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Why are some verbs learned before other verbs? Effects of input frequency and structure on children's early verb use*

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ABSTRACT

This study investigated the extent to which the nature of verb input accounts for the order in which children acquire verbs. We assessed the nature of verb input using a combined sample of the speech of 57 mothers addressing their Stage I children. We assessed the order of verb acquisition using as our database a combined sample of those children's speech 10 weeks later and using as our measure of order of acquisition the frequency of verb occurrence. The first set of analyses established the validity of this measure of acquisition order by comparing it with order of acquisition data obtained from checklist and diary data. The second set of analyses revealed that three properties of the input were significant predictors of the order of acquisition of the 25 verbs that were the focus of this study. The predictive properties of input were the total frequency, final position frequency, and diversity of syntactic environments in which the verbs appeared. These findings suggest that the way verbs appear in input influences their ease of acquisition. More specifically, the effect of syntactic diversity in input provides support for the

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syntactic bootstrapping account of how children use structural information to learn the meaning of new verbs.

INTRODUCTION

Are some verbs consistently learned before other verbs? A recent spate of interest in early verb learning has provided several databases for examining the order in which verbs appear in children's speech (Goldin-Meadow, Seligman & Gelman, 1976; Tomasello, 1992; Tomasello & Kruger, 1992; Marchman & Bates, 1994). Scrutiny of these databases reveals that, indeed, some verbs are produced consistently earlier and/or by more children than others. For example, *go*, *eat*, *play*, *tickle*, *open*, and *fall* are almost always produced earlier and/or by more children at a given age than *give*, *drop*, *pull*, *hug*, and *look*. What makes the verbs in the first group easier to learn than those in the second? The present study was designed to address this question, on the logic that finding out what makes some verbs easier for children to learn than other verbs will shed light on how children go about the process of verb learning.

While no research we know of has addressed the present question directly, others have considered the larger question of why some words are acquired before other words. For example, Brown (1958) inspired a line of work concerning why some nouns are learned before other nouns, and there has been a good deal of research concerning why (and whether) nouns might be learned before verbs (e.g. Gentner, 1982). In both these cases, the major question has been how much order of acquisition is rooted in characteristics of children's input as opposed to cognitive characteristics of the children that make some word meanings more accessible than others. In this paper, we extend this line of inquiry to within the domain of verbs and investigate the extent to which various characteristics of how verbs appear in children's input can account for the order of acquisition of those verbs.

Almost forty years ago, Roger Brown published a seminal paper in which he asked, in effect, why children learn some nouns before others; e.g. why *bird* before *sparrow* and *dime* before *metal* (Brown, 1958). Brown nominated frequency in input as a candidate explanation, while adding that words that are frequently used in speech to children tend to match the children's cognitive predilections. That is, Brown argued that adult speech to children includes frequent use of words that name things at what we have come to call the BASIC LEVEL 'so as to categorize them in a maximally useful way' (1958, p. 20); i.e. neither too broadly nor too narrowly (for more discussion see subsequent work by Nelson, 1973; Rosch, Mervis, Gray, Johnson & Boyes-Braem, 1976; Dromi, 1987). In sum, research on children's acquisition of nouns points to input frequency and word meaning (as it interfaces with children's conceptual development) as factors that influence why some words are learned before other words.

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More recently, a debate has emerged concerning whether and why nouns, as a class, might be learned before verbs, again as a class. Preliminary findings that children acquiring very different languages were nonetheless consistent in producing nouns before verbs led Gentner (1982) to propose that this 'noun bias' was a universal, explained by a universal predilection of languages to map nouns onto object concepts in a straightforward fashion. Thus, children could assume very early on that, whatever language they were exposed to, a single object concept mapped onto a single noun, and *vice versa*. In contrast, the mapping of verbs and action concepts can vary widely across languages and so must be learned. For example, English verbs of motion tend to encode the MANNER of motion (e.g. *She RUNS out of the house*), whereas Spanish motion verbs are more likely to encode the PATH of motion (e.g. *Esta SALIENDO de la casa*/*She's LEAVING the house*) (Talmy, 1985). Thus, the acquisition of verbs depends on some language-specific knowledge, and so might be expected to be delayed relative to nouns.

More in-depth analyses have confirmed an early noun bias for learners of English, Italian and Hebrew (Dromi, 1987; Goldfield, 1993; Casselli, Bates, Casadio, Fenson, Fenson, Sanderl & Weir, 1995; Choi & Gopnick, 1995; Tardif, 1996; Tardif, Shatz & Naigles, 1997); however, learners of Korean and Mandarin Chinese appear to learn verbs at least as early as they learn nouns (Choi & Gopnick, 1995; Tardif, 1996; but see Au, Dapretto & Song, 1994). It appears that aspects of the input may account for this cross-linguistic difference. Again, frequency appears to play a role, as verb types are more frequent than noun types in adult-to-child speech in Mandarin Chinese and Korean, but not in English or Italian. Moreover, the highly salient utterance-final position is more likely to contain verbs in Chinese than in English or Italian (Goldfield, 1993; Tardif *et al.*, 1997). In sum, research on children's acquisition of their first words points to two properties of children's input – frequency and positional salience – as factors that may explain why some categories of words are learned before other categories of words.

Frequency and positional salience in input may also play a role in explaining the order of acquisition within the class of verbs. Again, it is plausible to suppose that children would be better able to learn those verbs that appear more frequently in the input, and/or that appear in the salient utterance-final position, because these verbs would be more easily extracted from the sound stream and afford more opportunities for determining an interpretation. In fact, Smiley & Huttenlocher (1995) have recently invoked the notion of positional salience to explain why some English learners' earliest words for events are not verbs at all, but instead the verb particles *up*, *down* and *off*. They found that these terms appear frequently in the input language in utterance-final position (e.g. 'D'ya wanna get picked UP?'). In this study, we will investigate whether these aspects of the input language

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influence the order of acquisition within the verb lexicon. We would expect to find, for example, that the relative prevalence of *fall* versus *pull* in the input language predicts the relative prevalence and/or order of acquisition of these verbs in children's speech.

Recall, though, that the characteristic of words that Brown (1958) weighted most heavily in his discussion of noun order of acquisition was MEANING, the forerunner of the basic level of the taxonomic hierarchy of object categorization. In what way(s) might meaning play a role in VERBS' order of acquisition? First, some meanings might be cognitively easier than others. Clearly, verbs with more concrete meanings might be expected to be learned before those with more abstract meanings (i.e. *go* before *think*). Second, the input may influence how easily a meaning is accessed or adduced. For example, Tomasello and his colleagues have demonstrated the importance of social/pragmatic cues to learning verbs (e.g. Tomasello, 1992, in press; Tomasello & Kruger, 1992), so we might expect that verbs that are heard within familiar social routines (e.g. *tickle*, *kiss*) might be learned earlier than other verbs (e.g. *jump*, *pull*). However, even the strongest arguments for a social/pragmatic basis for word learning do not claim to be able fully to account for order of acquisition among verbs.

