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Vocabulary, syntax, and narrative development in typically developing children and children with early unilateral brain injury: Early parental talk about the *there-and-then* matters

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Abstract

This study examines the role of a particular kind of linguistic input—talk about the past and future, pretend, and explanations, that is, talk that is decontextualized—in the development of vocabulary, syntax, and narrative skill in typically developing (TD) children and children with pre- or perinatal brain injury (BI). Decontextualized talk has been shown to be particularly effective in predicting children's language skills, but it is not clear why. We first explored the nature of parent decontextualized talk and found it to be linguistically richer than contextualized talk in parents of both TD and BI children. We then found, again for both groups, that parent decontextualized talk at child age 30 months was a significant predictor of child vocabulary, syntax, and narrative performance at kindergarten, above and beyond the child's own early language skills, parent contextualized talk and demographic factors. Decontextualized talk played a larger role in predicting kindergarten syntax and narrative outcomes for children with lower syntax and narrative skill at 30 months, and also a larger role in predicting kindergarten narrative outcomes for children with BI than for TD children. The difference between the two groups stemmed primarily from the fact that children with BI had lower narrative (but not vocabulary or syntax) scores than TD children. When the two groups were matched in terms of narrative skill at kindergarten, the impact that decontextualized talk had on narrative skill did not differ for children with BI and for TD children. Decontextualized talk is thus a strong predictor of later language skill for all children, but may be particularly potent for children at the lower-end of the distribution for language skill. The findings also suggest that variability in the language development of children with BI is influenced not only by the biological characteristics of their lesions, but also by the language input they receive.

Keywords

linguistic input; decontextualized language; language development; early unilateral brain injury; functional plasticity

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When children arrive at school, they are expected to converse in “academic language,” the language used in schooling situations to make an argument, to comprehend a text, to give a presentation, to integrate information across multiple passages, etc. (Schleppegrell, 2004; Snow, 2010). Academic language is dense, abstract, and decontextualized and, as such, is distinct from the conversational informal language that young children are typically exposed to in their daily lives. Other types of linguistic input must then help prepare children for the challenges of academic language. We suggest that parental decontextualized talk is just this type of input.

Here we ask whether children’s early home environments vary in the opportunities they provide for children to hear decontextualized language and, if so, whether variation in parental decontextualized language input predicts children’s vocabulary, syntax, or narrative skills at school entry, even when controlling for parental contextualized language input, demographic factors, and child preschool language skill. Further, we examine parent decontextualized language input in the early home environments not only of typically developing children, but also of children who experienced early unilateral brain injury and are thus likely to be delayed in their acquisition of later developed, complex linguistic skills (Demir, Levine, & Goldin-Meadow, 2010; Reilly et al., 1998, 2004; Reilly, Wasserman, & Appelbaum, 2013). By comparing children who experienced brain injury to typically-developing children, we can address the theoretical goal of determining whether input effects differ as a function of biological characteristics of the learner, as well as the practical goal of determining whether similar types of input are useful for both groups (e.g. Rowe, Levine, Fischer, & Goldin-Meadow, 2009).

Parental decontextualized language input—Although children’s earliest conversations with parents tend to be limited to topics in the here-and-now (i.e., the talk is contextualized), parents, at times, engage in conversations with their children that are about the there-and-then—about invisible entities and abstract ideas (i.e., the talk is decontextualized) (Snow, 1991). Decontextualized language is typically seen in parents’ conversations about the past and future, pretend play, and explanations, and parents tend to increase this kind of language over the early childhood period (Rowe, 2012). Parent use of decontextualized language, while limited, predicts typically developing children’s language skills. For example, Rowe (2012) found that, controlling for input quantity, parent use of decontextualized language when children were 3.5 years predicted child vocabulary comprehension one year later (see also Beals, 2001; Katz, 2001). Parent decontextualized language also predicts child narrative development (Beals, 2001; Haden, Haine & Fivush, 1997; Fivush, 1991; Peterson & McCabe, 1994; Reese, Levya, Sparks, & Grolnick, 2010; Tabors, Roach & Snow, 2001). For example, Tabors, Roach and Snow (2001) found that the decontextualized talk low-income parents use with their 3- to 5-year-old children predicted child narrative production skill at kindergarten, controlling for family income and parent education. However, various questions regarding the nature of the relation between early parental decontextualized language and later language outcomes remain unanswered. First, does decontextualized input differ from other kinds of parental input in terms of its linguistic properties? Second, does the contribution of decontextualized language to later outcomes hold when considering possible confounds, such as parent contextualized talk, demographic factors, and child preschool language skill? Third, does decontextualized language input play a similar or different role in predicting later outcomes for children with perinatal brain injury, compared to typically developing children?

There are a variety of reasons why exposure to decontextualized talk might enhance children's oral language skills. Westby (1991) placed language use on a continuum from contextualized to decontextualized, where the two ends differ functionally and structurally. Functionally, contextualized language is used to regulate social interactions, whereas decontextualized language is used to convey information removed from the immediate context and is thus conceptually more challenging. Structurally, decontextualized language requires use of more elaborate vocabulary and more precise syntactic marking of the temporal and causal nature of events (Curenton & Justice, 2004). Thus, with respect to vocabulary development, decontextualized language might provide children with relatively elaborate vocabulary, which could promote the development of academic vocabulary. Moreover, decontextualized language might challenge children to use the linguistic context, rather than the physical world, to figure out the meanings of previously unknown words, a skill that is likely to be useful in the later stages of vocabulary development, which often depend on comprehending written text (Sternberg, 1987). With respect to syntactic development, decontextualized language, which tends to be structurally sophisticated (Curenton & Justice, 2004; Westby, 1991), might expose children to a greater variety of complex syntactic forms. With respect to narrative development, decontextualized conversations about the past and the future in narrative talk, about cause-and-effect relations in explanations, and about fictional worlds in pretend play might expose children to the linguistic and macro-structures that are important components of full-fledged narratives (e.g., connectors and anaphoric pronouns, Curenton & Justice, 2004; Peterson & McCabe, 1992; Uccelli, Pan, & Snow, 2005; Westby, 1991). Although decontextualized talk has the potential to promote child language development, it is not yet known whether parent decontextualized input does, in fact, provide children with linguistically complex language. One goal of our study is to fill this gap.

Another question that remains unanswered concerns the role of children's own language skills in parents' production of decontextualized language. Environmental effects on child development are increasingly being interpreted according to transactional and dynamic systems views, which acknowledge the mutual relations between the two interlocutors (Lewis & Mayes, 2012; Sameroff, 2010; van Geert, 2011). Given the complexity of decontextualized language, children with more advanced language skills might make it possible for their parents to talk beyond the "here-and-now" more often and in greater depth than children with less advanced language skills. Previous studies showed that parents continuously adapt their language to the language level of the child they are talking to, and modify their interactions as the child develops (Soderstrom, 2007; van Dijk et al., 2013). Thus, it is important to explore the role that the child's own language development plays in eliciting early parent decontextualized input, and whether early parental decontextualized input predicts later child language outcomes above and beyond the child's own early language skills, the second goal of our study.

