The open CV syllable is the basic, 'unmarked' syllable type in the world's languages and in the phonological development of children. This paper charts the course of acquisition of final consonants by children acquiring a language rich in such consonants and proposes four major characteristics: (1) The number of different consonant phone types in final position is equal to or less than the number in initial position; (2) fricatives and liquids are more likely than stops and nasals to be acquired first in final position; (3) final velars are more likely to be attempted than non-final velars or final non-velars; and (4) final voiced consonants pose a special problem for children, and some children may make use of nasals in attempting to produce them. These characteristics are systematically related to the occurrence of final consonants in children's babbling, to the distribution of final consonants in the world's languages, and to strength hierarchies proposed for consonants.

INTRODUCTION

The open CV syllable is the basic, 'unmarked' syllable type in the world's languages and in the phonological development of children. Reflecting on the vocalizations of their 13-month-old subjects, Kent and Bauer [1] comment on the "primacy" of the CV syllable shape, which may be viewed as a "simplest form...or a kind of atom in the formulation of speech" (p. 527). Although many languages have syllable-final and word-final consonants and even consonant clusters, these final consonants are much less frequent than initial consonants (both types and tokens). Also, final consonants are of very low incidence in babbling, regardless of the language spoken around the child. The acquisition of final consonants can thus be expected to pose a phonological challenge for children, from either a linguistic-universal or a biological-developmental perspective.

The identification and explanation of constraints on types of consonants occurring in final position in the world's languages constitute a significant part of the total characterization of the phonological structure of human languages ('phonological universals'), and analysis of the phenomena of final consonant acquisition can contribute to this 'universal phonology' ([2]).

Word-initial position is typically the position of greatest consonantal diversity in phonological inventory, though medial position in some languages for some classes of segments may be greater; final position is typically the position of least diversity, though preconsonantal position may be even more limited. These constraints may be expressed in terms of strength hierarchies of optimal syllable-initial segment classes and their mirror image for syllable-final position: stops, fricatives, nasals, liquids, glides, vowels ([3], ch. 10). Such hierarchies are intended to show universal relations, but admit of some language-specific variation. Whatever perceptual, articulatory, cognitive processing, and social/conventional constraints account for those hierarchies may be expected to result also in developmental patterns of order of acquisition and types of substitution and assimilation. Thus it may be expected that final fricatives, nasals, and liquids will not only be more frequent than final stops and occur in languages without final stops, but will also be acquired earlier. The present paper explores the actual phenomenon of acquisition of final consonants in the light of this expectation. English is an especially appropriate language for the investigation since the incidence of initial, medial and final consonants in running text is virtually identical (36% initial vs. 32% each medial and final: [4]). We will restrict ourselves here to the analysis of word- (or vocalization-) final consonants, since syllable-final consonants which are not also word-final are extremely rare in children's early productions.

Final consonants in babbling

Several careful accounts of the phonetic characteristics of babbling have documented the relative rarity of final consonants [1, 5-8]. On the other hand, in an analysis of consonant frequency in the babbling and word production of 10 English-learning subjects, Vihman, Ferguson and Elbert [8] found the mean proportion of final consonants to increase gradually with growth in the children's use of words, ranging from a mean of 6% final consonants early on to 17% when 25 or more words could be identified.

Differences have also been reported in the incidence of different manner categories in initial vs. final position in babbling. Oller et al. [5] reported a 10 to 1 ratio of stops to fricatives and affricates in initial position and a 3 to 1 ratio of final fricatives to stops (based on tokens).
Similarly, deBoysson—Bardies et al. [6] reported a 9 to 1 ratio of initial stops to fricatives and affricates and an 8 to 1 ratio of final fricatives and stops in the babbling of their French subject. In inventories of consonant types used in babbling only a small and higher proportion of fricative and liquid segments were found in final position (28%), as compared with initial position (12%), based on the true consonant categories of stop and nasal, and on fricative, affricate, and liquid (continuant). [8]. Overall, only 19% of all initial consonants were continuant, while 32% of all final consonants were continuant. As increasing numbers of final consonants began to be used, the slight initial bias toward continuant consonants in final position was strengthened.

Recent work on the transition from babbling to speech has strongly demonstrated the continuity in phonetic tendencies across that transition [3, 9, 10]. Accepting Locke's assertion that the beginnings of phonological development antedate the child's first use of adult-based words [9], it is important to consider the process by which final consonants are incorporated into the system in the course of acquiring a language characterized by heavy use of final consonants.

**Final consonants in early word use**

In general, final consonants are rare in early words, as the finding of continuity from babbling to speech lends us to expect, and the range of occurring segments is correspondingly small. In her longitudinal study of the phonetic inventories of 15 words for 33 children, Stoel-Gammon [11] found that the typical inventory of initial phonemes tended to be about twice as large as the typical inventory of final phonemes.

