

Young Children's Imitation of Sentence Subjects: Evidence of Processing Limitations

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Elicited imitation was used to determine whether young children's inconsistent production of sentence subjects was due to limitations in their knowledge of English or in their ability to access and use that knowledge. Nineteen young children (age range = 1 year 10 months to 2 years 8 months; Mean Length of Utterance [MLU] range = 1.28 to 4.93) repeated sentences that varied in length, structure, and type of subject. A competence-deficit hypothesis would predict that children below MLU 3 would differentially omit expletive subjects and subjects preceded by a discourse topic more often than children above MLU 3. That hypothesis was disconfirmed. A performance-deficit hypothesis would predict that children below MLU 3 would omit more subjects from long sentences than short ones, and that the high-MLU children would not show a length effect. That hypothesis was confirmed. Processing limitations, rather than a defective grammar, explain very young children's absent subjects.

The relation between children's knowledge of the syntax of their language and their ability to use and access that knowledge—the relation between competence and performance—has been studied in several domains. The domain at issue here is children's knowledge of the status of subjects in their language. Languages like English require overt subjects in order to be grammatical, but languages like Italian and Chinese do not require overt subjects. Thus, in English, the declarative in 1) is ungrammatical, but its equivalents in Italian and Chinese are fully grammatical.

1) Like grass

Languages like English that require overt subjects are often referred to as non-null subject languages, whereas languages like Italian and Chinese are referred to as null subject languages. In the principles-and-parameters framework adopted here, the "null" subject is *pro* (pronounced "little pro"), an abstract subject that is not overtly realized but has most of the properties

of pronouns. In Italian and Chinese, *pro* is a possible subject, whereas in English it is not. That basic variation between language types is conceptualized as two different values of the null subject parameter. Parameters are linguistically significant core dimensions that characterize the world's languages (Chomsky, 1981). Each parameter has (at least) two possible values. The basic syntax of a given language thus consists of a set of parametric values (plus the absolute universals).

Parameters have entailments. One entailment of the non-null setting of the null subject parameter is the presence of expletive (nonreferential) subjects like *it* and *there*. In null subject languages like Italian and Spanish, expletives do not exist. Italian has no equivalent for the *it* and *there* in sentences 2) to 4). (The Italian clitic *ce* is not an expletive.)

- 2) It seems quiet in here
- 3) It's raining today
- 4) There are turtles in the lake

In non-null subject languages expletives exist (as it were) because the subject position must be occupied by an overt Noun Phrase (NP), whether that NP refers to anything or not. In null subject languages all overt subjects are referential. (There is some dispute about whether expletives are universally absent from null subject languages, but the possible exceptions are not well-attested.) One complication for the child, however, is that casual American speech allows the absence of expletive subjects. For example, 5) and 6) are not uncommon in conversation.

- 5) Seems quiet in here
- 6) 'S raining today

Another parametric entailment concerns the role of discourse in languages like Chinese, where the null subject is syntactically linked to a topic that has been established in the discourse (Huang, 1984). Chinese, unlike Romance null subject

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languages, has no inflection at all. The linkage between a topic and a subject allows a null subject to be identified.

Here, too, there is a complication for the child. All speakers, regardless of language, may occasionally omit the subject if a topic has been established, for pragmatic rather than syntactic reasons. That is, American adults might also tend to use a subject less if a topic has been established, for pragmatic reasons of the sort Greenfield and Smith (1976) have articulated, rather than because a topic is syntactically linked with null subjects.

Children who are near the onset of combinatorial speech, roughly ages 1 year 10 months (1;10) to 2 years 3 months (2;3) are inconsistent in their use of subjects, even in English, which requires overt subjects. The question is why. The present experiment uses elicited imitation to determine whether young English speakers are inconsistent because their grammars are incorrect, or because their performance systems are too limited to allow the full expression of their knowledge. We hypothesize that children's inconsistencies in subject inclusion will be best accounted for by performance limitations.

Hypotheses

Competence-Deficit Hypotheses

Some researchers (Hyams, 1986, 1992; Hyams & Wexler, 1993; Lillo-Martin, 1994) have taken American children's inconsistent usage of subjects to reflect a lack of knowledge, or a competence deficit, on the child's part. Hyams (1986), for example, claimed that at the outset of development, the American child has the null subject parameter set to the wrong, null, value, so that his or her grammar is like Italian or Chinese rather than English. American children are thus seen as having a competence deficit that allows *pro* in their grammar. Following Valian (1991), we refer to this account as the *pro* hypothesis. In a related analysis, American children's (and adults') subjectless utterances have a null constant as their subject (Rizzi, 1994). The null constant is different from *pro*, but its identity is recovered from preceding discourse. Very young children overuse the null constant.

A different competence deficit—referred to as the VP hypothesis because the child has no phrasal categories higher than the Verb Phrase (Valian, 1991)—has been suggested by Guilfoyle and Noonan (1992) and Radford (1990). They suggested that all children's grammars are initially limited in what kinds of categories they contain. They also suggested that children have the lexical categories of noun, verb, adjective/adverb, and preposition, but lack the functional categories of determiner (e.g., *a* and *the*), tense, infinitival *to*, modals (e.g., *can* and *will*), and complementizers (e.g., the *that* of "I thought that she liked bananas"). According to the VP hypothesis, one consequence of the lack of functional categories is inconsistent use of subjects. Once functional categories emerge, subjects become consistent. In a related hypothesis, American children's lack of subjects is specifically linked to an absence of tense (Roeper & Rohrbacher, 1995).

Performance-Deficit Hypotheses

In contrast to the two competence-deficit hypotheses just described are performance-deficit hypotheses. Several researchers

(L. Bloom, 1970; P. Bloom, 1990, 1993; Gerken, 1991; Nuñez del Prado, Foley, Proman, & Lust, 1993; Valian, 1991, 1994) have argued that even very young English-speaking children understand that English requires subjects; children's inconsistent use of subjects reflects processing limitations, or a performance deficit. Very young children use subjects inconsistently because of limitations on how much they can remember and plan at one time (but see L. Bloom, Miller, & Hood, 1975, for a different explanation).

There are two possible explanations of why children's performance limitations become less severe over time. The first possibility is that children's overall working memory capacity increases with development, but Chi (1978) has argued that apparent development in working memory capacity reflects other factors, such as improved knowledge in particular domains and the greater use of efficient mnemonic strategies. A second possibility is that children's ability to make use of a fixed memory capacity increases. Case and his colleagues (Case, Kurland, & Goldberg, 1982), for example, claim that developmental increases in memory span reflect the fact that basic cognitive and perceptual processes increase in speed and accuracy. Because less processing space is then required, effective attentional capacity is increased.