There is another proposal for where, in their input, children might find further information about verb meaning. Recent work has demonstrated that the syntactic frames in which verbs appear contribute to children's ability to make conjectures about the meanings of those verbs (Naigles, 1990, 1996; Naigles, Gleitman & Gleitman, 1993; Naigles & Kako, 1993; Fisher, Hall, Rakowitz & Gleitman, 1994). We elucidate the theoretical and empirical background for this proposal – known as the syntactic bootstrapping hypothesis – below.

The role of syntax in verb acquisition

Individual verbs differ as to their syntactic privileges of occurrence. For example, intransitive verbs such as *go*, *walk* and *think* disallow direct objects (*The zebra goes the lion* is ungrammatical), while transitive verbs such as *bring*, *give* and *put* mandate them (*The zebra brings* is also ungrammatical). These and other syntactic differences have been found to correspond to semantic differences between verbs; for example, the transitive/intransitive difference often corresponds to a causative/non-causative difference. Similarly, verbs that appear with sentence complements often involve mental states (*I think* THAT IT WILL RAIN), and verbs that appear with prepositional phrases (PPs) often involve motion (*She walked* TO THE STORE; cf. Landau & Gleitman, 1985; Talmy, 1985; Fisher, Gleitman & Gleitman, 1991; Levin, 1993). Furthermore, because verbs often appear in several different syntactic frames (e.g. *know* can appear with a direct object (*I know* THAT SONG!), a sentence complement (*I know* HOW TO DO IT), or a direct object plus sentence

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complement (*I know* HIM TO BE AN HONOURABLE MAN)), meaningful differences between verbs may be encoded in the SET of frames associated with each verb. For example, the verb *see* can appear with directional PPs (e.g. *I can see* ALL THE WAY TO THE MOUNTAINS), which would suggest that it should be categorized as a verb of motion. Yet *see* differs from other motion verbs in that its motion is covert, non-physical and abstract (the above sentence means something like *my gaze goes all the way to the mountains*). This more cognitive part of the meaning of *see* is captured in that it can also appear with sentence complements (e.g. *I don't see* WHAT YOU ARE GETTING AT), as mental state verbs do. Thus, either frame reveals only one aspect of the meaning of *see*; the two of them together indicate that *see* involves both motion and mental states, and so is a verb perception (Jackendoff, 1983; Landau & Gleitman, 1985).

These correlations between verb syntax and verb semantics, while not categorical, have been hypothesized to be strong enough to allow children to make conjectures about a verb's meaning based on the syntactic frame(s) in which it is presented (Landau & Gleitman, 1985; Gleitman, 1990; Naigles, 1990, 1996; Naigles & Kako, 1993; Fisher *et al*., 1994; Naigles & Hoff-Ginsberg, 1995).[1] That is, hearing a verb in a transitive frame would lead a child to target the causative actions in the environment as possible referents of the verb, while hearing a verb with a sentence complement might lead children to consider their or others' relevant mental states as the verb's meaning. Moreover, hearing a verb in its varied syntactic frames would contribute to children's ability to learn some of the finer distinctions between verb meanings e.g. between *see* and *know*.

Recent experimental research has provided strong evidence that young two-year-olds exploit both single and multiple-frame syntax when presented with novel verbs and actions. For example, Naigles & Kako (1993) (see also Naigles, 1990) taught children aged 2;4 novel verbs for which there were two possible action referents. The children who heard the verbs presented in intransitive frames targeted synchronous actions as the referents of the verbs, whereas those who heard the verbs in transitive frames chose the causative actions or contact activities as their referents. Moreover, when Naigles (1996) investigated how young two-year-olds might distinguish contact activities from causative actions, she found that girls of this age could exploit the semantic implications of PAIRS of syntactic frames. That is, when a novel verb was presented in transitive and intransitive frames in the causative alternation (e.g. *The duck is blicking the bunny! The bunny is blicking!*), all children chose the causative action (e.g. the duck making the bunny bend over) as the referent of the verb. In contrast, when the verb was presented in transitive

[1] An orthogonal procedure, called SEMANTIC BOOTSTRAPPING, proposes that children use the semantics of verbs to determine the syntactic structure of the clauses in which the verbs appear (Grimshaw, 1981; Pinker, 1984).

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and intransitive frames in the omitted object alternation (e.g. *The duck is blicking the bunny! The duck is blicking!*), more of the girls chose the contact activity (e.g. the duck tapping the bunny's head) as the verb's referent, consistent with the semantic properties that have been proposed to be associated with this alternation (e.g. Dixon, 1991; Levin, 1993). In sum, these studies show that hearing novel verbs in single or multiple syntactic frames enables children to make either broad or narrow distinctions in selecting the actions that are the referents of these verbs.

Recent research has also shown that the input children hear can support the use of syntax in English verb acquisition. Naigles & Hoff-Ginsberg (1995) parsed the utterances containing 25 common verbs in a corpus of adult-to-adult speech at two levels of detail. (a) At one level, the input utterances were categorized into broad, theory-driven frames such as TRANSITIVE (i.e. followed by a noun phrase: *the boy broke THE WINDOW*), PREPOSITIONAL PHRASE (i.e. followed by a PP: *the girl ran DOWN THE HILL*), SENTENCE (i.e. followed by a sentence: *the girl wanted TO GO TO THE STORE*), and ADVERB (i.e. followed by an adverb: *the child ran QUICKLY*). (b) At a second level the input utterances were parsed according to narrow, data-driven frames, possibly approximating how a child with some rudimentary syntax might parse her input. A total of 45 such narrow frames was needed to parse all the utterances in the corpus (a sampling of the narrow frames for utterances that were also coded as transitive at the broad level is the verb followed by the following: NP P PP, NP NP, NP P, NP P Adj, NP P (conjunction) S, NP PP (conjunction) S).