The total incidence of initial and final consonant segment types in words and babble reported by Gammon and Cooper [14] is given in Table 1. In both inventories, only 10% of the consonant segments occurred in final position. While the overall proportion of consonants occurring in words was smaller (40%) than the proportion occurring in babble, the proportion occurring in final position of all consonants occurred in babble (48%) was somewhat smaller (40%) than the proportion occurring in initial position (59%). Some final consonants occurred in final position. While the proportion of final consonants occurring in initial position (24%) was lengthened and followed by [i]: 2225 final consonants occurred in final position (48%). Some final consonants occurred in final position of all consonants occurring in final position (40%). In an inventory implied the presence of an initial stop or nasal. Fricatives and affricates showed great individual variation. Nine subjects had inventories with final fricatives preceding final ones, while 7 subjects had inventories with final fricatives preceding initial ones. However, liquids showed a consistent pattern in which the final nasal of the adult form was replaced by the homorganic nasals, sometimes followed by the corresponding voiceless stop: *con* (*kun*), *bub* (*bub*). (Gumen, aged 1;8–1;10; *egg* (*eg*), *mack* (*mac*). It is striking that nasals or nasal release were more word-final than stops, developing an idiosyncratic final production strategy or "word recipe" and also more velars in medial and final position. For example, the idea of a natural hierarchy of segment classes was determined through a study of the acquisition of word-final obstruents. (p.226). Daniel seemed to select his earliest words (m [cnzi]; cheese [(a)It]). Like the initial segments of a stop-final monosyllable, nasal-final words. Both word patterns sub-

**CHARACTERISTICS OF FINAL CONSONANTS**

**Table 1. Incidence of Initial vs. Final Consonant Types in Babbling and Words (based on [4], Table 5).**

<table>
<thead>
<tr>
<th>Consonant Type</th>
<th>Babble Words</th>
<th>Word Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>217 136</td>
<td>21 19</td>
</tr>
<tr>
<td>4-word</td>
<td>123 59</td>
<td>11 7</td>
</tr>
<tr>
<td>15-word</td>
<td>94 79</td>
<td>10 12</td>
</tr>
<tr>
<td>Initial consonants</td>
<td>stage</td>
<td>babble words</td>
</tr>
<tr>
<td>4-word</td>
<td>123 59</td>
<td>11 7</td>
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<td>217 136</td>
<td>21 19</td>
</tr>
</tbody>
</table>

**Stage 1**: The initial proportion of initial fricatives is lower than that of initial stops and nasals. However, initial fricatives and affricates sometimes appear in final position. At the earliest stages of word use initial consonants tend to be more prominent in babble than in words. As the finding of continuity from babble to words lends us to expect, the range of occurring segments is correspondingly small. In her longitudinal study of the phonetic inventories of 15 words for 33 children, Stoel-Gammon [11] found that the typical inventory of initial phonemes tended to be about twice as large as the typical inventory of final phonemes. The total incidence of initial and final consonant segment types in words and babble reported by Gammon and Cooper [14] is given in Table 1. In both inventories, only 10% of the consonant segments occurred in final position. While the overall proportion of consonants occurring in words was smaller (40%) than the proportion occurring in babble, the proportion occurring in final position of all consonants occurred in babble (48%) was somewhat smaller (40%) than the proportion occurring in initial position (59%). Some final consonants occurred in final position. While the proportion of final consonants occurring in initial position (24%) was lengthened and followed by [i]: 2225 final consonants occurred in final position (48%). Some final consonants occurred in final position of all consonants occurring in final position (40%). In an inventory implied the presence of an initial stop or nasal. Fricatives and affricates showed great individual variation. Nine subjects had inventories with final fricatives preceding final ones, while 7 subjects had inventories with final fricatives preceding initial ones. However, liquids showed a consistent pattern in which the final nasal of the adult form was replaced by the homorganic nasals, sometimes followed by the corresponding voiceless stop: *con* (*kun*), *bub* (*bub*). (Gumen, aged 1;8–1;10; *egg* (*eg*), *mack* (*mac*). It is striking that nasals or nasal release were more word-final than stops, developing an idiosyncratic final production strategy or "word recipe" and also more velars in medial and final position. For example, the idea of a natural hierarchy of segment classes was determined through a study of the acquisition of word-final obstruents. (p.226). Daniel seemed to select his earliest words (m [cnzi]; cheese [(a)It]). Like the initial segments of a stop-final monosyllable, nasal-final words. Both word patterns sub-

**Focus on word-final consonants**

Recent work in child phonology has emphasized the individual differences among children learning the same language [13]. Differential attention to consonants in final position is one such individual characteristic. Menn [12] described her son Daniel’s early phonological strategy as a decision to focus on word-final positions. She noted that when she focused on initial consonants, she tended to select for initial segments, while when she focused on final consonants, she predicted a phonemic rapprochement between the obstruent-final words, with their heavy aspiration: "while children are attracted perceptually to the idea of a natural hierarchy of segment classes in their native language, they may be more "natural" in final position than stops, though less so than the continuous consonants.

**SUMMARY AND CONCLUSIONS**

Study of the acquisition of word-final consonants in English yields the following generalizations.
(1) Word-final consonants are acquired later than initial consonants. At any point in development, the number of different consonant phone types in final position is equal to or less than the number in initial position. However, a few children utilize a strategy of making final position more salient than initial for consonant variety and stability.

(2) Continuants are more likely than non-continuants to be acquired first in final position. Of the continuants, liquids are most likely to be acquired first in final position; fricatives are more variable.

(3) Velar consonants have a special affinity for final position. Final velars are more likely to be attempted than non-final velars or final non-velars.

(4) Final voiced consonants pose a special problem for children, and some children adopt unusual strategies for producing them (e.g., nasal stop clusters, nasal offglides, vowel lengthening).

These characteristics are systematically related to the occurrences of final consonants in children's babbling, to the distribution of final consonants in the world's languages, and to strength hierarchies proposed for consonants. This systematic relationship is the essence of Jakobson's influential model of phonological development [24, 25]. The child language data give further specification to the relationship and also in effect extend the Jakobson model to pre-speech, where he denied its relevance, and to final position, which he did not consider. The evidence for final consonants also strongly suggests that where there is relative infrequency and variability in phonological systems world-wide we may expect to find corresponding patterns of individual variation among children acquiring a particular language.

REFERENCES