

A construction based analysis of child directed speech

Thea Cameron-Faulkner^{a,1}, Elena Lieven^{b,*}, Michael Tomasello^b

^a*Department of Linguistics, University of Manchester, Manchester M13 9PL, UK*

^b*Psychology Department, Max Planck Institute for Evolutionary Anthropology,
Deutscher Platz 6, D-04103 Leipzig, Germany*

Received 5 October 2001; received in revised form 28 March 2003; accepted 11 June 2003

Abstract

The child directed speech of twelve English-speaking mothers was analyzed in terms of utterance-level constructions. First, the mothers' utterances were categorized in terms of general constructional categories such as Wh-questions, copulas and transitives. Second, mothers' utterances within these categories were further specified in terms of the initial words that framed the utterance, item-based phrases such as *Are you . . .*, *I'll . . .*, *It's . . .*, *Let's . . .*, *What did . . .*. The findings were: (i) overall, only about 15% of all maternal utterances had SVO form (most were questions, imperatives, copulas, and fragments); (ii) 51% of all maternal utterances began with one of 52 item-based phrases, mostly consisting of two words or morphemes (45% began with one of just 17 words); and (iii) children used many of these same item-based phrases, in some cases at a rate that correlated highly with their own mother's frequency of use. We suggest that analyses of adult-child linguistic interaction should take into account not just general constructional categories, but also the item-based constructions that adults and children use and the frequency with which they use them.

© 2003 Cognitive Science Society, Inc. All rights reserved.

Keywords: Language development; Input; Constructions; Syntax

1. Introduction

Research on how children learn the structure of their language has tended to be conducted in the context of two major propositions that derive ultimately from Chomsky's early

* Corresponding author. Tel.: +49-341-3550-400; fax: +49-341-3550-444.

E-mail addresses: t.cameron@man.ac.uk (T. Cameron-Faulkner), lieven@eva.mpg.de (E. Lieven), tomas@eva.mpg.de (M. Tomasello).

¹ Tel.: +44-161-275-3198.

formulations. The first is usually called ‘the poverty of the stimulus’ and states that the nature of adult speech is such that children could not infer structure from what they hear. In response to this, there has been a long tradition in the child language literature of suggesting that adult speech provides children with more information than the Chomskian position suggests and that children start by abstracting relatively simple structures from what they hear i.e., that children’s early language structure may be different in kind from that of adults and simpler to learn. The second proposition states that ‘you can’t get there from here’, namely that it would be impossible for children to learn how to move from these simpler structures to those of the adult language. There is no doubt that these are the crucial issues for an account of how children learn the structure of their language: firstly how do they abstract structure from what they hear and secondly, how do they move from their initial representations to those of the adult system?

In our view, however, there is, by now, a body of research from a variety of approaches that begins to suggest that the Chomskian answer—namely that important aspects of linguistic structure must be pre-given—may be wrong. These lines of research are: (1) studies suggesting that children’s early language is low-scope and lexically specific and develops towards more abstract and general representations only gradually; (2) linguistic theories which argue against Chomsky’s separation of form from function in linguistic representation and suggest instead that the adult system is function- and usage-based; and (3) computational approaches to the learning of aspects of language structure. In this paper we briefly review this research before turning to a novel analysis of child-directed speech which shows that many of the lexically specific patterns that children produce are present in the speech that they are hearing. Later in ontogeny, these patterns must of course be generalized.

2. Early structure

It has been known for many years that much of English-speaking children’s early language can be analyzed in terms of specific linguistic items and phrases with open slots (e.g., Braine, 1976; Clark, 1974; Ewing, 1982; MacWhinney, 1978). More recently, Tomasello (1992) suggested that verbs are the main centers of organisation of these patterns while Pine and Lieven (1993) and Lieven, Pine, and Baldwin (1997) suggested that pronouns and pronoun-clitic combinations (e.g., *It’s X-ing*; *Where’s X?*) can also form the fixed element in these low-scope patterns. Children acquire these constructions, together with a functional meaning, as a whole, and they also have a function for the slot—though this is unlikely to fully reflect the abstract grammatical category that ‘fills the slot’ in the adult grammar. Which constructions are acquired and whether they are fully lexically specific will depend on a number of factors including the type and token frequencies of the construction and its parts in the input, together with its functional salience for the child (Lieven, Behrens, Speares, & Tomasello, 2003; Tomasello, 2003).

Of course, naturalistic observations of children’s speech can never prove that the limited patterns they use really reflect low-scope knowledge rather than underlying abstract structure. Indeed, criticisms of the conclusions of this research by those coming from the Generative tradition is usually that children must, of course, learn the lexicon of their language relatively

slowly, but lexical specificity does not prove an absence of underlying structure. However, experiments which control precisely what the child has heard and then test for the capacity to generalize grammatical structure suggest that the ability to generalize morphology and argument structure does, indeed, develop between the ages of about 2;0 to 4;0. Thus, to give just two examples, children's ability to generalize verb morphology to novel verbs develops after they are already well able to do this for novel nouns (Tomasello, Akhtar, Dodson, & Rekau, 1997); their ability to correct ungrammatical utterances with novel verbs to canonical word order is much stronger at 4;0 than at 2;6 (Abbot-Smith, Lieven, & Tomasello, 2001) (see Tomasello, 2000, for a summary and Fisher, 2002 and Tomasello & Abbot-Smith, 2002 for further discussion).

3. Characterizing the target language: usage-based linguistic theory

In our view, these findings fit much better with cognitive linguistic theories than they do with theories of the adult system derived from the Generative perspective. For 'usage-based' cognitive linguists (e.g., Bybee, 1995; Croft, 2001; Langacker, 1987) a particular utterance will be multiply represented at levels in the speaker's system ranging from the lexical specificity of the actual utterance (for instance *I dunno*, Bybee & Scheibmann, 1999) through to its place in an abstract network of related constructions and paradigms. Exactly how it is represented and at which levels will depend on issues of type and token frequency i.e., on previous usage of the same or related utterances. By implication how an utterance is generated, and at what level of lexical specificity, will depend on the context in which the utterance is being used and the representations and the connections between these representations that the speaker/listener has available. The significance of this approach for the study of children's grammatical structure is that the target language is defined in a way that suggests, in principle, that children could 'get there from here' where 'here' means starting with a small inventory of lexically specific constructions. In the case of the Bybee & Scheibman study, for instance, children might initially have a number of patterns, some entirely lexical like *I dunno*, others with slots like *I can't X it*, and these might slowly build up into constructions in which Subjects and Auxiliaries are also represented at a much more general and abstract level.

4. Computational analyses of latent structure in the target language

Recently there have been a number of computationally based studies which have indicated, first, that a machine which calculates the distributional dependencies between word or morpheme-like entities in a more or less realistic target language can (a) to some extent model aspects of language learning (Elman, 2001; Freudenthal, Pine, & Gobet, 2002; Plunkett & Marchman, 1993) and (b) detect, to a considerable degree, clusters of words which broadly conform to the categories of the adult language (Brent & Siskind, 2001; Mintz, Newport, & Bever, 2002; Redington, Chater, & Finch, 1998). Since we know that, prior to the age of about 12 months, children can already segment words from the speech stream and are sensitive to

quite abstract patterns of input (Gómez & Gerken, 1999; Jusczyk & Aslin, 1995; Marcus, Vijayan, Bandi Rao, & Vishton, 1999; Saffran, Aslin, & Newport, 1996), it seems likely that they may be acquiring sensitivity to a wide range of distributional relationships in the language they are hearing at a much earlier stage than has previously been thought. However, a sensitivity to different stimuli only slowly develops into the ability to operate with these as categories in a meaningful way.

5. Studies of child directed speech

Classic studies of child directed speech (CDS) in the 1970s investigated how Western middle-class adults speak to young children and found that it differed in important ways from the ways they speak to one another. When these adults speak to their young children they use a higher pitch and exaggerated intonation, they restrict the range of conversational topics they talk about, and they are highly selective in the words and syntactic constructions they use (see the papers in Snow & Ferguson, 1977, for classic studies; see Lieven, 1994, for discussion of other cultural and linguistic settings). There is good evidence that prelinguistic infants prefer CDS to adult-to-adult speech (Fernald, 1985) and are better able to segment items out of the speech stream when they hear CDS (Jusczyk, 1997).

Of special interest in these studies were the syntactic dimensions of CDS, since Chomsky (1965) and others had claimed that the linguistic structures children hear represent a very “impoverished” sampling of the full range of linguistic structures characteristic of adult syntactic competence. Results suggested that the truth of this claim depended on what was meant by “impoverished”. On the one hand, a number of studies suggested that adults’ speech to children contained fewer false starts and hesitations and was therefore more grammatically “correct” than speech between adults (Drach, 1969). On the other, it was clear that children were receiving a very skewed input by comparison with the range of structures in principle available to adults: for instance more questions and fewer complex sentences (Broen, 1972; Furrow, Nelson, & Benedict, 1979; Newport, Gleitman, & Gleitman, 1977; see Pine, 1994; Richards, 1994 for reviews).

Much of the early work on CDS was also devoted to discovering whether and in what ways these linguistic adjustments for young children affected their language development. Most of the earliest studies used very global measures of the syntactic complexity of both CDS and the child’s later language development, for example, mean length of utterance or total amount of speech (Pine, 1994). However, some studies also focused more specifically on particular linguistic structures, such as auxiliary fronted questions, noun phrases, verb phrases, and the like. Thus, Newport et al. (1977) found correlations between (i) the way individual mothers used noun phrases and the number of inflections per noun phrase their children produced, and (ii) the way mothers used auxiliary-fronted questions and the number of auxiliaries per verb phrase their children produced (see also Furrow et al., 1979; Richards, 1990). Subsequent research identified many methodological and interpretive problems in looking for relationships between CDS and children’s language development (e.g., Gleitman, Newport, & Gleitman, 1984; Hoff-Ginsberg & Shatz, 1982), and other studies found that what is especially crucial is the discourse contexts in which children hear certain structures, for example, as recasts or

expansions of their immediately preceding utterances (e.g., Barnes, Gutfreund, Satterly, & Wells, 1983; Hoff-Ginsberg, 1985).