Naigles & Hoff-Ginsberg's analyses of this parsed input yielded four relevant findings. (1) Verbs overwhelmingly appeared in their appropriate broad syntactic frames: i.e. actor-patient (e.g. causative) verbs almost always appeared with direct objects, motion verbs appeared with prepositional phrases more than mental state verbs did, and mental state verbs appeared with sentence complements more than motion verbs did. (2) The broad syntactic frames were reliable cues for the appropriate semantic classes of verbs: i.e. if a verb appeared with a direct object, it was almost always an actor–patient verb, if it appeared with a prepositional phrase it was most likely to be a motion verb, and if it appeared with a sentence complement it was most likely to involve mental states. (3) More than three-quarters of the verbs were presented multiple times over the course of a morning's visit, and over 75% of these verbs were presented in multiple syntactic frames (both broad and narrow) over the same time period. (4) The set of narrow syntactic frames in which each of the 25 verbs appeared had the potential to distinguish it from all others in the sample. That is, the set of utterances containing each verb was captured by a unique subset of the 45 frames. For example, while *drop* and *move* both appeared with direct objects and particles and utterance-finally, *drop* was also used with PPs and adverbs whereas *move*

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was used with locatives and post-verbal sentences. It is not obvious how these narrow frame differences might translate into meaning differences for the children; however, it is clearly the case that narrow frame differences have the potential to make some meaning-based distinctions among these verbs. In sum, the analyses in Naigles & Hoff-Ginsberg (1995) established that the input children receive contains broad syntactic frames that provide reliable cues to semantically based verb classes and narrow syntactic frame profiles that uniquely specify each verb.

The foregoing evidence, then, establishes that (1) children are sensitive to the semantic implications of single and multiple syntactic frames when learning novel verbs in experimental settings, and (2) the input that children receive has the potential to support a significant role for syntax in verb acquisition. Thus the stage is set to extend the experimental work with nonsense verbs and the descriptive work on how verbs appear in adult-to-child speech by asking whether verb frame diversity in the input language influences aspects of children's conventional (i.e. English) verb acquisition. The prediction of the syntactic bootstrapping hypothesis is that the more frames in which a child hears a verb, the easier that verb will be to learn because each additional syntactic frame has the potential to provide additional semantic information. Verbs heard in a more diverse set of frames should be acquired earlier than those heard in fewer frames.

In sum, previous theoretical and empirical work suggests the following as influences on the order in which verbs are acquired: verb meaning, socio-pragmatic cues available for interaction, and three properties of how verbs appear in input – frequency, frequency in the perceptually salient utterance-final position, and the diversity of syntactic frames in which they are used. The goal of the present study is to investigate the influence of the three properties of input listed, asking whether the input factors that have been found to be relevant to order of acquisition in other domains would also apply to verb learning and testing the prediction of the syntactic bootstrapping hypothesis that diversity of the syntactic environments in which verbs appear also contributes to differences in order of acquisition.

Naigles & Hoff-Ginsberg (1995) provided detailed analyses of how verbs are used in input to children based on a combined sample of the speech of 57 mothers talking to their young children. In the present study, we measure order of verb acquisition using a combined sample of the speech produced by those children, in different conversations which took place 10 weeks after the conversations that provided the basis for assessing input. We will correlate the children's verb use during the second session with these measures of the adult language produced during the first session. Our predictions are that verbs that the input illustrates more frequently, more often in the salient utterance-final position, and in diverse syntactic frames, will tend to be the same verbs that the children use more frequently 10 weeks later.

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How to measure order of acquisition?

An important question to ask before performing those analyses of the correlations between properties of verb use in input and the order of verb acquisition concerns the validity of verb prevalence in such a combined sample of children's spontaneous speech as a measure of the order in which those verbs are acquired. Is it necessarily the case that verbs that are used more frequently are those that were learned earliest? The literature includes three other production-based ways to measure young children's verb knowledge: diaries, checklists and elicited production. In the diary method, each verb produced by a given child is recorded and rank ordered by age of first production (e.g. Tomasello, 1992). In the checklist method, parents check off the verbs they have heard their children produce, and the verbs can be ordered in terms of the percentage of (approximately) same-age children who produce them (Tomasello & Kruger, 1992; Marchman & Bates, 1994). In the elicited production method (Goldin-Meadow *et al.*, 1976), children are asked to label actions, and the verbs can similarly be ordered by the percentage of children who produce them. The diary method has the advantage of potentially providing a direct measure of order of acquisition; however, researchers must also decide whether to count the very first production of 'eat', say, as the point of acquisition, or to wait for more consistent usage. Moreover, if the child is a fast learner, and is producing many new verbs in a short period of time, the precise order of acquisition may be more difficult to determine. The checklist and elicited production methods actually measure prevalence of use across children, and so are less direct because they make the inference that verbs that are used by more children of a specific age are also those that were learned first. On the other hand, the checklist method has been shown to reflect the words each child uses more or less consistently in spontaneous language samples and structured language tests (Fenson, Dale, Reznick, Bates, Thal & Pethick, 1994). Moreover, researchers using checklist data routinely discuss order of acquisition of specific lexical items in terms of the percentage of children who are reported to produce them at a specific age. The implication is that if, say, more children aged 1;4, use word X than word Y, then word X was probably acquired before word Y (Fenson *et al.*, 1994).

No one has yet studied the extent to which frequency or prevalence of verb use among children at a given age reflects the order in which those verbs are acquired, although within the noun-vs.-verb debate mentioned earlier, there is wide acceptance of both longitudinal and cross-sectional methods of assessing order of acquisition (Au *et al.*, 1994; Casselli *et al.*, 1995; Choi & Gopnik, 1995; Tardif, 1996; Tardif *et al.*, 1997). In this study, we will address the measurement issue in three ways: first, we will compare the findings on verb order of acquisition from published and unpublished studies using the

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three established methods – diary (Tomasello, 1992), checklist (Tomasello & Kruger, 1992; Marchman & Bates, 1994; L. Naigles, unpublished data), and elicited production (Goldin-Meadow *et al.*, 1976). Is it the case that the verbs that parents check off most often, that children produce most often in an elicited production task, and that appear earliest in diaries are the same? Second, we will compare the order of acquisition suggested by the frequency of use in our sample of spontaneous speech with those from the other three methods.

Third, we will not rely solely on frequency of use as our measure of what children have learned about verbs. Another marker of verb knowledge is the flexibility and productivity with which a given verb is used in combination with other words. A verb that is less well-known should be used in less varied combinations, whereas a verb that is better known should be used in more diverse combinations. Thus, as a second measure of verb acquisition we will count how often each verb is used in a variety of syntactic frames – essentially, the same verb diversity analysis that was performed on the adult input (Naigles & Hoff-Ginsberg, 1995). The frames will be couched in syntactic terms (e.g. followed by a NP, a PP, and/or a S); however, we are making no claims at this time that the children are representing their utterances in these terms. Thus, the present study tests the hypothesis that verbs that the input provides more frequently, more often in utterance-final position, and in diverse syntactic frames, are verbs that children subsequently use more and in more diverse ways.