Parental language input in children with early brain injury—Children with pre- or perinatal unilateral brain injury (BI) have remarkable plasticity for the aspects of language that are learned early in development, even when their lesions impinge on classical language areas (Bates & Dick, 2002; Feldman, 2005; Stiles, Reilly, Paul, & Moses, 2005; Woods & Teuber, 1978). Although children with BI develop alternative neural organizations for language in the brain (e.g., Beharelle, Dick, Josse, Solodkin, Huttenlocher, Levine, & Small, 2010), after an initial delay in getting language off the ground, children with BI tend to perform within the low-normal to normal range on measures assessing basic lexical and syntactic skills (e.g., Bates et al. 1997; Eisele & Aram, 1995; Feldman, Holland, Kemp, & Janosky, 1992; Rowe et al., 2009; Sauer, Levine, & Goldin-Meadow, 2010; Thal et al., 1991, Vargha-Khadem, Isaacs, & Muter, 1994). But recent studies indicate that there are important limits to this plasticity in that children with BI, as a group, tend to fall behind their peers on complex language tasks, such as narrative production (e.g. Demir et al., 2010; Levine et al., in press; Reilly et al, 1998, 2004). Moreover, there are large individual differences within children with BI—some children with BI perform within the normal range on all aspects of language; others experience delays in their language milestones (e.g., Sauer et al., 2010; Demir, Fisher, Goldin-Meadow, & Levine, 2014).

Most studies examining the variation in language skill found in children with BI have searched for the origins of this variation in the biological characteristics of the child’s lesions, for example, lesion size, lesion location, lesion type (periventricular, cerebral infarct), and lesion laterality (e.g. Bates et al., 2001; Dall’Oglio, Bates, Volterra, Di Capua, & Pezzini, 1994; Feldman et al., 1992; Levine, Kraus, Alexander, Suriyakham, & Huttenlocher, 2005; Reilly et al., 1998; Stiles, Reilly, Levine, Nass, & Trauner, 2012; Vargha-Khadem, Isaacs, & Muter, 1994). Environmental factors, such as parent language input, have received much less attention, although these factors have long been regarded as important (Chelune & Edwards, 1981; Seidel, Chadwick & Rutter, 1975; Thomas & Chess, 1975). The studies that have examined environmental factors have largely focused on global indices of input (e.g., socioeconomic status, stability of the home environment and parental attitudes) and global indices of child outcomes (e.g., IQ, behavioral and psychiatric problems) (e.g., Thomas & Chess, 1975; Seidel, Chadwick & Rutter, 1975). One exception is a study by Rowe, Levine, Fisher and Goldin-Meadow (2009), which examined the impact of vocabulary diversity and syntactic complexity in parent talk on the growth of vocabulary diversity and syntactic complexity in children with BI, in addition to examining the role of lesions characteristics. Controlling for parental SES and characteristics of children’s lesions, Rowe et al. (2009) found that the diversity of parent vocabulary predicted growth in child vocabulary for children with BI and a control group of TD children. However, the syntactic complexity of parent input behaved differently—it played a larger role in predicting later child syntax in children with BI than in the typically-developing group. The third goal of our study is to build on these findings and explore the effect of *decontextualized* parent talk on subsequent child vocabulary, syntax, and narratives in both children with BI and TD children. One possibility is that complex language input, in the form of decontextualized language, might play the same role in children with and without BI, supporting the view that language learning mechanisms are robust in the face of early injury. Alternatively, this input might play a less important role than it does in TD children, possibly because the lesion limits the child’s ability to profit from the rich input provided. Finally, environmental input may play a more important role in supporting language development following BI, suggesting that input can help compensate for the deleterious effects of brain injury.

The current study—In the current study, we build on prior research by addressing three questions: (1) Is parent decontextualized language linguistically richer than contextualized language input, providing a possible mechanism for the (positive) impact that decontextualized input appears to have on child language development? (2) Does early parent decontextualized talk predict child vocabulary, syntax, and narrative performance at kindergarten, controlling for parent contextualized talk, demographic factors, and child preschool language skill? (3) Does parent decontextualized language input early in development play a differential role in predicting subsequent vocabulary, syntax, and narrative skill at kindergarten in children with BI, compared to TD children.

We focus on vocabulary and syntax skills because they represent areas of language development in which children with BI typically perform within the normal range by kindergarten; we include narrative skills because they represent an area of language development in which some children with BI experience difficulty relative to TD children. We focus on parent decontextualized talk at child age 30 months, a time period when children are first exposed to decontextualized topics by their parents. Previous literature shows that, at earlier ages, decontextualized language input is rare and is not a predictor of children’s later language outcomes (Rowe, 2012). At later ages, children start producing decontextualized talk themselves, which may encourage parents to increase the amount of decontextualized talk they address to their children (Sachs, 1983; Uccelli, Pan, & Snow, 2005).

Method

Participants

Forty-nine typically developing children (22 girls) and their parents participated in the study. Children and parents were drawn from a larger sample participating in a longitudinal study of children’s language development in the greater Chicago area (see Goldin-Meadow, Levine, Hedges, Huttenlocher, Raudenbush & Small, 2014). The original sample of children and their families was recruited from the Chicago area via mailings in specific zip codes and via an advertisement in a free parent magazine. Families were interviewed and the sample was selected based on a stratified design to represent the socioeconomic diversity of the Chicago area. Children were 14 months at the time of their first visit, and were visited in their homes every four months after that point. To be included in the current analysis, the dyad needed to have the relevant home visit at 30 months and at least one child kindergarten outcome measure. The children interacted at home with their primary caregiver, the mother for 48 children and the father for one child. Thirty children were White, nine children were African-American, six were Hispanic, and four were of mixed race. All children were being raised as monolingual English speakers. None of the children in our sample was early preterm (i.e., born prior to 34 weeks gestation). The average income for the sample was

$59,322 (*SD* = 3,294). The average years of education for the primary caregiver was 16 (*SD* = 2) years, corresponding to a Bachelor's degree.

Nineteen children with BI (14 girls) and their parents were recruited by contacting pediatric neurologists in the greater Chicago area and by establishing relationships with parent support groups in the area (Childhood Stroke and Hemiplegia Connections of Illinois, CSHC; Pediatric Stroke Network, PSN; and Children's Hemiplegia and Stroke Association, CHASA). Every family that was interested was included in the study, as long as the child had a unilateral pre- or perinatal brain injury and was a monolingual English-speaker. Fourteen of the children had their first visit within the first year of life, and five within the second year. The children interacted at home with their primary caregiver(s), the mother for 13 children with BI, mother and father for five children, and grandmother for one child. Eighteen children were White, and one was of mixed-race. The average income for families of children with BI was $81,447 (*SD* = 2,072), and was significantly higher than the average income for families of the TD children, $t(51.9) = -3.41$, $p < .01$.[1] The average number of years of education for the primary caregiver was 15.7 (*SD* = 2.2), and was not significantly different from the average number of years of education for parents of TD children, $t(65) = 0.64$, $p > .10$. For the two samples taken together, parent education and income were combined in a composite score of SES. The composite was generated using Principal Components Analysis (PCA). The first principal component weighted education and income positively and equally, and accounted for 81% of the original variance.

Coding brain lesion characteristics in the children with BI

Lesion information came from clinical MRI films or medical reports provided by families. In addition, five children were scanned using a 3-tesla GM Scanner at the University of Chicago when they were five years of age or older (i.e., when scans could be obtained without sedation). All scans were evaluated by a pediatric neurologist and a neurologist who coded lesions according to location, size and type. The specific lesion characteristics considered in our analysis were lesion laterality (left, right), lesion type (periventricular, cerebrovascular infarct), and lesion size (small/medium, large).

