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A Metrical Account of Children's Subjectless Sentences

LouAnn Gerken

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Introduction

The most frequent errors made by young children during the early stages of language acquisition involve the omission of elements that would be required in an adult version of the utterance. These omissions fall into two general categories: word level and sentence level. At the word level, children tend to omit weakly stressed syllables from multi-syllabic words. At the sentence level, they omit subjects and function morphemes, such as articles, verb inflections, and auxiliaries. These categories of omissions are typically not treated within the same theoretical framework, nor even by the same theorists. Word level omissions are seen to be within the domain of child phonology, whereas sentence level omissions are viewed as syntactic (or occasionally as pragmatic). Frequently, different explanations are given for different categories of sentence level omissions as well; for example article omissions are usually not viewed as related to sentential subject omissions. The lack of a unified developmental or linguistic explanation for the range of children's omissions is largely the result of the way language

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acquisition is viewed within many linguistic theories. Those theories with the goal of discovering universal principles of language (as opposed to describing particular languages) treat language acquisition as a natural extension of linguistics and a testing ground for specific linguistic principles. In this framework, child language data are typically not seen within a model of the language learner, but rather, particular child language phenomena are seen in relation to apparently corresponding adult language phenomena that are explicable in linguistic theory. Therefore, if one set of children's omissions appear to be related to different adult language facts than another set, each set will be given a different linguistic explanation.

An example of such an approach to language acquisition can be observed in the recent parameter theory account of children's subjectless sentences (e.g., Hyams, 1986). On this account, young English speakers' failure to produce subjects in many declarative sentences is treated in relation to a similar cross-linguistic phenomenon in adults. In contrast with this approach, I will present a phonological account of English speaking children's subjectless sentences that is derived from a metrical principle demonstrated in their early word productions. I will show that the metrical account predicts the entire pattern of sentence level omission data better than previous accounts. It also allows us to see children's early word level and sentence level productions on a continuum, opening the door to an internally consistent and psychologically real model of the child learner.

### Three Accounts of Children's Subjectless Sentences

Although young children learning English often produce declarative sentences without subjects, they virtually never produce sentences containing transitive verbs without objects. All accounts of children's subjectless sentences have taken as their primary goal explaining this subject/object omission asymmetry. In this paper, I will compare three accounts: parameter setting, pragmatic, and metrical. Because each account explains the subject/object asymmetry, the basis that we must use to choose among them is how well each is able to explain children's other omissions. Therefore, for each account, I will outline how it explains the subject/object asymmetry and then evaluate its generality in explaining other omissions.

The parameter setting explanation is based on the observation that languages of the world differ as to whether or not they allow declarative sentences without subjects. Non-pro-drop languages such as English do not allow these sentences, whereas pro-drop languages such as Italian or Chinese allow pronominal subjects to be omitted when the identity of the

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subject can be recovered from inflectional or contextual information. Hyams (1986, 1987) has argued that children are born with the pro-drop parameter set to allow subjectless sentences. On this account, young English speakers omit pronoun subjects, because their grammar allows them to do so. Hyams' account also links the pro-drop parameter to verb agreement, thereby explaining why children also omit verb inflections and auxiliaries during the same period that they omit subjects. When children discover evidence that English is in fact a non-pro-drop language, they begin to consistently produce sentences with overt subjects as well verb inflections and auxiliaries. In summary, the pro-drop account explains the subject/object asymmetry in children's omissions based on the fact that many languages spoken by adults also demonstrate this asymmetry. It also accounts for those function morpheme omissions associated with verb agreement. It does not, however, account for the omission of other function morphemes, such as articles, and it does not account for children's word level omissions.

The pragmatic explanation of children's subjectless sentences is based on the notion that children cannot produce all of the elements in their intended utterances due to performance constraints, and that they therefore omit those elements least crucial to communicating their message (Bates, 1976; Greenfield & Smith, 1976). Because subjects tend to contain given, as opposed to new, information they are omitted. This account may also be able to explain children's function morpheme omissions, based on the notion that these elements typically carry less communicative weight than the co-occurring content items. Unfortunately, because no elaborated theory of communicative importance has yet been proposed, it is difficult to say exactly which sentential items are unimportant and under what circumstances. In any case, the pragmatic account, like the syntactic account, cannot explain children's word level omissions, because weak syllables in multi-syllabic words are not communicatively unimportant in the same way as sentential subjects and function morphemes.

