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The Influence of Lexical Familiarity on Children's Function Morpheme Omissions: A Nonmetrical Effect?

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Previous research on children's production of function morphemes demonstrated an effect of meter, such that syllabic morphemes that fit a Strong–weak metrical template were omitted less frequently than morphemes not fitting such a template. The current research addressed the question of whether all omissions of syllabic function morphemes occur when a syllable does not fit a metrical template, or whether other factors, such as lexical familiarity, also play a role. Two experiments demonstrated that 2-year-olds are more likely to omit object articles from sentences containing novel nouns or verbs than sentences containing well-known words. Furthermore, familiarity appears to influence omissions independent of meter, suggesting that function morpheme omissions are caused by at least two mechanisms. One possible mechanism, control over utterance timing, is discussed.

Children's early utterances often do not contain all of the items that are obligatory in adult grammar. In particular, English-speaking children tend to omit function morphemes, such as pronouns, articles, and verb inflections (e.g., Brown, 1973). Although many researchers have proposed that children's function morpheme omissions reflect a failure to perceive or represent these elements (e.g., Bates, 1976; Echols, 1993; Echols & Newport, 1992; Gleitman & Wanner, 1982; Pinker, 1984), a growing body of data suggests that this is not the case. Rather it appears that even very young children have quite rich representations of function morphemes and use these representations in sentence comprehension (Gelman & Taylor, 1984; Gerken, Landau, & Remez, 1990; Gerken & McIntosh, 1993; Katz, Baker, & McNamara, 1974; Petretic, & Tweney, 1977; Shipley, Smith, & Gleitman, 1969). For example, 24-month-olds who produced no function morphemes in their own speech nevertheless selected the correct picture more frequently when hearing grammatical sentences like 1a than ungrammatical sentences like 1b (Gerken & McIntosh, 1993). Such studies suggest that children have sufficient representations of function morphemes to be affected by ungrammatical usage.

1a. Find the dog for me.

1b. Find was dog for me.

If children represent function morphemes and attend to them in sentence comprehension, why do they omit them from their utterances? One possibility is that children have limitations on the complexity of utterances that they can plan and produce. When the complexity of an intended utterance exceeds this limit due, for example, to the inclusion of an unfamiliar word, children attempt to reduce complexity by getting rid of some element in the sentence (e.g., Bates, 1976; Bloom, 1970, 1991; Panagos, Kline, & Klich, 1979). Although such an account is intuitively appealing, it does not predict which element(s) chil-

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dren will omit in order to reduce complexity. That is, why do children omit function morphemes overwhelmingly more frequently than content words? Perhaps they omit function morphemes because these elements are optional in their grammar (e.g., Brown, 1973; Hyams, 1986), or because they do not carry as much of the meaning of sentences as content words (e.g., Bates, 1976; Greenfield & Smith, 1976).

Another alternative is that function morpheme omissions reflect the workings of the child's language planning and production system. In particular, several researchers have proposed that omissions reflect processes at the phonological level of language production (Demuth, 1992; 1995; Gerken, 1991, 1994a, 1994b, 1995b; Gerken et. al., 1990; Pye, 1983; Wijnen, Krikhaar, & den Os, 1994). One form of evidence favoring this proposal comes from the observations of the role of meter in children's omissions of both morphemes and weak syllables from multisyllabic words (Allen & Hawkins, 1980; Echols, 1993; Echols & Newport, 1992; Gerken, 1991, 1994a, 1994b, 1995a; Klein, 1981; McGregor, & Leonard, 1994). For example, 26- to 30-month-olds are more likely to omit an object article when it follows a verb with a syllabic inflection (2a) than a verb with a nonsyllabic inflection (2b; Gerken, 1995b). Such a pattern of omissions is consistent with the hypothesis that children apply to their intended utterances a metrical production template for a strong syllable followed by an optional weak syllable, S-(w) (Gerken, 1991, 1994a, 1994b, 1995a, 1995b; Gerken et al., 1990). S-(w) templates are applied by aligning the strong syllable of each template with a strong syllable of the intended utterances.[1] Weak syllables that do not fit into a template (marked with an asterisk) are more likely to be omitted than those that do.

[1] Throughout the discussion, syllables are designated as ''weak'' if they are either unstressed syllables of multisyllabic words or monosyllabic function morphemes. Syllables are designated as ''strong'' if they are either a monosyllabic content word or a syllable of a multisyllabic content word receiving primary or secondary stress.

2a.	TOM	KISSes	the	PIG
	S-(w)	S-w	*	S-(w)
2b.	TOM	KISSED	the	PIG
	S-(w)		S-w	S-(w)

The effect of meter on children's function morpheme omissions is not consistent with accounts in which children omit elements that are optional in the grammar or relatively less meaningful. That is, an object article following a verb with a syllabic inflection should not be more optional or less meaningful than any other article. Rather, the effect of meter on children's omissions of function morphemes and nonmorphemic weak syllables suggests that these omissions are phonological, not syntactic or morphological, in nature. Do all omissions of syllabic function morpheme omissions occur when weak syllables fail to fit S-(w) templates at the phonological level of language production? That is the question we addressed in the research presented here.

