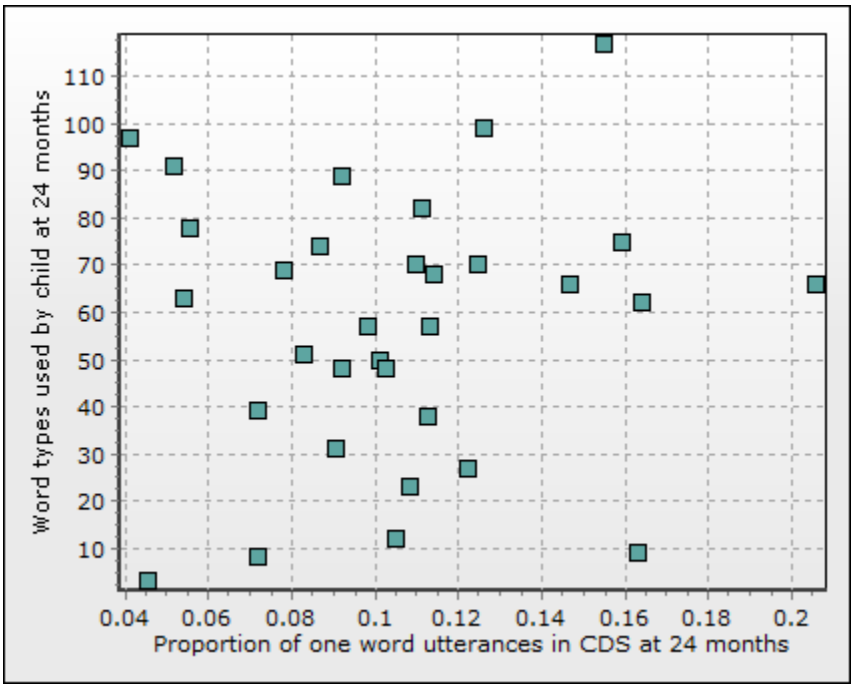

Figure 53. Proportion of one-word utterances in CDS at 24 months and word types used by child at 24 months (r (30) = .083, p = .65).

Proportion of nouns in CDS and child language outcomes

Mean values for proportion of noun types and tokens are significantly different at 11 and 24 months. The mean proportion of word types that are nouns increased from an average of .27, to an average of .31 (t (32) = 4.3, p<.001). The mean proportion of noun tokens, however, decreased significantly, from an average of .19 to .16 (t (32) =3.7 , p < .001). Nouns made up a greater proportion of the types of words said at age two, but a lower number of the tokens. This result may be consistent with increased naming, which would introduce more types, but each is unlikely to be used many times. With a Bonferroni correction of .05/8 = .006 (two related independent variables and four dependent variables), there were no statistically significant results for measures of proportions of nouns in CDS at either eleven or twenty-four months. Only one relationship approached significance: that of the proportion of noun tokens in CDS at eleven months to the MCDI vocabulary scores (r (31) = .37, p = .04, see Figure 68). MCDI has been more sensitive to several other CDS factors, as well. It is unclear why it is proportion of tokens, rather than the proportion of types, that trends toward significance here. For receptive measures, rare word *types* had a stronger effect but in this case, multiple repetitions were more beneficial. With largely pre-verbal infants at eleven months, most of these "repetitions" are likely to be mothers either directly repeating themselves, or frequently returning to a core vocabulary. Measures of the proportion of nouns in mothers' speech did not, however, have strong effects on child vocabulary outcomes.

Table 11. Proportions of noun types and tokens in CDS at 11 and 24 months.

Type of maternal speech	Proportion noun types	Proportion of noun tokens
CDS at 11 months	M = .27	M = .19

	SD = .05 range = .15-.35	*SD* = .041 range = .12-.30
CDS at 24 months	*M* = .31 *SD* = .04 range = .22-.4	*M* = .16 *SD* = .03 range = .12-.26

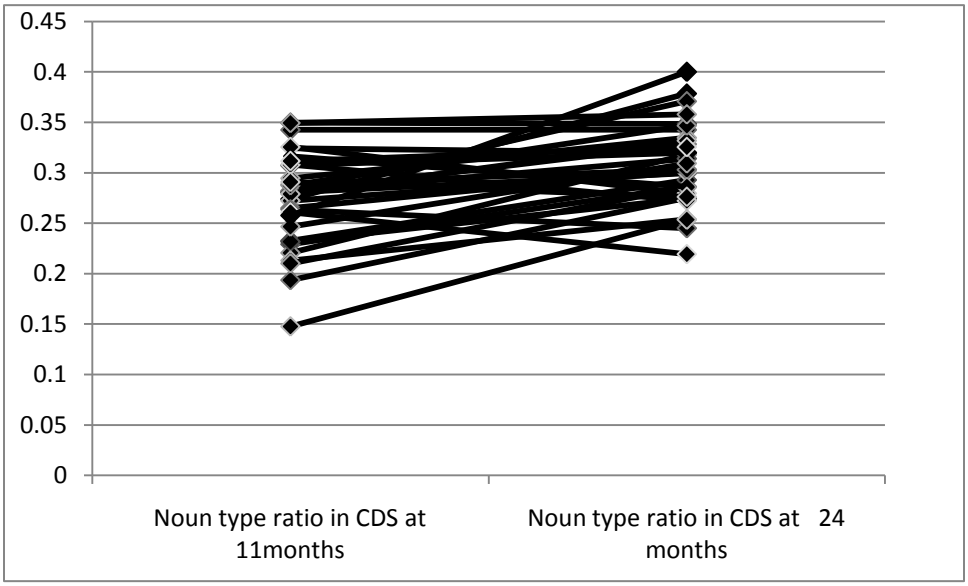

Figure 54. Noun type ratios in CDS at 11 and 24 months.