One potential problem with these studies is that they investigate adults' and children's language on a relatively abstract level. Thus, if some hypothetical mother only used yes-no questions of the type "Are you . . ." and no other auxiliaries, would we really expect children to use more auxiliaries of other types, for example, *is*, *have*, and *does*? A much more realistic expectation is that children acquire the particular words and phrases they are exposed to—given that this exposure happens in a learner-friendly manner—and they make generalizations to more abstract structures on their own. Indeed, Broen's 1972 study indicated clearly the very lexically specific nature of much of the mothers' speech showing, for instance that three verbs, *look*, *put* and *see*, accounted for 53% of all imperative sentences in the sample. A few, more recent studies have also investigated how the particular grammatical words and phrases adults use, might be related to what children learn. Thus, De Villiers (1985), Naigles and Hoff-Ginsberg (1998), and Theakston, Lieven, Pine, and Rowland (2001) found that the verbs first used by the children in these studies and the constructions in which they were first used, were those most frequently used by their mothers. Looking at the acquisition of morphology, Farrar (1990), found that children's acquisition of some particular grammatical morphemes in English (e.g., past tense *-ed*, plural *-s*, progressive *-ing*, etc.) were related to the frequency with which and the ways in which their mothers used those same precise morphemes in discourse. What all of these studies suggest is that there may be close links between the way adults use particular syntactic phrases and expressions in CDS and the way children learn those same lexically specific phrases and expressions—much closer links than if syntactic constructions are defined in terms of abstract, adult-like syntactic categories and constructions (that may have no psychological reality for children just beginning to learn a language).

However, research also suggests that while children often begin with the most frequent forms and structures that they hear in the language spoken to them, their use of these forms is often narrower than in the adult language. Pine and Martindale (1996) and Pine and Lieven (1997) showed that the two groups of children in their studies initially learned determiners as part of low-scope patterns such as *I want a X*, *There's the X* and that, for all but one of the children, the overlap in the nouns which appeared with both *a* and *the* in the children's speech was very different from that of the mothers who had a much higher overlap score. Thus, while children are picking up the most frequent forms and patterns that they hear in the language addressed to them, the suggestion is that these are initially not connected up into the network of constructions that allows adults the syntactic and conversational flexibility that they show in their language production and comprehension.

In light of these findings, the current study had three aims. The first was simply to document the proportional distribution of the kinds of utterances that children hear early in their third year of life—where 'kind of utterance' is defined in terms of the utterance-level construction that it instantiates (e.g., transitives, intransitives, imperatives, wh-questions, etc.). To our knowledge, the only study that has documented the proportional distribution of the totality of utterance types that children hear in the speech directed to them is Broen (1972). This study recorded five minutes of free play between mothers and their children in a laboratory situation and analyzed all the maternal utterances into one of five sentence categories. Since these categories were

not mutually exclusive, it is difficult to fully assess the significance of the results but the fact that the percentage of questions (37%) is higher than that of declaratives (30%), that there are many imperatives (24%) accords with results from the studies cited above. In addition the high proportion of single words and fragments ('grammatically incomplete sentences' = 30%, p. 29) is interesting. Other, relatively large-scale studies—for example, Newport et al. (1977), Cross (1977), Wells (1981) and Beckwith (1988)—have all focused on one or another subset of mothers' speech to young children. Second, within each of these general construction types, we identified the most frequently occurring initial words and phrases that framed the particular utterances the children heard. This allowed us, for example, to compare the frequency with which young, English-speaking children hear such things as *Are you . . . ?* questions and *Is it . . . ?* questions. The issue was whether the way mothers talk to children—for example, with much repetition of some key words and phrases—might highlight certain specific words and phrases in ways that contribute to the child's early item-based grammatical organization.

Third, we correlated some of these item-based frequencies between parents and their children to see if there was any discernable relationship. This is the first study, to our knowledge, that calculated correlations for a range of syntactic frames at this level of item specificity. Previous studies have—almost without exception—correlated relatively abstract construction types between mothers and children (see Parisse & Le Normand, 2000, for a recent impressive example). But if children really are operating with specific, lexically defined linguistic constructions, then this level of analysis (not abstract constructions) is the most appropriate one for determining correlational relationships.

6. Method

6.1. Participants and data

The data were taken from the Manchester corpus (Theakston et al., 2001) which was accessed from the CHILDES database (MacWhinney & Snow, 1985, 1990). The corpus consists of data taken from twelve English-speaking mother-child dyads. The dyads were recruited through newspaper advertisements and local nurseries in the Manchester and Nottingham areas. All the children (six girls and six boys) were firstborns, monolingual and were cared for primarily by their mothers. Although socio-economic status was not taken into account with respect to recruitment, the children were from predominantly middle-class families. The participants were recorded at home in the presence of an investigator on two separate occasions in every three week period for twelve months. Each recording was divided into two half-hours with a break. During the recording the mother and child were engaged in free play activities. The present study analyses a total of two hours taken from four consecutive half hour recordings spanning a six-week period. During this period the child's MLU was calculated to be at Brown's stage II, that is, between 2.00 and 2.49. The age of the children ranged between 1;9.28 and 2;6.23. Partially unintelligible utterances and communicators (formulaic performatives such as *hello*, *good-morning*, *good-bye*, *please*, *thank-you*, *yes*, *no*; MacWhinney, 1995) were excluded from the analysis. In total 16,903 CDS utterances were included in the data sample (about 1,400 per dyad; range = 1,007–1,753).

6.2. Analytic procedure

All mother utterances were coded at two levels of analysis. First, they were coded into utterance-level construction types based on standard linguistic criteria (with sub-categories in some cases). The categories were:

- *Fragments*—utterances without subject and predicate (Subcategories: One Word, Noun Phrase, Verb Phrase, Prepositional Phrase, Other Multi-Word);
- *Questions*—utterances transcribed with a question mark and having question syntax in the main clause (Subcategories: Wh-question, Yes/No-question) (NB: intonation-only questions were treated as statements, and any tags after full utterances were ignored in this analysis);
- *Imperatives*—subjectless requests for child action;
- *Copulas*—utterances in which the main verb was some form of *to be*;
- *Subject–Predicate*—utterances with both a subject and single lexical predicate (Subcategories: Transitive, Intransitive, Other);
- *Complex*—utterances with two lexical verbs.

Reliability analyses were conducted by a second coder, blind to the hypotheses of the study, on all of the transcripts for two randomly selected mothers (representing about 15% of all mother utterances in the sample). A Cohen's Kappa of .96 was obtained.

Second, within each of these categories, item-specific patterns in utterances were identified, starting from the first word. For the purposes of this paper, we present only those patterns that start with the same 1–3 morphemes or words. This means that we have not analyzed item-specific patterns that may have occurred later in the utterances: tags at the end of yes/no-questions are likely to be an example. If a specific pattern was used 4 or more times by a particular mother—an average of once for each of the four half-hour samples analyzed—that pattern was called a ‘frame’ for that mother. We felt this set a reasonably stringent criterion, within the sampling limitations that are always a feature of this type of research. A frame could be followed by an unspecified number and/or diversity of other linguistic items, in some cases restricted by category (e.g., *It's [NP]*). We then tabulated for the sample as a whole the mean proportional frequencies of all frames used by at least one mother (i.e., we included all mothers for each frame regardless of how often, or even whether, they used the frame). For instance, if *What can* was a frame (used more than four times) within wh-questions for at least one mother, its proportional frequency would be calculated by first tabulating for each mother the proportion of her wh-questions that began with *What can*, and then by averaging those proportions for the sample as a whole. This procedure thus corrected for the different levels of talkativeness of the different mothers, as well as for mothers' differential use of particular construction types. Singled out for special attention were frames used by half or more of the mothers (i.e., a frame used four or more times by six or more mothers). Because of their high frequency both within and between mothers, these were designated ‘core frames’. In the case of the most frequent frames, we also performed an additional analysis to investigate how far through the utterance item-specificity extended. For purposes of correlational analyses, we also identified for some of these item-based frames corresponding child utterances.

7. Results

The description of the mothers' language is presented at two levels of analysis: (1) utterance-level constructions, considered as abstract types; and (2) item-based utterance frames within these abstract construction types. A third section presents some correlations between mothers' and children's use of item-based frames. At relevant points, brief commentary sections are provided.

7.1. Utterance-level construction types

Table 1 presents the mean proportion of maternal utterances that fall within each of the general construction types together with their token frequencies. Twenty percent of all of the mothers' utterances were sentence fragments of one type or another, with about one-third of these being single words and two-thirds being multi-word. These fragments are most often answers to questions and other discourse replies for which such "incomplete sentences" are perfectly appropriate pragmatically. Thirty-one percent of maternal utterances are questions, with 16% being wh-questions and 15% being yes/no-questions. Imperatives account for 9% and copula constructions account for 15% of the mothers' utterances. The remaining 24% of the utterances have both a subject and a full lexical verb, including simple transitives (10%), simple intransitives (3%), other subject–predicate constructions (5%), and complex utterances (6%).

Comment. The surprisingly high proportion of questions presumably reflects a discourse situation in which the mothers are attempting, more than they would in some other situations

Table 1

Mean proportions, ranges and number of tokens for major construction types in current study and in subsample of Wells (1983)

Construction type	Current study		Wells (1981)	
	Mean proportion	Number of tokens	Mean proportion	Number of tokens
Fragments (range)	.20 (.13–.32)	3351	.27 (.21–.35)	92
One word	.07		.08	
Multi-word	.14		.19	
Questions (range)	.32 (.20–.42)	5455	.21	74
Wh-	.16		.08	
Yes/no	.15		.13	
Imperatives (range)	.09 (.05–.14)	1597	.14 (.06–.24)	48
Copulas (range)	.15 (.08–.20)	2502	.15 (.10–.19)	51
Subject–predicate (range)	.18 (.14–.26)	2970	.18	64
Transitives	.10		.09	
Intransitives	.03		.02	
Other	.05		.07	
Complex (range)	.06 (.03–.09)	1028	.05 (.03–.07)	18

without experimenters present, to elicit language and interaction from their children. Imperative and copulas reflect the mothers' desire to regulate the child's behavior and to identify interesting objects and properties in the immediately surrounding context.