There are several reasons to think that there may be a cause of children's function morpheme omissions separate from metrical templates. One reason is that children do not preserve all weak syllables that fit metrical templates—they simply preserve them more frequently than those that do not (e.g., Gerken, 1994a, 1994b, 1995b). This observation suggests that some mechanism may cause children to omit weak syllables in general, not just weak syllables that fail to fit a S-(w) metrical template. Other evidence that failure to fit a metrical template is not the only cause of children's function morpheme omissions comes from studies indicating that omissions are influenced by syntactic, morphological or lexical factors. For example, Menyuk and Looney (1972) employed a sentence imitation task and found that children were more likely to omit function morphemes in syntactically complex sentences like passives than simpler sentences like actives. Although these researchers controlled for the number of words, it is unlikely that they were able to control for the phonetic complexity of the target sentences or equate

for metrical pattern, number of syllables, or segmental coarticulation. Because it is difficult to manipulate syntactic factors while keeping other aspects of language constant, it may not be possible to isolate syntax as a nonphonological influence on children's function morpheme omissions.

Other researchers have reported lexical familiarity effects on children's omissions. For example Bloom, Miller, and Hood (1975) noted that children were less likely to produce sentential subjects in their spontaneous speech when the verb was newly learned. Because these researchers examined spontaneous speech, it is difficult to infer the exact form of children's intended utterances. Therefore, it is impossible to determine whether the omitted subjects were function morphemes (i.e., pronouns), single content words or entire multiword phrases. Furthermore, utterances containing newly learned verbs may have been phonologically more complex (e.g., longer) than utterances with well-known verbs. However, if it could be shown that lexical familiarity per se influences the omission of function morphemes, we would have evidence of a nonmetrical influence on at least some omissions.

Experiment 1 was designed to test the effect of lexical familiarity specifically on children's object article omissions using an imitation task. Experiment 2 was designed to examine the relation between lexical familiarity and meter on object article omissions, and in particular to determine if the two factors influence omissions independently or whether they interact. A preliminary experiment suggests that there are indeed effects of lexical familiarity on children's object article omissions. In this experiment, 16 children with a mean age of 27 months imitated sentences like 3a–d, below. Although Bloom et al. (1975) found that verb familiarity affected children's sentential subject omissions, the stimuli in the preliminary experiment contained equal numbers of sentences with unfamiliar nouns (3c) as unfamiliar verbs (3d) in order to determine if the effect of lexical familiarity applies to both nouns and verbs (stimuli in Appendix A). Based on the results of Bloom et al. (1975), we hypothesized that children would preserve fewer object articles when imitating sentences containing unfamiliar words than in sentences containing familiar words.

TABLE 1

MEAN OBJECT ARTICLE PRESERVATIONS IN THE PRELIMINARY EXPERIMENT

	Noun targets	Verb targets	Mean
Familiar	55%	60%	57%
Unfamiliar	33%	50%	41%
Mean	44%	55%	49%

3a. She's brushing her tooth.

3b. She's touching the cat.

3c. She's brushing her tusk.

3d. She's tagging the cat.

The results of the preliminary experiment are presented in Table 1. As predicted, children preserved fewer object articles in sentences with unfamiliar targets than familiar targets, and this was the case for both nouns and verbs. However, the familiarity effect was only significant in the analysis by subjects, not in the analysis by items. A likely reason for the lack of an effect by items is that several of the targets designated as unfamiliar were in fact known by more than half of the children (as shown by a parent vocabulary checklist). Therefore, the first goal of subsequent experiments was to increase the difference in children's familiarity with targets designated familiar vs unfamiliar.

The effect of lexical familiarity found in the preliminary experiment suggests that there are nonmetrical influences on children's function morpheme omissions. However, it is possible that this effect is not due to lexical familiarity per se, but rather to the phonological or articulatory complexity of familiar vs unfamil-

iar items. An examination of the target items revealed that the unfamiliar words contained more consonant clusters (78%) than the familiar words (22%). Because young children do not accurately produce clusters in their spontaneous speech (e.g., Ingram, 1974, 1986; Menn, 1978; Smith, 1976), it is reasonable to assume that they find words containing clusters to be phonetically more difficult than words without clusters. Therefore, the difference in the number of clusters found in familiar vs unfamiliar targets suggests that the effect of familiarity may be phonetic rather than, or in addition to, being lexically based. Therefore, the second goal of subsequent experiments was to better equate the phonetic content of familiar and unfamiliar items.