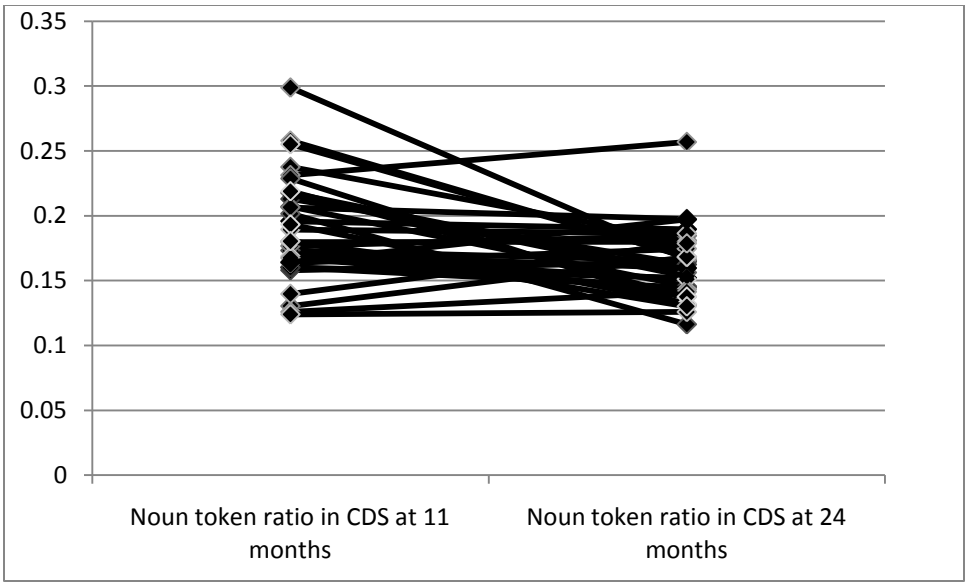

Figure 55. Noun token ratios in CDS at 11 and 24 months.

Table 12. Child language outcome measures and noun type rations in CDS at 11 and 24 months

Language outcome measures	Proportion noun types in 11-month CDS	Proportion of noun tokens in 11 - month CDS
EOWPVT-III	r (31) = .12, p = .50	r (31) = .21, p = .25
PPVT-III	r (31) = .20, p = .27	r (31) = .13, p = .49
MCDI	r (31) = .10, p = .56	r (31) = .37, p = .04*
Word types used by child in play session	r (30) = -.14, p = .43	r (30) = .01, p = .96
		**this result approaches, but does achieve statistical significance.*

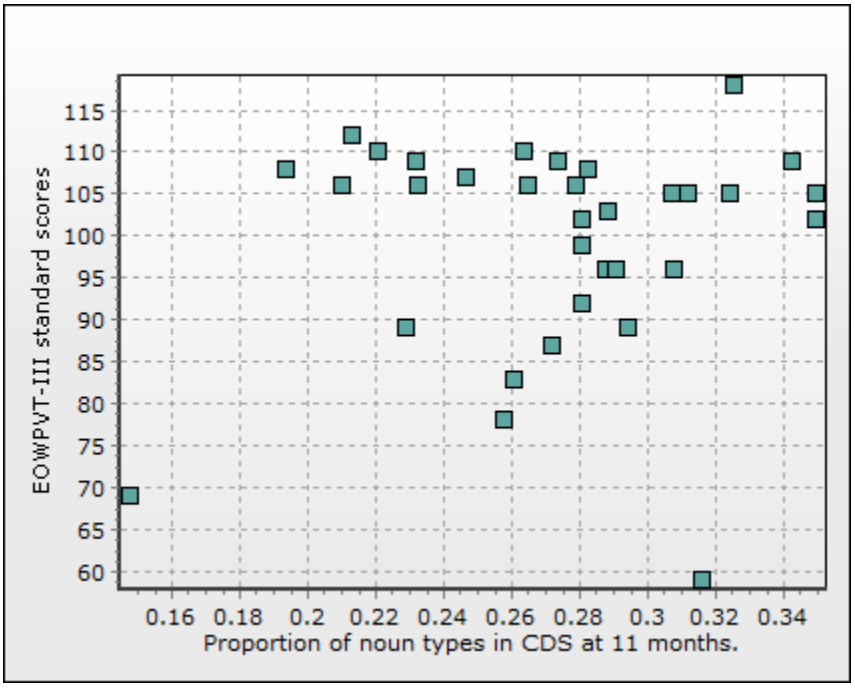

Figure 56. Proportion of noun types in CDS at 11 months and EOWPVT-III scores (r (31) = .12, p = .50).

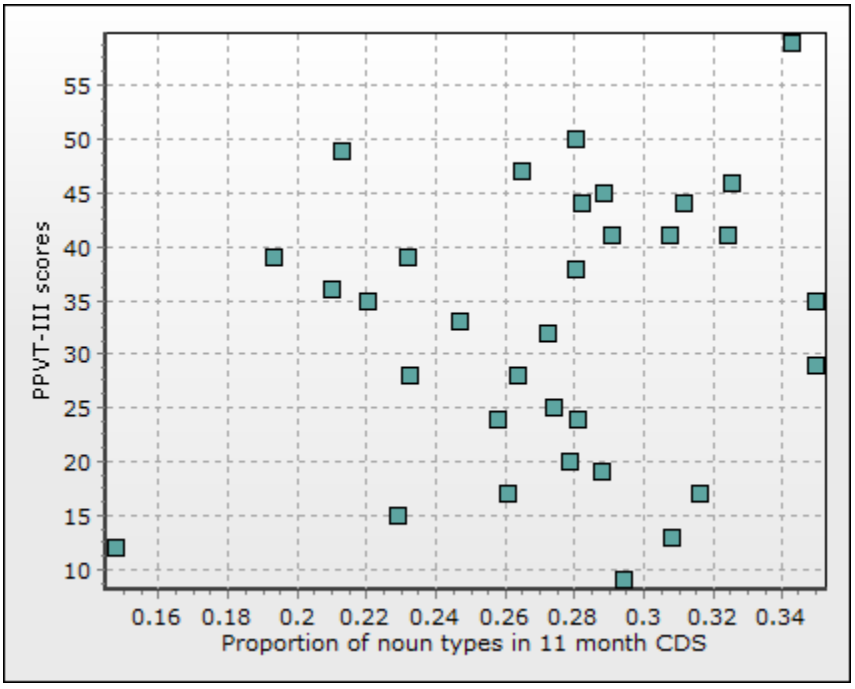

Figure 57. Proportion of noun types in CDS at 11 months and PPVT-III raw scores (r (31) = .20, p = .27).