On the tapes analyzed, each child heard approximately 700 utterances per hour. If the child were to experience 10 such hours in a day, that would make for a total of 7,000 utterances per day. One can then derive daily frequency estimates for particular construction types by simply multiplying the relevant proportions in Table 1 by 7,000. It may be, however, that the sampled hours in this corpus are not representative of the other hours of the day in the child's life (e.g., mothers talk more when playing with their child, especially when experimenters are present). A legitimate question is therefore whether the context in which these mothers and their children were talking to one another—the usual play with toys—is representative of other situations in the child's daily life. As a check on this, the CDS from four mothers in the Wells (1981) corpus were coded in the same way as those in the current sample. The data in the Wells corpus were collected using a child-attached microphone that turned on at various random times of the day, thus sampling something close to the full range of activities in which the child was engaged. The numbers obtained are also in Table 1 and show a surprising convergence with the current findings. The major difference was that there were somewhat fewer questions than in the current sample (specifically, fewer *wh*-questions) and the Wells' mothers used somewhat more imperatives and fragments, although the difference is not so great in either of these cases. In all, the toy play context does not seem to be a particularly unrepresentative one for sampling the language that children hear throughout their daily lives—at least at the very gross level of analysis represented by these classes of construction types. (Total frequency of utterances could not be reliably estimated from the Wells' data because the individual time samples were so small.)

Perhaps the most interesting aspect of this global analysis is the relatively large proportion of questions and fragments in CDS (making up over half of all utterances), and the surprisingly small proportion of fully transitive utterances—supposedly the canonical English sentence type. However, this is close to the figures found by both Broen (1972) and Newport et al. (1977) and must therefore be regarded as a relatively stable feature of this type of CDS. With respect to subjects in general, close to 30% of all utterances have no subject (fragments, imperatives, and a few others), and another 30% or more have subjects that follow the auxiliary or main verb (questions). In addition, almost 15% have the copula as the main verb, with many of these having the subject after the verb (in *here*- and *there*-presentational utterances; e.g., *There are my shoes*). In all, there are only about one-quarter of all utterances that represent full subject–predicate constructions with a lexical verb, with less than half of these being transitive utterances with both subject and object. Our sample of CDS thus contains a grand total of approximately 15% of all utterances that are canonical transitive utterances with subject, lexical verb, and object. This fact may help to explain why English-speaking children take so long to construct an abstract transitive construction (Tomasello, 2000)—they hear utterances with others kinds of arrangements of V, S, and O more often, by several orders of magnitude, than they hear canonical SVO utterances. Which aspects of these findings concern CDS in particular—as opposed to spontaneous spoken discourse in general—awaits similar analyses on the spontaneous conversations of adults with one another.

7.2. Item-based frames within construction types

Some of these maternal construction types show within them a fair amount of lexical diversity, whereas others have much more lexical consistency.

7.2.1. Fragments

The one-word utterances (7%) obviously showed much lexical diversity (since they were mostly content words), with about half of these being nouns and the other half being distributed among various other word types. Multi-word fragments (14%) were classified as: noun phrase (NP), verb phrase (VP), preposition phrase (PP), and other fragments. In all, about 43% of the multi-word fragments were NPs, 23% were VPs, 10% were PPs, and 24% were other fragments. First, using the criterion of 4+ tokens for at least one mother (henceforth: '4+ criterion'), 14 lexical frames were identified in the NP category (see Table 2a). Together, these 14 frames meeting the 4+ criterion—virtually all of which would be considered by most linguists as prototypical English NPs—accounted for nearly two-thirds of all NP fragments. NPs of the form *A NOUN*, and *The NOUN* accounted for almost one third of all tokens proportionally. Each was used more than four times by about two-thirds of mothers, and so they were designated as 'core frames'. Three additional core frames are not fully lexically specific across all children, namely *[Color] NOUN*, *[Numeral] NOUN* and *[Possessive] NOUN*. However, these frames were included in the analysis since the variety of colors, numerals, and possessives used by any given mother was extremely restricted—typically a set of no more than two or three per child (though a slightly different set for each child).

Ten frames meeting the 4+ criterion were identified in the VP fragment category (see Table 2b). The distinction between VP fragments and imperatives was based upon the discourse situation. VP fragments were most often used in a commentary style of discourse with the mother 'talking through' the actions of the child rather than directing them. These frames include such things as negatives (*not V-ing*), modals (*can't VP*, *don't VP*), and a few high frequency lexical verbs (*e.g., go-ing, draw NP, make NP*). As Table 2b indicates, none of these ten frames had an especially high proportional frequency, and together they accounted for only about 30% of all VP fragment constructions.

PP fragments were established by means of the type of preposition occurring in the first slot of the PP construction, for example, *On [NP]*, *At [NP]*. In all, six frames were identified at the 4+ criterion, as shown in Table 2c, and together they accounted for well over half of all PP constructions in the data sample. *In [NP]* and *On [NP]* are the two most frequently occurring frames, accounting for just over one third of all PP constructions by themselves. There is only one core frame, *In [NP]*.

The remaining fragment constructions that do not fit into any of the other types have been coded as *Other Fragments* (see Table 2d). There are three relatively low frequency frames (two adverbials and one elliptical copula construction), which together account for about 10% of this diverse set of utterances.

Comment. Brent and Siskind (2001) have reported that most of the words that children learn and use early in development, at the one word stage, are words that their mothers have used as one word utterances. Mothers in the current sample used nouns much more often than any other word type (about 6 times more often than verbs). This might help to account for

Table 2

Mean proportions of item-based frames meeting the 4+ criterion within the various fragment constructions^a

Table 2a. Noun Phrases.		Table 2b. Verb Phrases.	
A [N]	.20	<i>Not [VP]</i>	.07
The [N]	.10	<i>Put [NP]</i>	.04
[Numeral] [N]	.07	<i>Don't [VP]</i>	.03
[Poss] [N]	.06	<i>Go-ing</i>	.03
<i>[Adj] one</i>	.04	<i>Got [NP]</i>	.03
<i>That [N]</i>	.03	<i>Make [NP]</i>	.03
<i>[Color] [N]</i>	.03	<i>Can't [VP]</i>	.02
<i>Not [N]</i>	.03	<i>Have to [VP]</i>	.02
<i>This [N]</i>	.02	<i>Draw [NP]</i>	.02
<i>Some [N]</i>	.02	<i>Leave</i>	.01
<i>Poor [N]</i>	.02	TOTAL	.30
<i>Another [N]</i>	.02		
<i>More [N]</i>	.01		
<i>Big [N]</i>	.01		
TOTAL	.66		

Table 2c. Prepositional Phrases.		Table 2d. Other Fragments.	
In [NP]	.18	<i>Like [NP]</i>	.05
<i>On [NP]</i>	.17	<i>Very [ADJ]</i>	.03
<i>With [NP]</i>	.10	<i>[Pro] isn't</i>	.02
<i>For [NP]</i>	.06	TOTAL	.10
<i>Over [NP]</i>	.03		
<i>At [NP]</i>	.03		
TOTAL	.56		

^a Core frames in bold and shaded.

the fact that nouns often predominate over other word types in middle-class English-speaking children's early vocabularies. Along with the finding that there is considerably less lexical consistency in VP fragments than in NP fragments, these finding might also provide a reason why children learning English might have trouble learning verbs as compared with nouns. However, since it does also seem to be the case that nouns can show a predominance in children's early lexicons for languages in which they are not dominant in the input, this can only be part of the explanation: as suggested by a number of researchers, the relative accessibility of noun meanings by contrast to verb meanings is likely also to be involved (Fisher,

Hall, Rakowitz, & Gleitman, 1994; Gentner, 1982; Genter & Boroditsky, 2001; Gleitman, 1990).

The category of ‘Other fragments’ is the place for all interrupted, incomplete, false start, and otherwise ungrammatical utterances (as coded by the transcribers, following CHAT format). These account for only 7% of the Other Fragments—which means that they account for only about 2% of all of the multi-word fragments and a vanishingly small percentage of all of the mothers’ utterances.

The importance of all of these different types of CDS fragments in children’s language acquisition has perhaps not been fully appreciated until relatively recently. In a number of recent analyses of CDS, there has been an emphasis on ‘prosodic bootstrapping’ (e.g., see the papers in Morgan & Demuth, 1995). The idea is that children might be able to discern syntactically important constituent boundaries by various kinds of intonation contours. However, what is often not noted is that in some ways the most salient such contour would be a clear utterance boundary. What we found in the current analysis when we looked at discrete utterances defined as either a full conversational turn or an isolated intonation unit, is that about one in five of all of the discrete utterances that 2-year-old children hear are fragments in the sense that they do not conform to any conventional adult construction type that is generally considered to be a ‘full sentence’. Virtually all of these are ‘grammatical’ in context, however, in the sense that they are either single words as appropriate conversational replies or attention-getters, or else they are some kind of coherent phrase such as NP, VP, or PP. These findings accord in a general way with the analysis of adult speech in spoken narratives, where about 96% of all intonation units, including fragments, correspond to grammatical units of one sort or another (Croft, 1995). It is thus clear that CDS contains many cues to syntactic constituency at the level of what adults choose to use as complete utterances—and of course these are the kind of fragments that beginning language learners often use as utterances themselves with some regularity (see Brent & Siskind, 2001; Jusczyk, 1997; Lieven et al., 1997; Morgan & Demuth, 1995). The pervasiveness and repeated nature of sentence fragments in speech to children has been noted from time to time in previous research and authors have suggested that this might assist children in language learning (early examples are Newport, 1977; Snow, 1972). We would also suggest that the highly item-specific nature of some of these multi-word fragments, especially NPs and PPs, may be additionally helpful.

7.2.2. Questions

The two construction types subsumed under questions—wh-questions and yes/no-questions—account for just under one-third of all of the mothers’ utterances to their children.

7.2.2.1. *Wh-questions.* Wh-questions and yes/no-questions were of roughly equal proportional frequency in the sample (15–16% each).

Frames found in wh-question constructions are based upon the wh-word and its immediately following constituent, which in the majority of cases is an auxiliary verb, as in *What’-has . . .*, *Where’-is*. Table 3 lists the 31 frames identified within the wh-question construction.