EXPERIMENT 1

In order to meet the goals outlined in the discussion of the preliminary experiment, the stimuli for Experiment 1 were modified in several ways from those shown in Appendix A. First, target words that were designated unfamiliar but that were known by many children in the preliminary experiment were changed in order to maximize differences between familiar and unfamiliar items. We predicted that this change would result in a significant familiarity effect by items, as well as by subjects. Second, in order to determine if lexical familiarity per se, and not phonetic complexity, played a role in children's object article omissions, Experiment 1 employed two types of unfamiliar target words. As in the preliminary experiment, one type comprised unfamiliar synonyms of familiar targets. The second type comprised CVC nonsense syllables containing segments that appear relatively early in children's word production. If the familiarity effect in the preliminary experiment was due to lexical familiarity per se, children should produce more object articles in sentences with familiar targets than in sentences with either unfamiliar or nonsense targets.

Methods

Subjects. In all of the experiments reported here, the names of potential subjects were obtained from archival records of birth announcements in the Buffalo, New York area and from parents whose children had already participated in the study. Subjects in Experiment 1 were 15 children ranging in age from 26 to 28 months, with a mean of 28 months. Each child's Mean Length of Utterance (MLU, Brown, 1973) was calculated from the spontaneous speech s/he produced during the experimental session. MLUs ranged from 1.53 to 3.49, with a mean of 2.31 morphemes. Subjects imitated an average of 96% of the test sentences. An additional 5 children were excluded from the study because they failed to imitate at least 75% of the sentences (n = 4), or because they failed to omit any object articles (n = 1). The latter child was judged to be beyond the developmental stage of interest in the study.

Materials. The stimuli for Experiment 1 varied on two dimensions. First, targets were either familiar words (4a–b), unfamiliar real words (4c–d) or nonsense syllables that were designed to minimize phonetic complexity (4e–f). Second, words designated as targets were either nouns (4a, 4c, 4e) or verbs (4b, 4d, 4f).[2] Based on the information from the parental vocabulary checklist administered in the preliminary experiment, three pairs of target words were modified or replaced. Two new synonym pairs were created, for a total of 18 target word pairs. A list of 18 nonsense words was also created. The nonsense words were CVC monosyllables that began and ended with nasals or stops and contained short vowels. A nonsense word was randomly assigned to each target word pair to form a triplet. When the nonsense word was used as a verb, an -ing inflection was added. Three lists of stimuli were created, so that each member of a triplet occurred on a separate list. Each

[2] The reader might note that sentences designated as containing familiar nouns or familiar verbs are not theoretically different from each other, in that both types contain only familiar words. However, we chose to employ a 3 familiarity (familiar, unfamiliar, nonsense) × 2 word class (noun, verb) design, because the items within triplets (e.g., 5a, 5c, 5e) were closely matched.

list contained three sentences of each the six types (see Appendix B). A practice sentence that contained only familiar words was included at the beginning of each list.

4a. She's brushing her tooth.

4b. He's touching the cat.

4c. She's brushing her tusk.

4d. He's tagging the cat.

4e. She's brushing her tem.

4f. He's gubbing the cat.

A vocabulary check list of all actual nouns and verbs from the stimulus sentences was presented to the parents of children who participated in Experiment 1. Target words designated as familiar were known by an average of 82% of the children; target words designated unfamiliar were known by an average of 13% of the children; and nontarget nouns and verbs (presumed to be familiar) were known by an average of 87% of the children.

Procedure. An experimenter visited each child at his/her home. At the beginning of a session, the experimenter and child looked through the picture book for 10 to 15 min until the child seemed comfortable. The child was then asked to look at some of the experimenter's favorite pictures. The experimenter said she was going to say what was happening in the pictures and see if the child could say the same thing. The experimenter showed the child a picture and said the appropriate sentence. The child was asked to repeat what the experimenter had said. If the child did not imitate after three repetitions, the experimenter went on to the next sentence. All sessions were audio taped, and following each visit, the tapes were transcribed by the experimenter and checked by another person. The experimenter and checker agreed on 97% of the transcriptions of test sentence imitations. Any disagreements were resolved through replay and discussion between experimenter and checker.

TABLE 2

MEAN OBJECT ARTICLE PRESERVATIONS IN EXPERIMENT 1

	Noun targets	Verb targets	Mean
Familiar	67%	57%	62%
Unfamiliar	29%	33%	31%
Nonsense	19%	26%	23%
Mean	38%	39%	39%

Results

The results of a 3 Familiarity (familiar, unfamiliar, nonsense) $\times$ 2 Word Class (noun, verb) ANOVA showed a main effect of familiarity ($F_s(2,26) = 15.25$, $p < .0001$, $F_i(2,32) = 15.04$, $p < .0001$; see Table 2). Pairwise comparisons (Newman–Keuls, $p < .05$) further revealed that children preserved more object articles in sentences containing familiar target words than in sentences containing unfamiliar or nonsense target words; the difference in omissions in the latter two sentence types was not significant. There was no main effect of Word Class ($F_s(1,13) = .01$, n.s.; $F_i(1,16) = .02$, n.s.), nor a significant Familiarity $\times$ Word Class interaction ($F_s(2,26) = 1.03$, n.s.; $F_i(2,32) = .65$, n.s.)