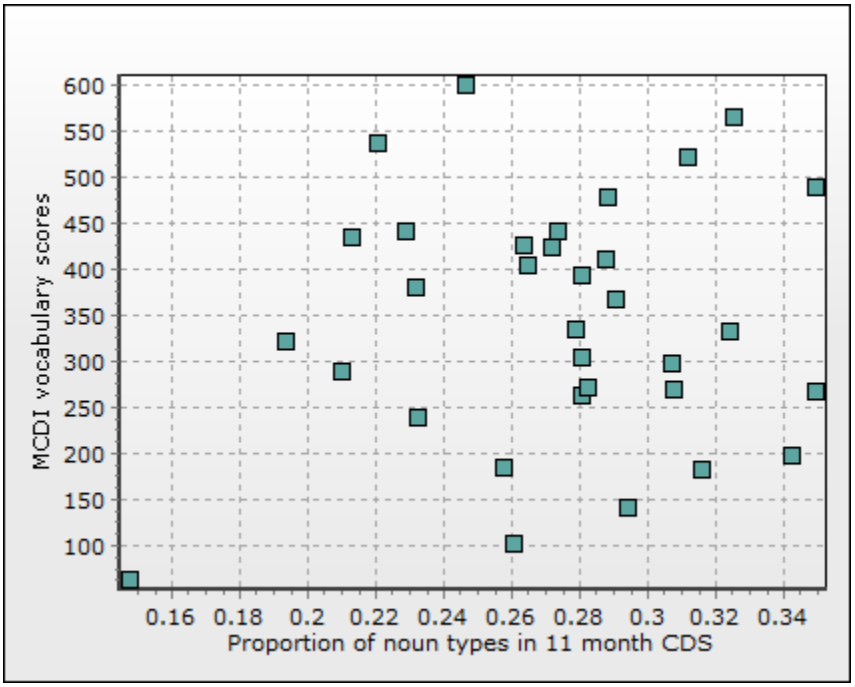

Figure 58. Proportion of noun types in CDS at 11 months and MCDI vocabulary section scores (r (31) = .10, p = .56).

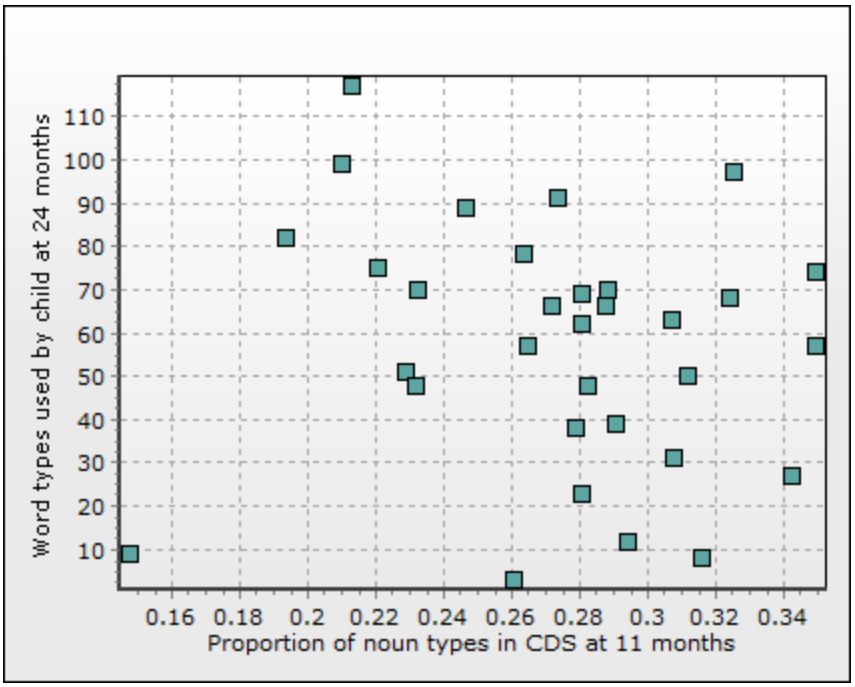

Figure 59. Proportion of noun types in CDS at 11 months and word types used by child at 24 months (r (30) = -.14, p = .43)

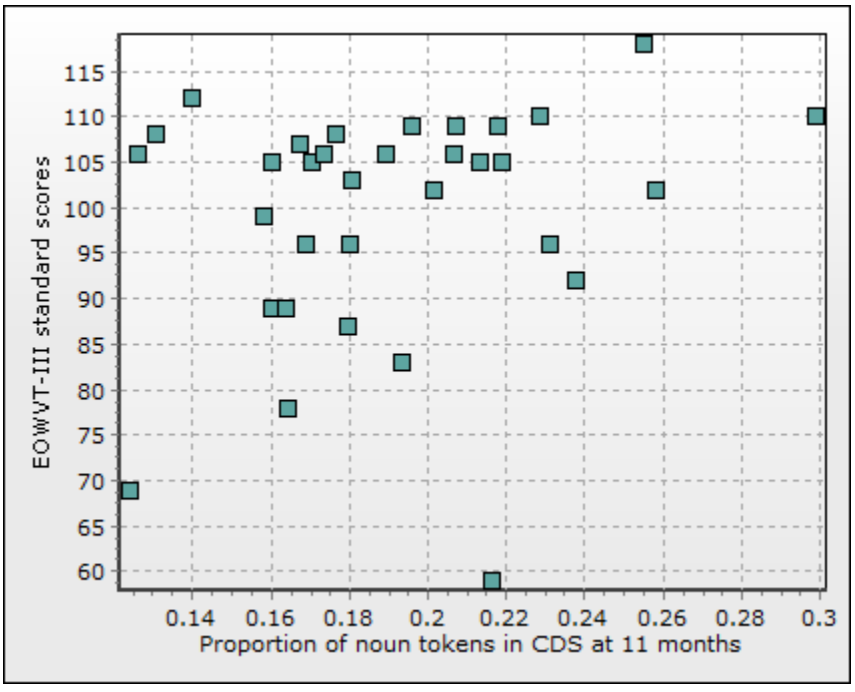

Figure 60. Proportion of noun tokens in CDS at 11 months and EOWPVT scores (r(31) = .21, p = .25).