The pro-drop account assumes that children's subject omissions are pronoun omissions. If this is correct, then the vast majority of sentence level elements that children omit (e.g., pronouns, articles, verb inflections, etc.) receive weak stress in English. Many researchers have linked weak stress to children's sentence level omissions (e.g., Brown & Fraser, 1964; Pye, 1983). Therefore, it appears that the phonological property of weak stress is linked to both children's word level and sentence level omissions. If a stress-based principle could be found to explain the subject/object asymmetry, we could account for the entire range of children's omissions within a single framework. Interestingly, children also show an asymmetry in their omissions from multi-syllabic words: They omit weak

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syllables from iambic metrical feet (weak-strong) more frequently than from trochaic feet (strong-weak). For example, "giRAFFE" is more frequently reduced to "RAFFE" than "MONkey" is reduced to "MON" (Allen & Hawkins, 1980; Echols & Newport, 1989; Ingram, 1986; Smith, 1973).

Data from previous research (Gerken, 1987; Gerken, Landau, & Remez, 1989) suggests that a similar metrical asymmetry exists in children's sentence level productions. In this research, two-year-olds (mean age: 26 months) imitated the four-syllable VP portion of sentences such as 1a-1d below (+ indicates division into metrical feet, see definition below). As in their spontaneous speech, children frequently omitted the weakly stressed syllables (-es the & -o na) from their imitations. If children are more likely to omit weak syllables from iambic feet than trochaic feet, they should have omitted the second functor (the & na) more frequently than the first (-es & -o), because the former occur in iambic feet while the latter occur in trochaic feet. This was in fact the pattern of omissions in two out of three experiments (averaged data in Table 1). (There was no difference in the one experiment. See Gerken et al, 1989, for a discussion.)

- 1a. PETE + PUSHes + the DOG
- 1b. PETE + BAZes + the DEP
- 1c. PETE + PUSHo + na DOG
- 1d. PETE + BAZo + na DEP

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TABLE 1, OMISSIONS OF FUNCTORS FROM FIRST AND SECOND POSITIONS

<u>Functor Type</u>	<u>First Position</u> (trochaic foot)	<u>Second Position</u> (iambic foot)
English	1.5%	16.5%
Nonsense	1.5%	9.5%

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Therefore, it appears that the same metrical principle governs both children's word level and sentence level omissions. Before discussing how this principle might account for the subject/object asymmetry in children's subjectless sentences, let me briefly elaborate on the rules used to divide sentences into metrical feet. First, based on Selkirk (1984), I assume that

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mono-syllabic pronouns, verb inflections, auxiliaries, and articles receive the weakest level of sentence stress in normal prosody. Second, a metrical foot contains one and only one strong syllable. Third, following Hayes (1982) and Kelly (1988)], intended utterances are divided into binary feet whenever possible. Fourth, intended utterances are divided into feet from left to right. Finally, syntactic and metrical levels are independent, so that a metrical boundary does not necessarily coincide with a syntactic boundary.

Based on these rules, children's more frequent omission from iambic feet than from trochaic feet can provide an explanation for the subject/object asymmetry seen in their subjectless sentences. Subject pronouns are sentence initial and therefore weak syllables in iambic feet (sentence 2a), whereas object pronouns can occur in trochaic feet with a strongly stressed verb (sentence 2b). Thus, children's tendency to omit weak syllables from iambic feet coupled with the rigid word order of English results in subject pronouns being omitted more frequently than object pronouns. The metrical account of subjectless sentences also predicts that children will omit subject articles more frequently than object articles, because the former are always weak syllables in iambic feet (sentence 2b), whereas the latter can occur in a trochaic foot (sentence 2c).

- 2a. he KISSED + the BEAR
- 2b. the BEAR + KISSED him
- 2c. PETE + KISSED the + BEAR

The pro-drop, pragmatic, and metrical accounts of children's subjectless sentences all explain the subject/object asymmetry. The basis on which each account does so results in differing predictions about two other aspects of children's omissions. First, both the pro-drop and metrical accounts assume subject omissions are pronoun omissions. The pragmatic account does not make this assumption. However, if it could be shown that children do in fact omit pronoun subjects more frequently than lexical subjects, supporters of the pragmatic account might argue that, because pronouns are more likely than lexical NPs to contain given information, they are omitted more frequently. This points out an earlier mentioned weakness in the pragmatic account: Because it is not based on a theory of communicative importance, it fails to make clear predictions about what items will be omitted.