Comment. The most salient aspect of this table is that these 31 frames account for no less than 80% of all of the wh-questions produced by all of the mothers, and there are 11 core frames. Thus, across mothers, the same 2-word beginnings are used over and over to ask wh-questions—

Table 3

Mean proportions of item-based frames meeting the 4+ criterion within the Wh-question constructions^a

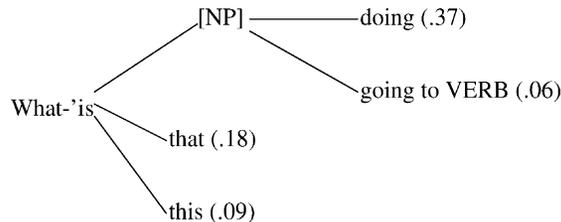
<i>What</i>	's	.18	<i>Who</i>	's	.08
	're	.09		-se [N]	.01
	do	.05		're	.01
	did	.04		did	.01
	color	.04	TOTAL		.09
	's [has]	.03	<i>Why</i>	<i>don't</i>	.01
	about	.03		<i>do</i>	.01
	shall	.02		's	.01
<i>can</i>	.02	<i>not</i>		.01	
<i>does</i>	.01	TOTAL		.03	
<i>happened</i>	.01	<i>How</i>	<i>many</i>	.01	
<i>were</i>	.01		<i>did</i>	.01	
<i>'ve [have]</i>	.01	TOTAL		.02	
<i>kind of</i>	.01	<i>Where</i>	's	.05	
<i>number</i>	.01		's [has]	.02	
TOTAL	.54		'd [did]	.01	
			're	.01	
		<i>shall</i>	.01		
		TOTAL	.10		
		<i>Which</i>	one	.02	
			TOTAL	.02	
		GRAND			
		TOTAL		.80	

^a Core frames in bold and shaded (most auxiliaries that can be cliticized were cliticized).

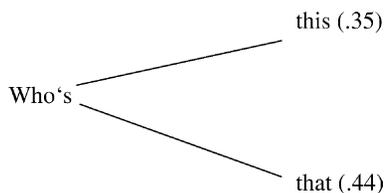
at least partly due to the limited number of wh-words and auxiliaries in English, of course. Two other points of particular interest can also be observed in the table. First, although six different wh-word types are found in the frame analysis, *what* is by far the most common and accounts for over half of all the wh-question utterances the mothers produce. Second, the most commonly used frames in the wh-question sample contain the auxiliary *is*, typically in the contracted 's form. *What's*, *Where's*, and *Who's* thus account for almost one-third of all wh-question utterances.

Detailed frame analysis: Because the wh-questions were so frequent and so repetitive in their beginning words, we also explored what occurred beyond these initial words—i.e., in the utterance as a whole—for the three highly frequent frames with *is* (*What's . . . ?*, *Who's . . . ?*, and

Where's ... ?) for one mother. The outcome was as follows. Carl's mother used *What's ... ?* constructions extremely frequently, but in a limited number of item-based utterance types. The diagram below indicates that she had four frames at the level of her entire utterance, and these four lexically specific frames accounted for more than 69% of all of her *What's ... ?* constructions. (The numbers in parentheses denote the proportion of the total *What's ... ?* questions represented and so sum to 69%; the other 31% of Carl's mothers' *What's ... ?* questions occurred less than four times each.)



Within the *Who's ... ?* utterances two especially prominent utterance-level frames—*Who's this?* and *Who's that?* account for 79% of all *Who's ... ?* frames. In a small minority of cases the frames shown in the diagram below are followed by other constructions, as in *Who's this talking to Thomas?* or *Who's that on the sofa?* Despite their small number, these complex *Who's this/that* frames are very interesting since they could aid in the segmentation of such things as VPs and PPs. (Again, the numbers in parentheses denote the proportion of the total *Who's ... ?* questions represented and so sum to 79%; the other 21% of these type questions occurred less than four times each.)



All of the *Where's* frames used by Carl's mother (100%) were followed by NPs; that is, the questions were all asking for a concrete location as opposed to, for instance, asking the child to anticipate the path of motion for a particular person or object (i.e., there are no instances of *where's NP VP* type questions). Within the NPs that followed *Where's*, NPs with the definite article *the N* accounted for just under 50% of Carl's mother's *Where's* question constructions.

7.2.2.2. Yes/No-questions. The Yes/No-questions (and one frame of the *You want what?* variety) used by mothers were also quite frequent and lexically specific—predominantly based on an utterance-initial auxiliary and a following pronoun. As is shown in Table 4, 23 frames were identified (a 24th, occurring less than 1% of the time, was *You want what?* as a whole utterance). These 23 frames account for 82% of the utterances in this category and there are 9 core frames which account for 71% of yes/no-questions by themselves.

Detailed frame analysis: The most frequent frame is *Are you ... ?* and so it was analyzed at the whole utterance level for Nic's mother, since she had the most tokens of this frame. There were five utterance-level frames identified in Nic's mother's speech, and these accounted

Table 4

Mean proportions of item-based frames meeting the 4+ criterion within the yes/no-question constructions^a

<i>Are</i>	you	.17
	<i>they</i>	.01
	<i>we</i>	.01
<i>Aren't</i>	<i>you</i>	.01
TOTAL		.20

<i>Can</i>	you	.09
	<i>I have</i>	.02
<i>Can't</i>	<i>you</i>	.01
TOTAL		.11

<i>Do</i>	you	.14
<i>Don't</i>	<i>you</i>	.01
<i>Did</i>	<i>you</i>	.03
	<i>we</i>	.01
<i>Does</i>	<i>it</i>	.01
TOTAL		.19

<i>Have</i>	you	.04
<i>Has</i>	<i>it</i>	.01
TOTAL		.05

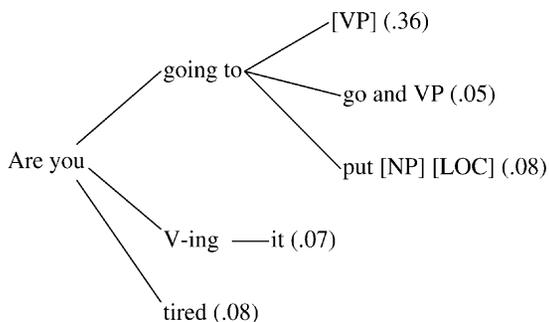
<i>Is</i>	it	.06
	that	.06
	he	.02
	<i>this</i>	.01
	<i>she</i>	.01
TOTAL		.15

<i>Shall</i>	we	.10
	I	.03
	<i>Mummy</i>	.01
<i>Should</i>	<i>we</i>	.01
TOTAL		.14

Grand		
Total		.82

^a Core frames in bold and shaded.

for 65% of her question utterances with *Are you . . . ?*; they are shown in diagram below. (Again, the numbers in parentheses denote the proportion of the total *Are you . . . ?* questions represented and so sum to 65%; the other 35% of these type questions occurred less than 4 times each.)



Comment. Both wh-questions and yes/no-questions showed a great deal of lexical specificity in their first two elements—mainly because the first two elements in both cases come from a small closed class such as wh-words, auxiliary verbs, or personal pronouns. In addition, however, when we move past the first two elements to look at utterances as wholes—at least in the case of the high-frequency frames analyzed—we find a very high degree of lexical specificity in the utterances as wholes for a given child as well. In each case, about two-thirds of them come in only a handful of patterns. It is hardly surprising, then, that children’s earliest wh-questions have been frequently reported to be the fully-formulaic, What’s that? and the semi-formulaic, Where’s X? (Dabrowska, 2000). In our acquisitional framework, this can then begin to provide the basis for further segmentation (e.g., of the concatenated auxiliary ‘s and of the material appearing after the repeated utterance beginnings, Lieven et al., 2003) and for working out the syntax of English questions—points we return to in the Discussion.

7.2.3. Imperatives

Imperatives account for 9% of mothers’ utterances. There are 15 item-specific frames that meet the 4+ criterion for imperative constructions (see Table 5a). These 15 frames account for an average of 66% of the mothers’ utterances, and the 6 core frames account for the vast majority (53%).

Comment. Imperatives provide an interesting contrast to questions, because they begin mostly with lexical verbs rather than with closed class items such as pronouns or auxiliary verbs. We therefore might expect much less item-specificity. This, however, does not turn out to be the case. It seems that mothers have a relatively delimited number of things they continually and repeatedly exhort their 2-year-olds to do—such things as *come, look, put, go, and get*. Thus, the frames that we have identified account for two-thirds of the mothers’ imperative utterances (with only a small part of this coming from the modal-type elements *Let’s* and *Don’t*) and six frames account for over half of them. Taken together the results for questions and imperatives give a clear indication of two of the forces driving the amount of item-specificity that we have identified: first, the syntax of English and the way in which this results in a very limited number of lexical types in the prominent first position of questions and second, the pragmatics and semantics of interaction between mothers’ and their two-year-olds which limits lexical choice in imperatives.

7.2.4. Copula constructions

Copulas account for 15% of mothers’ utterances. Table 5b shows the 12 item-based frames for the copula construction. These frames account for 86% of copula utterances in the mothers’ speech to their children. The three two-element combinations *It-’is*, *That-’is*, and *There-’is* (mostly in contracted form), by themselves, account for an average of about two-thirds of all of the copulas used by the mothers; there are 5 other core frames as well. All of these frames are of course used most often with reference to objects, mostly to name them, locate them, or draw attention to them in some way.

Detailed frame analysis: The most frequent of the frames is *That-’is*. Carl’s mother has the most tokens of this frame, accounting for just under 40% of all of her copula utterances. At the level of whole utterances, six frames were found in Carl’s mother’s *That-’is* constructions;

Table 5

Mean proportions of item-based frames meeting the 4+ criterion within the imperative and copula constructions^a

Table 5a. Imperative constructions.

<i>Come</i>	.11
<i>Look</i>	.11
<i>Let's</i>	.10
<i>Put</i>	.09
<i>Don't</i>	.06
<i>Go</i>	.06
<i>Get</i>	.02
<i>Let me</i>	.02
<i>See</i>	.02
<i>Take</i>	.02
<i>Turn</i>	.01
<i>Make</i>	.01
<i>Watch</i>	.01
<i>Leave him</i>	.01
<i>Press</i>	.01
<i>Have a look</i>	.01
TOTAL	.66

Table 5b. Copula constructions.

<i>That's</i>	[NP/Adj]	.33
<i>It's</i>		.21
<i>There's</i>		.10
<i>He's</i>		.03
<i>Here's</i>		.02
<i>This's</i>		.02
<i>That one's</i>		.01
<i>This one's</i>		.01

<i>They're</i>	[NP/Adj]	.03
<i>You're</i>		.03
<i>It was</i>	[NP/Adj]	.01
<i>That was</i>		.01

<i>Here/There</i>	<i>it is.</i>	.02
<i>There we/you</i>	<i>are.</i>	.02
<i>Here we/you</i>	<i>are.</i>	.01
<i>Your [N]</i>	<i>is/are.</i>	.01

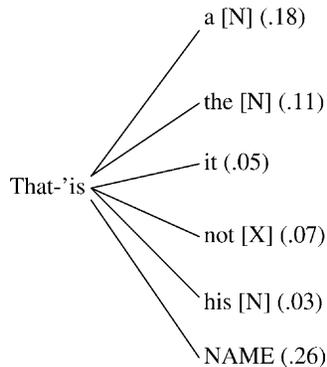
GRAND TOTAL	.86
--------------------	------------

^a Core frames in bold and shaded (contracted and uncontracted *is*, in *It's* and *It is*, were combined).

they are shown in diagram below. The six frames in the diagram account for over 70% of all of Carl's mother's *That-'is* constructions.