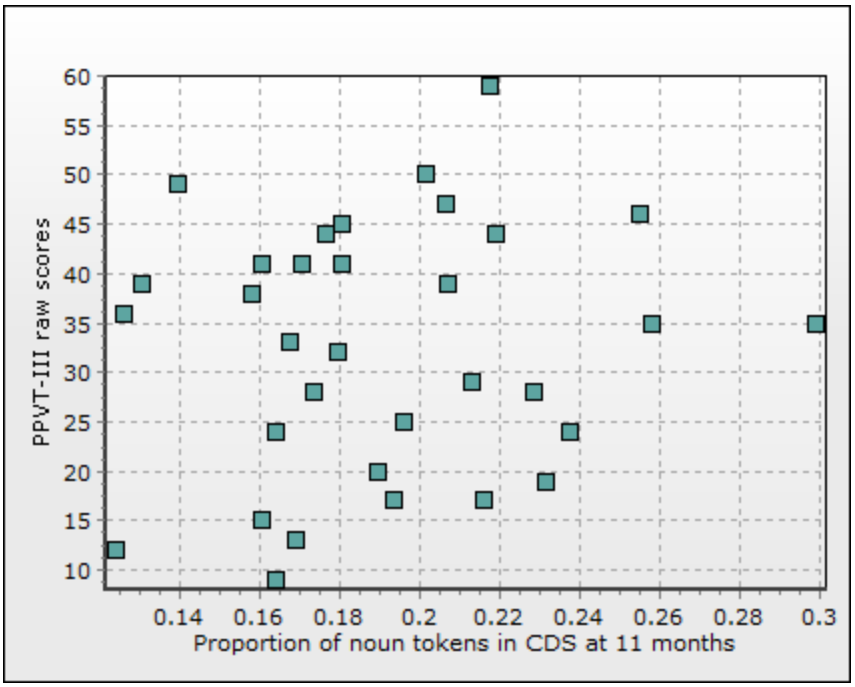

Figure 61. Proportion of noun tokens in CDS at 11 months and PPVT-III scores (r (31) = .13, p = .49).

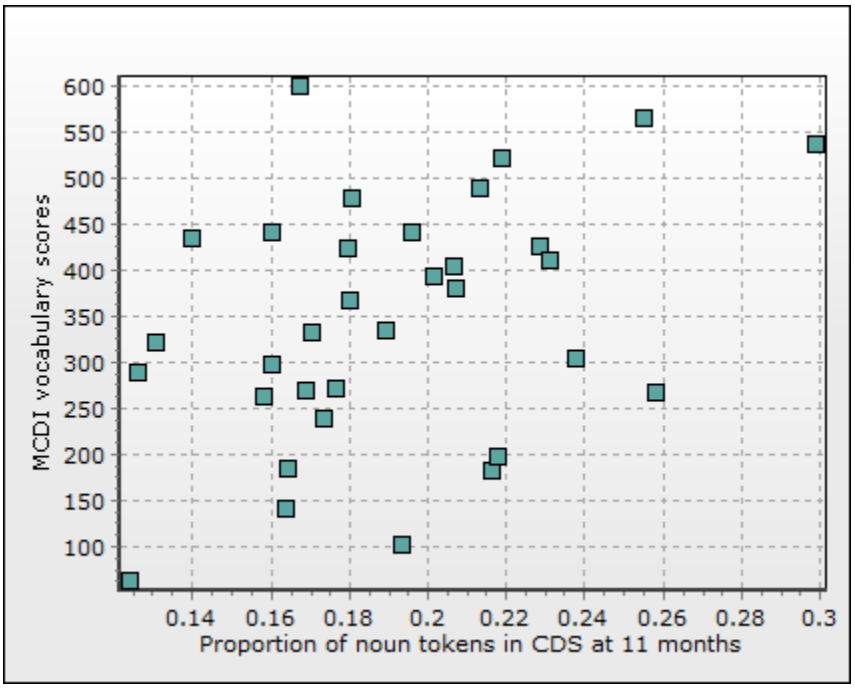

Figure 62. Proportion of noun tokens in CDS at 11 months and MCDI vocabulary section scores (r (31) = .37, p = .04.). This correlation approaches, but does not achieve significance.

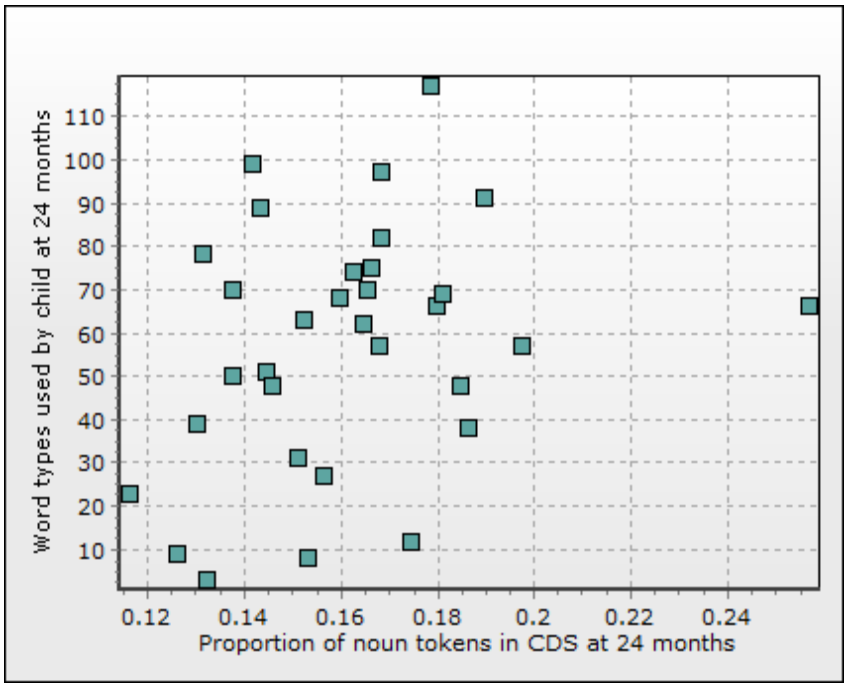

Figure 63. Proportion of noun tokens in CDS at 11 months and word types used by child at 24 months. (r (30) = .01, p = .96).

Table 13.Child language outcome measures and noun type rations in CDS at 11 and 24 months

Language outcome measures	Proportion noun types in 24-month CDS	Proportion of noun tokens in 24 - month CDS
EOWPVT-III	r (.10) = .12, p = .58	r (31) = .07, p = .69
PPVT-III	r (31) = .07, p = .67	r (31) = -.13, p = .47
MCDI	r (31) = .06, p = .73	r (31) = .06, p = .76
Word types used by child in play session	r (30) = .10, p = .60	r (30) = .29, p = .11