When this conception of development is applied to children's use of subjects, it predicts that utterance planning and production will become more automatic with experience (see also L. Bloom, Miller, & Hood, 1975). With development, speech production will require less and less attentional supervision and be less and less subject to interference from other, concurrent tasks. Consequently, the child's effective working memory will increase. That in turn will allow the child to include subjects and other required elements in his or her productions with greater consistency, thus more fully expressing the grammatical knowledge that underlies his or her speech.

Data

Existing Data on Competence Deficits

Previous research on children's understanding of subjects has primarily examined children's natural productions, but has also included elicited imitation. The fullest comparative production data yielding numerical estimates of subject use are presented by Valian (1991), who compared cross-sectional speech of 21 U.S. (henceforth, American) children with longitudinal speech of 6 Italian children. American children aged 1;10 to 2;2, with a Mean Length of Utterance (MLU) between 1.5 and 2.0 morphemes, used subjects much more often than did Italian children at a roughly comparable point of acquisition. The very-low-MLU American children used subjects in just under 70% of their (nonimitative and nonimperative) utterances with verbs; their Italian peers used subjects 30% of the time. Recent data on comparable children learning Portuguese (also a null subject language) show subject use 28% of the time (Valian & Eisenberg, in press). Chinese, Japanese, and Korean are all null subject languages. Data on Chinese children (Wang, Lillo-Martin, Best, & Levitt, 1992), Japanese children (Mazuka, Lust, Wakayama, & Snyder, 1986), and Korean children (Kim, in press) show that those children, like Italian and Portuguese-speaking children, produce subjects less often compared with American

children. Children's speech thus reflects the characteristics of their target language even at the outset of production.

Valian's (1991) 2-year-old Americans with low MLUs—between two and three—used subjects just under 90% of the time. Those with high MLUs—above three—all used subjects more than 90% of the time, which is the adult level. Children from other language groups also gradually approach the adult level, which is greater than their initial level.

Elicited imitation has also been used to examine cross-linguistic differences. Nuñez del Prado et al. (1993) contrasted American and Puerto Rican children's imitation of redundant NPs in coordinate (7) and subordinate (8) structures. Because of the complexity of the sentences, there were few young 2-year-olds in the sample, but the data are suggestive.

7) Mickey sneezes and Mickey whistles

8) Pluto sneezes when Pluto wakes up

The question of interest was how the children would treat the second NP. Both English and Spanish allow the second NP to be dropped in a coordinate structure like 7), but only Spanish allows the second NP to be dropped in a subordinate structure like 8). The American children differentiated between the two sentence structures and seldom replaced the second NP in 8) with an empty subject, in contrast to the Puerto Rican children.

In two areas, production data have been nonexistent or partial: children's knowledge of expletives and children's understanding of the role of discourse. Hyams (1986), analyzing the data of three children, claimed that the children's speech switched from never including expletive subjects to including expletives; the switch was reported to occur at the same time that the children began using subjects consistently. Valian (1991), however, failed to confirm that finding in her analysis of 21 children. All the children, regardless of MLU and frequency of subject usage, infrequently used contexts that would require expletives. Overt expletive use was scattered across the MLU range from 1.5 to 4.0, and rare at every MLU. There was no suggestion of a linkage between rate of subject use and the presence of expletives. Subject use as a function of discourse has never been analyzed for English-speaking children.

Finally, there is much dispute concerning children's early knowledge of inflection, and little quantitative data are available. Valian (1991) concluded that children above MLU 3 showed full knowledge of inflectional elements, children above MLU 2 showed at least partial knowledge, and children under MLU 2 varied. Two of the 5 children she observed who were below MLU 2 showed little if any knowledge of inflection. The other 3 showed partial knowledge.

Existing Data on Performance Deficits

Production data from American children have directly implicated performance limitations. L. Bloom (1970), analyzing one child's utterances with the verb *make*, found that subjects were more likely to be absent with longer VPs. L. Bloom (1991) has suggested that "children omit the subject (or some other sentence part) when their cognitive processing abilities are exceeded, for example, when they use new verbs, nouns, or pronouns or add negation or attribution to the sentence" (p. 25). P. Bloom (1990) similarly proposed that longer VPs increased cognitive load and thereby decreased the likelihood of a subject.

Analyzing the speech of three children, he found that they produced the shortest VPs with a full lexical NP as subject (e.g., *the girl*), the next longest with a pronominal subject (e.g., *she*), and the longest if they used no subject. Valian (1991) found that same pattern dominant in children under MLU 3 ($n = 10$) and infrequent in children above MLU 3 ($n = 11$), as would be expected if children are most limited in processing at the earliest stages of acquisition.

Using an elicited imitation technique, Gerken (1991, 1994) examined the effects of metrical structure on omission of subjects and other constituents. In an experiment with 18 American children ranging in MLU from 1.25 to 3.74, Gerken (1991) found that the children included subjects in about 80% of their imitations. Children's imitations of targets with pronominal subjects were less likely to include a subject than their imitations of targets with full lexical subjects (e.g., *Pete or the bear*). Gerken explained that result as the interaction of performance limitations and preference for a particular metrical pattern. Children prefer a structure in which the initial syllable is stressed; since sentence-initial pronouns are unstressed, children produce pronouns less often than full lexical NPs. Similar results were obtained by McGregor and Leonard (1994).

Gerken's (1991) result is an example of evidence that complements, rather than converges with, the spontaneous speech data. It is even in apparent contradiction to the production data. Those data show both that a majority of the subjects American children produce are pronominal (Valian, 1991) and that pronominal subjects are apparently less "costly" than full lexical NPs, in that they are associated with longer VPs (P. Bloom, 1990; Valian, 1991). At the same time, however, pronominal subjects in spontaneous speech increase as a function of MLU, and children of all languages (null subject as well as non-null subject) appear to increase their production of pronominal subjects during development (L. Bloom, Lightbown, & Hood, 1975; Valian, 1994; Valian & Eisenberg, in press), suggesting that pronominal subjects pose problems.

Further evidence of difficulties with pronominal subjects comes from studies by Read and Schreiber (1982) and Ferreira and Morrison (1994). They reported that children aged 5 and older have more difficulty identifying and repeating a pronominal subject than a lexical subject. The children tend to include the verb along with the pronoun.

It is possible to resolve the apparent contradiction by considering yet another datum. In both null and non-null subject languages studied thus far, lexical NP subjects are roughly constant over development; the reduction in empty subjects is accomplished by the increased production of pronominal subjects (Valian & Eisenberg, in press). Lexical NP subjects, despite their cost, do not increase across development for two reasons. A minority of contexts require them, and, to satisfy communicative demands, children early produce them in the required contexts.¹

Testing Competence- and Performance-Deficit Hypotheses

The present elicited imitation experiment was designed both to replicate previous production and elicited imitation findings

¹ We are grateful to L. A. Gerken and an anonymous reviewer for suggesting a similar line of argument.

and, more importantly, to test predictions of competence- and performance-deficit hypotheses that have not been tested before. By replicating previous findings (such as the finding from the production literature that production of verbs is highly correlated with production of subjects and the finding from elicited imitation literature that children repeat pronominal subjects less often than full lexical subjects), we can determine where tasks yield converging evidence. But our focus is on what differentiates children who produce subjects inconsistently from those who produce subjects consistently. Is it competence, performance, or both?