The second difference among the three accounts is that the metrical account predicts that children omit subject articles

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more frequently than object articles. This is because a subject article is always the weak syllable in iambic foot, while an object article can be the weak syllable in trochaic foot. This prediction is not made by the pro-drop account in which article omissions are not explained at all. It is not clear if the pragmatic account predicts an asymmetry in article omissions. All articles should be viewed as communicatively uninformative, but perhaps subject articles, because they occur in the part of the sentence containing given information, may be omitted more frequently than object articles. However, if the pragmatic account predicts any asymmetry for articles, it should predict that all subject articles will be omitted more frequently than all object articles. No differences should exist among object articles in different metrical structures. The metrical account, on the other hand, predicts that object articles in iambic feet (sentence 2a) will be omitted as frequently as subject articles, while object articles in trochaic feet (sentence 2c) will be omitted less frequently than subject articles.

An Experiment

In order to test these predictions, Gerken (1989) asked two-year-olds to imitate short sentences like those in 2a-c in which subject and object NPs were either pronouns, proper names, or common NPs. A set of sample sentences appears in 3a-3i, below. Subjects were eighteen children ranging in age 24 to 30 months, with a mean of 27 months. Each child's mean length of utterance was calculated from his/her spontaneous speech; the mean MLU was 2.54 morphemes. At the beginning of the experimental session, children were introduced to two puppets, a bear named Pete and a lamb named Jane. The experimenter and child played with these for approximately ten minutes to ensure that the child was familiar with them before the actual imitation task was begun. In the imitation task, the experimenter said each sentence and enacted it with the puppets. She then asked the child to say the sentence, and repeated the sentence again. For example, the experimenter would say for sentence 3a, "He kissed her. Can you say that? He kissed her". Children were cooperative and had little trouble imitating the sentences.

- 3a. he KISSED her
- 3b. he KISSED + JANE
- 3c. he KISSED + the LAMB
- 3d. PETE + KISSED her
- 3e. PETE + KISSED + JANE
- 3f. PETE + KISSED the + LAMB
- 3g. the BEAR + KISSED her
- 3h. the BEAR + KISSED + JANE
- 3i. the BEAR + KISSED the + LAMB

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Consistent with previous research (e.g., Fraser, Bellugi & Brown, 1963; Slobin & Welsch, 1968), the imitation data were highly similar to data from children's spontaneous sentence production. This is demonstrated by a significant negative correlation between the frequency of weak syllable omission in imitation and MLU ( $r = -.55$ ,  $df = 16$ ,  $p < .01$ ). The correlation means that, as a child produced longer morpheme strings in spontaneous speech, s/he was correspondingly more likely to produce more (omit fewer) morphemes in the imitation task. Therefore, data from the imitation experiment can reasonably be generalized beyond the experiment itself.

The results of the imitation experiment were best predicted by the metrical account (see Table 2; all reported results were significant at the  $p < .05$  level or below in analyses of variance by subjects and by items). Consistent with the subject/object omission asymmetry found in children's spontaneous speech, children omitted subject NPs overwhelmingly more frequently than object NPs. Consistent with the assumption of the pro-drop and metrical accounts, children omitted significantly more pronoun subjects than either proper or common NPs. Therefore, it appears that the majority of children's subjectless sentences represent pronoun omissions. Consistent with the metrical account and perhaps the pragmatic account, children would omit subject articles more frequently than object articles. Finally, consistent only with the metrical account, a comparison of object articles in iambic feet (as in 3c) and those in trochaic feet (as in 3f & 3i) showed that the former were omitted significantly more frequently than the latter. This result provides the strongest support for the metrical account, because it indicates that the type of metrical foot that a weak syllable is in, rather than sentence position (subject vs object), is the determining factor for omission. Note that the omission rates for all weak syllables in iambic feet (pronoun subjects, subject articles, and object articles in target sentences with pronoun subjects) are nearly identical, suggesting the same underlying mechanism. In sum, while the pro-drop and pragmatic accounts can each explain some of the data, the metrical account can explain the entire pattern of weak syllable omissions within a single framework.