Cerebrovascular infarcts (CV) were infarcts that impinged on middle cerebral artery territory, and tended to affect the inferior frontal, parietal and/or superior temporal regions. Periventricular lesions (PV) primarily involved subcortical white matter tracts, the thalamus, basal ganglia and/or the medial temporal lobe. All children with PV lesions showed evidence of subcortical injury, enlarged ventricles or reductions in the white matter tract (especially the internal capsule), as noted in Table 1. Small (S) lesions affected only one lobe, or minimally affected subcortical regions. Medium (M) lesions extended into more than one lobe or subcortical region. Large (L) lesions affected three or four lobes and were typically cerebrovascular infarcts; these lesions affected multiple cortical areas and often involved the thalamus and subcortical regions. Children with small and medium lesions were categorized into a single group, as preliminary analyses indicated that the two groups did not differ from each other on various language measures.

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[1] The results reported below did not change when we used a sub-sample of TD children matched to children with BI in terms of income.

Lesion characteristics for each participant are reported in Table 1, including whether the child had experienced recurrent seizures (treated with anticonvulsant medications), or not (no seizures or a single febrile seizure during the first year of life). There was no significant association between lesion laterality and type, X^2 (1, n = 19) = 0.54, $p > 0.10$, or lesion laterality and size, X^2 (1, n = 19) = 2.85, $p > 0.10$. However, lesion type and size were significantly related, X^2 (1, n = 19) = 9.32, $p < .01$. Six out of nine children with CI had large lesions, whereas only one of 10 children with PV had a large lesion.

Procedure

Measures taken at child age 30-months—Parents were asked to interact with their children as they normally would, and parent-child dyads were videotaped for a 90 minute period. Typical activities included meal time, book reading, toy play etc., but no direction was given to engage in any particular activities. We coded the videotape taken at child age 30-months as described below.

Speech coding categories and language measures: All parent and child speech in the videotaped sessions was transcribed. The unit of transcription was the utterance, defined as any sequence of words that was preceded and followed by a pause, a change in conversational turn, or a change in intonational pattern. Transcription reliability was established by having a second individual transcribe 20% of the videotapes with a reliability criterion of 95% agreement on utterance transcription. We calculated parent and child total number of word tokens, total number of different word types, and mean length of their utterances measured in words (MLU-w) from the transcripts.

Parent and child contextualized and decontextualized talk: Decontextualized language utterances produced by parents and children were identified and coded as described in Rowe (2012). Categories of decontextualized language included narrative, pretend, and explanation (see Table 2). Reliability was achieved by having two coders independently code 10% of the videotaped sessions for decontextualized language. Percent agreement averaged 95.6% with a mean Cohen’s kappa value of 0.73. All utterances that were not coded as decontextualized were considered contextualized. Number of decontextualized and contextualized utterances was transformed using log transformation before statistical analyses.

Measures taken at child age kindergarten

Child vocabulary comprehension: Children were administered the Peabody Picture Vocabulary Test (PPVT-3) in winter or spring of kindergarten (PPVT-III, Dunn & Dunn, 1997). PPVT-3 scores collected in winter of preschool were used for three of the TD children who missed their kindergarten visits. Raw scores were converted to standardized scores based on the published age norms. The average age at the time the PPVT-III was administered was 6.11 years ($SD = 0.63$) for TD children and 6.34 years ($SD = 0.43$) for children with BI, $t(66) = 1.46$, $p > 0.10$.

Child syntax production: Children were administered the Recalling Sentences subtest of Clinical Evaluation of Language Fundamentals (CELF-3) in winter or spring of kindergarten

(Semel, Wiig, & Secord, 2003). Raw scores were converted to standardized scores based on the published age norms. Data from four TD children and six children with BI were not collected due to experimenter error or child fatigue, leaving a sample of 45 typically developing children and 13 children with BI who received this measure. The average age at the time the task was administered was 5.91 years (SD = 0.57) for TD children and 5.81 years (SD = 0.57) for children with BI, $t(56) = 0.48$, $p > 0.10$.

Child narrative production: Children were administered a narrative task (described below) in the winter of kindergarten. Data from four TD children and two children with BI were not collected on this measure due to experimenter error or child fatigue, leaving a sample of 45 typically developing children and 17 children with BI[2]. The average age at the time the task was administered was 6.01 years (SD = 0.42) for TD children, and 5.80 years (SD = 1.53) for children with BI, $t(60) = 0.96$, $p > 0.10$.

Stimuli consisted of short (30–73 sec) cartoons made in Germany about a mouse and his friends, unfamiliar to American children (the Maus cartoons, www.diemaus.de). The stories in the selected cartoons had at least one goal, an initiating event, an attempt to achieve the goal), and an outcome or resolution. Each story was thus defined by a series of events that were causally connected. Children were asked to watch two cartoons on a DVD player and describe what they had seen immediately after viewing each.[3] Children were videotaped during all phases of the task. To introduce each story, a still picture of the story characters appeared on a DVD player and the experimenter identified the characters by name and key objects in the story (e.g., bicycle, camera, socks, telephone). After the cartoon ended, the experimenter asked, “Can you tell me the story, as much as you remember?” Children who did not respond were prompted with questions including, “Who was in the story?” or “Can you tell me what happened?” The retelling of each story continued until the children spontaneously indicated they were finished, or until they responded “yes” when asked whether they were finished.

Each narration was transcribed and coded for narrative structure on a scale from 0 to 6. Narrative structure was evaluated using a hierarchical system adapted from Stein and colleagues (Stein, 1988; Trabasso, Stein, Rodkin, Munger, & Baughn, 1992). Narrations were categorized as follows: (0) Zero-level narrative; (1) A descriptive sequence; (2) Action sequence; (3) Reactive sequence narrative; (4) Incomplete goal-based narrative; (5) Complete goal-based narrative; (6) Complete goal-based narrative. Coding details and examples of stories in each narrative structure category are provided in the Appendix (for further information on coding see Demir et al., 2014). To establish reliability, a second coder analyzed the narratives produced by six TD children and three BI children. Interclass correlation coefficient between the raters on the narrative structure scores was substantial (0.76) and was consistent with agreement scores in similar narrative studies (James &

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[2] All analyses reported in the results section were repeated with the subset of children who were administered all three measures (45 TD children, 13 children with BI). The pattern of results was unchanged.

[3] For a more detailed discussion of the design, see Demir et al., 2014. Children were also presented with three comprehension questions after each story. There were no significant differences in the children’s responses to comprehension questions, $t(58) = 0.53$, $p > .10$; both groups performed relatively well on these questions, indicating that the questions were not particularly challenging for either group (TD: M = 0.75, SD = 0.20, BI: M = 0.72, SD = 0.24).

Pellegrini, 1996, McCabe, Bliss, Barna & Bennett, 2008). Discrepancies were resolved through discussion. Raw scores were transformed using log transformation before any statistical analyses were conducted.

Results

Parent language input

Parents produced many more contextualized utterances than decontextualized utterances—93% of all utterances were contextualized for the parents of TD children, 89% for the parents of children with BI. However, there was considerable variability in parents' use of contextualized and decontextualized utterances. For example, one parent did not produce any decontextualized utterances; another produced over 400 decontextualized utterances (see Table 3).