The evidence reviewed earlier shows that 2-year-old American children above MLU 3 know that English requires subjects, that their grammars include the inflectional elements *to*, *-ed*, and modals, and that they have fewer processing limitations than children below MLU 3. At issue is the competence and performance of children below MLU 3. We examine children in both MLU groups. If a competence-deficit hypothesis is correct, the children in the two MLU groups should differ on those measures that test competence. If, as we propose, a performance-deficit hypothesis is correct, the children in the two groups should differ on measures that test performance but look similar on competence measures.

The "Chinese" form of the *pro* hypothesis and the null constant hypothesis, for example, should predict that low-MLU children (below MLU 3) are influenced by the presence or absence of a prior topic, but high-MLU children (above MLU 3) are influenced much less. In spontaneous speech, it is difficult to set up criteria for the presence of a prior topic that is recognized as a topic by the child. In elicited imitation, one can formally establish a topic and then ask the child to imitate a sentence concerning that topic. What is crucial for the argument that low-MLU children have a different grammar from high-MLU children is the demonstration that only low-MLU children omit subjects more when a topic is provided. We predict otherwise, that both MLU groups will be affected by a topic to the same degree. Either both groups will show an effect of topic or neither group will. The importance of the high-MLU group is clear. With only a low-MLU group, a finding that subjects are less likely to be repeated if a topic is present could be interpreted as evidence of an incorrect grammar. But if the high-MLU group shows the same effect, even though that group has the correct grammar, the low-MLU group's behavior must receive a different interpretation.

To take a second example, the *pro* hypothesis should predict that low- but not high-MLU children will have more difficulty imitating expletive pronouns than referential pronouns. As mentioned, spontaneous production data concerning expletives are sparse. Elicited imitation can compensate for the lack of spontaneous speech data to provide a test. The reasoning is the same as for the role of topic. If low-MLU children use subjects inconsistently because their grammar includes *pro*, only they will omit the expletives in sentences like 2) to 4). The high-MLU children will include expletives. Unless that sort of interaction is found, the competence-deficit claim has no empirical backing. As with topic, we predict that both MLU groups will behave similarly. Either both groups will omit expletives more than referential pronouns or neither group will. We favor the former alternative, because both groups are likely to be at-

tuned to the adult input, which suggests that expletives are more "omittable" than referential pronouns.

Elicited imitation can also allow examination of the VP hypothesis and the hypothesis linking subjects and tense. Children who lack inflection should be unable to reproduce the past tense, modals, or infinitives, since all those elements are inflectional. The VP hypothesis should predict the absence of inflectional elements in the imitations of children below MLU 2. In addition, since the VP hypothesis proposes a link between consistent subject use and lack of inflections, it should also predict that children who inconsistently imitate subjects, regardless of their MLU, should imitate few if any inflectional elements. Our stimuli allow us to test those hypotheses.

In addition to examining competence-deficit hypotheses, we examine performance-deficit hypotheses. On the assumption that length adds cognitive load, we predict that low-MLU children will imitate the subjects of "short" targets more than "long" ones. In contrast, high-MLU children will be relatively unaffected by target length, because they are less subject to performance limitations. The performance account accordingly predicts an interaction, in which length effects are largely confined to low-MLU children.

Although our materials were not specifically designed to test a metrical explanation of children's omissions, they do allow testing of the basic finding that pronominal subjects are omitted more often than lexical subjects (Gerken, 1991). We have also derived predictions from a metrical account so that its applicability to a wider set of sentences can be tested.

In summary, the present experiment was designed to examine children's imitations of pronominal and lexical subjects in a variety of sentence structures and in targets of different lengths. By including two groups of children, those below MLU 3 and those above MLU 3, we could determine which aspects of subject use change as a function of development and which are constant across the MLU range examined. By using children above MLU 3 as a competence benchmark, we could evaluate the behavior of the children below MLU 3. Given previous research, we predicted that children above MLU 3 would repeat subjects more often than would children below MLU 3 but that the total pattern of data would be best explained by appeal to increased performance capacity.

In the present experiment, children imitated sentences in five different categories. Category 1 examined the role of topic; Category 2 examined expletive subjects; Category 3 examined infinitives; Category 4 examined modals; Category 5 examined past tense. In each of Categories 3 to 5, half the subjects were pronominal and half were lexical. Sentences varied in length within each category.

Method

Children

Nineteen 2-year-olds were recruited through day-care centers, nursery schools, and personal contacts. All children were White, with middle- to upper-middle-class parents. The children's mean age was 27 months ($SD = 3.15$); ages ranged from 22 to 32 months. The children's mean MLU (see below for calculation) was 3.06 ($SD = 0.90$); MLUs ranged from 1.28 to 4.93. The children were originally selected by age, to form a younger ($M = 2;0$) and older ($M = 2;6$) group, but a subsequent correlational analysis (see Table 1) showed that MLU correlated

more strongly with subject imitation rate than did age. With age partialled out, MLU correlated .58 with subject imitation ($p < .02$). With MLU partialled out, age correlated more modestly with subject imitation ($r = .44, p < .07$). We therefore divided the children by MLU. Nine children were below MLU 3.0, with a mean MLU of 2.34 (range = 1.28–2.9) and a mean age of 2;3 (range = 1;10–2;7); 2 children were below MLU 2, and 7 were between MLU 2–3. Ten children were above MLU 3.0, with a mean MLU of 3;71 (range = 3.05–4.93) and a mean age of 2;4 (range = 2;0–2;8); 6 children were between MLU 3–4, and 3 were above MLU 4.

Stimuli and Comparisons Among Stimuli

Thirty target sentences were presented to the child to imitate. They consisted of six tokens of five structures: topic, expletive, infinitive, modal, and past tense. Sentences varied in length from 2 morphemes ("Like grass") to 10 morphemes ("The girls loved those little dolls"). Proper names were never used for subjects or objects. The complete set of sentences is shown in the Appendix.

Topic. For topic sentences only, line drawings were used; for all other categories, the child simply heard the target sentence. Of the six topic sentences, three targets included a subject (two pronominal and one lexical) and three did not. We compared imitation of the three topic sentences with subjects with imitation of the sentences in infinitive, modal, and past tense. The three that did not include a subject were used to determine whether children would ever insert a subject that was not present in the target and were not otherwise included in analyses.