Discussion

Consistent with the findings of Bloom et al. (1975), children in Experiment 1 omitted more object articles from sentences containing unfamiliar words (either real words or nonsense items) than from sentences containing familiar words. Thus, it appears that lexical familiarity indeed influences function morpheme omissions. Furthermore, the lack of an interaction with word class suggests that familiarity plays a role regardless of whether the unfamiliar word is a noun or a verb. The inclusion of CVC nonsense stimuli in Experiment 1 allowed us to test whether the familiarity effect was due to lexical familiarity per se or to the phonetic complexity of unfamiliar words. The fact that children preserved more object articles in sentences with familiar targets than

with either unfamiliar or nonsense targets suggests that the large number of consonant clusters found in real unfamiliar words was not responsible for the familiarity effects. In summary, the data from Experiment 1 confirm and extend the findings of Bloom and her colleagues in three ways: First, we can now be sure that lexical familiarity affects the omission of function morphemes per se. Second, the presence of either unfamiliar nouns or verbs affect omissions. And third, it appears that familiarity, and not phonetic complexity, is responsible for omissions.

What is the nature of the familiarity effect, and how is it related to the effect of meter on children's omissions? One possibility is suggested by a *template model* of children's speech production proposed by Gerken (1991, 1994a). The template model is based on adult speech production models in which an intended utterance is given a representation at several levels, including syntactic, lexical, morphological and phonological (e.g., Dell, 1986; Garrett, 1975; Levelt, 1989). In this model, all omissions of syllabic function morpheme occur when weak syllables fail to fit S-(w) templates at the phonological level of language production, but other levels can influence the likelihood of omissions at the phonological level. In the model, there are rules at each level for creating a range of structures, as well as templates for creating the most frequent or well-practiced structures. The S-(w) metrical template is a well-practiced phonological structure for young children and is responsible for weak syllable omissions. Each intended utterance is allocated a fixed amount of resources, and an utterance that involves unpracticed structures or unfamiliar lexical items uses more resources than one that involves only well-practiced templates and words. When an utterance uses up many of the allocated resources early in the planning stages, the speaker is more likely to resort to templates at later levels. The model predicts that an utterance containing an unfamiliar word would use up more resources at a semantic or lexical access level of utterance planning than an utterance comprising only familiar words. Therefore, children should be more likely to apply S-(w) metrical templates in utterances with unfamiliar words than utterances with familiar words, resulting in a larger lexical familiarity effect in utterances that do not fit a S-(w) template than utterances that do. That is, the template model predicts an interaction between familiarity and meter.

An alternative account of the lexical familiarity effect is that all weak syllable omissions do not occur when a syllable fails to fit a S-(w) metrical template. Rather, some weak syllables are omitted for this reason, while others are omitted due to constraints on the production of all weak syllables, not just those in particular metrical patterns. The *two-source* account is consistent with the fact that, in studies of the effect of meter on weak syllable omissions, weak syllables that fit metrical templates are not always preserved—they are simply preserved more frequently than weak syllables that do not fit metrical templates (e.g., Gerken, 1994a, 1994b, 1995b). Such data strongly suggest a source of omissions in addition to the application of S-(w) metrical templates.

One possible nonmetrical source of weak syllable omissions concerns demands of utterance timing (e.g., Allen & Hawkins, 1980; Donegan & Stampe, 1979; Pollock, Brammer, & Hageman, 1993). In normal adult speech, strong and weak syllables are typically produced with different durations, and the durations of strong syllables are further adjusted depending on whether the words they comprise contain adjacent weak syllables (e.g., the length of *stick* is longer when it comprises a single monosyllabic word than when it is the first syllable of *sticky,* Lehiste, 1972). Producing this complex pattern of syllable durations requires sophisticated speech timing abilities. Both young children and adult non-fluent aphasics, who omit unstressed function morphemes and weak syllables from multisyllabic words, show atypical durational relations between strong and weak syllables as compared with normal adults (e.g., Baum, 1992; Kent &

Forner, 1980; Pollock et. al., 1993). Such findings suggest that difficulties with utterance timing may be a nonmetrical source for some weak syllable omissions. Because unfamiliar words are by definition unpracticed, they may introduce special difficulties with utterance timing and thereby result in more weak syllable omissions than utterances containing only familiar words. Therefore, the two-source account predicts that lexical familiarity and meter will influence children's object article omissions independently, one via the utterance timing mechanism and the other via S-(w) template application. The goal of Experiment 2 was to compare the predictions of the template and two-source accounts of children's object article preservations.