ANCOVAs with group (parents of TD children, parents of children with BI) as the between-subjects variable, and parent SES as the covariate, were conducted on total contextualized utterances and total decontextualized utterances, and also on each of the three types of decontextualized utterances (narrative, pretend, explanation). The ANCOVAs on contextualized as well as decontextualized utterances revealed a significant main effect of parent SES (contextualized: $F(1,64) = 5.77$, $p < .05$; decontexualized: $F(1,64) = 6.76$, $p < .05$), and no effect of group (contextualized: $F(1,64) = 0.54$, $p > .10$; decontextualized: $F(1,64) = 0.84$, $p > .10$). Thus, higher SES parents produced more of both types of talk, but there was no average difference between parents of TD children and parents of children with BI. For narrative utterances, there was no effect of SES, $F(1,64) = 2.35$, $p > .10$, or group, $F(1,64) = 0.47$, $p > .10$. For explanations, there also was no effect of SES, $F(1,64) = 0.58$, $p > .10$, but parents of children with BI produced significantly more explanation utterances than parents of TD children, $F(1,64) = 11.99$, $p < .01$. For pretend utterances, there was an effect of SES, $F(1,64) = 4.53$, $p < .05$, but no effect of group, $F(1, 64) = 0.08$, $p > .10$ (see Table 3). Parent uses of the three types of decontextualized utterances were correlated with each other. For parents of TD children, the correlations ranged from $r = 0.34$ *to* $r = 0.63$. For parents of children with BI, the correlations ranged from $r = 0.44$, *to*, $r = 0.76$. As a result, and because the patterns of results were the same for total decontextualized utterances and for each separate category, we use total number of decontextualized utterances, without distinguishing the types, in all subsequent analyses.

We used the mean length of contextualized and decontextualized utterances in words (MLU-w) as our measure of linguistic complexity (see Table 3). A repeated measures ANOVA on MLU-w, revealed a main effect of utterance type $F(1,66) = 101.12$, $p < .01$. The average MLU-w for parent decontextualized utterances was 6.25 words ($SD = 1.89$), compared to 3.96 words ($SD = 0.55$) for contextualized utterances. Again, neither the main effect of group, $F(1,66) = 0.01$, $p > .10$, nor the interaction between group and utterance type, $F(1,66) = 0.01$, $p > .10$, was significant. Thus, on average, parent decontextualized utterances were more linguistically complex than contextualized utterances.

Child language at 30-months

ANCOVA analyses were conducted on children's word types at 30 months with group (TD vs. BI) as the between-subjects variable, and parent SES as the covariate. This analysis revealed a significant effect of SES, $F(1,64) = 5.90$, $p < .05$, but no effect of group, $F(1,64) = 0.01$, $p > .10$. A parallel analysis on children's MLU-w showed no significant effect of either SES, $F(1,64) = 2.63$, $p > .05$, or group, $F(1,64) = 1.67$, $p > .10$. Similar ANCOVAs were conducted on children's contextualized and decontextualized utterances at 30 months, with group (TD children, children with BI) as the between-subjects variable and parent SES as the covariate. The ANCOVA on contextualized utterances revealed no significant effect of SES, $F(1,64) = 2.86$, $p <.10$, or group, $F(1,64) = 0.19$, $p >.10$. The ANCOVA on decontextualized utterances revealed a significant effect of SES, F (1,64) = 9.33), $p <0.01$, but no effect of group, $F(1,64) = 2.38$, $p > .10$.

The number of decontextualized utterances parents produced at child age 30-months was significantly correlated with children's decontextualized utterances at 30 months (TD: $r = 0.82$, $p < 0.01$, BI: $r = 0.84$, $p < 0.01$), but parent-child contextualized utterances were not correlated with each other (TD: $r = 0.26$, $p < .10$, BI: $r = 0.05$, $p > .10$) (see Table 3). The high correlations between parent use of decontextualized language and child use of decontextualized language did not allow us to control for child decontextualized language skill in our analyses because of multicollinearity. Instead, we used a measure of child sensitivity to parent decontextualized language, which we call *child follow-ups*, to control for the child's contribution to decontextualized conversations. Child follow-ups were measured by the percent of parent decontextualized utterances that were followed by a child response. Parent decontextualized language was significantly correlated with child follow-ups, but the correlations was not as high ($r = 0.25$, $p < 0.04$) as the correlation between parent and child decontextualized language. The correlations between parent decontextualized utterances at 30 months and child language measures at 30 months (word types, MLU-w, narrative utterances) were significant, with values ranging from $r = 0.34$ to $r = 0.56$. When we examine the relation between parent decontextualized language input and later child outcomes, we control for the specific child language measure at 30 months most relevant to the outcome variable (e.g., word types for vocabulary, MLU-w for syntax, and child narrative utterances for narrative outcomes). Indeed, children's word types were significantly correlated with vocabulary outcomes (TD: $r = .57$, $p < .01$, PL: r = .68, p < .01), MLU-w with syntax outcomes (TD: $r = .44$, $p < .01$, PL: $r = .70$, $p < .01$) and their narrative utterances with narrative outcomes (TD: $r = .31$, $p < .05$, PL: $r = .26$, $p = .26$).

Child vocabulary, syntax and narrative skills in kindergarten

Child vocabulary (PPVT) scores averaged 108.20 ($SD = 16.89$) for TD children, and 105.79 ($SD = 18.42$) for children with BI. Child syntax (CELF) scores averaged 10.63 ($SD = 3.04$) for TD children and 10.85 ($SD = 3.18$) for children with BI. The groups did not differ on either PPVT, $t(66) = 0.51$, $p > .10$, or CELF, $t(56) = 0.23$, $p > .10$. However, the groups did differ on mean narrative structure score, which was significantly higher for TD children ($M = 3.63$, $SD = 1.43$) than for children with BI ($M = 2.62$, $SD = 1.55$), $t(66) = 2.44$, $p < .05$.

Relation between early parent input and later child language skills

Predicting child vocabulary skill at kindergarten—Table 4 presents the correlations between child PPVT scores and parent SES, parent contextualized utterances, and parent decontextualized utterances. For TD children, PPVT was related to all three variables. For children with BI, PPVT was related only to parent decontextualized utterances related, possibly because the SES range was narrower in the BI group than in the TD group. Table 5 presents a multiple regression analysis examining the relation between parent decontextualized utterances and child PPVT, controlling for parent SES, parent contextualized utterances, child group (TD vs. BI), and child word types at 30-months. In all regression analyses, we first include control variables: parent SES, child characteristics (group, oral language at 30 months), and parent overall talk. We then introduce decontextualized input measures and the interaction terms. We keep only the significant interaction terms in the final models.

Parent SES was a significant ($p < .01$) positive predictor of PPVT (Model 1)[4]. Controlling for parent SES, group was not a significant predictor of PPVT (Model 2). Controlling for parent SES and group, number of child word types at 30 months was a significant ($p < .01$) positive predictor of later PPVT (Model 3). Parent contextualized utterances (Model 4) was not a significant predictor of PPVT above the other controls. However, parent decontextualized utterances was a significant ($p < .05$) positive predictor of PPVT, with parent SES, parent contextualized utterances, child word types at 30 months, and group controlled (Model 5). Interaction terms between group and decontextualized language input and child word types and decontextualized language input were tested and were not significant (Model 6). Decontextualized utterances remained a significant predictor of PPVT even when we controlled for child follow-ups (in addition to other control variables), $\beta = 0.89$, $p = .02$ (Model 7).