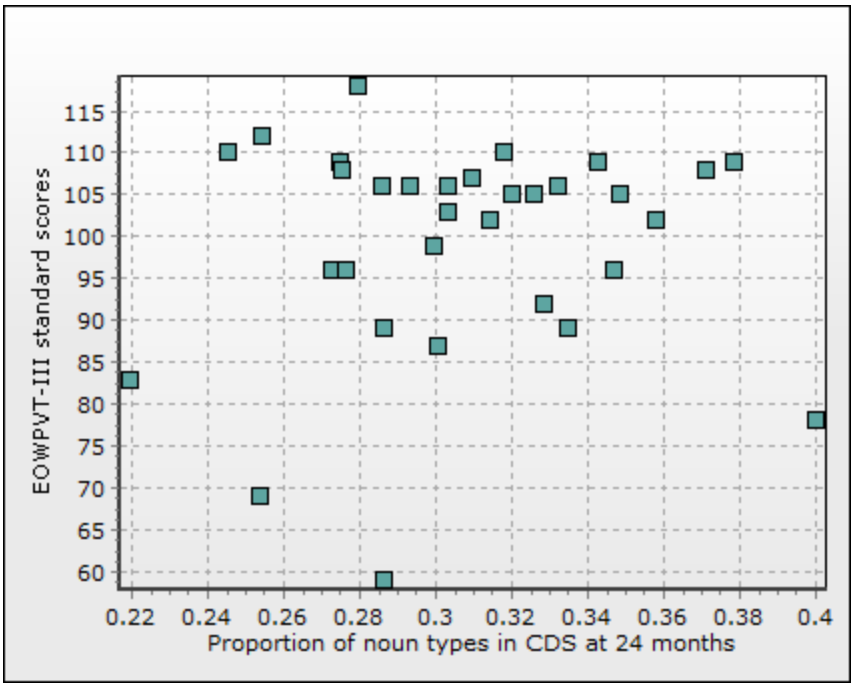

Figure 64. Proportion of noun types in CDS at 24 months and EOWPVT-III scores (r (.10) = .12, p = .58).

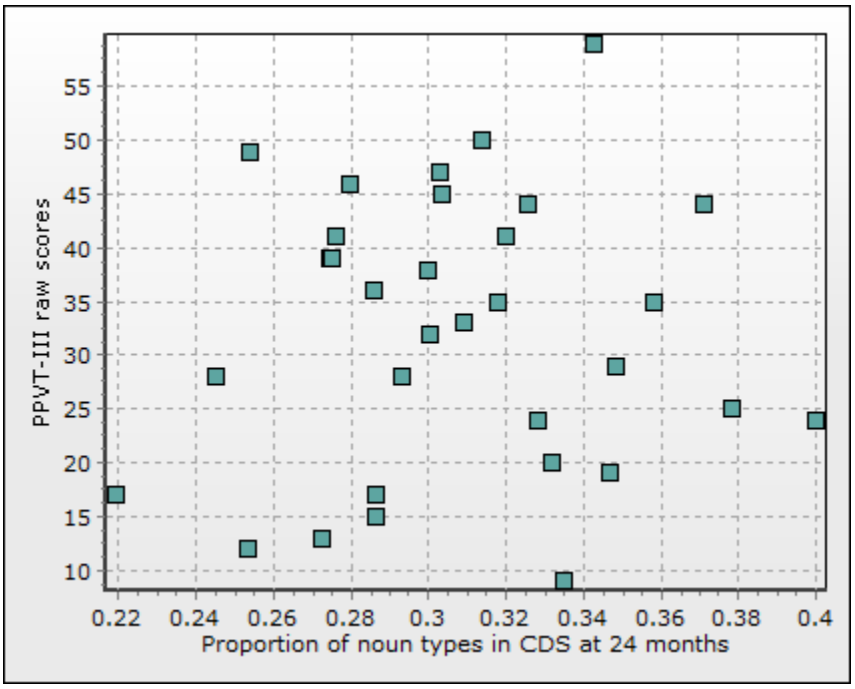

Figure 65. Proportion of noun types in CDS at 24 months and PPVT-III scores (r (31) = .07, p = .67).

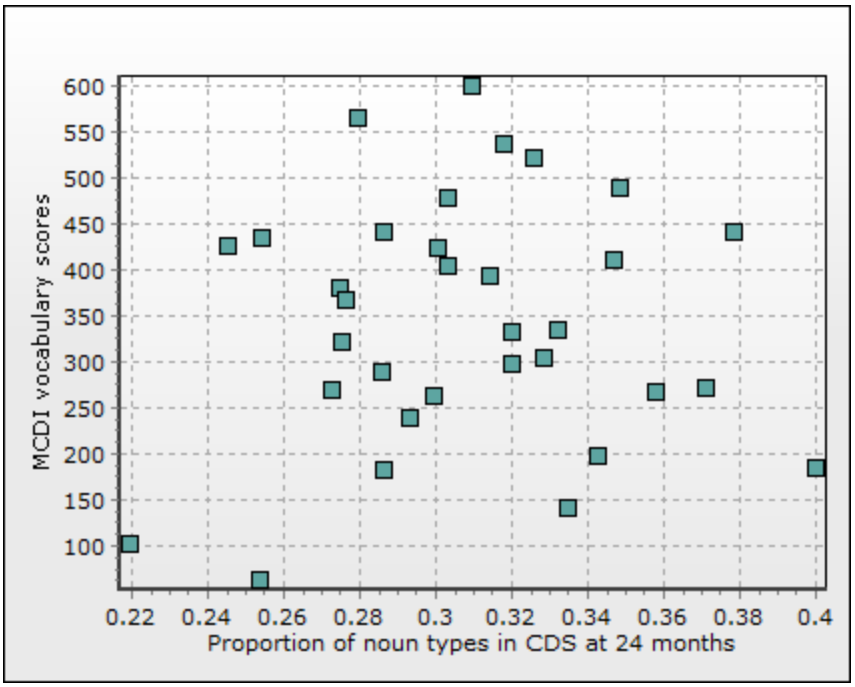

Figure 66. Proportion of noun types in CDS at 24 months and MCDI vocabulary scores (r (31) = .06, p = .73).