EXPERIMENT 2

Like Experiment 1, Experiment 2 compared children's object article preservations in sentences containing either a familiar word (5a–b) or an unfamiliar synonym (5c–d). Experiment 2 also manipulated the meter of the to-be-imitated sentences by choosing verbs that take a nonsyllabic inflection (5a and 5c) or a syllabic inflection (5b and 5d). When S-(w) templates are applied to the utterances in 5a and 5c, the object article occupies the weak syllable slot. In contrast, the syllabic inflection in 5b and 5d occupies the weak slot of a template, leaving the object article without a slot. Therefore, on metrical grounds, children should preserve the object article in 5a and 5c more frequently than in 5b and 5d. Note that all of the sentences used in the preliminary experiment and Experiment 1 were like 5b and 5d, with a syllabic verb inflection (-ing) preceding the object article.

5a. She cooks the soup
* S-w S-(w)

5b. He pushes the dirt
* S-w * S-(w)

5c. She cooks the broth
* S-w S-(w)

5d. He pushes the soil
* S-w * S-(w)

The main question of interest in Experiment 2 concerns the relation of lexical familiarity and meter. The template model of speech production predicts an interaction between familiarity and meter, such that familiarity has a larger effect in sentences for which S-(w) template application results in object article omissions. That is, the template model predicts that the object article in 5b will be preserved more frequently than in 5d, but that there will be no difference or a smaller difference in preservations between 5a and 5c. In contrast, the two-source account predicts that meter and familiarity will influence object article omissions independently and that there should be main effects of both factors and no interaction.

Methods

Subjects. Subjects for Experiment 2 were 18 children ranging in age from 25 to 27 months, with a mean of 26 months. MLUs ranged from 1.51 to 3.59, with a mean of 2.61 morphemes. Subjects imitated an average of 98% of the test sentences. An additional 10 children were excluded, because they either failed to imitate 75% of the sentences ($n = 7$) or to omit any object articles ($n = 3$).

Materials. The stimuli for Experiment 2 were 20 sentences varying on two dimensions. First, target words, which were always nouns, were either familiar (5a–b) or unfamiliar (5c–d). Second, the object article occurred either in a S-w pattern (5a and 5c) or it failed to fit the weak syllable of a S-(w) template (5b and 5d). The metrical pattern was always manipulated by using verbs that either take a nonsyllabic third person present inflection (-s) or a syllabic inflection (-es). Two lists of stimuli were created, so that each member of a familiar–unfamiliar pair occurred on a separate list. Each list contained 5 sentences of each type

TABLE 3

MEAN OBJECT ARTICLE PRESERVATIONS IN EXPERIMENT 2

	Article fits S-w pattern	Article does not fit S-w pattern	Mean
Familiar	84%	52%	68%
Unfamiliar	69%	42%	55%
Mean	77%	47%	62%

(see Appendix C). A practice sentence that contained only familiar words was included at the beginning of each list.

A vocabulary check list including both target nouns and nontarget verbs was presented to children's parents. Target nouns designated as familiar were known by an average of 87% of the children, and nouns designated as unfamiliar were known by an average of 7% of the children. The nontarget verbs were known by an average of 75% of the children.

Procedure. The procedure was the same as in Experiment 1. The transcriber and coder agreed on 93% of the transcriptions of test sentence imitations.

Results

The results of a 2 Familiarity (familiar, unfamiliar) × 2 Meter (fits template, does not fit template) ANOVA showed that children preserved object articles significantly more frequently before familiar nouns than unfamiliar nouns ($F_s(1,17) = 10.74$, $p < .005$, $F_i(1,18) = 7.04$, $p < .02$; see Table 3). Children also preserved object articles that fit into the weak slot of a S-w template more frequently than articles that did not fit a template ($F_s(1,17) = 26.70$, $p < .0001$; $F_i(1,18) = 52.16$; $p < .0001$). The Familiarity × Meter interaction did not approach significance ($F_s(1,17) = .73$, n.s.; $F_i(1,18) = .12$, n.s.)

Discussion

The results of Experiment 2 replicate the effect of lexical familiarity found in Experiment 1 and found in spontaneous speech by Bloom et al. (1975). They also replicate the effect of meter on object article preservations reported by Gerken (1995b). More interestingly, the results from Experiment 2 indicate that lexical familiarity and meter influence children's object article productions *independently.* Thus, counter to the predictions of the template model of speech production, and consistent with the two-source account, children demonstrated an effect of familiarity regardless of whether the object article fit a S-(w) metrical template.

GENERAL DISCUSSION AND CONCLUSION

The independent effects of meter and familiarity found in Experiment 2 are consistent with the two-source account, in which there are two distinct sources of children's weak syllable omissions. Consistent with a variety of data demonstrating an effect of meter on young children's omissions, we hypothesize that one of these sources is the failure to fit a S-(w) metrical template. Although Experiment 2 was not designed to examine the nature of the second source of omissions, one possibility is a difficulty in mastering the complex timing relation between strong and weak syllables, which results in the omissions of weak syllables in general, not just those failing to fit metrical templates. Thus, consistent with the template model, the two-source account holds that children omit function morphemes as weak syllables. However, unlike the template account, the two-source account is able to explain the observation that children do not preserve all weak syllables that fit S-(w) templates; they simply do so more often than those that do not. Before discussing in more detail the nature of the utterance timing source of children's weak syllable omissions, let us consider two alternative accounts for the effect of lexical familiarity that do not assume that function morphemes are omitted as weak syllables.