METHOD

Subjects

The participants were 57 children and their mothers, selected from a larger sample collected by Hoff-Ginsberg and described in Hoff-Ginsberg (1991; see also Naigles & Hoff-Ginsberg, 1995). All the participants were white, native speakers of American English; all the families were monolingual. None of the mothers worked outside the home more than 15 hours per week on a regular basis. Thus, the measures of properties of these mothers' speech are, effectively, measures of properties of the language these children heard.

The children were selected to be at the point where they were just beginning to combine words at the time of the first recorded visit. Each child was heard to produce at least three different two-word combinations in a preliminary screening visit, but no more than 50% of any child's utterances were multi-word utterances. In terms of Roger Brown's stages (Brown, 1973), they were all early Stage I speakers at Time 1. The mean MLU in morphemes was 1·28 (S.D. = 0·13). Age of the child was not a selection criterion; as a result, the ages of the children varied fairly widely, from 1;6

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TABLE 1. *Measures of verb use in children's input and children's speech*

	Input measures				Children's speech measures		
Verb	Number of tokens	Number of mothers	Number of tokens in final position	Number of different syntactic frames used	Number of tokens	Number of children	Number of different syntactic frames used
listen	1	1	0	1	0	0	0
lie	2	2	0	2	0	0	0
run	9	8	3	3	1	1	1
hear	24	15	8	4	1	1	1
jump	21	12	12	4	4	3	1
know	151	48	32	5	7	3	3
drop	12	6	2	5	2	1	1
give	113	42	0	6	1	1	1
move	19	16	12	6	2	2	1
think	213	54	19	7	2	1	2
lay	18	13	1	8	0	0	0
fall	97	31	21	9	18	9	3
like	162	48	5	9	12	6	3
need	62	27	3	10	9	5	2
open	57	26	11	11	33	9	4
pull	37	21	1	12	2	2	2
want	475	57	44	13	37	19	6
look	295	55	77	15	10	5	3
see	409	53	166	14	52	23	3
take	208	46	2	15	20	13	5
sit	178	44	14	17	21	12	4
push	179	37	41	18	15	7	4
put	807	57	7	20	44	15	14
come	198	53	24	22	34	9	8
go	1122	57	437	27	107	36	14

to 2;5 (mean age = 1;10·5, S.D. = 0·9). At Time 2, the children's mean age was 2;0·12 years (S.D. = 0·9), and their mean MLU had reached 1·62 (S.D. = 0·29).

Procedure

After at least one preliminary visit by a researcher, each mother–child dyad was videotaped at home two times, 10 weeks apart. At each time, over the course of half a day, each dyad was videotaped in four settings: meal-time, dressing, toy play and book reading; however, only utterances from the first three settings were analysed for this study. Other family members were not present during the videotaping.

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Transcription and extraction

The videotapes of these interactions were transcribed by trained undergraduate research assistants following the conventions for the use of the Systematic Analysis of Language Transcripts (SALT) program (Miller & Chapman, 1985). The sample of input was created by combining the Time 1 speech samples of 57 mothers. Each mother's sample was truncated to 393 utterances so that all mothers contributed equally to the combined speech sample. This combined sample was examined for production of the verbs *come*, *go*, *fall*, *drop*, *move*, *push*, *pull*, *open*, *see*, *look*, *lie*, *lay*, *hear*, *listen*, *give*, *take*, *need*, *think*, *know*, *sit*, *put*, *want*, *like*, *run*, and *jump*; there were 4863 tokens of these 25 verb types. These verbs were chosen because they varied in both their semantic and syntactic properties: on the syntax side, some are transitive, some take sentence complements and some appear with prepositional phrases. On the semantics side, some verbs involve motion, some causation and some internal states.

The utterances containing these tokens were tabulated and analysed by Naigles & Hoff-Ginsberg (1995; please see for a full description). In brief, each verb was used with an average frequency of 194·52 (range = 1 (*listen*) to 1116 (*go*)). The average number of verb tokens that mothers produced was 88·26 (S.D. = 17·67); the average number of verb types was 14·56 (S.D. = 1·90, range = 11–19). The post-verbal parts of the utterances were parsed into narrow, data-driven frames according to the conventions of X-bar syntax (Radford, 1988) with some modifications (see below). A total of 45 different frames was necessary to capture the diversity of syntactic frames in which these verbs appeared in maternal speech. Each frame appeared with an average of 5·67 different verbs (range = 1–20). Table 1 presents the frequency counts for each verb in maternal speech, the number of mothers contributing to each frequency count and the number of frames in which each verb appeared. Also included in Table 1 are the frequency counts for each verb in utterance-final position. In sum, our analyses of the maternal speech described, for 25 verbs that commonly appear in children's input, their frequency and the syntactic frames in which they were used. Moreover, notice that the large number of mothers contributing to each verb's tally, even to the low frequency verbs (e.g. 8 mothers responsible for the 9 tokens of *run*, 6 mothers responsible for the 12 tokens of *drop*), indicates that this description is of the corpus as a whole, and is not just attributable to the speech of one or two mothers. This resultant description of the input, then, provides the predictor variables for the current study.

The outcome measures for the present study come from similar analyses of a sample of children's speech. The children's speech sample was created by combining the Time 2 transcripts of the 57 children in the study. Each child's sample was truncated to 90 utterances (the size of the smallest sample

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TABLE 2A. *Diversity of syntactic environments in children's speech for 25 common verbs*[a]

	Post-verb structures												
Verb	#	NP	P	S	AMBIG.[b]	P LOC	NP P	# (P)	# (wh-Q)	# (LOC)	LOC P	NP	PP
listen													
lie													
run	+												
hear		+											
jump	+												
know	+	+		+									
drop	+												
give													
move	+												
think	+			+									
lay													
fall	+		+			+							
like		+		+	+								
need	+	+											
open	+	+			+								
pull			+				+						
want	+	+	+	+	+								
look	+				+	+							
see	+	+			+								
take	+	+	+				+						
sit	+		+								+		+
push	+	+	+				+						
put	+	+	+		+	+	+				+	+	
come	+	+	+	+		+				+			
go	+	+	+	+	+	+		+	+	+	+	+	+
# of verbs	18	12	9	6	7	5	4	1	1	2	3	2	2

[a] Based on 434 utterances from 57 children ranging from 20 to 31 months of age, 10 weeks after achieving Stage 1.
[b] AMBIG. frames were those in which the material following the verb was unintelligible or it could not be easily coded for grammatical category (e.g. LIKE SLIDE).