The experimenter preceded each target sentence by saying "See the x?" and pointing to a line drawing that illustrated the subject of the sentence. The drawing did not illustrate the events in the sentence. For example, for the sequence "See the man? The man plays games," the experimenter first showed the child a line drawing of a man's head. The man was not playing and no games were shown. The drawing remained visible while the experimenter read the two-sentence sequence. The intention was to establish the content of the drawing as the topic. We also wanted to ensure that the second sentence presented something new to

say about the topic, so that the child would find the predicate pragmatically worth repeating.

Expletive. Of the six expletive sentences, four used *it* as the subject, and two used *there*, as illustrated in 2) to 4). We compared imitation of subjects in the expletive category with imitation of pronominal subjects in the infinitive, modal, and past tense categories.

Infinitive. In the six infinitive sentences, the infinitive always had as its implicit subject the subject of the main clause (e.g., in "The dog needs to chew bones," the implicit subject of chew is "the dog"). We examined how often the children's attempts included both verbs in their imitation and how often they included *to* if both verbs were present.

Modal. In the six modal sentences, three modals appeared in present tense (*can* and *will*) and three appeared in past tense (*could*, *would*, and *should*). We examined how often the children's attempts included a modal and how often the children included a subject if the modal was present versus absent.

Past tense. In the six past tense sentences, a regularly inflected main verb was used. For the sentences in the other categories, the main verb was either in present tense or untensed (because it was preceded by a modal). We examined how often the children's attempts included the tense and how often the children included a subject if the tense was present versus absent.

Procedure

A session with a child lasted approximately 30–45 min. The experimenter introduced himself or herself to the child, brought out a Richard Scarry (1963/1991) book (*Richard Scarry's Best Word Book Ever*), and used the book to develop rapport with the child and gather spontaneous speech so that MLU could be calculated. After approximately 20 min of conversation, the experimenter introduced the imitation task as a game in which the child was to say what the experimenter said. This procedure worked well. Overall, children attempted to imitate 92% of the targets (see Table 1).

The six topic sentences were presented to the child first, followed by the remaining 24 sentences in a different random order for each child. The topic sentences were presented first because, being accompanied by pictures, they served as a bridge between the earlier activity of discussing scenes in the picture book and the later activity of imitating sentences without any pictorial support.

Of the six topic sentences, the three topic sentences that included a subject were presented first, in random order, followed by the three

Table 1
Correlations Among Mean Length of Utterance (MLU); Age; Verb, Subject, Pronominal, and Lexical Imitation Rate; Response Rate

Variable	1	2	3	4	5	6	7
1. MLU	—	.48*	.58**	.70****	.71****	.43	.37
2. Age		—	.54*	.61***	.60**	.18	.29
3. Verb rate			—	.92****	.75****	.63***	0
4. Subject rate				—	.91****	.60**	.16
5. Pronominal rate					—	.37	.37
6. Lexical rate						—	-.28
7. Response rate							—
<i>M</i>	3.06	2;4*	0.81	0.76	0.76	0.90	0.92
<i>SD</i>	0.90	3	0.17	0.22	0.26	0.12	0.10
Range	1.28–4.93	1;10–2;8*	0.47–1.0	0.28–1.0	0–1.0	0.63–1.0	0.63–1.0

Note. Verb = percentage imitations including a verb; subject rate = percentage imitations including a subject; pronominal rate = percentage of pronominal subject targets imitated; lexical rate = percentage of lexical subject targets imitated; response rate = percentage targets imitated.

*Age is presented in years and months (years; months).

* $p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.

strings that did not include a subject (e.g., "See the moon? Shines at night"), also in random order. We used that order because pilot work suggested that children were confused if, by chance, they were presented with a subjectless sequence as the first item.

If a child did not imitate a target sentence, the experimenter repeated it once. If the child still did not imitate the target, the experimenter continued with the remaining targets and returned to the unimitated target after all the other targets had been imitated. Thus, a child could hear a sentence a maximum of three times.

Scoring

For most measures the denominator was the number of imitations attempted by the child and the numerator was the number of times the imitation included the element being measured. For example, to compute percentage of subjects in a given stimulus category type, the denominator was the number of intelligible attempted imitations (usually out of a possible six), and the numerator was the number of subjects. In the few cases in which an unintelligible sound occurred in the correct location for the subject, we scored an absent subject.

Below we present details on the calculations for response rate, subject imitation rate, and subject imitation as a function of target sentence length. Other details are presented as appropriate in the Results section.

Response rate. The numerator was the number of attempted imitations; the denominator was the number of targets presented. The children's overall response rate was 92% ($SD = 10$), with a range from 63% to 100%. As Table 1 shows, response rate was not correlated with age, MLU, or subject imitation. An analysis of variance (ANOVA) with MLU as the between-subjects variable and sentence category as the within-subjects variable also yielded no main effects and no interaction. Children in both MLU groups responded at a high rate, and equally so for each category.

Subject imitation rate. The numerator was the number of imitations with subjects; the denominator was the number of attempts. To be credited with a subject, no target item other than the subject was necessary. If the child substituted a different subject for the target subject, the subject was scored as present, but only if a verb or object was also present in the imitation. That additional criterion was necessary to be sure that the substitution was a substitution for the subject and not the object or adjunct. Four of the children below MLU 3 made such substitutions an average of 10% of the time, and 6 of the children above MLU 3 made substitutions an average of 8% of the time. Substitutions were almost always another lexical NP for a lexical NP, and a pronoun for a pronoun. Across all children, a lexical NP was reduced to a pronoun twice, and a pronoun was expanded to a lexical NP once.

Subject imitation rate as a function of target length. To determine whether there was a relationship between target length and subject imitation rate, we compared the percentage of subjects in short targets versus long targets for infinitives, modals, and past tense. Sentence category was ignored. One comparison used morphemes: short targets (7) were 3 to 5 morphemes; long targets (11) were 6 to 10 morphemes. Pronouns were the subjects in 4 of the 7 short targets, and in 5 of the 11 long targets. The other comparison used syllables: short targets (10) were 3 to 5 syllables; long targets (8) were 6 to 8 syllables. We also compared how often the children included a subject if their own VPs contained one, two, three, or four morphemes.

Analyses

We conducted ANOVAs using participants as the random effect (F_1), and in some cases we also used items as the random effect (F_2). In reporting the results, we rounded all percentages, standard deviations, and mean square errors to the nearest digit. We expected that pronouns and lexical subjects would not behave identically and that short and long sentences would not behave identically. But with six items per category,

subdivisions were generally not feasible. Thus, we only conducted item analyses when they seemed meaningful.