On one account, the presence of unfamiliar words increases the semantic complexity of an intended utterance, so that the utterance exceeds some complexity limit. Children attempt to reduce complexity by getting rid of

some element in the sentence (Bates, 1976; Bloom, 1970; 1991; Panagos, Kline, & Klich, 1979). The other, similar account is that, because unfamiliar words were used to refer to pictures of familiar actions and objects, sentences with unfamiliar words were simply more semantically confusing than sentences with familiar words. Although both of these proposals are consistent with the lexical familiarity effect reported here, neither predicts the specific consequences of being faced with a complex or confusing utterance. That is, why do children omit the object article and not the novel word itself? Perhaps children did not know that the novel nouns in Experiment 2 required articles. Recall however, that the familiarity effect was also found with verb targets in Experiment 1. Or perhaps omitting the article most effectively preserves the meaning of the sentence while reducing complexity. One way to test such an account might be to determine if familiarity affects only function morpheme omissions or omissions of weak syllables from multisyllabic words. If all weak syllables are affected, the notion that ''less meaningful'' elements are omitted would be less tenable.

If future studies support the hypothesis that function morphemes are omitted as weak syllables, we must begin to examine possible nonmetrical mechanisms underlying omissions of weak syllables. In keeping with suggestions of previous researchers, we have proposed that difficulty mastering the timing relation between strong and weak syllables is one such mechanism (e.g., Allen & Hawkins, 1980; Donegan & Stampe, 1979; Pollock et al., 1993). Let us now consider this hypothesis in more detail. One way that a lack of control over syllable duration might lead to weak syllable omissions can be seen in a study in which acoustic measurements were made of 2-, 3-, and 4-year-olds' imitations of two syllable nonsense words (Pollock et al., 1993). The 2-year-olds omitted many weak syllables (especially in weak–strong words), and the weak syllables that they did produce were not significantly different in duration than strong syllables. Thus two-year-olds seem unable to produce the large differences in duration typically observed in adults' productions of strong vs weak syllables (also see Allen & Hawkins, 1980). Indeed, it is possible that their weak syllable omissions reflect the 2-year-olds' failed attempts to reduce the duration of these syllables with respect to strong syllables.

How might difficulties in controlling the durations of weak and strong syllables explain the lexical familiarity effect observed in the experiments reported here? One possibility is that novel words are unlikely to have a preexisting motor program, which may result in even less durational control for these items than for familiar words. Perhaps this lack of control spills over to nearby words, resulting in more omission of unstressed object articles. Note that, on this account, the lack of durational control of the unfamiliar word itself is responsible for more frequent omissions of adjacent function morphemes. A somewhat different account is that the presence of an unfamiliar word introduces general linguistic or cognitive complexity, which in turn reduces the resources that children can devote to controlling utterance timing. An apparent example of such general complexity effects can be found in a study by Abbeduto (1987), who examined the average syllable duration of sentence imitations by 5-year-olds, 8-year-olds, and adults. The sentences differed from each other in terms of meter and syntactic and semantic well-formedness. In addition to finding decreasing syllable durations with increasing age, Abbeduto reported that all three age groups had shorter syllable durations for rhythmically alternating strings than nonalternating strings. Furthermore, 5-year-olds and adults had marginally shorter syllable durations for syntactically and semantically well-formed strings than for anomalous strings, even though the meanings of the individual words in the anomalous strings were well known. Abbeduto interpreted shorter syllable durations to indicate more efficient or controlled utterance timing abilities. Thus, he interpreted the

effects of rhythmicity, syntactic and semantic well-formedness on syllable duration to mean that each of these factors ultimately influences control over utterance timing.

If we are to take seriously the notion that difficulty controlling syllable duration is one source for children's weak syllable omissions, we clearly must begin to make acoustic analyses of young children's productions.[3] Indeed, it is possible that apparently omitted morphemes are actually present in some form, but the durational properties of children's utterances makes it difficult for adult listeners to perceive them (see Peters, 1989). We must also analyze the durational properties of sentences containing familiar vs unfamiliar lexical items in order to determine if the relation of weak and strong syllables is different in the two sentence types. Finally, we must explore the relation of syllable duration and meter to determine if the metrical basis of children's omissions is just a special case of a more general utterance timing mechanism (e.g., Allen & Hawkins, 1980).