obtained). Across children the utterances were drawn in roughly equivalent proportions from the three settings recorded. All utterances that contained any of the 25 target verbs were extracted in their entirety from this combined sample for frequency tabulation and parsing. These verbs were considered to be appropriate for an assessment of early order of acquisition on three counts: first, many of the verbs are commonly used by young children; in Tomasello's diary study all but four (*lie*, *hear*, *think*, *know*) had been produced before that child subject was two years of age. Second, the verbs appear to vary in their order of acquisition in Tomasello's corpus, in that first

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TABLE 2B. *Diversity of syntactic environments in children's speech for 25 common verbs*

	Post-verb structures										
Verb	V	ADJ P LOC V		NP ADV	NP PP	NP P PP	NP LOC	P LOC NP	NP NP		# Syntactic frames
listen											0
lie											0
run											1
hear											1
jump											1
know											3
drop											1
give										+	1
move											1
think											2
lay											0
fall											3
like											3
need											2
open	+										4
pull											2
want										+	6
look											3
see											3
take				+							5
sit											4
push											4
put			+	+	+	+	+	+			14
come	+		+								8
go	+	+									14
# of verbs	3	1	2	2	1	1	1	1	2		

recorded use ranged from 1;3 to 1;9 years of age. Third, inclusion of some apparently rare verbs in child speech strengthens our investigation of order of acquisition: if we only included the earliest-learned verbs, then no variation, which might be explained by input frequency, position or structure, would even occur. The children's tokens of use for each verb were counted; in addition, as described below, the utterances containing each verb were parsed into narrow frames.

Parsing

The children's utterances were parsed by a graduate student in Linguistics at Yale University into narrow syntactic frames using the conventions of X-bar syntax (Radford, 1988) with some adaptations, as described below. The parsing scheme was the same as that described by Naigles & Hoff-Ginsberg

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(1995) to parse the mothers' utterances. In brief, the post-verbal elements of each utterance were categorized by their grammatical constituents: i.e. particles (P) such as *up* and *down*, prepositional phrases (PPs) such as *to the door*, sentence complements (S) such as *I want WENDY WEAR HAT*, adverbs (Adv) such as *go NOW*, and noun phrases (NPs) as described above. In addition, the category LOC was added to capture words for locations like *home* and *there*. The category V (verb) was also used in the children's parses, although it had not been used in the mothers' parses, because the children sometimes produced two verbs in sequence (e.g. 'open push') which were not elaborate enough to qualify as sentence complements (a sentence complement had to have at least a verb and a noun, e.g. *want PLAY BALL*). The grammatical categories were then ordered just as they had been produced, with no attempt to impose any higher-order structure on them. For example, 'put in' was parsed as P, 'put doll in bag' as NP PP, and 'put down chute pajamas' as P LOC NP. Finally, as in our parsing of the mothers' speech, wh-questions and exclamations were parsed as containing moved units. For example, the question 'where go?' was parsed as having an utterance-final verb with a moved wh-word: # (wh-Q), and the exclamation 'here it comes!' was parsed as having an utterance-final verb with a moved locative: # (LOC). A total of 22 different syntactic frames was needed to capture the children's speech. Table 2 shows which frames appeared with which verb(s).

Comparison databases

For our investigation into the validity of different measures of the order of acquisition of children's first verbs, we used the verb production data from five studies in addition to the database described above: (1) the diary study of Tomasello (1992), which is a record of the non-nominals produced by one child during her second year. Only those words which are verbs in adult English were included in this analysis. The order of verb acquisition constructed from these diary data was organized by age of first use (months, days), as gleaned from Tomasello's appendix. (2) The elicited production study of Goldin-Meadow *et al*. (1976), in which 12 children between the ages of 1;2 and 2;2 were asked to label 30 actions performed live by the experimenters. (3) The checklist study of Tomasello & Kruger (1992), in which the mothers of 24 children (aged 1;9) were given a checklist containing 30 verbs and asked to check off which verbs their children produced. (4) The checklist study of Marchman & Bates (1994), in which the mothers of 1130 children between the ages of 1;4 and 2;6 filled out the MacArthur Toddler CDI (Fenson *et al*., 1994), which contains 103 verbs. (5) An unpublished checklist study from Naigles' laboratory, in which the mothers of 48 children (aged 1;8–1;10) were given a checklist containing 42 verbs, modified from Rescorla, Escarce & Hadicke-Wiley (1993). For each of these four non-diary

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studies, the order of verb acquisition was organized by the percentage of children in each database who produced a given verb.

RESULTS

Database description

Of the 25 verbs for which input characteristics were assessed, 22 appeared in the combined sample of children's speech. There was a total of 432 uses of these 22 target verbs, yielding a mean of 17·36 tokens per verb type (S.D. = 23·64, range = 0–107). Each child produced an average of 6·60 verb tokens (S.D. = 17·04, range = 0–29) and 2·93 verb types (S.D. = 1·91, range = 0–8). This comprises 8·5% of the 5130 child utterances in the extracted corpus, 64% of all verb tokens produced and 25% of all verb types produced. Thus, this database captures much of children's verb use at the beginning of verb acquisition.[2] Table 1 shows how many tokens of each verb type were produced, how many children contributed to each verb's frequency count and the number of narrow frames that were observed to occur with each verb. Notice that, as with the input corpus, each high-frequency target verb in the child speech corpus includes contributions from multiple children (on average, fewer than 2·5 tokens per child per verb). Moreover, even the low-frequency verbs were produced by several children (e.g. 5 children contributed to *need*'s 9 tokens, 3 to *know*'s 7 tokens, and 3 to *jump*'s 4 tokens), and the 15 child contributors to the 9 lowest frequency verbs (*run*, *hear*, *jump*, *know*, *drop*, *give*, *move*, *think*, *pull*) were all different children. That is, the 3 children who produced 'jump' were not the same children as the 3 who produced 'know', all of whom differed from the 2 children who produced 'pull'. Thus, this child speech corpus may be considered to be representative of child speech overall at this stage in language development; it does not reflect the verb use of only a few children.

Because we included diversity of frames used with each verb as a measure of verb acquisition, we also tabulated descriptive data on the diversity of frames in which the target verbs appeared in the corpus of child speech. A central question that these descriptive data address is whether the syntax–semantics correspondences that are characteristic of the target language also appear in child speech. If they do, such a finding supports the argument that acquiring a verb lexicon, at the stage of development under study, includes acquiring the ability to use verbs in their appropriate syntactic environments. To address this question, we categorized the 25 verbs into semantic groups on two independent dimensions, as in Naigles & Hoff-Ginsberg (1995). One dimension concerned whether the verb involved actor-and-patient relations (AAP verbs: *give*, *put*, *take*, *like*, *want*, *pull*, *push*, *lay*), actor-only relations

[2] Only 15 other verbs were produced by at least five of the children; these included forms of *do*, *be*, and *get*, plus *comb*, *cut*, *eat*, *help*, *hide*, *hold*, *play*, *read*, *ride*, *turn*, and *watch*.