TABLE 2, OMISSIONS IN THE IMITATION EXPERIMENT

<u>Type of Element</u>	<u>Omission Frequency</u>
Pronoun Subjects*	32%
Proper NP Subjects	11%
Common NP Subjects	13%
Subject Articles*	31%
Pronoun Objects	1%
Proper NP Objects	0%
Common NP Objects	0%
Object Articles (trochaic feet)	12%
Object Articles (iambic feet)*	28%

\* weak syllables in iambic feet

Now I would like to turn to the question of why children occasionally omitted lexical subjects in their imitations. These elements are not weakly stressed, and therefore their omission was not predicted by the metrical account. A possible explanation within the metrical framework comes from the unexpected fact that children substituted pronoun subjects in 23% of sentences with lexical subjects. This is no doubt because the same puppets were being referred to in each sentence. Children virtually never made such substitutions in the object, perhaps indicating that they are aware of the pragmatic bias for old information to be marked with pronouns and to occur in the subject. Given such overt pronoun substitutions, it is possible that some, if not all, subject omissions from sentences with lexical subjects were actually cases in which children substituted a pronoun subject and subsequently omitted it. If this is the case, the metrical hypothesis could account for all omissions in the imitation experiment. To test this, a pronoun substitution rate of 26% was derived by dividing the number of pronoun substitutions by the number of non-omitted subjects (instead of all subjects) in target sentences with lexical subjects. Based on this derived figure, I will assume that 26% of all lexical subjects in target utterances were replaced by pronouns in children's intended utterances. I will also assume that the omission rate for weak syllables in iambic feet is 32%, based on subject pronoun omissions. The resulting predicted values, as well as the actual data, appear in Table 3. There are several predicted values that may need explanation: First, the predicted rate of subject omissions in sentences with lexical subjects (8%) is based on the derived pronoun substitution rate

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(26%) and the omission rate for weak syllables in iambic feet (32%). Second, if children represented 26% of lexical subjects as pronouns in their intended utterances, then only 74% (100% - 26%) of target sentences with common NP subjects were actually represented with articles in the intended utterance. Therefore, the predicted value for subject article omissions (24%) reflects the frequency of articles in the underlying representation (74%) and the omission rate (32%). Finally, if 26% of lexical subjects were represented as pronouns in children's underlying representation, then object articles in 26% of target sentences with lexical subjects were in iambic feet (as in sentence 3c) and thus omissible. Therefore, the predicted value for object article omissions in target sentences with lexical subjects (8%) reflects the frequency with which lexical subjects were replaced by pronoun subjects (26%) and the omission rate (32%). Based on these predictions, a Pearson correlation was calculated on the six actual and predicted omission rates appearing in Table 3. The correlation was highly significant ( $r=.96$ ,  $df=4$ ,  $p<.01$ ). This means that the metrical account, in conjunction with an assumption about children's use of a pragmatically motivated pronoun substitution rule, explains 92% (96% squared) of the data from the imitation experiment.

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TABLE 3, ACTUAL AND PREDICTED OMISSIONS OF NPS AND ARTICLES

<u>Type of element</u>	<u>Actual</u>	<u>Predicted</u>
Subject Pronoun	32%	32% (from actual)
Lexical Subject	12%	8% (26% x 32%)
Subject Article	31%	24% (74% x 32%)
Object NP	.3%	0%
Object Article (lexical subjects)	12%	8% (26% x 32%)
Object Article (pronoun subjects)	28%	32%

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I have been assuming throughout this discussion that children assign a metrical structure to the entire intended utterance before omitting weak syllables. The independence of metrical assignment and omissions can be seen in the fact that children omitted object articles in target sentences with pronoun subjects, regardless of whether or not they omitted the subject. This would not be predicted if omissions occurred simultaneously with metrical assignment, as might be the case if the the goal of children's omissions was to create an utterance composed entirely

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of trochaic feet. Consider sentence 3c (he KISSED + the LAMB): If the entire metrical structure is assigned before omission of weak syllables from iambic feet occurs, children should omit both the pronoun subject and the object article. And, the frequency of object article omissions should be independent of whether or not the subject is omitted. Whereas, if omission occurs simultaneously with metrical assignment, then object article omission should be dependent on subject omission. This is because subject omission results in a metrical structure with one trochaic foot followed by a single syllable foot (KISSED the + LAMB). Thus, children should not omit the object article in sentences from which they already omitted the subject, because the metrical analysis of such sentences puts the object article in a trochaic foot. But in those sentences where the subject pronoun is retained, children should omit the object article, because it is in an iambic foot. To test this, I examined object article omissions from target sentences like 3c and compared the omission frequency in sentences where children had retained the subject vs sentences where they had omitted the subject. There was not a significant difference in object article omissions from these two sets of sentences (sentences with subjects: 28% object article omissions; sentences without subjects: 36% object article omissions;  $t(30) = .047$ ,  $p > .50$ ). Notice that the difference is not in the direction predicted by the view that metrical assignment and omissions occur simultaneously. Therefore, it appears that weak syllable omissions occur in some later representation of the intended utterance than the assignment of metrical structure.