Results

The results are divided into four sections. The first presents overall data relevant to previous findings. The data converge well with previous studies and thus demonstrate the validity and utility of a paradigm like elicited imitation. The second section presents data testing our hypothesis that children's failure to include subjects is due to processing limitations rather than to a grammar that allows null subjects; the data support our hypothesis. The third section presents data testing the VP hypothesis and a link between subjects and inflections. Here the data show that there is no link between production of inflectional elements and inconsistent production of subjects. The final section presents data relevant to the metrical hypothesis and concludes that a metrical explanation is at best a partial account of children's subject omissions.

Replications of Previous Findings

From previous work on spontaneous speech (Valian, 1991), we expected that MLU and age would correlate with each other, that MLU and age would correlate with imitation of verbs and imitation of subjects, and that verb imitation rate would correlate with subject imitation rate. All those relations were found, as Table 1 shows. From previous work with elicited imitation (Gerken, 1991), we expected that children would imitate pronominal subjects less often than lexical subjects. That result was also replicated. Details of the analyses follow.

Correlations among variables. We computed correlations among age, spontaneous speech MLU, verb imitation rate, subject imitation rate, and pronominal subject imitation rate. For verb imitation rate the denominator consisted of all attempted imitations and the numerator consisted of imitations with a verb; sentence category was ignored. For subject imitation rate the denominator again consisted of all attempted imitations and the numerator consisted of imitations with a subject. Similar proportions were used to calculate lexical and pronominal subject rate.

Table 1 shows summary data for the variables and a correlational matrix for the simple Pearson product-moment correlations. As expected, older children had higher MLUs ($r = .48$, $p = .036$). Older children also tended to imitate verbs at a higher rate compared with younger children ($r = .54$, $p = .017$) and to imitate subjects more often ($r = .61$, $p = .005$). MLU correlations were stronger. High MLU children tended to imitate verbs at a higher rate than low MLU children ($r = .58$, $p = .009$) and tended to imitate subjects more often ($r = .70$, $p = .001$). As can be seen in Table 1, verb imitation rate was strongly correlated with subject imitation rate ($r = .92$, $p < .001$). Even with age and MLU partialled out, verb imitation rate continued to be highly correlated with subject imitation ($r = .87$, $p < .001$).

Subject imitation rate. The percentage of subjects in each of the six sentence categories was calculated for ANOVAs with MLU and sentence category as variables. For F_1 , MLU was the between-subjects variable and sentence category was the within-subjects variable; for F_2 , MLU was the within-subjects

variable and category was the between-subjects variable. Overall, subjects were imitated 75% ($SD = 28$) of the time. As expected, children below MLU 3 (63%, $SD = 29$ vs. 87%, $SD = 21$), $F_1(1, 16) = 7.43$, $MSE = 1,766$, $p < .02$; $F_2(1, 22) = 39.69$, $MSE = 207$, $p < .0001$. There was also a strong effect of category for $F_1(4, 64) = 7.84$, $MSE = 278$, $p < .0001$, and a slightly weaker effect for $F_2(4, 22) = 2.68$, $MSE = 390$, $p < .06$. There was no interaction between MLU group and sentence category. As can be seen from Table 2, topic sentences and expletives were least likely to include a subject. The individual means are shown in Table 2. Infinitives, modals, and past tense were higher and roughly equal.

We were unable to examine through ANOVAs imitation of subjects as a function of the presence of inflectional elements because we had too few data points to conduct a meaningful analysis. In the case of modals, 6 children included a modal only once, 6 omitted a modal only once, and 3 never omitted a modal. A similar condition held for the past tense. Three children included the past tense only once, 6 omitted it only once, and 3 either never included or always included the past tense.

Pronominal versus lexical subjects. Previous elicited imitation work (Gerken, 1991) found pronominal subjects less often repeated than lexical subjects. To verify that finding, we compared how often the children repeated referential pronominal subjects (pooling data in categories infinitive, modal, and past tense) versus lexical subjects (in the same categories). We performed ANOVAs with MLU and subject type (lexical vs. pronominal) as variables. In this analysis, children imitated 83% ($SD = 21$) of subjects. Table 3 displays the data.

As expected, there was a main effect of MLU, with children below MLU 3 repeating 72% ($SD = 25$) of subjects and children above MLU 3 repeating 93% ($SD = 10$) of subjects, $F_1(1, 17) = 14.12$, $MSE = 298$, $p < .003$; $F_2(1, 16) = 25$, $MSE = 166$, $p = .0001$. There was also a main effect of subject type, with lexical subjects being repeated more often (90%, $SD = 11$) than pronominal subjects (76%, $SD = 26$), $F_1(1, 17) = 9.65$, $MSE = 229$, $p < .01$; $F_2(1, 16) = 9.12$, $MSE = 209$, $p < .01$.

Finally, there was an interaction between MLU group and subject type, $F_1(1, 17) = 6.34$, $MSE = 229$, $p < .03$; $F_2(1, 16) = 9.34$, $MSE = 166$, $p < .01$. As Table 3 shows, only the children below MLU 3 repeated pronominal subjects (58%) less often than lexical subjects (86%); children above MLU 3 repeated the two types of subjects equally often (92% vs. 95%). The MLU groups differed little in their repetition of lexical subjects (86% vs. 95%).

Tests of the Performance Hypothesis Against the "pro" Hypothesis

The performance-deficit hypothesis predicts that the two MLU groups will perform similarly on comparisons involving competence but will perform differently on comparisons involving performance. We accordingly predicted that if topic contributed to lower use of subjects, it would do so equally for both MLU groups. Similarly, if expletives were produced less often than referential pronouns, perhaps because of regularities in adult speech, the difference should be equivalent for the two MLU groups. In contrast, length should be a factor for the low-MLU group but not the high-MLU group. All three predictions were confirmed.

Subject imitation as a function of topic. We compared repetition of subjects in topic sentences (the three targets that contained a subject) with repetition of subjects in the infinitive, modal, and past tense categories (pooled). As Table 4 shows, children below MLU 3 used subjects less often than children above MLU 3 (62% vs. 85%), $F_1(1, 16) = 7.97$, $MSE = 600$, $p < .02$; $F_2(1, 19) = 12.29$, $MSE = 236$, $p < .005$. There was also a significant difference in how often the subjects of the topic sentences were repeated compared with the other sentences for F_1 (64% vs. 82%), $F_1(1, 16) = 15.18$, $p < .002$; the effect was slightly weaker for F_2 , $F_2(1, 19) = 4.33$, $MSE = 357$, $p < .06$. Importantly, as predicted, there was no interaction. Children in both MLU groups were affected equally by the provision of a topic.

Since the topic sentences that included a subject had two pronouns and one lexical NP, we also performed two subcomparisons. The first contrasted lexical subjects in topic versus nontopic sentences, and the second contrasted pronominal subjects in topic versus nontopic sentences. (Because of the small number of items, only F_1 was calculated.) The data are also included in Table 4. For lexical subjects, as can be seen, there were no main effects and no interaction.