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(AO verbs: *come*, *sit*, *go*, *think*, *fall*, *jump*, *look*, *listen*, *lie*, *run*) or relations that could be actor-only or actor-patient (actor-or-patient, AOP verbs: *need*, *drop*, *hear*, *open*, *move*, *see*, *know*). The second dimension divided the verbs according to whether they involved motion or internal states. We then collapsed many of the narrow frames in Table 2 into the three broad frames Transitive (NP, i.e. verb is followed by a direct object), Prepositional Phrase (PP, i.e. the verb is followed by a particle (e.g. *up*) or PP), and Sentence (S, i.e. the verb is followed by a sentence). We calculated the frequency with which each verb appeared in each broad frame, and these frequencies were averaged within each semantic group of verbs. The results, together with those found by Naigles & Hoff-Ginsberg for the adult corpus, are shown in Table 3. Note that one reason that the percentages are so low for the children's sample is that over 40% of the child verb tokens were produced utterance-finally.

TABLE 3. *Syntax–semantics correspondences in adult and child speech*

TABLE 3A. *Mean % of verb uses followed by a NP for verbs in the semantically defined categories of actor-and-patient* (*AAP*), *actor-or-patient* (*AOP*), *and actor-only* (*AO*)

	Verb group		
Speakers	AAP ($N = 8$)	AOP ($N = 7$)	AO ($N = 10$)
Children	59·68	32·07	2·00
Adults	86·84	45·34	0·80

TABLE 3B. *Mean % of verb uses followed by a S for motion and internal state verbs*

	Verb group	
Speakers	Motion ($N = 16$)	Internal state ($N = 9$)
Children	1·60	8·40
Adults	5·80	27·25

TABLE 3C. *Mean % of verb uses followed by a P or PP for motion and internal state verbs*

	Verb group	
Speakers	Motion ($N = 16$)	Internal state ($N = 9$)
Children	27·80	1·50
Adults	49·70	21·28

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Table 3 shows that the children's frame use is very similar to that of the mothers. That is, these children are using direct objects with their transitive verbs more than half the time, but practically never with intransitive verbs. They are using PPs with motion verbs more than with internal state verbs, and sentences with internal state verbs more than with motion verbs (although the overall rates are quite low, making significance tests unrealistic). Thus, even at this early stage of language development, the children are using the verbs in broad frames that follow the standards of the adult language, making similar distinctions between AAP, AO and AOP verbs, and between motion and internal state verbs.

Is frequency of use a valid measure of order of acquisition?

We assessed the validity of our measure of order of acquisition in two steps, first asking whether the other databases available yield a consistent picture and then asking how our measure compares to these others. For the first step, pairwise correlations were performed between all the comparison databases, using only the verbs that each pair of studies had in common. The results (for r^2) are presented in Table 4. With one exception, the orders of verb

TABLE 4. *Across-study correlations* (r^2) *between measures of verb acquisition and early use*

	2	*N*	3	*N*	4	*N*	5	*N*	6	*N*	7	*N*
1. Marchman & Bates	0·41**	16	0·38**	22	0·82***	28	0·15*	39	0·38**	18	0·09	18
2. Tomasello & Kruger			0·81**	7	0·42*	11	0·06	19	0·67*	7	0·34	7
3. Goldin-Meadow *et al.*					0·59***	16	0·035	19	0·54*	9	0·23	9
4. Naigles							0·02	26	0·33*	12	0·04	12
5. Tomasello									0·07	21	0·02	21
6. Hoff-Ginsberg database (tokens)											0·72**	25
7. Hoff-Ginsberg database (syntactic frames)												

N, number of verbs in common between each pair of studies.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.005$.

acquisition that emerged from the different studies were significantly correlated. This is true even when different methods of measuring order (i.e. checklist and elicited production) were employed. The exception was the data from Tomasello's (1992) diary, which correlated significantly with only one other study, namely, the checklist study of Marchman & Bates. Moreover, the value of r^2 for this correlation, 0·15, was modest.

The absence of significant correlations between Tomasello's diary data and

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most of the other studies' checklist and elicited production data can be traced to the large number of verbs in the diary data that had identical ages of acquisition. This occurred because the focus of the diary was on the child's verb combinations, so that the precise age of first use of 17 of the earliest verbs was not recorded. For example, five verbs (*jump*, *fall*, *push*, *bite*, *ride*) are listed as being used in single-word utterances between the age of 1;5 and 1;6; therefore, for the purposes of our analysis, they all had to be given the same age of acquisition. Ties like these severely limit the power of correlational analysis. In the case of the Marchman & Bates (1994) study, the limitation was overcome because these two studies shared data on so many other verbs.

To ask how the present measure of verb use compared with these other, relatively consistent databases, pairwise correlations were performed between each comparison study and the two measures of children's verb use assessed in the present study. As Table 4 shows, the present measure of total number of tokens in a combined sample of children's speech correlates robustly with each of the other cross-sectional studies, although not with the Tomasello diary study. Thus, tapping the prevalence of children's verb use, whether in elicited production, checklists, or spontaneous production, yields a robust and reliable measure which, if the sample is large enough, does correlate with more direct measures of order of acquisition. In contrast, the other measure of verb knowledge in the present study – the number of narrow syntactic frames in which a given verb appeared – was not consistently related to these measures of acquisition. Thus, this measure is not redundant with the frequency of use measure, and is not a measure of order of first use as the other measures are. Rather, the number of frames with which a verb is used appears to reflect another aspect of children's early verb knowledge – a likely possibility is that it reflects the children's DEPTH of knowledge about that verb.

Do the input characteristics of verbs affect child verb use?

Having thus established that the relative frequency with which verbs appear in child speech is an indicator of the order in which children acquire these verbs, we now turn to the question of whether how these verbs appear in input accounts for their appearance in early child speech and thus, by implication, accounts for their order of acquisition. Three characteristics of verb use in input were tested as predictors: (1) total frequency, (2) frequency in final position, and (3) diversity of syntactic environments in which the verbs appeared. These measures were assessed on the basis of the Time 1 mother–child conversations. Two different measures of verb use in child speech were the outcome variables: (1) total frequency and (2) diversity of syntactic environments in which the verbs were used. These child verb use

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measures were assessed on the basis of the conversations which occurred 10 weeks later (Time 2). Our intended analyses also required us to remove the variance in verb use in child speech at Time 2 that could be accounted for by child verb use in the Time 1 conversations; thus, total frequency for each verb was also assessed in the Time 1 child speech sample (Time 1 child syntactic diversity was not assessed separately because at this early stage of development multiword combinations including verbs were vanishingly rare).