Predicting child syntax skill at kindergarten—For both TD and BI children, CELF was related to parent decontextualized utterances (Table 4). Table 6 presents a multiple regression analysis examining the effect of parental decontextualized utterances on children’s CELF Recalling Sentences score, controlling for parent SES, parent contextualized utterances, child group (TD vs. BI), and child MLU-w at 30 months. Parent SES was a significant ($p < .01$) positive predictor explaining 14% of the variation in CELF (Model 1). Controlling for parent SES, whether the child was in the TD or BI group was not a significant predictor of CELF (Model 2). Controlling for parent SES and group, child MLU-w at 30 months was a significant predictor of later CELF ($p < 0.01$) (Model 3). Neither parent contextualized utterances (Model 4) nor parent decontextualized utterances (Model 5) was a significant predictor of CELF, with parent SES, parent contextualized utterances, child utterances at 30 months, and group controlled (Model 5). However, the interaction between child MLU-w and parent decontextualized utterances was negative and

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[4] All analyses were repeated using percent of decontextualized utterances as predicting later outcomes instead of the number of decontextualized utterances. Controlling for other control variables, percent of decontextualized utterances did not significantly predict later vocabulary ($\beta = 0.13$, $p = 0.24$), or syntax scores ($\beta = 0.16$, $p = 0.23$), but significantly predicted narrative scores ($\beta = 0.30$, $p = 0.02$). The results suggest that while for vocabulary and syntax outcomes, the sheer number of decontextualized talk might be the important factor, for higher-order language functions, such as narrative outcomes, both the sheer frequency and the density of decontextualized talk in everyday language might play a significant role in predicting later outcomes.

significant, suggesting that as child MLU-w increased, the relation between parental decontextualized input and CELF grew smaller (Model 6). An interaction term between group and decontextualized language input was also tested and found not to be significant (Model 6). A final model, in which we removed the non-significant interaction term, explains 42.3 percent of the variation in CELF (Model 7). Decontextualized utterances remained a significant predictor of later syntax even controlling for child follow-ups (in addition to other control variables), $\beta = 1.38$, $p = .01$ (Model 8).

Predicting child narrative skill at kindergarten—For both TD children and children with BI, parent decontextualized utterances correlated with later narrative structure scores, but parent contextualized utterances and parent SES did not (Table 4). Table 7 presents a multiple regression analysis examining the relation of parent decontextualized utterances to child narrative structure scores, controlling for parent SES, parent contextualized utterances, child group (TD vs. BI), and child narrative utterances at 30 months. Parent SES (Model 1) was not a significant predictor of later narrative structure, but group was ($p < .01$, Model 2). Child narrative utterances at 30 months was also a significant ($p < .05$) predictor of narrative skills in kindergarten, controlling for SES and group (Model 3). Parent contextualized utterances did not predict narrative skills above and beyond controls (Model 4), but parent decontextualized utterances was a significant ($p < .01$) positive predictor (Model 5). We tested interaction terms in Model 6. The interaction between group and decontextualized language was significant ($p < .05$), indicating that the effect of decontextualized language input on later child narrative skill was larger for children with BI than for TD children. Similarly, the interaction between child narrative utterances and parent decontextualized utterances was negative and significant, suggesting that the effect of parent decontextualized input was stronger for children who produced fewer narrative utterances at 30 months. Model 6 is the best fitting model to the data and explains 45 percent of the variation in kindergarten narrative skill. Decontextualized utterances remained a significant predictor of later narrative even when we controlled for child follow-ups (in addition to other control variables), $\beta = 1.14$, $p < .01$ (Model 7).

Note that children with BI had significantly lower narrative outcomes (but not vocabulary or syntax outcomes) than TD children in kindergarten. This difference raised the possibility that narrative skill, rather than brain injury status, was driving the greater effect that parent decontextualized input had on children with BI than on TD children. Figure 1 presents narrative structure scores at kindergarten as a function of parent decontextualized talk at 30 months for TD children (left graph) and for children with BI (right graph). Parent input is more strongly related to child kindergarten narrative score in children with BI ($R^2 = 0.56$) than in TD children ($R^2 = 0.24$). But the figure also categorizes children according to narrative skill level at kindergarten—children at the low end of the distribution (i.e., below the group mean for all children) are indicated by triangles; children at the high end (i.e., above the group mean) are indicated by squares. Note that a large proportion of the children with BI performed poorly on the narrative task at kindergarten (i.e., there are proportionally more triangles in the right graph than in the left graph). To determine whether the group by parent decontextualized language input interaction for narrative skills is related to brain injury status *per se*, or to the lower narrative skill level of children in the BI group, we carried out a regression analysis on a subset of 15 TD children and 15 children with BI, matched on narrative structure scores. To create the matched sample, for each child with BI, one TD child with a matching or closest narrative score was selected. In cases of ties, a TD child with the closest PPVT and CELF scores was selected. Two children with BI performed lower than all TD children in terms of their narrative scores and thus were excluded from the matched sample. In this matched subset, TD children and children with BI did not significantly differ from each other on vocabulary ($t(28) = 0.69$, $p > .10$), syntax ($t(25) = 0.12$, $p > .10$), or narrative ($t(28) = 0.08$, $p > .10$). The regression analysis revealed a significant effect of parent decontextualized utterances on narrative structure, $b = 0.76$, $t(29) = 2.53$, $p < .05$, but no significant effect of group, $b = 0.17$, $t(29) = 0.35$, $p > .10$, and no significant interaction between group and decontextualized language, $b = 0.02$, $t(29) = 0.04$, $p > .10$, controlling for parent SES, parent contextualized utterances and child narrative utterances. Thus, when the two groups are equated with respect to narrative skill, the differential effect that parent input appeared to have on children with BI than on TD children disappears. However, this result should be interpreted with caution given that equating children on the basis of narrative skill made the sample size smaller and removed a fair amount of variance in the performance of children, which might have made it less likely to observe a significant interaction.

Decontextualized language features mediating effects of parent input

Parent decontextualized utterances were linguistically more complex than contextualized utterances. They also significantly predicted later child vocabulary, syntax and narrative outcomes. Our next step was to determine whether the linguistic properties of parent decontextualized utterances mediated (i.e., were at least partially responsible for) the relation between parent decontextualized utterances and later child vocabulary, syntax, and narrative outcomes. To do this analysis, we added MLU-w (our measure of linguistic complexity) into the regression analyses reported above. In predicting child vocabulary outcomes, when we controlled for parent MLU-w, parent decontextualized utterances ceased to be a significant predictor (Table 5, Model 7). Similarly, in predicting child syntax outcomes, controlling for parent MLU-w, parent decontextualized utterances ceased to be a significant predictor (Table 6, Model 8). In contrast, predicting child narrative outcomes, when we controlled for both parent MLU-w, parent decontextualized utterances remained a significant predictor (Table 7, Model 7). These findings suggest that the linguistic features of parent decontextualized language input are responsible for the relation between parent decontextualized language and child vocabulary and syntax, but not for the relation between parent decontextualized and child narrative.

Parent input and child outcomes in relation to child lesion characteristics

Table 8 presents the number of decontextualized utterances produced by parents of children with BI at child age 30 months as a function of the child's lesion characteristics: lesion laterality (LH versus RH lesions), lesion type (PV versus CI lesions), and lesion size (S/M versus L lesions). Three ANCOVAs were conducted to examine the relation between parent decontextualized language and child lesion characteristics, using parents of TD children as a comparison group and controlling for parent SES. Parent decontextualized language did not vary as a function of child lesion laterality, *F* (2,63) = 0.43, $p > .10$, lesion type, *F*(2,63) = 1.19, $p > .10$, or lesion size, *F*(2,63) = 1.55, $p > .10$.