Regardless of the results of such investigations, the research reported here strongly suggests that there is a nonmetrical source of young children's function morpheme omissions. Studies examining the nature of this source and its relation to the metrical source will shed much needed light general properties of language planning and production in young children.

Appendix A

Stimuli for the Preliminary Experiment

She's touching/tagging the cat
She's sawing the wood/plank
She's painting the wall/fence
She's slicing the meat/steak
He's cutting/carving the meat
He's riding on the boat/raft
She's brushing her tooth/tusk
She's baking the pie/quiche
He's digging in the dirt/soil
He's kicking/punting the ball
He's drinking/gulping the milk
He's pulling/towing the car
He's watching/guarding the water
He's cooking/grilling the hot-dogs
He's making a fire/flame
He's washing/squirting his head

Appendix B

Stimuli for Experiment 1

He's sitting on the chair/stool/bip
She's touching/tagging/gubbing the cat
She's sawing the wood/plank/nug
She's painting the wall/fort/pim
He's holding the bag/sack/gorb
He's cutting/carving/kibbing the meat
He's riding on the boat/raft/dack
She's brushing her tooth/tusk/tem
She's baking the pie/quiche/tob
He's digging/spading/nidding the dirt
He's breaking the stick/twig/kad
He's kicking/punting/depping the ball
He's pulling/towing/gamming the car
He's watching/guarding/pooking the water
He's mowing the grass/turf/tup
He's cooking/grilling/nerting the hot-dogs
He's pushing/clearing/pagging the snow
He's washing/drenching/bimming his head

Appendix C

Stimuli for Experiment 2

She cooks the soup/broth
He bounces the ball/sphere
He saws the tree/stump
He paints the wall/fort
She washes the clothes/garb
He slices the meat/roast
He catches the fish/perch
He climbs the hill/cliff
She bakes the pie/quiche

[3] Although the stimuli in the experiments reported here were not designed for an acoustic examination of children's imitations, we measured vowel durations of a subset of familiar vs unfamiliar object nouns that contained the same vowel in Experiment 2. We found that unfamiliar words were produced with significantly shorter vowel durations than familiar words. If such a pattern is replicated in a future research, one possible explanation is that the lack a motor program for unfamiliar words makes it difficult to lengthen them in utterance-final position.

He fixes the car/Ford
He touches the block/brick
He drinks the milk/cream
He pushes the dirt/soil
She rides the horse/mare
He walks the pig/hog
He watches the bird/gull
He splashes the plant/vine
He cuts the grass/turf
He smashes the stick/stake
He makes a fire/blaze

REFERENCES

ABBEDUTO, L. (1987). Syntactic, semantic, and rhythmic influences on children's and adults' motor programming of speech. *Journal of Psycholinguistic Research,* **16,** 201–221.

ALLEN, G., & HAWKINS, S. (1980). Phonological rhythm: definition and development. In G. H. Yeni-Komshian, J. F. Kavanagh & G. A. FERGUSON (Eds.), *Child phonology, vol. I: Production.* New York: Academic Press.

BATES, E. (1976). *Language and context.* New York: Academic Press.

BAUM, S. R. (1992). The influence of word length on syllable duration in aphasia: Acoustic analyses. *Aphasiology,* **6,** 501–513.

BLOOM, L. (1970). *Language development: Form and function in emerging grammars.* Cambridge, MA: MIT Press.

BLOOM, L. (1991). *Language development from two to three.* New York: Cambridge Univ. Press.

BLOOM, L., MILLER, P., & HOOD, L. (1975). Variation and reduction as aspects of competence in language development. *Minnesota Symposium on Child Psychology,* **9,** 3–55.

BROWN, R. (1973). *A first language.* Cambridge, MA: Harvard Univ. Press.

DELL, G. S. (1986). A spreading activation model of retrieval in sentence production. *Psychological Review,* **93,** 283–321.

DEMUTH, K. (1992, October). *Competence of performance? What phonology shows about children's emerging syntax.* Paper presented at the Boston University Conference on Language Development.

DEMUTH, K. (1995). *Markedness and the development of prosodic structure.* NELS.

DONEGAN, P., & STAMPE, D. (1979). The study of natural phonology. In D. A. Dinnesen (Ed.), *Current approaches to phonological theory.* Bloomington, IN: Indiana Univ. Press.

ECHOLS, C. H. (1993). A perceptually-based model of children's earliest productions. *Cognition,* **46,** 245–296.

ECHOLS, C. H., & NEWPORT, E. L. (1992). The role of stress and position in determining first words. *Language Acquisition,* **2,** 189–220.

FISHER, C., GLEITMAN, H., & GLEITMAN, L. (1991). On the semantic content of subcategorization frames. *Cognitive Psychology,* **23,** 331–392.

GARRETT, M. F. (1975). The analysis of sentence production. In G. Bower (Ed.), *Psychology of learning and motivation* (Vol. 9, pp. 133–177). New York: Academic Press.