For pronominal subjects, however, children below MLU 3 used subjects less often than children above MLU 3 (49% vs. 79%), $F(1, 16) = 6.08$, $MSE = 1403$, $p < .03$. There was also a significant difference in how often the pronominal subjects of topic sentences were repeated compared with the other sentences (53% vs. 75%), $F(1, 16) = 5.31$, $MSE = 837$, $p < .04$. Again, in line with our predictions, no interaction accompanied the main effects. The overall effect of establishment of prior discourse is confined to pronouns and is equal for children below and above MLU 3.

Table 2
Subject Imitation Rate in Percentage and Standard Deviation as a Function of Mean Length of Utterance (MLU) and Sentence Category

MLU group	Topic		Expletive		Infinitive		Modal		Past tense		Mean	
	%	SD	%	SD	%	SD	%	SD	%	SD	%	SD
Below 3.0	52	24	44	40	70	27	73	18	73	21	63	29
Above 3.0	76	25	79	32	91	11	91	17	96	7	87	21
Mean	64	27	61	39	81	22	82	19	85	19	75	28

Note. The difference between MLU groups and the category difference were significant; the interaction between MLU and category was not significant.

Table 3
Subject Imitation Rate in Percentage and Standard Deviation as a Function of Type of Subject: Lexical Versus Pronominal

MLU group	Lexical		Pronominal		Mean	
	%	SD	%	SD	%	SD
Below 3.0	86	14	58	27	72	25
Above 3.0	95	8	92	12	93	10
Mean	90	11	76	26	83	21

Note. Lexical sentences consisted of the nine items from infinitive, modal, and past tense with lexical subjects; pronominal sentences consisted of the nine items from the same categories with pronominal subjects. Both main effects and the interaction were significant. MLU = Mean Length of Utterance.

We separately examined the three topic sentences that lacked a subject. Eighty percent of the children repeated the sentences as presented, without a subject, but 4 of the 19 children inserted a subject at least twice. All 4 children had MLUs above 3 (3.22, 3.37, 3.67, 4.93), and all 4 were girls.

Referential pronominal versus expletive subjects. We compared expletives with referential pronouns (from the infinitive, modal and past tense categories), as shown in Table 5. The overall imitation rate was 69%, with children below MLU 3 repeating pronouns (whether expletive or not) significantly less often (51%, $SD = 34$) than children above MLU 3 (86%, $SD = 23$), $F_1(1, 17) = 8.63$, $MSE = 1322$, $p < .01$; $F_2(1, 13) = 48.73$, $MSE = 194$, $p < .0001$. As expected, there was a difference in imitation rate between expletive subjects (63%, $SD = 39$) compared with referential pronominal subjects (76%, $SD = 26$), though it was marginal for F_2 ; $F_1(1, 17) = 5.41$, $MSE = 306$, $p < .04$; $F_2(1, 13) = 3.72$, $MSE = 258$, $p < .08$.

Importantly, as predicted, there was no interaction between MLU group and pronoun type. Both groups omitted expletive subjects at a higher rate than referential pronouns. Four children (MLUs of 1.28, 2.16, 2.51, and 3.18) never included an expletive.

Subject imitation as a function of length. To test the prediction that the low-MLU children would use subjects more often in short than in long sentences, we compared the likelihood that the child would include a subject for short targets (3 to 5 morphemes in length) versus long targets (6 to 10 morphemes in length) in infinitive, modal, and past tense targets. As shown in Table 6, children below MLU 3 included subjects less often (74%, $SD = 22$) than did children above MLU 3 (93%, $SD = 10$). That difference was significant, $F_1(1, 17) = 9.13$, $MSE = 389$, $p < .01$; $F_2(1, 16) = 14.53$, $MSE = 227$, $p < .002$. For short targets, children included a subject 89% ($SD = 16$) of the time; for long targets, children included a subject 79% ($SD = 22$) of the time. That difference was significant for F_1 and marginal for F_2 , $F_1(1, 17) = 12.19$, $MSE = 99$, $p < .01$; $F_2(1, 16) = 3.42$, $p < .09$.

Importantly, as predicted, there was an interaction, $F_1(1, 17) = 9.36$, $MSE = 99$, $p < .01$. Because the interaction was compromised by the pronominal-lexical difference in items, the effect was weak for the items analysis, $F_2(1, 16) = 2.46$, $MSE = 227$, $p < .14$. To determine whether the interaction between length and MLU was genuine, we computed an F_2 just on short

and long sentences with pronominal subjects. The main effect of length was reduced but showed a clear trend, $F_2(1, 7) = 4.7$, $MSE = 120$, $p < .07$, and the interaction between length and MLU reached conventional levels of significance, $F_2(1, 7) = 5.6$, $MSE = 187$, $p < .05$. Only the children below MLU 3 were subject to length effects, using subjects about 20 percentage points more often for short targets compared with long targets. Children above MLU 3 were almost identical in their subject use for the two lengths. (Similar results, though slightly less strong, were found when syllables were compared rather than morphemes.)

Our second comparison examined the likelihood that the child would include a subject in his or her imitation as a function of the length of the VP in the child's imitation. The comparison did not lend itself to a statistical test. The low-MLU group primarily produced VPs between one and four morphemes long, whereas the high-MLU group primarily produced VPs between two and five morphemes long.

The two groups did differ. For the children below MLU 3, as the VP length of their imitations increased from one to four morphemes, the percentage of time that they included a subject decreased from 100% to 83% to 75% to 67%. The children above MLU 3 showed a very different pattern. As the VP length of their imitations increased from two to five morphemes, the percentage of time that they included a subject stayed roughly constant, going from 91% to 98% to 90% to 98%. Thus, the high-MLU children were unaffected by the length of their own VP.

Although the low-MLU group showed a mean decrease in subject use as VP length increased, only 1 child demonstrated

Table 4
Subject Imitation Rate in Percentage and Standard Deviation as a Function of Presence or Absence of Prior Discourse

MLU group	Type of prior discourse					
	Topic		No topic		Mean	
	%	SD	%	SD	%	SD
Lexical and pronominal subjects combined						
Below 3.0	52	24	71	17	62	23
Above 3.0	76	25	93	8	85	20
Mean	64	27	82	17	73	24
Lexical subjects only						
Below 3.0	78	44	86	14	82	32
Above 3.0	89	33	95	8	92	24
Mean	83	38	90	12	87	28
Pronominal subjects only						
Below 3.0	39	49	58	27	49	39
Above 3.0	67	35	92	12	79	29
Mean	53	44	75	27	64	37

Note. Topic sentences = 3 items with subjects; No topic sentences = 18 items from infinitive, modal, and past tense groups. For the combined analysis and the pronominal subjects only analysis, the Mean Length of Utterance (MLU) and category differences were significant; the interaction was not. For the lexical subjects only analysis, no differences were significant.