Table 8 presents PPVT, CELF and narrative structure scores at kindergarten for children with BI as a function of child lesion characteristics. An ANOVA analysis revealed that neither child PPVT, *F*(2,59) = 0.19, $p > .10$, nor CELF, *F*(2,55) = 0.60, $p > .10$, varied with lesion laterality, but narrative structure did, *F*(2,59) = 3.91, $p < .05$. Bonferroni corrected post-hoc pairwise comparisons revealed that children with RH lesions had lower narrative structure scores than TD children, $p < .05$. No other differences were significant. Turning next to lesion type, we found that neither child PPVT, *F*(2,65) = 1.88, $p > .10$, nor CELF, *F*(2,55) = 1.42, $p > .10$, varied with lesion type, but narrative structure scores did, *F*(2,59) = 8.53, $p < .01$. Bonferroni corrected post-hoc pairwise comparisons revealed that children with CI lesions received significantly lower narrative scores than both children with PV lesions, $p < .05$, and TD children, $p < .01$. Further, we found significant effects of lesion size on PPVT, *F*(2,65) = 3.33, $p < .05$, and narrative structure, *F*(2,59) = 4.79, $p < .05$, but not on CELF, *F*(2,55) = 1.92, $p > .10$. Children with large lesions received significantly lower PPVT scores than children with small/medium lesions, $p < .05$, and marginally lower scores than TD children, $p = .09$. Children with large lesions received significantly lower narrative structure scores than TD children, $p < .05$.

Last, we examined whether the effect of parent input on narrative structure varied depending on child lesion characteristics. Our sample of children with BI was small and different lesion characteristics were highly correlated with each other. Analyses examining whether lesion size, type, and laterality interacted with parent input all revealed the same patterns; as a result, we provide only a single regression analysis (lesion type) to illustrate the pattern. Because neither parent SES nor parent contextualized utterances predicted narrative structure, we included only child narrative utterances, lesion type, parent decontextualized utterances, and the interaction between lesion type and parent decontextualized utterances in the regression analysis. Parent decontextualized utterances was a significant predictor of child narrative structure, $b = 1.01$, $t(16) = 3.05$, $p = 0.01$, controlling for child narrative utterances, lesion type, and the interaction between lesion type and parent decontextualized utterances, none of which were significant predictors of narrative structure. These variables explained 66% of the variance in narrative structure. Although the results of this analysis should be interpreted with caution because of the small sample size, overall, the findings suggest that the effect of parent decontextualized input does not vary by lesion type for children with pre- or perinatal unilateral brain injury[5].

Discussion

Previous studies indicate that parent decontextualized language—talk about the *there-and-then*—predicts later child language (Rowe, 2012, Tabors, Roach & Snow, 2001).

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[5] Analyses examining whether lesion size and lesion laterality interact with parent input revealed a similar pattern as the lesion type results. Neither the interaction between decontextualized language input and lesion size nor the interaction between decontextualized language input and laterality reached significance (lesion size: $b = 0.01$, $t(16) = 0.02$, $p > .10$, lesion laterality: $b = -0.11$, $t(16) = -0.14$ $p > .10$) but, in both of these analyses, there were significant main effects of decontextualized language (lesion size: $b = 0.72$, $t(16) = 2.04$, $p = 0.06$, lesion laterality, $b = .88$, $t(16)=3.33$, $p< 0.01$)

Researchers have hypothesized that this is because talk that extends beyond the *here-and-now* contains diverse vocabulary and complex linguistic structures (Beals, 2001; Curenton & Justice, 2004; Rowe, 2012). Our study provides evidence for this hypothesis. (1) We find that syntactic complexity (as measured by MLU in words) in parent decontextualized language is, indeed, higher than parent contextualized language. (2) We also find that parent decontextualized language does, indeed, predict later child language skills, controlling for early child language, parent SES and, importantly, parent contextualized talk, which constitutes the bulk of the language input young children receive. (3) Finally, we find that in predicting later vocabulary and syntax skill, the richness of decontextualized language mediates the relation between parent decontextualized language and child vocabulary and syntax outcomes. However, parent decontextualized language remains a significant predictor of child narrative outcomes even when we control for linguistic complexity, suggesting that the macro-features of decontextualized language, e.g. connectors, anaphoric pronouns, might also be contributing to narrative skill. Importantly, we find a significant relation between parent decontextualized language and later child language outcomes for both TD children and for children with BI.

One of the contributions of our study is to show that the experience-dependent nature of language learning is robust in the face of early brain injury. The same kinds of language input that support language development in typically developing children also support language development in children who are learning language with a brain that has been modified by an early injury. Moreover, our findings show that decontextualized language, the specific type of input that is important in fostering later language skills, has the potential to be more important for children with BI than for TD children, particularly when it comes to the complex narrative language with which children with BI often have difficulty. Recall that, in our data, parent decontextualized language played a larger role for children with BI than for TD children in the development of narrative skill, but not syntax or vocabulary; and that the children with BI had lower outcomes in kindergarten than the TD children in narrative skill, but not syntax or vocabulary. When the children with BI were matched to the TD children in terms of their narrative skill in kindergarten, the difference between groups disappeared—that is, parent input no longer had a bigger effect on child output for children with BI than for TD children, although our findings need to be replicated with a larger sample size that has a wider skill range. Our findings thus suggest that differences between children with BI and TD children in the impact that parent input has on child output may be due, not to children's brain injury *per se*, but to their relatively low levels of linguistic skill.

Rowe, Levine, Fisher & Goldin-Meadow (2009) also found that parent input can play a more powerful role for children with BI than for TD children (see also Wilcox & Shannon, 1996). The effect Rowe and colleagues found was selective—parent input played a more powerful role for children with BI than for TD children with respect to productive syntax but *not* with respect to vocabulary. Our findings suggest that this difference may be an outgrowth of the fact that the children with BI performed worse than the TD children with respect to syntax but *not* with respect to vocabulary.

In support of the hypothesis that input has the potential to play a greater role for children with lower language skills, we found that the effect of parent decontextualized talk on syntax and narrative outcomes was greater for children with lower syntax and narrative skills at 30 months than for children with higher skills. This phenomenon holds for both typically and atypically developing children. Consistent with Rowe et al. (2009), we did not find a comparable effect for either group for vocabulary – the impact of parent input on vocabulary did not vary as function of child vocabulary, which is a less complex skill than either syntax or narrative. Intervention and parent input have also been shown to play a greater role for TD children from low-SES families, who typically have lower levels of language skills, than for TD children from high-SES families (Brooks-Gunn, Gross, Kraemer, Spiker, & Shapiro, 1992; Loken, Mogstad, & Wiswall, 2012; Rowe, Raudenbush, & Goldin-Meadow, 2012). Our findings thus add to a growing literature suggesting that language input has its biggest effects when language development is delayed, either due to biological or environmental risk factors.

Although our small sample size precludes definitive conclusions about the relation between lesion characteristics and language development, the findings are consistent with our hypotheses and the existing literature. Within the children with BI, we found that lesion characteristics were related to narrative skill. In particular, as expected, CI lesions, which tend to be larger and involve more brain regions than PV lesions, are associated with lower narrative skills than PV lesions. The finding that children with right hemisphere lesions tend to have lower narrative skills than children with left hemisphere lesions is consistent with previous studies (Dardier, Reilly, Bates, Delaye & Laurent-Vannier, 2005, Reilly, Stiles, Wulfeck, & Nass, 2005).

Given the correlational nature of our study, which used parent talk in naturalistic parent-child interactions to predict children’s later language skills, we cannot rule out the possibility that the parents were providing more decontextualized language to children with more advanced language and/or with better nonverbal interactional skills (e.g., better able to attend or follow the caregivers’ joint attention)—that is, that the parents’ use of language was reflecting their child’s linguistic skill rather than shaping it. We did control for the children’s linguistic competence and the extent to which the children were sensitive to their parents’ decontextualized utterances in our analyses. But the only way to cleanly make the causal argument is to randomly assign children to groups receiving different amounts of decontextualized language input (e.g., Rogosa, 1980; Shadish, Cook, & Campbell, 2002). Nevertheless, our findings support the possibility that increasing the amount of decontextualized language that parents provide may be beneficial to children’s later-developing, more complex language skills. The next step is to test this prediction experimentally by encouraging parents to incorporate decontextualized talk into their conversations with children. If this manipulation has positive effects, it would have implications for the development of interventions for children at risk for language difficulties, whether from biological or environmental causes.