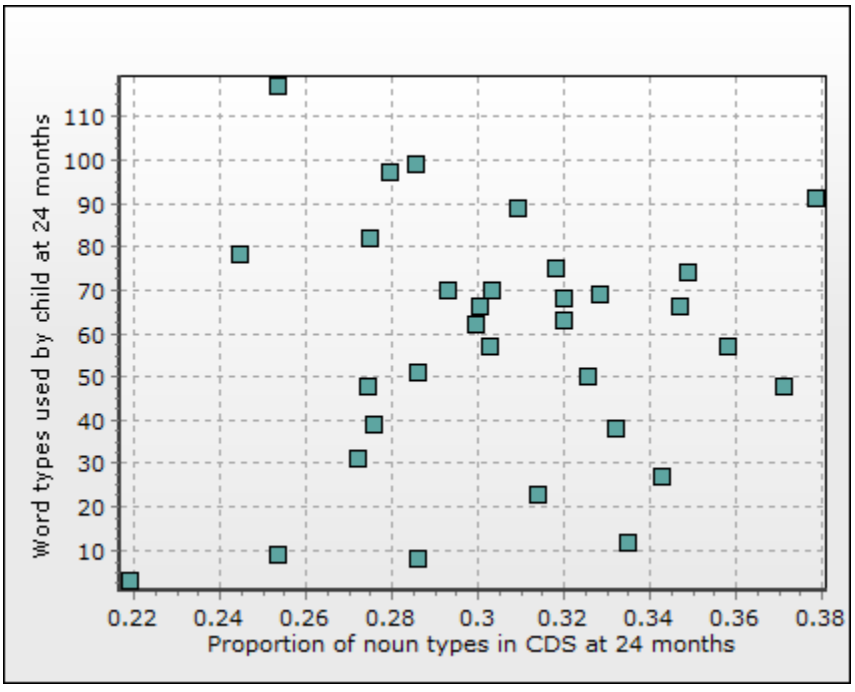

Figure 67. Proportion of noun types in CDS at 24 months and word types used by child at 24 months (r (30) = .10, p = .60).

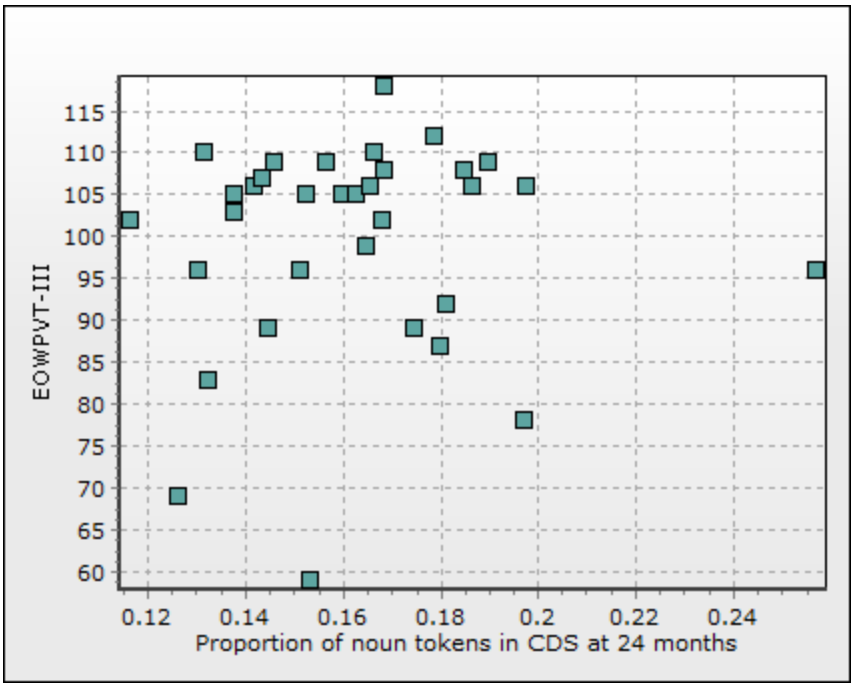

Figure 68. Proportion of noun tokens in CDS at 24 months and EOWPVT-III scores. (r (31) = .07, p = .69).

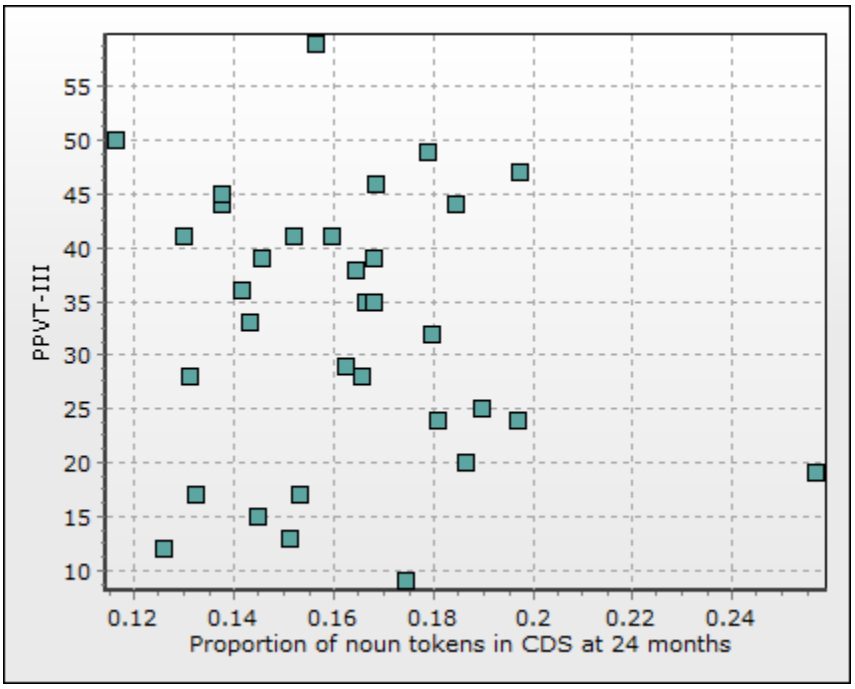

Figure 69. Proportion of noun tokens in CDS at 24 months and PPVT-III scores. (r (31) = -.13, p = .47).