Table 5
*Subject Imitation Rate in Percentage and Standard Deviation
 as a Function of Type of Pronominal Subject:
 Expletive Versus Referential*

MLU group	Type of pronoun					
	Expletive		Referential		Mean	
	%	SD	%	SD	%	SD
Below 3.0	44	40	58	27	51	34
Above 3.0	80	30	92	12	86	23
Mean	63	39	76	26	69	33

Note. Expletive sentences consisted of the six items in the expletive category; referential sentences consisted of the nine items from infinitive, modal, and past tense with pronominal subjects. The difference between Mean Length of Utterance (MLU) groups and the difference in pronoun type were significant. The interaction was not significant.

that group pattern. Examination of the low-MLU children's means showed that all the children included a subject at a VP length of one morpheme, and that the group became more variable as VP length increased. The odds of including a subject decreased as VP length increased, but not in a linear fashion for each child.

Tests of the Performance Hypothesis Against the VP Hypothesis

The performance-deficit hypothesis claims that children's inconsistent production of subjects is due to performance limitations, rather than due to an incomplete grammar that lacks functional categories. Since the performance-limitation hypothesis and the VP hypothesis make similar predictions, it is difficult to tease them apart. In addition, the VP hypothesis applies most strongly to children below MLU 2, and there were only 2 children below MLU 2 in the present study.

In its strongest form the VP hypothesis predicts the absence of functional categories in the imitations of at least some children, but all our children, including the 2 below MLU 2, imitated some functional elements. In a weaker form the VP hypothesis might predict minimal production of functional categories by children under MLU 2. The 2 children below MLU 2 are possible candidates, because they seldom produced inflectional elements. The child at MLU 1.28 never included an infinitive, used a modal only once, and never included the past tense; the child at MLU 1.78 could not be evaluated for use of *to* (because she never included both verbs), used a modal only once, and never used the past tense.

The weaker form of the VP hypothesis should also predict minimal production of functional categories by those children whose imitation of subjects appears optional, because the hypothesis links production of inflections and production of subjects. Five children imitated subjects in fewer than 60% of the targets: 1.28 (42%); 2.16 (28%); 2.51 (52%); 2.61 (58%); and 3.18 (57%). If the VP hypothesis were correct, those children should lack inflectional elements, but only 1 of those children (the child at MLU 1.28) is a good candidate. The other 4 children used at least two of the inflectional element types. The

weaker form also should predict inconsistent subject use among the 2 children with minimal imitation of inflectional elements, but only 1 child showed that pattern. The double dissociation shows that production of inflections is not linked to production of subjects.

Infinitive, modal, and past tense imitation. For those imitations that contained two verbs, we compared how often the two MLU groups included the infinitive *to*. The sample of the low-MLU group was reduced to 6 because 3 children never produced two verbs. A single-factor ANOVA showed that children below MLU 3 included *to* in 63% ($SD = 49.4$) of their imitations, and children above MLU 3 included *to* in 93% ($SD = 12.3$) of their imitations. That difference was marginally significant, $F(1, 14) = 3.54$, $MSE = 967$, $p < .10$. Two children ($MLUs = 1.28$ and 2.51) never included the infinitive.

Every child produced at least one modal, but 6 children ($MLUs = 1.28, 1.78, 2.51, 2.67, 2.9, 3.18$) used a modal only once. A single-factor ANOVA showed that the children below MLU 3 included modals in 35% ($SD = 20$) of their imitations, whereas the children above MLU 3 included modals in 82% ($SD = 22$) of their imitations, $F(1, 17) = 24.02$, $MSE = 429$, $p = .0001$.

The 2 lowest-MLU children (1.28 and 1.78) never included the past tense. A single-factor ANOVA showed that the children below MLU 3 included the past tense in 40% ($SD = 26.6$) of their imitations, whereas children above MLU 3 included the past tense in 67% ($SD = 25.9$) of their imitations, $F(1, 17) = 5.06$, $MSE = 687$, $p < .04$.

Tests of the Metrical Hypothesis

Five tests of the strongest form of the metrical account were conducted, the first three of which have already been reported. Only the first confirmed the predictions we derived from Gerken's (1991, 1994) account. (a) Pronominal subjects, as predicted and in replication of previous work (Gerken, 1991; McGregor & Leonard, 1994), were imitated less often than lexical subjects. (b) Expletive pronouns were repeated less often than referential pronouns. There should have been no difference between them, since both are low-stress sentence-initial syllables. (c) Likewise, pronominal subjects were repeated less when a topic sentence was provided, showing that when metrical effects are held constant, the influence of other factors is

Table 6
*Subject Imitation Rate in Percentage and Standard Deviation
 as a Function of Length of Target: Short Versus Long*

MLU group	Length of target					
	Short		Long		Mean	
	%	SD	%	SD	%	SD
Below 3.0	84	19	63	21	74	22
Above 3.0	94	11	93	9	93	10
Mean	89	16	79	22	84	19

Note. Short = 3–5 morphemes, $n = 7$; long = 6–10 morphemes, $n = 11$. Both main effects and the interaction were significant. MLU = Mean Length of Utterance.

visible. (d) Object determiners were repeated equally often, whether the subject was a pronoun or a lexical NP, but should have been repeated less often if the subject was a pronoun, because in that case the determiner is a weak syllable beginning a phonological phrase and therefore does not fit a strong-weak pattern. (e) Modals were somewhat less likely to be included with pronominal subjects (54%) than lexical subjects (67%), $F(1, 17) = 4.21$, $MSE = 420$, $p < .06$, but they should either have been omitted equally in the two contexts (Gerken, personal communication, August 1994), or omitted more often following lexical subjects (our analysis).

Discussion

The major predictions of the study were confirmed. Children below MLU 3 showed clear evidence of performance limitations. They showed no evidence of having a competence deficit in which *pro* or a null constant was part of their grammar. They showed no evidence of linking subject use with inflections.

As would be expected on the basis of prior work, children below MLU 3 imitated subjects at a lower rate compared with children above MLU 3. That result is important for the present study for both theoretical and methodological reasons. Theoretically, it confirms previous research claiming that at least by MLU 3, 2-year-old American children understand that their language requires subjects. Methodologically, the superior performance of the high-MLU children allows meaningful comparison between the groups on individual sentence categories, types of subjects, and lengths of sentences. If there were no development as a function of MLU, it would be impossible to test for interactions, and the pattern of interactions we report is extremely informative.