In summary, we have found that early parent decontextualized language is a particularly rich form of language, and perhaps as a result, reliably predicts later language skill in both children with early brain injury and in typically developing children—even when contextualized parent input, demographic factors, and child preschool productive language skill are controlled. The variability in language development observed in children with BI is thus a product not only of the biological characteristics of the children’s lesions, but also of the language input the children receive. Being exposed to decontextualized language early in development has the potential to mitigate the later-appearing difficulties that children with early brain injury often experience on complex linguistic tasks.

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Appendix. Examples of narrative in each structure category

(0) Zero-level narrative: Narrative without a descriptive sequence and without structure TD: none. PL: *I think tail flying.*

(1) Descriptive sequence narrative: Contains the physical and personality characteristics of an animate protagonist

TD: *She was going to wake up Ellie. There was a high telescope.* PL: *Mouse answers the phone, and the cord is broken.*

(2) Action sequence narrative: Contains actions described in a temporal, but not causal, order

TD: *He was stuck in a hole, and his tail was spinning, and he got where --, he was walking on the other side.* PL: *They were sleeping. Then somebody woke up and put a --.*

(3) Reactive sequence narrative: Contains actions that are causally organized, but does not include the protagonist's goal

TD: *After the mouse was sleeping. Then the elephant was sleeping. Then they were snoring. Then the mouse can't sleep. He sleeps again. Then the elephant just snored, and he put the top on. And the elephant can't sleep because he sneezed. Then the mouse—the top hits the mouse in the face. He never saw nobody.* PL: *The elephant was snoring. The mouse put the beer cap on his trunk, and the elephant woke up, and he was like--, and it hit the mouse, and woke him up.*

(4) Incomplete goal-based narrative: Contains a goal statement and/or an attempt, but no outcome

TD: *The mouse—he wanted to keep the tea warm, and he kept going from hat to hat to hat to hat, and then he found the elephant Ellie.* PL: *He tried to see the telescope. He was bouncing on a trampoline, and he was trying to look out the telescope again.*

(5) Complete goal-based narrative with one episode: Contains one episode with temporal and causal structure, goal of the protagonist, an attempt to achieve the goal and an outcome of these attempts

TD: *Mouse was taking a walk and enjoying the day, but he fell in the hole, and he tried to get up and his tail spinned like a helicopter, and it took him up, and he said that's how you get out of a deep dark hole.* PL: *Mouse wanted to jump over, but then he found a hole, and he used his tail to get out.*

(6) Complete goal-based narrative with multiple episodes: Contains multiple episodes with multiple goal–attempt–outcome sequences

TD: *And that he -- it was a nice day for laundry, and then he hanged up some socks. They -- the wind was so strong. It blew them away. He tried again. They blew them away. Then he thought the holes would do it. He -- he threaded the --*

the socks and holes. He put it on. The wind blew at it, but it didn't go away. The end. PL: *After school Ellie likes to take a nap. Mouse was looking for a phone. He wanted to call the friend, but there was no answer. So Mouse tried again but -- but first he can't get the phone number, and then tried again and then again, but then Ellie -- then he saw Ellie, but then he saw that the cord was broken. So he put the tail in there, and it worked. The end.*

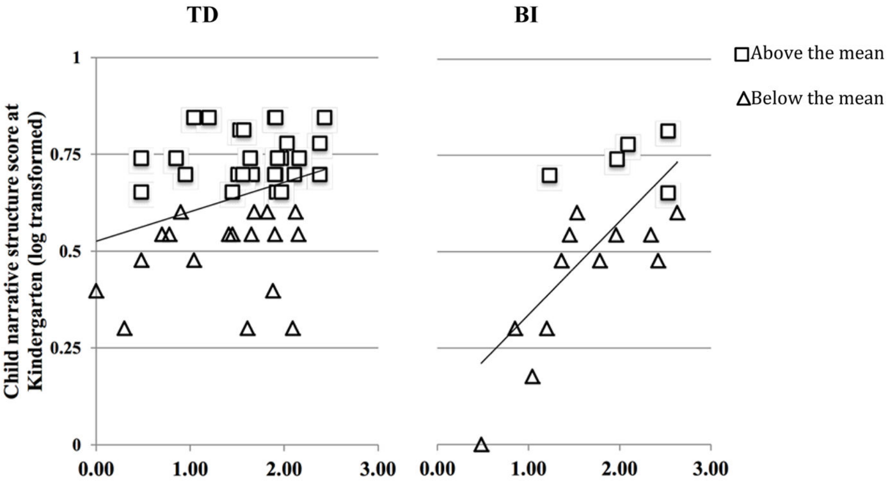

Figure 1.

Child narrative structure score at kindergarten as a function of number of parent decontextualized utterances produced at child age 30 months for TD children (left graph) and children with BI (right graph). Children are also categorized according to whether their narrative scores were below (triangles) or above (squares) the group mean combined across groups in kindergarten; data are log transformed. Note that a large proportion of the children with BI were below the mean at kindergarten (marked with triangles), and that children who were above the mean (marked with squares) in the BI group displayed the same pattern as children above the mean (also marked with squares) in the TD group.

Table 1

Lesion characteristics of children with pre- or perinatal brain injury.

ID	Gender	Side	Type	Size	Areas Affected	Seizure History
1	F	LH	CI	Large	F,T,P,O,S	No
2	F	LH	PV	Medium	S	No
3	F	RH	CI	Large	F,T,P,S	Yes
4	M	RH	PV	Small	S	Yes
5	F	RH	PV	Small	T,P,S	No
6	F	RH	CI	Large	F,T,P,S	Yes
7	M	RH	PV	Large	T, S	Yes
8	F	LH	PV	Small	S	No
9	F	RH	CI	Small	F,P	Yes
10	F	LH	CI	Medium	F,T,P,S	No
11	F	LH	CI	Large	F,T,P,S	No
12	M	LH	CI	Large	F,T,P,S	Yes
13	M	LH	PV	Small	F,T,S	Yes
14	F	LH	CI	Large	F,T,P,O,S	No
15	F	LH	CI	Medium	F,T,P	No
16	F	LH	PV	Small	S	No
17	F	LH	PV	Small	S	No
18	M	RH	PV	Small	T,S	No
19	M	RH	PV	Small	S	No

Note: LH=left hemisphere, RH=right hemisphere, CI=cerebrovascular infarct, PV=periventricular, F=frontal, T=temporal, P=parietal, O=occipital, S=subcortical.

Table 2

Definition and examples of decontextualized language categories in the parents of TD children and children with BI.

Definition	Examples
Narrative: Talk about events that happened in the past or will happen in the future (Beals & DeTemple, 1993; Beals & Snow, 1994).	TD: “Mom is going to go to the foot doctor tomorrow.” “Remember when we got those cars at our vacation?” BI: “Daddy's going to bring you home early for lunch.” “All the little kids kept trying to help and they were actually scaring her away.”
Pretend: Talk during pretend episodes of interaction, including making an object represent another, attributing actions, thoughts or feelings to inanimate objects, assuming a role or persona, enacting scripts or routines (Katz, 2001).	TD: “Do you think the baby wants to have some juice?” “I will save you from the wicked sister.” BI: “Can I pour you a cup of tea?” “Come on horsies, gallop back to your stall.”
Explanations: Talk that requests or makes logical connections between objects, events, concepts or conclusions (Beals, 1997; Beals, 2001).	TD: “Yes, let's turn the blocks so you can see the patterns on them.” “If we don't have all of our ingredients, all the things to put into the cookies, we won't be able to make them.” BI: “Because we already washed our hands, I think we should just put the crayons away for now.” “We need to get you in the big girl swing so you get a little more fun again.”