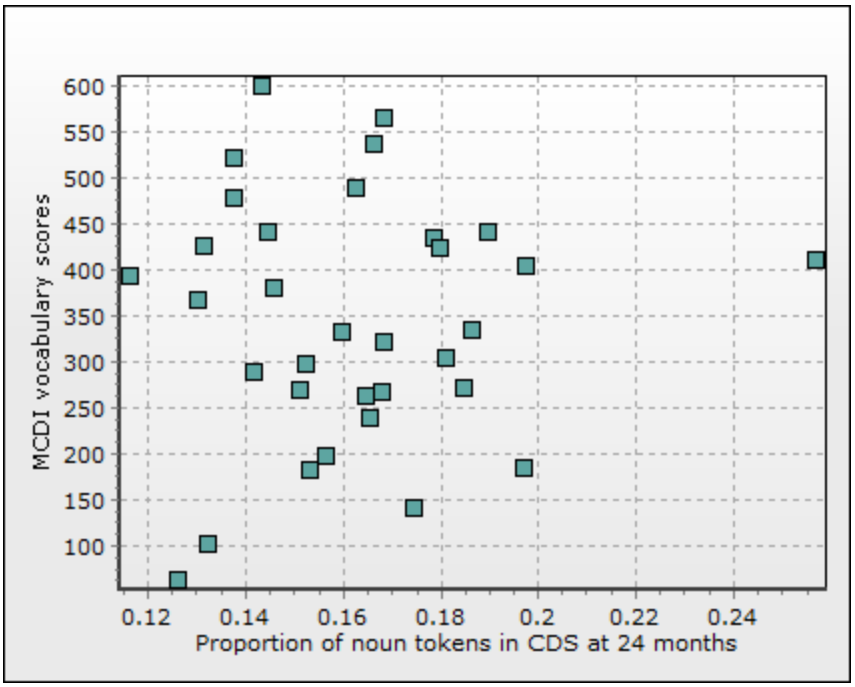

Figure 70. Proportion of noun tokens in CDS at 24 months and MCDI vocabulary scores. (r (31) = .06, p = .76).

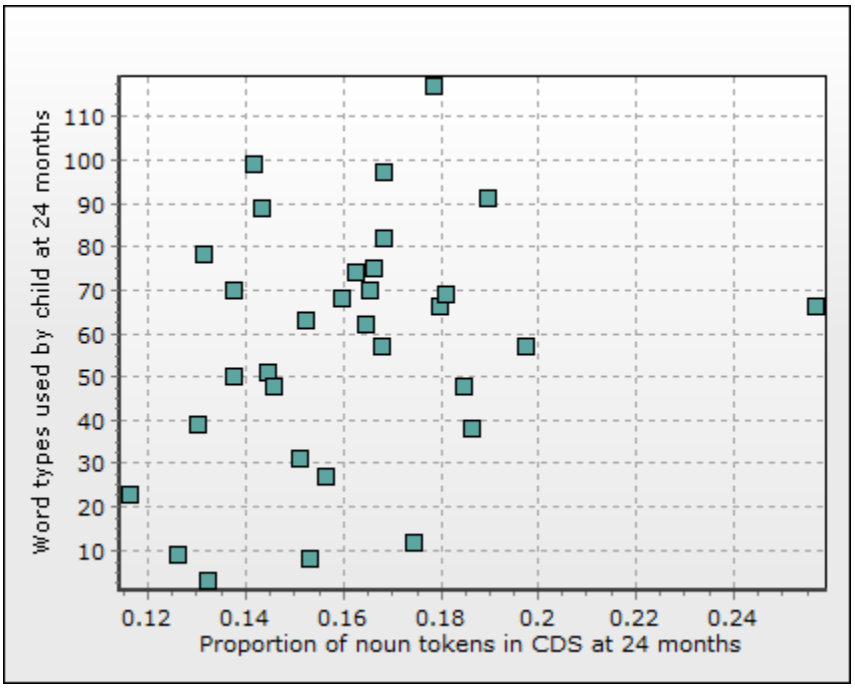

Figure 71. Proportion of noun tokens in CDS at 24 months and word types used by child at 24 months. (r (30) = .29, p = .11).

Chapter 9: Conclusions

The first research goal was to determine the size and level of consistency of differences in lexical diversity and syntactic complexity between ADS and CDS to eleven- and twenty-four-month-old children and to establish whether parents maintain a rank order of linguistic sophistication across communicative contexts, or whether different parents adjust their speech by differing amounts.

These data do not show that parents who use more lexical diversity and syntactic complexity in ADS also do so in CDS. Nor do they show a consistent pattern of "simplification". Most mothers did show substantial downward adjustment of MLU to eleven-month-olds, and slightly less, but still significant simplification of MLU for children at two. However, individual mothers varied substantially in the lexical diversity of their speech, with some increasing, and some decreasing lexical diversity to children at both ages.

Yet while the gap between ADS and CDS in individual mothers was not consistent, once mothers had chosen a level of linguistic complexity in CDS, they maintained it vis-à-vis other mothers, even as their children grew. Maternal CDS style is related at the two age points in *VOCD,* and MLU, even though play sessions and interviews were monitored by two different experimenters over a year apart, and children at eleven months and two years old have very different language skills and make very different communicative partners.

If mothers do not derive their base level of CDS from their adult-directed speech, then this raises the question of what determines the level of simplification they choose. Rowe (2008) found that knowledge of child development mediated the relationship

between SES (and relative language ability) and child-directed speech. A questionnaire gauging mothers' knowledge of language development could prove a valuable addition to the current longitudinal study.

Even if larger sample sizes bring out correlations between mean increases in MLU and VOCD and toddler language outcomes, it may be more fruitful and more appropriate to consider other, specific syntactic and lexical characteristics of CDS. For this study, we considered: proportions of rare words used, proportions of one-word utterances, and proportion of nouns in CDS. An interesting result of working with more specific measures of syntactic complexity and lexical diversity was that they had relationships with specific aspects of children's vocabulary knowledge as captured by different tests. The lexical rarity measure, or more accurately, the measure of how much mothers strayed beyond the most central, core vocabulary used by other mothers in a similar context, related to receptive vocabulary scores on the PPVT-III. The proportion of one-word utterances used related to expressive measures. Both the number of tokens used by mothers, and the proportion of tokens used that were nouns, related only to the MCDI. This unlikely to be due to differences in what the MCDI, the EOWPVT-III, and the number of word types used by children in the language sample measure, because they all measure expressive vocabulary. It is more likely that the MCDI provides a more sensitive and accurate measure. The MCDI is a cumulative parent report, and is therefore more likely to reveal more of the child's vocabulary, than a sample of a restricted number of names for pictures or fifteen minutes of speech.

None of the toddler language outcome measures were adversely affected by decreased simplification from parent ADS or increased complexity in CDS. Many of

what are referred to as results here did not achieve statistical significance and must be treated with caution, but none of the non-significant results showed the inverted u-shape that would be characteristic of a point of excessive lexical complexity. It may be that, even if parents occasionally overshoot, few consistently maintain levels of complexity that are high enough to impede language development. Parents with a tendency toward more complex CDS would also be providing substantial linguistic input an optimally high level of complexity, so no effect would be seen. This question remains pertinent for ensuring that therapeutic interventions designed at increasing the sophistication of linguistic input to children do not overshoot their goal. However it is a question that maybe better investigated through experimental research, as few naturalistic language samples are likely to provide the consistently linguistically sophisticated input necessary for testing this hypothesis. Furthermore, mean levels of lexical sophistication could conceivably mask other specific input factors, such as one-word utterances, that may have a greater effect.