We predicted that the children below MLU 3 would simultaneously show evidence of a performance deficit compared with the children above MLU 3 and show no evidence of a competence deficit. Conforming to our performance predictions, we found that the length effect was restricted to children below MLU 3. Those children imitated subjects from short sentences more often than they imitated subjects from long sentences, whereas the high-MLU children showed ceiling performance on both lengths. Our results are the first to show that the lengths of the sentences children are *hearing* can have an effect on their use of subjects. We also found that the low-MLU children were more variable in their inclusion of subjects as the VP length of their imitations increased, in confirmation of the spontaneous speech data (L. Bloom, 1970; L. Bloom, Miller, & Hood, 1975; P. Bloom, 1990; Valian, 1991).

We propose that, in the elicited imitation paradigm, a great deal of the processing load is experienced during comprehension. In spontaneous speech, the bulk of the load appears in syntacticizing, lexicalizing, and articulating the message. In elicited imitation, the message comes syntacticized and lexicalized; it must be understood and then articulated. Thus, processing limitations begin their influence in the comprehension phase of the task and continue through production. Our results suggest that both comprehension and production become more automatic as development proceeds.

Our competence predictions concerned the *pro* hypothesis, the null constant hypothesis, the VP hypothesis, and a hypothesis linking inflections and subjects. The *pro* hypothesis comes in

two forms. In one form, American children have a grammar like Italian; in the other form, American children have a grammar like Chinese. The data concerning expletives test both the Italian and Chinese variants. The data concerning topic sentences are the best test of the Chinese variant and of the null constant hypothesis.

We found that expletive subjects were less likely to be repeated than referential pronominal subjects for both MLU groups equally. If expletives had been omitted more only by the low-MLU children, that would have suggested that those children had a competence deficit allowing null subjects in their grammar and correspondingly disallowing overt expletives. Since both groups showed the effect, and since the high-MLU group otherwise performed at ceiling, that suggests that the omission of expletives is not a competence effect. We suggest instead that both groups of children are sensitive to the regularities in their input, where expletives are more acceptably omitted than referential pronouns.

We similarly found that the provision of a topic resulted in lower imitation of subjects, again for both MLU groups equally. If the low-MLU group had differentially omitted subjects in topic sentences, that would have lent credence to the supposition that those children's overall low use of subjects was due to their having a Chinese-style grammar that allowed null subjects or to their overusing a null constant. Since both groups showed the effect, and the high-MLU group's overall performance was incompatible with a competence deficit, we conclude that even competent speakers are more likely to omit a subject when a topic has been established.

The topic and expletive findings, then, suggest equal competence between the two MLU groups with respect to subjects. The VP hypothesis is more difficult to evaluate. First, the VP hypothesis may hold only for children at the very onset of combinatorial speech; our sample included only 2 children below MLU 2. Second, since those children are severely limited in how many words they can string together, they are likely to omit all but the most essential words. In other words, competence and performance are severely confounded in a child with an MLU below 2.

Recall that the 2 children below MLU 2 fit some predictions of the VP hypothesis, by almost never using inflectional elements. Our lowest-MLU children thus lend some support to part of the VP hypothesis, but when one keeps in mind how low the children's MLUs were, it is remarkable that they included any inflections at all. Furthermore, some children above MLU 2, who are not good candidates for the VP hypothesis, also produced inflectional elements sparingly. For example, MLU 2.51 never included the infinitive *to*; 2.51, 2.67, 2.9, and 3.18 all used a modal only once.

The other part of the VP hypothesis—that children's inconsistent use of subjects is a consequence of the lack of inflectional elements—is disconfirmed by our data. Of the 6 children who imitated subjects less than 60% of the time, only 1 lacked inflectional elements. Of the 2 children who lacked functional categories, only 1 (the same one) imitated subjects less than 60% of the time. Children's use of subjects appears independent of their use of inflectional elements.

Our elicited imitation data confirmed earlier findings from spontaneous production and the main finding from earlier elicited imitation. There was a strong relation between verbs and

subjects. Analyses of spontaneous speech have shown that higher verb use goes along with higher subject use (Valian, 1991). The same relation was found here for imitation of verbs and imitation of subjects. We interpret our results as showing that children understand that verbs require subjects. Low-MLU children are limited by performance factors in their production of verbs, and also in their production of subjects.

Our data confirm the previous elicited imitation finding that pronominal subjects are imitated less often than lexical subjects (Gerken, 1991). In our experiment that finding was restricted to the children below MLU 3, as would be expected if the root of the phenomenon is the limited processing abilities of that group. We used four other contrasts to test a metrical model (Gerken, 1994) for children's omission of function words and pronouns, but none of them supported a strong metrical hypothesis. Since our presentation was normal, rather than synthesized, speech, and since we exerted no control over intonation, our comparisons may not be the best test of Gerken's (1994) explanation. But, at a minimum, our comparisons demonstrate that if metrical structure influences children's use of subjects, it is not the only influence. As suggested by L. Bloom, Lightbown, and Hood (1975), factors such as the syntactic structure of the sentences, the availability of prior discourse, and sentence length contribute independently to subject inclusion and omission.

The correspondences between our elicited imitation data and prior spontaneous production data suggest that elicited imitation is an important technique providing converging evidence for children's knowledge of language (Nuñez del Prado et al., 1993). Elicited imitation allows one to test regularities found in spontaneous speech and allows one to test relations that spontaneous speech cannot straightforwardly reveal. For example, the fact that pronominal subjects are more difficult to imitate than lexical subjects is only very indirectly suggested by spontaneous speech, where most of children's subjects are pronouns, but where an increasing percentage of children's subjects are pronouns as development proceeds (Valian, 1994; Valian & Eisenberg, in press). As another example, the infrequent use of expletive subjects in children's spontaneous speech makes it difficult to determine whether their absence is related to the children's grammar or has an independent source.

We conclude that even low-MLU children understand that English requires subjects, and that their inconsistent use of subjects reflects a performance deficit, not a competence deficit.

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Appendix

Target Sentences Arranged by Type

Topic

Each Topic target was preceded by "See the x?" and accompanied by line drawings depicting the subject but not the action or context.

With subjects (drawing)

The man plays games. (man's face)
They catch flies. (three frogs)
It needs water. (tree in leaf)

Without subjects (drawing)

Like grass. (three cows)
Eats honey. (bear)
Shines at night. (crescent moon)

Expletive

It's time for a nap.
It seems quiet in here.
It's raining today.

It's hot outside.
There are kids in my school.
There are turtles in the lake.

Past tense

The girls loved those little dolls.
The monkey peeled the banana.
The cat licked the floor.

We kicked the cans.
They cleaned the dishes.
I jumped over those big rocks.

Modal

Those boys should know your name.
The horse can run.
The chair will break.

They can fit in the window.
We would have fun.
I could leave.

Infinitive

The dog needs to chew bones.
Birds like to fly.
Fish get to swim every day.

She hates to go home early.
I try to jump high.
We want to walk fast.

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