#### General Discussion and Conclusion

All three accounts of children's subjectless sentences discussed here are able to explain the subject/object asymmetry. The metrical account, unlike the other two, also predicted children's more frequent omissions of articles from iambic feet than from trochaic feet. Furthermore, the metrical account predicted the entire pattern of children's sentential omissions based on a principle that has been well-demonstrated in their early word productions. Therefore, the metrical account offers a better explanation of children's subjectless sentences, because it employs a more general mechanism than either the prop-drop or pragmatic account. I have not discussed other recently presented explanations of subjectless sentences (e.g., Bloom, 1989; Valian, 1989), because these are less general than either the pro-drop or pragmatic accounts. (For a full discussion, see Gerken, 1989.)

The fact that children omit weak syllables from iambic feet more frequently than from trochaic feet at both the word and sentence levels indicates that this is a powerful principle in the acquisition of English. (Interestingly, a similar principle can be seen in Broca's aphasics; these speakers are more likely

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to omit weak syllables from utterance-initial than utterance-internal positions; see Goodglass, Fodor & Schulhoff, 1967.) What is the nature of this principle? I will briefly outline three possible models: one competence-based and two performance-based (for a more complete discussion, see Gerken, 1989). The competence-based model follows work by child phonologists such as Smith (1973) who treat children's weak syllable omissions as part of their phonological rule system. The reason that children would form such a rule is unclear. Perhaps they overgeneralize instances of syllable omission from adult speech, for example "potato" -> "tato". Alternatively, children may employ a syllable omission rule as a response to performance pressures. This explanation is consistent with the view of child phonologists who hypothesize that children's phonological rules serve at least partially to mediate between an adult model and what they are able to produce. As such, it may be better characterized as a mixture of phonological competence and performance factors.

In contrast, the performance-based models assume that children's weak syllable omissions are entirely the result of performance constraints. One of these is based on the fact that the vast majority of multi-syllabic English words begin with a stressed syllable (Cutler & Carter, 1987). If children are sensitive to this fact, they may create a production template for trochaic feet, and this in turn may cause them difficulty in producing iambic feet. The other performance explanation is based on adult models of speech production in which an utterance is translated from the message level, through several intermediate forms of representation, to the articulatory level (e.g., Dell, 1986; Garrett, 1975). The particular model I am proposing makes four assumptions: first, metrical feet serve as the planning unit in which the intended utterance is passed from the phonemic to the phonetic level of representation (see Gerken, 1989); second, activation of the second syllable's phonetic representation begins while the first syllable's representation is still being assigned (see Dell, 1986); third, the activation of weak syllables takes longer or has a higher threshold than the activation of strong syllables; and fourth, syllables not assigned a phonetic representation in an allotted time will not appear in the surface representation. This model accounts for the fact that all weak syllables are omitted more frequently than strong syllables (e.g., Gerken, 1987; Gerken et al, 1989) based on the assumption that weak syllables have a higher threshold or slower activation time. It also accounts for the fact that weak syllables in iambic feet are omitted more frequently than those in trochaic feet: The presence of an initial strong syllable allows more time for the following weak syllable to be activated or to reach threshold; whereas an initial weak syllable is less likely to become sufficiently activated to be included in the

final utterance. All three explanations are highly speculative at this point and await further cross-linguistic and speech production data.

In conclusion, the results from the imitation experiment in conjunction with observations of children's spontaneous speech indicate that children's word level and sentence level omissions can be accounted for by a single principle. Further analysis of the pattern of children's omissions also revealed the way in which target utterances were transformed into intended utterances using a pragmatic substitution rule, and the way in which children's intended utterances are transformed into actual productions. I believe that such insights into the nature of children's language would be considerably harder to achieve by relating child language data directly to linguistic theory. Clearly, we eventually want our theory of language acquisition to be consistent with linguistic theory. But just as clearly, we want such an acquisition theory to be internally consistent and based on a psychologically real model of the child learner. Only within this dually-constrained framework can research on children's language contribute significantly to our overall understanding of human linguistic abilities.

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