7.2.5. Subject–Predicate constructions

What we are calling Subject–Predicate constructions encompass what are traditionally known as transitives, intransitives, ditransitives, resultatives, locatives, and a few others. That is, these are all of the utterances with a subject and a lexical predicate (not a copula), except complex utterances containing two lexical verbs, which are analyzed below.



The mothers' transitive utterances made up only 10% of their utterances overall and were of course very diverse. However, as is well known, in speaking to their children English-speaking mothers quite often begin with a high frequency pronoun, often with an auxiliary verb cliticized to it, such things as *I'll*, *He's*, and *You've*. Table 6a lists the 17 frames meeting the 4+ criterion—including 5 core frames—that started off mothers' transitive utterances. These account for approximately 57% of all of their transitive utterances. Clearly, most of the lexical specificity in these transitive frames derives from the restricted set of pronouns and auxiliaries in the English language. *You* and *I* are the most frequently occurring pronouns across the frames, accounting for three frames and 26% of the utterances and four frames and 11% of the utterances, respectively.

The mothers' intransitive utterances were even less frequent (about 3%) and followed a similar pattern. Table 6b lists the 11 frames within the intransitive construction meeting the 4+ criterion. These account for approximately 54% of all intransitive utterances, with over half of this coming from four core frames. In this case the inanimate subject pronoun *It* (and *That one*) are especially frequent, accounting for about 20% of all intransitive utterances. It is noteworthy that this is more than 3 times as frequent as inanimate pronouns as subjects in transitive utterances, and so it seems that a major distinguishing feature of intransitives in English CDS is that they are used more often than transitives for talking about inanimate objects. *You* and its variants also account for 20% of the intransitive utterances, a figure comparable to that for transitives.

Finally, the other Subject–Predicate constructions were fairly low frequency (less than 5% total) and relatively heterogeneous among such things as ditransitives, resultatives, locatives and others. Because of this diversity, there were no lexical frames in this category meeting the 4+ criterion.

Because of the important role of pronouns in Subject–Predicate constructions, especially as utterance-initial elements (i.e., subjects), we also analyzed what went into the various argument slots of all of these utterances. A clear pattern emerged from this analysis (see Table 7). In all Subject–Predicate construction types there is a strong tendency for mothers to use pronouns in utterance-initial position as subjects. Overall, the proportion is over 80% (see also Valian, 1991). However, in the direct object slot immediately following the verb, nouns outnumbered pronouns by almost 2 to 1 in the transitives, while they were approximately equal in frequency

Table 6

Mean proportions of item-based frames meeting the 4+ criterion within the transitive and intransitive constructions^a

Table 6a. Transitives (all followed by VP+NP).		Table 6b. Intransitives (all followed by VP).	
<i>You</i>	.20	<i>It</i>	.11
<i>You've</i>	.04	<i>That one</i>	.06
<i>You're</i>	.02	<i>It's</i>	.03
<i>I</i>	.06	<i>You</i>	.11
<i>I'll</i>	.03	<i>You're</i>	.05
<i>I've</i>	.01	<i>You've</i>	.03
<i>I'm</i>	.01	<i>I</i>	.05
<i>We</i>	.05	<i>He</i>	.02
<i>It</i>	.03	<i>He's</i>	.02
<i>It's</i>	.02	<i>She's</i>	.02
<i>That</i>	.01	<i>The phone</i>	.01
<i>He's</i>	.05	<i>There [pro] go</i>	.09
<i>She</i>	.01	TOTAL	.60
<i>They(ve)</i>	.01		
<i>Mummy</i>	.02	Table 6c. Complex Constructions.	
<i>Mummy's [has]</i>	.01	<i>I think ...</i>	.15
<i>Ann</i>	.01	<i>I don't think ...</i>	.06
TOTAL	.57	<i>I thought ...</i>	.03
		<i>Think ...</i>	.02
		<i>I don't know ...</i>	.04
		<i>You know ...</i>	.02
		<i>If ...</i>	.12
		<i>Because ...</i>	.05
		<i>When ...</i>	.03
		TOTAL	.51

^a Core frames in bold and shaded (contracted and uncontracted auxiliary forms were combined in several cases).

in the other Subject–Predicate constructions. (Although it is not in the table, it should also be noted that indirect objects in ditransitive constructions were nouns about half the time as well.)

Comment. These findings are in rough agreement with the findings from spontaneous spoken adult–adult discourse in which most subjects are also pronouns, following the “light subject” constraint of Chafe (1994). In combination with the findings for the copula utterances (see

Table 7

Mean percentage frequency of noun and pronoun selection in intransitive, transitive, and other SV(X) utterances

	Intransitive		Transitive		Other	
	Pre-V	Post-V	Pre-V	Post-V	Pre-V	Post-V
Pronoun	.77	–	.83	.36	.86	.53
Noun	.23	–	.17	.64	.14	.47

above)—with their extremely high rate of pronoun subjects (especially inanimate pronouns)—the current findings are also compatible with a preferred argument structure analysis of CDS (along the lines of DuBois, 2001, for adults, and Clancy, 2001, for Korean-speaking children). In this analysis, for information processing reasons new information in the form of lexical nouns most often occurs in the postverbal (object) position of transitive and copular clauses—not in transitive or copular subjects, which should be topic-maintaining pronouns or the like.

7.2.6. Complex constructions

The complex constructions make up about 6% of the total utterances the children heard, with about two-thirds being complement constructions (e.g., *I think it's going to rain*) and one-third being adverbials with subordinate clauses introduced by such words as *Because*, *If*, and *When* (Table 6c). There were six item-specific frames within complement constructions that met the 4+ criterion (two core frames), accounting for about one-third of the total complex utterances. All were epistemic/evidential indications about the mother's certainty (or lack thereof) about the proposition in the complement clause, mainly (*I*) (*don't*) *think* . . . and *I don't/You know* . . . There were three item-specific frames that could be called broadly adverbial, accounting for 20% of the total complex utterances (two core frames). These all had to do with various hypothetical or temporal conditions—signaled by *If*, *Because*, and *When*—that were associated with the proposition in the main clause. Together, these nine frames accounted for about 51% of all of the complex utterances the mothers produced.

7.2.7. Overall summary of item-based analyses

These item-based analyses demonstrate that most of the utterances the English child hears occur in relatively predictable lexical frames in terms of the specific lexical item or items with which they begin. Fig. 1 provides an overall account for all of the different construction types. In this figure are represented the number of core frames within each construction type (i.e., those used 4 or more times by half or more of the mothers), along with the percentage of the utterances of that type that these account for. Overall, it can be seen that there are 52 core frames and together they account for 51% of all the utterances the children heard. Of the 52 core frames, about two-thirds consist of two or more morphemes and about one-third (mostly fragments and imperatives) consist of one morpheme only—all as the originating word or words of utterances. If we now move to the frames in general (i.e., those that at least one mother used 4 or more times), we find 156 frames, which account for 65% of all of the utterances the children heard. We should also note that, if the communicators that we excluded from the analysis (formulaic

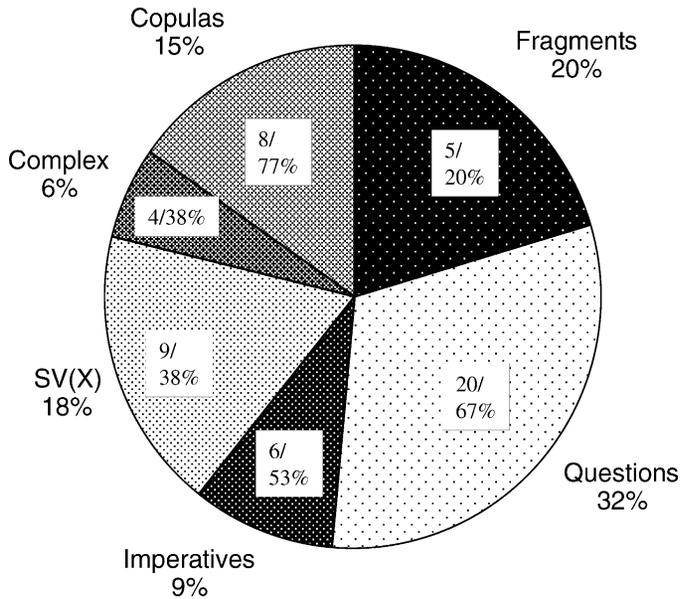


Fig. 1. Percentage of maternal utterances of different construction types. Numbers and proportions inside pie areas indicate number of core frames and the percentage of utterances accounted for by them.

expressions such as *hello, good-morning, good-bye, please, thank-you, yes, no*) were included, the overall proportion accounted for would be much higher, since these performatives occurred relatively frequent for all mothers.

As one final way of documenting the item-specific nature of the first words in the utterances English children hear, we summed across core frames with identical first words and found that 45% of all of the utterances English mothers say to their children begin with one of just 17 words (again, excluding communicators, which would make the total even higher). These words are: *What* (8.6%), *That* (5.3%), *It* (4.2%), *You* (3.1%), *Are/Aren't* (3.0%), *I* (2.9%), *Do/Does/Did/Don't* (2.9%), *Is* (2.3%), *Shall* (2.1%), *A* (1.7%), *Can/Can't* (1.7%), *Where* (1.6%), *There* (1.5%), *Who* (1.4%), *Come* (1.0%), *Look* (1.0%), and *Let's* (1.0%).

Thus, it is not only the case, as reported in previous research and replicated here, that the English-learning children so far studied are receiving a high proportion of utterances that are not in canonical SVO word order (fragments, questions and imperatives). Our research also demonstrates that within these syntactically defined, utterance categories, there is a very high degree of item-specificity at least at the beginnings of the utterances that children hear.