Each language input parameter considered here was measured both prior to the measurement of language outcomes (time-lagged) and at the same laboratory visit (concurrent). Prior research has insisted on time-lagged measures as necessary for establishing the chain of causality, but considered them a more stringent test. Concurrent measures are considered more likely to correlate, because the child's current language level may also have an impact on adult CDS. However, in this study, effects that were visible in the time-lagged measures were diminished, or absent, when concurrent measures were considered. More general measures of complexity were robustly related at different time points, but less related to child outcomes. More specific measures were

not reliably related at different time points. Furthermore, measures such as the proportion of one-word utterances capture elements of CDS that are helpful to children at a specific stage. It may be that the use of one-word utterances with children at age two is no longer beneficial. For measures such as this, there is no reason to expect concurrent measurements of language input to be effective. It is more likely that parents will have altered their language behaviors as their children's language develops.

None of the maternal language factors considered here explain more than a small amount of the variability in children's language development at twenty-four months. The question of what factors, besides CDS, determine children's early language development is still open. Other factors considered in the larger longitudinal study that are more specific to individual infants, such as statistical learning or speech-stream-parsing abilities in early infancy, may prove to have more significant roles. Factors that can explain why mothers adjust their speech to their children to different degrees, such as maternal understanding of child development also hold promise (Rowe, 2008). Nevertheless, the role of language input factors should remain a topic of high interest, because language input is one element in the complex equation governing children's language learning that parents, therapists, and educators have the potential to improve.

Limitations

There are limitations to this study on every level. Effects of maternal language input factors on child language outcomes that are real, but subtle, may achieve statistical significance with a larger sample size. More sophisticated statistical analyses are more appropriate for investigating child language input as only one of the subtle and combined factors that influence child language development. Rowe's 2008 data supported a model

where child language input factors account for ten percent of the difference in children's language development. Multivariate models that control for other variables known to affect child language outcomes are more successful in identifying relationships between CDS and child language outcomes.

This sample is largely homogeneous in terms of social class. All mothers had college degrees of some kind. Results therefore pertain only to parents of this social class. Furthermore, this homogeneity in social class may have prevented larger variability among mothers in mean MLU and *VOCD* than have been found in samples including mothers from a broader socio-economic spectrum.

While mothers in this study were relatively homogeneous in socioeconomic status, they varied in whether, and for how many hours a week, they worked outside their homes. Mothers' work is not the only factor controlling the amount of time they spend directly involved in caring for and talking with their children but it does play a major role. Stronger effects of maternal CDS on children's language development may have been seen if it had been stipulated that all participants provide the bulk of their child's language input.

Laboratory procedures could also be tightened. Collection of samples could be more closely monitored to insure that they are similar in size and length of time. Audiotapes could be cut to standardize the length of time of samples. No attempt was made to control for potential effects of specific adult interviewers on ADS in parent interviews.

Language sample corpora are often the subject of research for many decades and accrue multiple layers of meticulous coding for lexical diversity and syntactic

complexity. This study is a very early analysis of a corpus that is still being collected. Further work with these transcripts will use more sophisticated definitions of grammatical complexity such as mean pre-verb length, syntactic complexity at the constituent and clausal levels, that require more complicated search routines and, in some cases, line-by-line coding in CHILDES.

This operationalization of core versus "rare" vocabulary in CDS is a first attempt. Choosing lexicons of different sizes, perhaps including one where, for eleven-month-olds, rare words also make up only one or two percent of words heard, would be of interest in order to see if eleven-month-old children also profit from such rare exposures as the preschoolers in Weizman and Snow. However, care would be required, perhaps through mapping of which specific lexical items children were learning, to ensure that what looks like an effect from very rare vocabulary items, is not the effect of mild extension beyond a *very* basic core vocabulary used more frequently in CDS in daily life.

Proportions of nouns in CDS did not show any effect on children's vocabulary growth. Other studies could, however, develop more precise ways to measure naming. Lists of the specific toys in the play session could be compiled, in order to count how many times mothers referred to these concrete referents. The effects of different contexts for naming (if the child is attending to the object, whether the mother uses an introductory syntactic frame, whether she repeats the name, or adds additional information) could all be investigated.

In addition, it may be that different groups of children respond to maternal linguistic complexity in different ways. We know that while most children acquire language without explicit training or therapy, others do not. Any sample of children

recruited in infancy will include some children who will develop typically and others who will exhibit language impairment. Failing to respond in predictable ways to linguistic input, including maternal CDS, early in childhood is, in some sense, the definition of language impairment. While often this is referred to as language *delay*, it could be that some of the children so classified have language learning differences, such that they respond very differently to the same levels of lexical diversity and syntactic complexity in CDS. This could be due simply to different learning styles, or it could be a question of language impairment. Consideration of groups of children with different levels of vocabulary may reveal relationships that were obscured when the data are grouped.

Clinical implications

Clinicians working with young children and their families would do well to keep the consistency of maternal CDS styles shown here in mind. Until we have a better understanding of some of the factors determining how mothers establish the "gap" between ADS and CDS, how parents speak to their children in everyday life may prove resistant to change. No significant relationship was found between mean levels of linguistic sophistication in CDS and child language development. This may serve as a caveat to avoid blanket recommendations for all parents. It is unlikely that any parent could respond successfully to the suggestion that they either raise or lower their MLU and *VOCD*.

In time, studies of specific characteristics of CDS that correspond to greater vocabulary development in toddlers may also yield more useful recommendations that are more specifically linked to a child's developmental age. Further research may confirm, for example, that deliberate use of an increased number of one-word utterances

when children are themselves at the one-word stage, has a beneficial effect. Optimal balances of core and relatively rare vocabulary may also be better understood. Furthermore, the possibility that different kinds of language input have differential impacts on different groups of children will be explored. Most children may respond better to more sophisticated input, while others may have a learning profile which profits from “say less”, “stress”, and “go slow”. The single outlier in the present study, whose mother used very sophisticated input and whose language development lagged, springs to mind here. Child differences could include age, level of language development, aptitude for pattern recognition in general or language acquisition in particular, or temperament. Until these profiles have been empirically established, each client can only be approached as a research study of one, by evaluating what factors, including, potentially, differing levels of lexical diversity and syntactic complexity language input, benefit(Phillips, 1973b) that particular child.

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