The intercorrelations among all the measured properties of input and child speech are presented in Table 5. Every correlation is significant, dem-

TABLE 5. *Intercorrelations among measures of verb use in input and in early child speech* ($N = 25$ *verbs*)

Measure	1	2	3	4	5	6
1. Input frequency (T1)	—	0·78***	0·76***	0·64**	0·89***	0·90***
2. Input final position frequency (T1)		—	0·58**	0·83***	0·85***	0·58**
3. Input syntactic diversity (T1)			—	0·55**	0·79***	0·85***
4. Child speech frequency (T1)				—	0·81***	0·47*
5. Child speech frequency (T2)					—	0·85***
6. Child speech syntactic diversity (T2)						—

*$p < 0·05$; **$p < 0·01$; ***$p < 0·001$ (two-tailed).

onstrating that how verbs appear in input is related to concurrent and subsequent verb use in child speech, but also demonstrating that the predictor and outcome variables are themselves interrelated. This is not so much an empirical finding as it is a logical necessity; in order to appear in multiple syntactic frames a verb must also be produced multiple times. Thus, to specify the variance in each of these measures of verb in the child speech corpus associated with each measured property of verb use in input, two hierarchical regression analyses were conducted.

Both hierarchical regression analyses used predictors from the Time 1 input corpus and outcome measures from the Time 2 child speech corpus. Notice first that these measures of verb use in input and child speech were extracted from different conversations. Thus any relationships found cannot be the result of a common influence of the topic of conversation or reciprocal influences of speakers on choice of words or choice of structures (see Bock, 1990). Moreover, the fact that the measures of input were taken from conversations that occurred 10 weeks BEFORE the conversations from which the measures of child speech were taken allowed us to ask whether the properties of verb use in input caused the subsequent level of verb use in the

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child speech corpus.[3] To test this strong causal hypothesis, though, we first needed to remove from the variance in the input and outcome measures the variance attributable to verb use in child speech at Time 1. Having thus statistically equated all the verbs at Time 1, we could ask whether differences observed at Time 2 were predictable from properties of input at Time 1. Such hierarchical regressions are extremely conservative tests of the influence of input on subsequent acquisition because some of the variance among verbs in the child corpus at Time 1 (removed from the variance to be accounted for at Time 2) quite probably reflects the same, but earlier-occuring, influences of input.

In both hierarchical regression analyses, the total frequency of each verb in the Time 1 child speech sample was entered first, followed by the input measures in the following order: total verb frequency, final position frequency, and, to provide the most stringent test of the syntactic bootstrapping hypothesis, diversity of syntactic environments in which the verbs appeared. Tables 6 and 7 present the R^2, the adjusted for sample size R^2, the change in R^2 with the associated probability at each step in the hierarchical regression, and the beta weight of each variable in the final simultaneous regression. For the dependent measure of frequency in the child speech corpus (see Table 6),

TABLE 6. *Hierarchical regression predicting frequency of verb use in child speech*

	Frequency in child speech corpus (T2)			
Predictors	R^2	Adj. R^2	ΔR^2	Final beta
Child speech total frequency (T1)	0·66	0·65	0·66***	0·30*
Input total frequency (T1)	0·90	0·89	0·24***	0·41**
Input final position frequency (T1)	0·90	0·88	0·00	0·15
Input syntactic diversity (T1)	0·92	0·90	0·02*	0·23*

*$p < 0·05$, **$p < 0·01$, ***$p < 0·001$ (two-tailed).

the results show that the residual variance in child verb frequency at Time 2 after removing effects of child verb frequency at Time 1 is significantly predicted by the verbs' total frequency in the input. Moreover, diversity of syntactic environments in the input is a significant predictor of child verb frequency over and above the effects of input frequency. However, final position frequency in input is not a significant predictor of the residual variance in frequency in the child speech corpus at Time 2.

For the dependent measure of the diversity of syntactic environments in

[3] It is also likely that these particular 10 weeks were a time of rapid language development in our child sample; for example, their mean MLU grew from 1·28 to 1·62 during this period.

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which verbs appeared, a parallel hierarchical regression analysis was conducted with the addition that verb frequency in the child corpus at Time 2 was entered prior to the input predictor variables. The purpose of this was to remove from the outcome measure of diversity variance that was redundant with variance in the frequency outcome measure. After thus removing variance attributable to child verb frequency at Time 1 AND at Time 2 (see Table 7), the results show that frequency in input is a significant

TABLE 7. *Hierarchical regression predicting syntactic diversity of verb use in child speech*

	Diversity in child speech corpus (T2)			
Predictors	R^2	Adj. R^2	ΔR^2	Final beta
Child speech total frequency (T1)	0·22	0·19	0·22*	−0·29*
Child speech total frequency (T2)	0·86	0·84	0·63***	0·68**
Input total frequency (T1)	0·90	0·89	0·04**	0·56**
Input final position frequency (T1)	0·93	0·92	0·03**	−0·33*
Input syntactic diversity (T1)	0·95	0·94	0·02*	0·24*

*$p < 0·05$, **$p < 0·01$, ***$p < 0·001$ (two-tailed).

positive predictor and final position frequency is a significant negative predictor. In addition, after all the variance due to input frequency is removed, the diversity of syntactic environments in which verbs appear in input is a significant positive predictor of the diversity of syntactic environments in which they appear in the child speech corpus.

DISCUSSION

This study investigated the extent to which aspects of the input language (i.e. adult verb use) accounted for the order of children's acquisition of verbs, as measured by verb prevalence and flexibility in a corpus of late Stage 1 speakers' spontaneous speech. We also investigated the validity of measuring the order of acquisition of verbs in terms of the prevalence of those verbs in a sample of children's speech by comparing our spontaneous speech measure with the three other measures that have been used in studies of lexical development. We have four major findings:

(1) With respect to the validity of different ways of measuring order of verb acquisition, we found that when this order is inferred from the relative prevalence of a verb in the vocabularies of many children, the three measures of prevalence – maternal checklists, elicited production and spontaneous speech samples – were all robustly intercorrelated. In contrast, these measures correlated only weakly if at all with the order of first verb use as recorded in the one diary study that provided comparable data. We conjecture that the

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lack of significant relations between the diary data and all the other measures can be attributed to the extremely rapid verb development displayed by the diary's single subject (119 verb types produced by two years of age). Clearly, more research on the order of verb acquisition using the diary method is needed. Still, the robust correlations between all the prevalence measures lead us to suppose that the prevalence of verb use in the spontaneous speech of a sample of linguistically similar children is a valid measure of the order in which children acquire these verbs. Interestingly, our other measure of verb use in spontaneous speech, syntactic frame (or combinatorial) diversity, correlated robustly only with the frequency measure from the same database of spontaneous speech. This finding suggests that children's early FLEXIBILITY of verb use, as measured by their syntactic diversity, while necessarily related to frequency, may not reflect exactly the same aspects of verb knowledge as frequency. As discussed below, we also found that these different measures of child verb use had different predictors in the input.