7.3. Item-based correlations between mothers and children

A question of obvious importance is whether the children use the same item-based expressions as their mothers. There are several methodological issues that argue for a careful selection of item-based constructions to compare. First, mothers say many things that two-year-old children are not ready—for many reasons—to learn; for example, the frequency with which mothers use complex constructions is probably irrelevant to a child just turning two years of

age. This is also true of many of the more complex question types (practically all of them except *Where* and *What* questions). Second, for pragmatic reasons, children simply do not use some constructions very often; for example, most children do not use so many imperatives to their mothers. It is also important that in many cases if the child is to imitate the adult's expression, she will do so not exactly but with a deictic substitution of first and second person pronouns (e.g., Mom: "I want you to eat"; Child: "You want me to eat?"). Third, and most importantly, to find correlations a certain amount of frequency in both mothers and children is required. This is a simple consequence of the fact that if one or both variables in a correlation has low variability—perhaps because many scores for individuals are at or near zero—then it is impossible to find a quantitative relationship.

For all of these reasons, we decided to focus our correlational analysis on a single, functionally coherent set of constructions that children typically master early in development and use frequently thereafter, and that mothers use in similar ways; namely, we focused on the many different ways that the mothers and children referred to and drew attention to objects using multi-word utterances. The two major categories were thus: NP fragments and copulas in which an object was identified or referred to. We searched the children's language for all of the core frames (i.e., core in the mothers' language) in these two categories. We then dropped any of these that the majority of children (7 or more) did not use, as these represented frequencies too low with which to perform meaningful correlations. By this procedure, all four core frames from the NP-Fragments of the mothers were included: *A [N]*, *The [N]*, *[NUM] [N]*, and *[POSS] [N]*. Three copula constructions were also included: *There's [N]*, *That's [N]*, and *It's [N]*. For these analyses, all child utterances that were immediate imitations of mother utterances (as determined by the transcribers) were excluded. The prediction was that mothers and their children would use similar constructions (and thus one-tailed tests of significance were used for this subset of correlations). The numbers of frames on which the correlations are based can be found in Appendices 1 and 2.

Tables 8a and 8b presents the Pearson Product-Moment correlations of individual mothers and children in the frequency with which they used these seven item-based frames (d.f. in all cases = 10). The NP-Fragments showed a very strong pattern (see Table 8a). Of the four correlations predicted (i.e., mother and child use of the same item-based frame), three were statistically reliable (at least $p < .05$), and the fourth was reliable at $p < .10$. Of the other 12 correlations between mothers' and children's use of item-based NP-Fragment frames, only

Table 8a
Pearson product-moment correlations for the four item-based NP-fragment frames

	Children			
	<i>A [N]</i>	<i>The [N]</i>	<i>NUM [N]</i>	<i>POSS [N]</i>
Mothers				
<i>A [N]</i>	.45	.73*	-.18	.12
<i>The [N]</i>	.07	.66*	-.07	.09
<i>NUM [N]</i>	-.05	-.15	.59*	-.15
<i>POSS [N]</i>	-.36	-.06	-.41	.65*

* $p < .05$ or less (one-tailed on diagonal; two-tailed elsewhere).

Table 8b

Pearson product–moment correlations for the three item-based copula frames

	Children		
	<i>There's [NP]</i>	<i>That's [NP]</i>	<i>It's [NP]</i>
Mothers			
<i>There's [NP]</i>	.61*	.48	.19
<i>That's [NP]</i>	.74*	.56*	.19
<i>It's [NP]</i>	.56	.39	.70*

* $p < .05$ or less (one-tailed on diagonal; two-tailed elsewhere).

one was reliable: mothers' use of *A [N]* with children's use of *The [N]*. This is due in some measure to the fact that in the mothers' language, these two frames were correlated at .67. Perhaps also there were many discourse sequences in which the mother originated a reference to a new object with *A [N]*, to which the child then replied, now that the object was not new, with *The [N]*. In all, there were proportionally more significant correlations between mothers' and children's use of the same frame (3 of 4—on the diagonal in Table 8a) than there were among their use of different frames (1 of 12—off the diagonal in Table 8a).

The copulas also showed a very strong pattern (see Table 8b; d.f. = 10 in all cases). In this case, of the three correlations predicted (i.e., mother and child use of the same item-based frame), all three were statistically reliable (at least $p < .05$). Of the other six correlations between mothers' and children's use of item-based copula frames (i.e., off the diagonal in Table 8b), only one was reliable: mothers' use of *That's [NP]* and children's use of *There's [NP]*. Again, this is due in some measure to the fact that in the mothers' language, these two frames were correlated at .54. But, in general, children tended to use *There's [NP]* often whenever their mothers either identified or located an object for them with any one of the three frames. In all, there were proportionally more significant correlations between mothers' and children's use of the same frame (3 of 3—on the diagonal in Table 8b) than there were among their use of different frames (1 of 6—off the diagonal in Table 8a).

As a second more global approach which allowed us to use all of the core frames within each of these two categories in two more general analyses, we also performed the correlations using the frames as "subjects". That is, we used as pairs the mean proportions of mothers and children on each item-based frame, and we then correlated across all the frames within that category. Thus, for the copulas there were seven pairs of numbers, each pair consisting of one number for the mothers as a whole (their mean proportion) and one number for the children as a whole (their mean proportion) for a particular frame such as *It's [NP]*. For the NP-Fragments, we did the same thing but had only four pairs. The Pearson product–moment correlations resulting from this procedure were: for copulas, $r = .93$, $p < .001$, and for the NP-Fragments, $r = .94$, $p < .05$.

Comment. Obviously, none of these correlations indicate a direction of causality, since they are all based on a single set of mother–child conversations. It is thus possible either that children are learning from their mothers or that mothers are adapting to their children. The point we have demonstrated is simply that individual mothers and their children use many item-based frames at similar levels of frequency.

8. General discussion

These results help to place in context the accumulating findings that children's early language consists not of an abstract and coherent formal grammar, but rather of a loosely organized inventory of item-based constructional islands. Thus, our data show that the most frequent and repetitive components of the utterances English-speaking children hear from their mothers exemplify a fairly skewed set of exemplars of the mothers' presumed underlying grammar. We found that (i) about half of all the utterances the child hears begin with one or another of 52 lexically specific frames, consisting mostly of two morphemes, (ii) almost two-thirds of all the utterances the child hears begin with one or another of 156 lexically specific (mostly two morpheme) frames, and (iii) 45% of all the utterances the child hears begin with one or another of 17 words. Placing these frames into some kind of formal syntactic organization is not easy as they include such diverse things as *In X*, *What do X*, *Are you X*, *It's X*, *Let's X*, *Look X*, *I think X*, *If X*, and on and on. As we see it, the child will come in time to master the less frequent and less repetitive elements of the English language, which correspond to the more canonical elements, but the initial "anchor points"—in the form of highly repetitive frames such as those we have identified—form a very heterogeneous set of syntactic constructions from which children enter into the more complex and formal aspects of language acquisition.

It is worth noting that when some very high-frequency frames were analyzed in a lexically specific manner for the whole utterance (i.e., not just the initial words but all the words in the utterance), only a small number of relatively frequent utterance-level patterns were found (e.g., *What's NP doing?*). While there may be some lexically specific whole utterance frames that children learn—*I dunno* and *Where's NP gone*, might be examples, it seems clear from our study that it is the *beginnings* of utterances in English CDS that show these highly frequent lexical effects. This is not surprising given (a) the pragmatics of the interactions which give rise to many questions and presentationals and (b) the fact that these are very likely to start with closed class items in English. We can therefore think of these as patterns created by high token frequencies. The nature of the slots that are created further down the utterance will depend on the type frequencies of the items that children hear in those slots.

8.1. The nature of the language heard by these children

The current findings also provide information about frequency and the role it may play in mother's speech and children's language learning. Based on our sample—and corroborated in a general way by similar analysis of a more diversely collected sample (Wells, 1981)—we can estimate that English-speaking children hear, every day, something on the order of 7,000 utterances—including about 2,000 questions, about 1,500 fragments, about 1,000 copulas, and about 400 complex utterances. On a item-specific level they hear about 360 *What is* questions and *Are you* questions, about half as many *Who's* and *Can you* questions, about 200 to 300 *That's* and *It's* constructions, and about 50–60 *I think* and *If* utterances. Clearly these figures can only be estimates, since they depend on the amount that mothers talk to their children at other times of the day but they nevertheless indicate that the children hear an enormous amount of language every day, much of it repetitive and with a considerable degree of item-specificity in at least the initial parts of the utterances.

We have also extended previous research which demonstrates that children hear relatively few utterances with a canonical transitive scheme (Broen, 1972; Newport et al., 1977). This might help to explain recent studies that have found that the majority of English-speaking children are unable to use word order alone as a productive cue for establishing agent-patient (subject-object) relations until after they are 3 years old (see Tomasello, 2000, for a review). The main point is that to construct a canonical transitive scheme the child has to ignore—or even override—the majority of utterances she hears. Thirty percent of the utterances she hears have no subject, another 40% have the subject after either the auxiliary or main verb, and of the remaining 30% only about half have a prototypical patient following the verb. Word order in English is thus not nearly as reliable a cue to agent-patient (object-subject) relations as adult intuitions (often based on written discourse containing very few questions, fragments, or imperatives) would have us to believe. It is also worth mentioning that there are a number of specific verbs that are used most of the time by English-speaking mothers as imperatives or in questions or fragments, and so these would be good candidates for verbs that children might use without subjects in their own speech.

Whether and in what way this overall pattern of constructional use matches that of spontaneous spoken discourse among adults is a question for future research. In the closest analysis of adult-adult discourse to date, Thompson & Hopper (2001) found that only about one-quarter of all clauses (whatever utterance-level construction type they might occur in) had both a subject and an object, and many of these had contracted copulas as the main verb. This suggests that many of the patterns we observed are characteristic of spontaneous spoken discourse in general, and so it is unlikely that children will be hearing a much higher proportion of transitive utterances later in their childhood. We should note that for the purposes of the ideas presented in this paper, the issue of whether CDS is different from some genres of adult-to-adult speech is not central. If it turns out that the speech that children hear addressed to others around them is also very repetitive and lexically specific, this would go some way to explaining how children who hear much less CDS or none at all, might also start to develop the constructions of the language (see Lieven, 1994 for a discussion). We should remember, however, that infants prefer CDS and that it might therefore give those infants who are hearing CDS some sort of head start into segmenting what they are hearing.