Table 3

Contextualized and decontextualized utterances produced by parents of children with BI,parents of TD children, children with BI and TD children at child age 30 months.

	30 months	
	TD (n=49)	**BI (n=19)**
	M (SD) Range	**M (SD) Range**
Number of parent contextualized utterances	838.25 (380.41) 244–1694	983.63 (353.76) 291–1744
Number of parent decontextualized utterances	62.98 (64.11) 0–271	120.16 (134.16) 2–426
Number of parent narrative decontextualized utterances	17.31 (33.06) 0–212	16.79 (21.14) 0–75
Number of parent pretend decontextualized utterances	37.96 (53.15) 0–250	80.00 (112.51) 0–315
Number of parent explanation decontextualized utterances	7.71 (5.76) 0–20	23.37 (21.05) 0–86
Number of child contextualized utterances	513.37 (224.17) 131–956	461.51 (212.45) 66–1237
Number of child decontextualized utterances	40.31 (45.46) 0–249	50. 11 (72.25) 0–260
Number of child narrative decontextualized utterances	7.31 (11.93) 0–56	6.21 (9.78) 0–35
Number of child pretend decontextualized utterances	32.63 (43.53) 0–245	43.26 (69.04) 0–242
Number of child explanation decontextualized utterances	0.36 (0.85) 0–3	0.63 (2.31) 0–10
Parent contextualized utterances mean length of utterance	3.96 (0.55) 2.54 – 5.18	3.95 (0.55) 2.79–4.69
Parent decontextualized utterances mean length of utterance	6.25 (1.87) 0 – 11.64	6.26 (2.07) 0.10–0.22

Table 4

Simple correlations between three parent measures (SES, contextualized utterances, decontextualized utterances) at child age 30 months and child outcome measures (PPVT, CELF, narrative structure score) at kindergarten.

	Child PPVT score		**Child CELF score**		**Child narrative structure score**	
	TD	**BI**	**TD**	**BI**	**TD**	**BI**
Parent SES	0.52[**]	0.31	0.17	0.33	0.09	0.42[~]
Parent contextualized utterances	0.30[*]	0.08	0.17	−0.23	0.04	0.28
Parent decontextualized utterances	0.47[**]	0.61[**]	0.39[*]	0.39[*]	0.31[*]	0.73[**]

[~] $p < .10$,

[*] $p < .05$,

[**] $p < .01$.

Table 5

A series of multiple regression models predicting child PPVT scores at kindergarten from early decontextualized parent input and controls.

	PPVT (Standardized β)						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Parent SES	0.45^{**}	0.47^{**}	0.32^{**}	0.31^{**}	0.29^{**}	0.28^{**}	$.28^{**}$
Group		0.14	0.14	0.14	0.15	$0.54^{\sim}$	.14
Child word types			0.51^{**}	0.51^{**}	0.41^{**}	0.90^{*}	$.41^{**}$
Parent contextualized utterances				0.03	−0.08	−0.06	−.09
Parent decontextualized utterances					0.25^{*}	0.83^{*}	$.21^{\sim}$
Group X Parent decontextualized utterances						−0.46	
Child word types X Parent decontextualized utterances						−0.77	
Decontextualized MLU							$.24^{**}$
R-Squared (%)	20.1	21.9	46	46.1	49.3	52.1	54.8

$^{*}p < .05$,

$^{**}p < .01$.

Table 6

A series of multiple regression models predicting child CELF scores at kindergarten from early decontextualized parent input and controls.

	CELF (Standardized β)							
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Parent SES	0.37^{**}	0.38^{**}	0.30^{*}	0.28^{*}	0.27^{*}	0.26^{*}	$0.23^{\sim}$	$.24^{*}$
Group		0.01	−0.01	−0.06	0.03	0.46	0.01	.02
Child MLU			0.46^{**}	0.46^{**}	0.38^{**}	1.51^{**}	1.36^{**}	1.19^{*}
Parent contextualized utterances				0.06	−0.07	−0.04	−0.07	−.08
Parent decontextualized utterances					0.24	1.42^{**}	1.05^{*}	$.90^{\sim}$
Group X Parent decontextualized utterances						−0.50		
Child MLU X Parent decontextualized utterances						-1.69^{*}	-1.48^{*}	−1.23
Decontextualized MLU								.11
R-Squared (%)	14	14	34.1	34.4	37.3	44	42.3	43.4

$^{\sim}$ $p < .10$,

* $p < .05$,

** $p < .01$.

Table 7

A series of multiple regression models predicting child narrative structure scores at kindergarten from early decontextualized parent input and controls.

	Narrative structure (Standardized β)						
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Parent SES	0.15	0.19	0.14	0.16	0.08	0.09	.09
Group		0.35^{**}	0.33^{**}	0.31^{*}	0.35^{**}	1.21^{**}	1.19^{**}
Child narrative utterances			0.28^{*}	0.31^{*}	0.10	1.10^{*}	$.89^{\sim}$
Parent contextualized utterances				−0.08	−0.25	−0.18	−.19
Parent decontextualized utterances					0.48^{**}	1.17^{**}	1.10^{**}
Group X Parent decontextualized utterances						-1.02^{**}	-1^{**}
Child narrative utterances X Parent decontextualized utterances						-1.16^{*}	−.94
Decontextualized MLU							.11
R-Squared (%)	2	14.1	21.7	22.2	34.3	45.2	46.4

$^{\sim}p < .10$,

$^{*}p < .05$,

$^{**}p < .01$.

Table 8

Number of parental contextualized and decontextualized utterances and child PPVT, CELF and narrative structure scores at kindergarten, as a function of child lesion characteristics (laterality, type, size) for children with BI.

	Lesion laterality		Lesion type		Lesion size	
	RH (n=8)	LH (n=11)	CI (n=9)	PV (n=10)	S/M (n=9)	L (n=10)
	M (SD) Range	M (SD) Range	M (SD) Range	M (SD) Range	M (SD) Range	M (SD) Range
Parent contextualized utterances	935.38 (364.47) 291–1486	1018.46 (359.32) 357–1744	1093.78 (387.37) 357–1744	884.50 (306.38) 291–1369	867.36 (338.16) 291–1369	1224.67 (332.52) 861–1744
Parent decontextualized utterances	92.38 (99.18) 10–265	140.36 (156.35) 2–426	68.89 (79.40) 2–217	166.3 (159.37) 15–426	168.82 (154.31) 2–426	36.67 (32.32) 6–90
Child PPVT score	104.03 (24.03) 69–135	107 (14.23) 75–125	98.11 (15.92) 70–115	112.7 (18.48) 69–135	113 (16.09) 75–135	97.17 (14.57) 70–113
Child CELF score	11.83 (3.25) 7–17	10(3.11) 6–15	9.33 (2.80) 6–13	12.14 (3.08) 8–17	9.74 (2.85) 8–17	5.35 (2.77) 6–13
Child narrative structure score	2.21 (1.44) 0.5–5	2.90 (1.63) 0–5.5	1.69 (1.07) 0–3	3.44 (1.47) 1–5.50	3.04 (1.67) 0–5	1.83 (0.93) 0.5–3

Note: LH=left hemisphere, RH=right hemisphere, CI=cerebrovascular infarct, PV=periventricular, S/M= small/medium, L= large