GELMAN, S. A., & TAYLOR, M. (1984). How two-year-old children interpret proper and common names for unfamiliar objects. *Child Development,* **55,** 1535–1540.

GERKEN, L. A. (1991). The metrical basis for children's subjectless sentences. *Journal of Memory and Language,* **30,** 431–451.

GERKEN, L. A. (1994a). Young children's representation of prosodic phonology: Evidence from English-speakers' weak syllable omissions. *Journal of Memory and Language,* **33,** 19–38.

GERKEN, L. A. (1994b). A metrical template account of children's weak syllable omissions. *Journal of Child Language,* **30,** 431–451.

GERKEN, L. A. (1995a). Phonological and distributional cues to syntax acquisition. In J. Morgan & K. Demuth (Eds.), *Signal to syntax: Bootstrapping from speech to grammar in early acquisition.* Cambridge, MA: MIT Press.

GERKEN, L. A. (1995b). *Prosodic structure in young children's language production.* Manuscript submitted for publication.

GERKEN, L. A., LANDAU, B., & REMEZ, R. E. (1990). Function morphemes in young children's speech perception and production. *Developmental Psychology,* **27,** 204–216.

GERKEN, L. A., & MCINTOSH, B. (1993). Interplay of function morphemes and prosody in early language. *Developmental Psychology,* **29,** 448–457.

GLEITMAN, L., & WANNER, E. (1982). The state of the state of the art. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art* (pp. 3–48). Cambridge, England: Cambridge Univ. Press.

GREENFIELD, P., & SMITH, J. (1976). *The structure of communication in early language development.* New York: Academic Press.

HYAMS, N. (1986). *Language acquisition and the theory of parameters.* Dordrecht: Reidel.

INGRAM, D. (1974). Phonological rules in young children. *Journal of Child Language,* **1,** 49–64.

INGRAM, D. (1986). Phonological development: production. In P. Fletcher & M. Garman (Eds.), *Language acquisition* (2nd ed., pp. 223–239). Cambridge England: Cambridge Univ. Press.

KATZ, B., BAKER, G., & MACNAMARA, J. (1974). What's in a name? On the child's acquisition of proper and common nouns. *Child Development,* **45,** 269–73.

KENT, R. D., & FORNER, L. L. (1980). Speech segment

durations in sentence recitations by children and adults. *Journal of Phonetics,* **8,** 157–168.

KLEIN, H. B. (1981). Production strategies for the pronunciation of early polysyllabic lexical items. *Journal of Speech and Hearing Research,* **24,** 389–405.

LANDAU, B., & GLEITMAN, L. (1985). *Language and experience: Evidence from the blind child.* Cambridge, MA: Harvard Univ. Press.

LEHISTE, I. (1972). The timing of utterances and linguistic boundaries. *Journal of the Acoustical Society of America,* **51,** 2018–2024.

LEVELT, W. J. M. (1989). *Speaking: From intention to articulation.* Cambridge, MA: MIT Press.

MCGREGOR, K., & LEONARD, L. B. (1994). Subject pronoun and article omissions in the speech of children with specific language impairment: A phonological interpretation. *Journal of Speech & Hearing Research,* **37,** 171–181.

MENN, L. (1978). Phonological units in beginning speech. In A. Bell & J. B. Hooper (Eds.), *Syllables and segments.* Amsterdam: North Holland.

MENYUK, P., & LOONEY, P. (1972). Relationships among components of the grammar in language disorders. *Journal of Speech and Hearing Research,* **15,** 395–406.

PANAGOS, J. M., KLINE, M. E., & KLICH, R. J. (1979). Syntactic and phonological influences on children's articulation. *Journal of Speech and Hearing Research,* **22,** 829–840.

PETERS, A. (1989, October). *From schwa to grammar: The emergence of function morphemes.* Paper presented at the Boston University Conference on Language Development.

PETRETIC, P. A., & TWEENY, R. D. (1977). Does comprehension precede production? The development of children's responses to telegraphic sentences of varying grammatical adequacy. *Journal of Child Language,* **4,** 201–209.

PINKER, S. (1984). *Language learnability and language development.* Cambridge, MA: Harvard Univ. Press.

POLLOCK, K. E., BRAMMER, D. M., & HAGEMAN, C. F. (1993). An acoustic analysis of young children's productions of word stress. *Journal of Phonetics,* **21,** 183–203.

PYE, C. (1983). Mayan telegraphese. *Language,* **59,** 583–604.

SHIPLEY, E., SMITH, C., & GLEITMAN, L. (1969). A study in the acquisition of language. *Language,* **45,** 322–342.

SMITH, N. V. (1973). *The acquisition of phonology.* Cambridge, England: Cambridge Univ. Press.

WIGNEN, F., KRIKHAAR, E., & DEN OS, E. (1994). The (non)realization of unstressed elements in children's utterances: A rhythmic constraint? *Journal of Child Language,* **21,** 59–83.

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