8.2. *Identifying segments, constituents and categories*

A further issue relates to the processes by which young children discern grammatically coherent constituents from the utterances they hear. There are certainly many prosodic cues available to young children in terms of stress, timing, and so forth within the utterances they have addressed to them (see papers in Morgan & Demuth, 1995). But the current findings go beyond these features to document the “fragments” that children hear as whole utterances. Approximately 98% of these are NPs, VPs, PPs, APs, or some other coherent grammatical unit—most often with the “rest” of the full utterance either present in the child’s preceding conversational turn or else pragmatically presupposed in the wider communicative context. Brent and Siskind (2001) found that beginning language learners acquire first the words that their mothers use as single-word utterances, and now we have found that children use as NPs the same lexically specific NPs that their mothers use (i.e., *The [N], A[N], [Poss] [N], [Num]*

[N]), without, we would suggest, this necessarily having the status of the NP category in the adult grammar. The pieces of language that mothers use in producing whole utterances would thus seem to be an especially privileged class of utterances in helping young children to discern grammatically coherent constituents in the speech they hear around them. The fact that these utterances instantiate full communicative intentions in the same way as more complex utterances—but without the need to partition this among so many diverse morphemes doing so many different jobs—apparently makes life relatively easy for the beginning learner of English.

Finally, the current findings provide data that may be relevant to the question of why most English-speaking children find it easier, initially, to learn nouns than verbs. The findings are: (i) English-speaking children hear nouns as single word utterances about six times more often than they hear verbs as single word utterances, (ii) English-speaking children hear NPs as whole utterances about twice as often as they hear VPs as whole utterances, and (iii) the syntactic contexts within which English-speaking children hear nouns are much more consistent than those in which they hear verbs. It is also true that nouns, as opposed to pronouns, appear quite often in CDS as the postverbal element in presentational copula constructions or in SVO constructions (as they do in adult speech; DuBois, 2001)—with the preverbal element in both cases being either a pronoun or demonstrative of some sort. The child thus has a chance to ground her understanding in a highly frequent, well-known frame to begin the comprehension process (e.g., with *That's a . . .*; *There's the . . .*) before the new, heavier information arrives in the form of a lexical noun after the predicate. This finding is thus somewhat different from Maratsos' (1990) claim that morphology is more consistent in the case of English verbs than English nouns (given proper nouns, mass nouns, etc.). This claim may be true—we did not study morphology here—but the surrounding words would seem to be more consistent for nouns than verbs (see also Mintz, 2002, who reports a greater variety of frames around verbs than around nouns). This is unlikely to be the whole story since findings for other languages suggest that it is not simply the prominence of nouns or verbs in the input or even, as we are suggesting, the frequency of the lexical frames within which they occur that accounts for patterns of noun and verb learning across languages, but also cognitive and perceptual salience (Genter & Boroditsky, 2001). We would simply suggest the need to look at the lexical frames that these categories of words occur in and their relative frequencies as well as their raw frequencies of syntactic positioning.

8.3. *Beyond item-specificity*

Whatever else it is, the acquisition of a language is the acquisition of a skill, and skills are crucially dependent on repetition and repetition with variation. Recent psycholinguistic and historical linguistic work has shown that the frequency with which particular item-based expressions are used in a language is the key factor determining whether they get regularized by children and so lose to some degree their item-based status (due to low frequency), or whether, alternatively, their frequency allows them to remain “irregular” and item-based (see papers in Bybee & Hopper, 2002). Also of key importance is the issue of type frequency (or range), for example, how many different nouns or verbs are found in different instantiations of the same construction. Maratsos and Chalkley (1980) also suggested this in their theory of how distributional frequency might contribute to the formation of categories and recent experiments on distributional learning suggest that this is, indeed, the case (Gerken & McInstosh, 1993;

Gómez, 2002). According to Bybee (1995), among others, type frequency in particular slots in constructions is the key to syntactic productivity, and so this kind of frequency is of crucial importance in helping to explain how children begin to construct more abstract and adult-like syntactic representations. Thus, Lieven et al. (2003) have suggested that children may develop a NP category that can be used across constructions earlier than other grammatical categories because of the wide range of variation in the slots of presentational copulas and wh-questions. The present study complements this by showing that children are exposed to high token and type frequencies in the syntactic constructions they hear. In sum, having relatively few frames for a given item class (e.g., nominals) may help children learn the words of that class, while having many items appearing in the same range of frames may help children to abstract the category (e.g., noun).

If this is an accurate characterisation of the early stages of children's linguistic competence, the question is how they move to a more general and abstract grammar. One important factor is thought to be the overlapping distribution of lexical and functional content between different constructions, that increasingly links the constructions. This results in more generative and potentially abstract comprehension and production (Elman, 2001; Freudenthal et al., 2002). However, other cognitive processes will almost certainly also be important, in particular the role of analogy (Gentner & Medina, 1998), though this has, as yet, been little studied in the specific case of the relations between constructions (though see Goldberg, 1995). A good example of the process itself can be found in Theakston, Lieven, Pine, and Rowland's (2002) study of the development of the semantics and syntax of the verb GO in 12 children between the ages of 2;0–3;0. This study shows that the different forms of GO (*go*, *does*, *went*, *gone*, etc.) first appear in different syntactic and semantic contexts (e.g., *This goes here*; *Daddy go in car*; *Baby gone to sleep*). These contexts are the most frequent for each form in the mothers' speech to the children; however each form in the children's speech initially has a considerably narrower and less overlapping range than that evidenced in the mothers' speech. By the age of 3;0, the children are showing a range of semantic and syntactic uses for all the forms of GO which is similar to that of the mothers.

There are a number of important and complex issues here for future research. We know very little about how patterns of lexical specificity might interrelate with types of constructions in languages other than English and, in turn, how this could affect both type and token frequencies of parts of constructions and their placement at the beginning or ends of utterances. Slobin has argued for many years (see, for instance, Slobin, 1985) that children are selectively sensitive to the ends of words. We need to develop our analyses to see how this would interact with our emphasis on constructions and lexically specific structures.

It is also important to stress that issues of frequency are intimately tied up with issues of sampling. Thus, for example, our estimates of frequency for English CDS are very likely accurate for high frequency items and expressions, but they are very likely not accurate for low frequency items and expressions—for well-known statistical reasons falling under the heading of “the law of large numbers”. Indeed, doing item-based correlations between mothers' and children's language for low frequency structures using a sparse sample of data is not going to be at all informative. If we are to document more thoroughly and accurately the nature of the language children hear, one essential requirement is that we obtain more than a 1% sample—where 1% is the figure for most longitudinal studies of language acquisition (including our

own) in which about one hour every ten days is sampled from mothers and children—and we sample from a more diverse array of discourse contexts. The issue is even more critical if we want to do item-based correlations for low-frequency items, with the goal of inferring something about the learning mechanisms that young children bring to the task of language acquisition. Issues of frequency and sampling are also of crucial importance for researchers attempting to construct computational models of the language acquisition process in which accurately characterizing the language that learners hear is of crucial importance.

The current study thus contributes to a growing body of research suggesting that human linguistic competence is based in large part—though obviously not exclusively—on the mastery of a large number of specific linguistic items and expressions (e.g., Fillmore, Kay & O’Conner, 1988; Pawley & Snyder, 1983). Much of mothers’ speech to their young children revolves around a particular subset of such items and expressions and so, quite naturally, this is what children learn and use first. But children also expand these constructions, and acquire less frequent and more abstract and complex constructions at some point as well. How they do this—and the role that child directed speech plays in this process—is obviously the central question for future research.

Acknowledgments

Thanks to the families who took part in the study, to Anna Theakston and Caroline Rowland who collected and transcribed all the data, and to Anna Theakston, Julian Pine, the Editor and three anonymous reviewers for extremely helpful comments on the manuscript. The data collection was funded by the U.K. Economic and Social Science Research Council grant number R000236393.

References

- Abbot-Smith, K., Lieven, E., & Tomasello, M. (2001). What children do and do not do with ungrammatical word orders. *Cognitive Development*, *16*, 1–14.
- Barnes, S., Gutfreund, M., Satterly, D., & Wells, G. (1983). Characteristics of adult speech which predict children’s language development. *Journal of Child Language*, *10*, 65–84.
- Beckwith, R. (1988). Learnability and psychologically constrained grammars. Unpublished PhD Dissertation, Teachers College, Columbia University.
- Braine, M. (1976). Children’s first word combinations. *Monographs of the Society for Research in Child Development*, *41*, no. 1.
- Brent, M. R., & Siskind, J. M. (2001). The role of exposure to isolated words in early vocabulary development. *Cognition*, *81*, B33–B44.
- Broen, P. A. (1972). The verbal environment of the English-learning child. ASHA Monographs, *17*, Washington, D.C.: American Speech and Hearing Association.
- Bybee, J. (1995). Regular morphology and the lexicon. *Language and Cognitive Processes*, *10*(5), 425–455.
- Bybee, J., & Hopper, P. (Eds.), (2002). *Frequency and the emergence of linguistic structure*. Amsterdam: Benjamins.
- Bybee, J., & Scheibmann, J. (1999). The effect of usage on degrees of constituency: The reduction of *don’t* in English. *Linguistics*, *37*, 575–596.
- Chafe, W. (1994). *Discourse, consciousness, and time*. Chicago: University of Chicago Press.