(2) Our second finding was that the frequency with which verbs appeared in the input was a significant predictor of both measures of child verb use, controlling for the earlier (Time 1) frequency of each verb. That is, the more often a verb appeared in the input, the more often and more flexibly it was used in the child speech corpus 10 weeks later. This finding extends Brown's (1958) original conjecture about the role of input frequency in noun acquisition to the domain of verbs – just as *dog* may be acquired early because it is heard frequently, so *go* may be acquired early because it appears frequently in children's input. Moreover, this finding supports more recent claims that input frequency plays a role in cross-linguistic similarities and differences in the relative timing of early noun and verb acquisition (Choi & Gopnik, 1995; Tardif, 1996; Tardif *et al.*, 1997). We think it is important to point out that the type of input frequency that has been shown to be important in vocabulary acquisition occurs within the OPEN class of words, i.e. nouns, verbs, adjectives, adverbs. In contrast, earlier claims that input frequency could not account for order of acquisition focused on the acquisition of the CLOSED class, i.e. grammatical morphemes (Brown, 1973; Gleitman & Wanner, 1984; deVilliers, 1985; see also Gentner, 1982). Thus, our finding that input verb frequency predicts subsequent child verb use further supports the notion that frequency plays a role in the acquisition of intrinsically meaningful, as opposed to grammatical, lexical items.

(3) Our third finding was that the positional salience of a verb in the input was a negative predictor of subsequent child verb flexibility of use, but not a predictor at all of the child verb frequency of use. That is, the more often a verb appeared in utterance-final position in the input, the FEWER different syntactic frames it appeared in the child speech corpus 10 weeks later. We conjecture that this negative correlation is rooted in the fact that verb uses in utterance-final position provide only the null syntactic frame as a model.

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That is, there is next to no syntactic information in the null frame for the child to use in constructing her own frames for the verb. If she only hears the verb bare, how is she to know that it can appear with prepositional phrases, complements and the like? In the extreme, this finding suggests that if a verb were heard only in the null frame, it would be used by the child with great frequency but little syntactic elaboration. And if there were several such verbs heard only in utterance-final position, a syntactic bootstrapping approach might predict that these verbs would be relatively difficult for the child to distinguish.

Why didn't frequency of utterance-final position in the input predict subsequent child verb frequency of use? This finding is at odds with that of Tardif *et al*. (1997, see also Goldfield, 1993; Smiley & Huttenlocher, 1995), who found that languages in which the utterance-final position is often filled by a verb tend also to be languages whose child learners produce, early on, more verbs relative to nouns. However, it is possible that the salience of the utterance-final position is most important for early word acquisition, when the child's task is to extract lexical items from running speech. Thus, for example, input final position frequency at some time prior to our Time 1 might be found to predict child verb frequency of use at Time 1. During the period from Time 1 to Time 2, the children whose speech composed our corpus might have become more adept at recognizing somewhat familiar verbs in other utterance positions, so that final position frequency plays less of a role.

(4) Our fourth finding was that the diversity of syntactic environments with which verbs appeared in the input was a significant and positive predictor of subsequent child verb frequency and syntactic diversity. This finding supports the multiple frames tenet of syntactic bootstrapping, that the more frames in which a verb is heard, the more distinctive it will be from other, related verbs, and the earlier (or more easily) it will be acquired (Landau & Gleitman, 1985; Gleitman, 1990; Naigles & Hoff-Ginsberg, 1995; Naigles, 1996). It also corroborates de Villiers' (1985) earlier findings in the domain of morphological development, that the variety of verbs with which mothers used grammatical morphemes such as *-ing*, *-ed* and auxiliary verbs predicted the frequency and variety with which their children used those morphemes. Furthermore, we found that children's verb uses closely matched the maternal syntax–semantics correspondences with the broad frames: verbs involving agent–patient relations appeared with direct objects more than other types of verbs, verbs involving motion appeared with PPs and verbs involving internal states appeared with sentences. The sparsity of narrow frames used by the children at this early point in their development (recall that over 40% of their verb uses were utterance-final) made the question of the similarity of maternal and child narrow frame diversity moot.

Taken together, these findings provide evidence of increasingly specific

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effects of the linguistic input on children's acquisition of verbs. That is, beyond the banal point that input MUST influence children's acquisition of verbs (because, e.g. the sound sequence [se] means *know* in French and *say* in English), these results tell us that particular factors in the input influence the order in which children acquire many of their verbs. As such, while our findings do not rule out a role for conceptual development and/or social interaction in an account of why some verbs are learned before other verbs, they do demonstrate that a full account must include a significant role for the child's linguistic input. The specific effects of the input also tell us what aspects of the input the child verb learner at this stage of development is attuned to – input frequency, as Brown (1958) and others have predicted, utterance-final position, as Smiley & Huttenlocher (1995) and Tardif *et al.* (1997) suggested, and syntactic frame diversity, as predicted by the multiple frames tenet of the syntactic bootstrapping hypothesis. In particular, these findings provide the first direct evidence that young children are paying attention to verbs' syntactic diversity in the course of their acquisition of conventional (as opposed to nonsense) verbs. That is, not only can children exploit the semantic implictions of multiple syntactic frames in the one-time experimental context of learning the referent of a nonsense verb (i.e. Naigles, 1996), but they can also take advantage of such syntactic diversity in the real-time naturalistic context of acquiring a lexicon of English verbs.

Finally, these findings give us some intriguing hints about what the child verb learners in our study used these input factors for; that is, what they learned about verbs from their input frequency, positional salience and syntactic frame diversity. From hearing some verbs used very frequently, the children may have learned enough about the verbs to use them frequently themselves. Moreover, the frequent hearings, especially in syntactically diverse utterances, appeared to have led the children to create more syntactically flexible verb entries as well – not just to produce the verbs more often. It is as if hearing particular verbs used more frequently and diversely led the children to a richer and more flexible understanding of those verbs.

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