- Chomsky, N. A. (1965). *Aspects of the theory of syntax*. Cambridge, Massachusetts: MIT Press.
- Clancy, P. (2001). The lexicon in interaction: Developmental origins of preferred argument structure in Korean. In J. DuBois (Ed.), *Preferred argument structure: Grammar as architecture for function*. Amsterdam: Benjamins.
- Clark, R. (1974). Performing without competence. *Journal of Child Language*, 1, 1–10.
- Croft, W. (1995). Intonation units and grammatical structure. *Linguistics*, 33, 839–882.
- Croft, W. (2001). *Radical construction grammar*. Oxford: Oxford University Press.
- Cross, T. (1977). Mothers' speech adjustments: The contribution of selected child listener variables. In C. E. Snow & C. A. Ferguson (Eds.), *Talking to children: Language input and acquisition*. Cambridge: Cambridge University Press.
- Dabrowska, Ewa. (2000). From formula to schema: The acquisition of English questions. *Cognitive Linguistics*, 11(1–20), 83–102.
- De Villiers, J. (1985). Learning how to use verbs: Lexical coding and the influence of input. *Journal of Child Language*, 12, 587–596.
- Drach, K. (1969). The language of the parent: A pilot study. In *Working Paper #14: The Structure of Linguistic Input to Children*. University of California, Berkeley: Language-Behavior Research Laboratory.
- DuBois, J. (2001) *Preferred argument structure: Grammar as architecture for function*. Amsterdam: Benjamins.
- Elman, J. L. (2001). Connectionism and language acquisition. In M. Tomasello & E. Bates (Eds.), *Language Development*. Oxford: Blackwell.
- Ewing, G. (1982). Word order invariance and variability in 5 children's three word utterances. In C. E. Johnson & C. L. Thew (Eds.), *Papers from the Second International Congress for the Study of Child Language*. University Press of America
- Farrar, M. J. (1990). Discourse and the acquisition of grammatical morphemes. *Journal of Child Language*, 17, 604–624.
- Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant Behavior and Development*, 8, 181–195.
- Fillmore, C., Kaye, P., & O'Conner, M. (1988). Regularity and idiomacity in grammatical constructions: The case of *let alone*. *Language*, 64, 501–538.
- Fisher, C. (2002). Structural limits on verb mapping: The role of abstract structure in 2.5-year-old's interpretations of novel verbs. *Developmental Science*, 5(1), 55–64.
- Fisher, C., Hall, D. G., Rakowitz, S., & Gleitman, L. (1994). When its better to give than to receive: Syntactic and conceptual constraints on vocabulary growth. *Lingua*, 92, 333–375.
- Freudenthal, D., Pine, J., & Gobet, F. (2002). Modeling the development of Dutch Optional Infinitives in MOSAIC. In W. D. Gray & C. D. Schunn (Eds.), *Proceedings of the 24th Annual Meeting of the Cognitive Science Society*. (pp. 328–333). Mahwah, NJ: Erlbaum.
- Furrow, D., Nelson, K., & Benedict, H. (1979). Mothers' speech to children and syntactic development: Some simple relationships. *Journal of Child Language*, 6, 423–442.
- Gentner, D. (1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. Kuczaj (Ed.), *Language development* (Vol. 2). Hillsdale, NJ: Erlbaum.
- Genter, D., & Boroditsky. (2001). Individuation, relativity and early word learning. In M. Bowerman & S. Levinson (Eds.), *Language acquisition and conceptual development* (pp. 215–256). New York: Cambridge University Press.
- Gentner, D., & Medina, J. (1998). Similarity and the development of rules. *Cognition*, 65, 263–297.
- Gerken, L. A., & McInstosh, B. J. (1993). Interplay of function morphemes and prosody in early language. *Developmental Psychology*, 25, 448–457.
- Gleitman, L. R. (1990). The structural sources of verb meanings. *Language Acquisition*, 1, 3–55.
- Gleitman, L. R., Newport, E. L., & Gleitman, H. (1984). The current status of the motherese hypothesis. *Journal of Child Language*, 11, 43–79.
- Goldberg, A. (1995). *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.
- Gómez, R. L. (2002). Variability and detection of invariant structure. *Psychological Science*, 13, 431–436.
- Gómez, R., & Gerken, L. A. (1999). 11-month-olds are sensitive to structure in an artificial grammar. *Cognition*, 70, 109–135.

- Hoff-Ginsberg, E. (1985). Some contributions of mothers' speech to their children's syntactic growth. *Journal of Child Language*, 12, 367–385.
- Hoff-Ginsberg, E., & Shatz, M. (1982). Linguistic input and the child's acquisition of language. *Psychological Bulletin*, 92, 3–26.
- Jusczyk, P. W. (1997). *The Discovery of spoken language*. Cambridge, MA: MIT Press.
- Jusczyk, P. W., & Aslin, R. N. (1995). Infants' detection of the sound patterns of words in fluent speech. *Cognitive Psychology*, 29, 1–23.
- Langacker, R. (1987). *Foundations of cognitive grammar* (Vol. 1). Stanford, CA: Stanford University Press.
- Lieven, E. V. M. (1994). Crosslinguistic and crosscultural aspects of language addressed to children. In C. Gallaway & B. J. Richards (Eds.), *Input and interaction in language acquisition*. Cambridge: Cambridge University Press.
- Lieven, E. V. M., Pine, J. M., & Baldwin, G. (1997). Lexically-based learning and early grammatical development. *Journal of Child Language*, 24, 187–219.
- Lieven, E. V. M., Behrens, H., Speares, J., & Tomasello, M. (2003). Early syntactic creativity: A usage-based approach. *Journal of Child Language*, 30, 2.
- MacWhinney, B. (1978). The acquisition of morphophonology. *Monographs of the Society for Research in Child Development*, No. 43.
- MacWhinney, B. (1995). *The Childes Project: Tools for analyzing talk*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- MacWhinney, B., & Snow, C. (1985). The Child Language Data Exchange System. *Journal of Child Language*, 12, 271–295.
- MacWhinney, B., & Snow, C. (1990). The Child Language Data Exchange System: An update. *Journal of Child Language*, 17, 457–472.
- Maratsos, M. (1990). Are actions to verbs as objects are to nouns? On the differential semantic bases of form class category. *Linguistics*, 28, 1351–1379.
- Maratsos, M., & Chalkley, M. A. (1980). The internal language of children's syntax: The ontogenesis and representation of syntactic categories. In K. Nelson (Ed.), *Children's language* (Vol. 2, pp. 127–213). New York: Gardner.
- Marcus, G. F., Vijayan, S., Bandi Rao, S., & Vishton, P. M. (1999). Rule learning by seven-month-old-infants. *Science*, 283, 77–80.
- Mintz, T. H. (2002, November). On the distribution of frames in child-directed speech as a basis for grammatical category learning. *Paper presented at the 27th Annual Boston University Conference on Language Development*. Boston, MA.
- Mintz, T., Newport, E., & Bever, T. (2002). The distributional structure of grammatical categories in speech to young children. *Cognitive Science*, 26, 393–424.
- Morgan, J. & Demuth, K. (Eds.), (1995). *From signal to syntax*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Naigles, L., & Hoff-Ginsberg, E. (1998). Why are some verbs learned before others? *Journal of Child Language*, 25, 95–120.
- Newport, E. L. (1977). Motherese: The speech of mothers to young children. In N. J. Castellan, D. B. Pisoni, & G. R. Potts (Eds.), *Cognitive theory* (Vol. 2). Hillsdale, NJ: LEA.
- Newport, E. L., Gleitman, H., & Gleitman, L. R. (1977). Mother, I'd rather do it myself: Some effects and non-effects of maternal speech style. In C. E. Snow & C. A. Ferguson (Eds.), *Talking to children: Language input and acquisition*. Cambridge: Cambridge University Press.
- Parisse, C., & Le Normand, M.-T. (2000). How children build their morphosyntax: The case of French. *Journal of Child Language*, 27, 267–292.
- Pawley, A., & Snyder, F. (1983). Two puzzles for linguistic theory. In J. Richards & R. Smith (Eds.), *Language and communication*. New York: Longmans.
- Pine, J. M. (1994). The language of primary caregivers. In C. Gallaway & B. J. Richards (Eds.), *Input and interaction in language acquisition*. Cambridge: Cambridge University Press.
- Pine, J. M., & Lieven, E. (1993). Reanalysing rote-learned phrases: Individual differences in the transition to multi-word speech. *Journal of Child Language*, 20, 551–571.
- Pine, J. M., & Lieven, E. (1997). Slot and frame patterns in the development of the determiner category. *Applied Psycholinguistics*, 18, 123–138.

- Pine, J. M., & Martindale, H. (1996). Syntactic categories in the speech of young children: The case of the determiner. *Journal of Child Language*, 23, 369–395.
- Plunkett, K., & Marchman, V. (1993). From rote learning to system building: Acquiring verb morphology in children and connectionist nets. *Cognition*, 48, 21–69.
- Redington, M., Chater, N., & Finch, S. (1998). Distributional information: A powerful cue for acquiring syntactic categories. *Cognitive Science*, 22, 425–469.
- Richards, B. J. (1990). *Language development and individual differences: A study of auxiliary verb learning*. Cambridge: Cambridge University Press.
- Richards, B. J. (1994). Child-directed speech and influences on language acquisition: Methodology and interpretation. In C. Gallaway & B. J. Richards (Eds.), *Input and interaction in language acquisition*. Cambridge: Cambridge University Press.
- Saffran, J., Aslin, R., & Newport, E. (1996). Statistical learning by 8-month old infants. *Science*, 274, 1926.
- Slobin, D. I. (1985). Crosslinguistic evidence for the language-making capacity. In D. I. Slobin (Ed.), *The crosslinguistic study of language acquisition*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Snow, C. E. (1972). Mothers' speech to children learning language. *Child Development*, 43, 549–565.
- Snow, C., & Ferguson, C. (Eds.), (1977). *Talking to children: Language input and acquisition*. Cambridge: Cambridge University Press.
- Theakston, A., Lieven, E., Pine, J., & Rowland, C. (2001). The role of performance limitations in the acquisition of verb-argument structure. *Journal of Child Language*, 28, 127–152.
- Theakston, A., Lieven, E., Pine, J., & Rowland, C. (2002). Going, going, gone: The acquisition of the verb 'go'. *Journal of Child Language*, 29, 783–811.
- Thompson, S. A., & Hopper, P. J. (2001). Transitivity, clause structure, and argument structure: Evidence from conversation. In J. Bybee & P. J. Hopper (Eds.), *Frequency and the emergence of linguistic structure*. Amsterdam: Benjamins.
- Tomasello, M. (1992). *First verbs: A case study in early grammatical development*. Cambridge: Cambridge University Press.
- Tomasello, M. (2000). Do children have adult syntactic competence? *Cognition*, 74, 209–253.
- Tomasello, M. (2003). *Child language acquisition: A usage-based approach*. Cambridge, MA: Harvard University Press.
- Tomasello, M., Akhtar, N., Dodson, K., & Rekau, L. (1997). Differential productivity in young children's use of nouns and verbs. *Journal of Child Language*, 24, 373–387.
- Tomasello, M., & Abbot-Smith, K. (2002). A tale of two theories: Response to Fisher. *Cognition*, 83, 207–214.
- Valian, V. (1991). Syntactic subjects in the early speech of American and Italian children. *Cognition*, 40, 21–81.
- Wells, C. G. (1981). *Learning through interaction: The study of language development*. Cambridge: Cambridge University Press.