The Status of Feet in Early Acquisition

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ABSTRACT

Previous study of children's early productions finds a stage of development where words are minimally and maximally a binary foot, or minimal word. The present study finds extensive truncation of early words to CV subminimal words in the speech of a French-speaking child, posing problems for such proposals. The paper shows how these findings can be accounted for within a theory of prosodic constraints that is sensitive to the statistics of language-specific prosodic word structures.

1. INTRODUCTION

It has long been noted that children omit initial unstressed syllables from early speech, with words like *banana* surfacing as [ˈnænə] [20]. The predominance of such forms has led researchers to propose a universal bias for children's early words to contain strong-weak (Sw) trochaic feet [1], [2]. This is consistent with the notion that 'unmarked' structures such as core (CV) syllables and minimal words (binary feet) are the first to emerge in children's early grammars [5], [14], [15], [29].

There have been several attempts to explain syllable omission in children's early speech. The *perceptual account* notes that stressed and final syllables are generally preserved in early speech [11], [12]. However, it is not clear how the perceptual account handles truncations such as [ˈbænə] for *banana*, where the onset to the initial unstressed syllable is mapped into the output form.

The *articulatory account* encounters similar problems [24], [25]. If language learners are articulatorily restricted in either syllable complexity or the number of syllables per word, we expect these maturational limitations to be found crosslinguistically. Yet research shows that Spanish-speaking children produce 3-syllable wSw words like *manzana* 'apple' several months before their English-speaking peers produce wSw words like *banana* [8], [16].

Finally, the *rhythmic production account*, which predicts early Sw trochaic feet [1], [2], [17], [18], encounters problems not only with the Spanish data, but also suffers from the lack of a developmental proposal for how children eventually move beyond the constraints of a trochaic template.

Many of the limitations of these proposals are addressed by a more abstract developmental theory of *prosodic constraints* [5], [6], [7], [9]. By appealing to different levels of structure in the prosodic hierarchy [28], [35], this proposal provides a framework for understanding early minimal words as a developmental stage along the path of increasing prosodic complexity. It also predicts that the shape of early words will be influenced by the frequency of language-specific prosodic structures [31].

French provides an ideal test case for exploring the validity of the theory of *prosodic constraints*. If language learners are sensitive to properties of the input, as infant speech perception studies suggest [19], [27, [33], we expect French learners' early words to take the form of iambic rather than trochaic feet. We also expect that after a brief initial period of subminimal (CV) truncated forms, French learners will observe lower bounds on word shape, producing well-formed bimoraic (CVC, CVV) or bisyllabic (CVCV) minimal words, as found for other languages.

2. THE STUDY

We assessed these predictions by analyzing longitudinal diary data from the child Suzanne's acquisition of Parisian French between the ages of 1;1-1;7 [10]. The corpus contains 220 utterances, with 50 word types reported by 1;4 years. Although the data are not ideal (stress was not marked, utterances were noted in orthographic form, and only new shapes of words were recorded, resulting in quasi-type counts), they nonetheless constitute a rich source of information regarding French prosodic word development [36].

3. RESULTS

3.1 PROSODIC SHAPE OF TARGET WORDS

The prosodic word shapes Susanne attempted are provided in Figure 1. Although the frequency of these words shapes probably differs from the prosodic word types and tokens she actually hears, it provides some idea of her linguistic environment.

Given the high frequency of 2-syllable targets, we might expect Susanne to produce binary feet from the onset of word production. Given the low frequency of 3- and 4-syllable words we might also expect these to be truncated to a binary foot. The more interesting case is that of 1-syllable words, divided here in to CVC minimal words and CV subminimal words. Together, these constitute about 50 percent of her target words. If Suzanne produces coda consonants, or if she epenthesizes a final vowel to the

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CVC targets, these will be realized as minimal words, or binary feet. If she cannot produce coda consonants, and chooses not to epenthesize, she will end up producing many words which are less than a binary foot. Given previous findings from English and Dutch we might expect Suzanne to epenthesize when it is necessary to form a binary foot. On the other hand, given the high number of subminial target words she attempts, and the fact that coda consonants are acquired late in closely related Spanish [23], we might expect Suzanne to exhibit an extended period of subminimal word production.

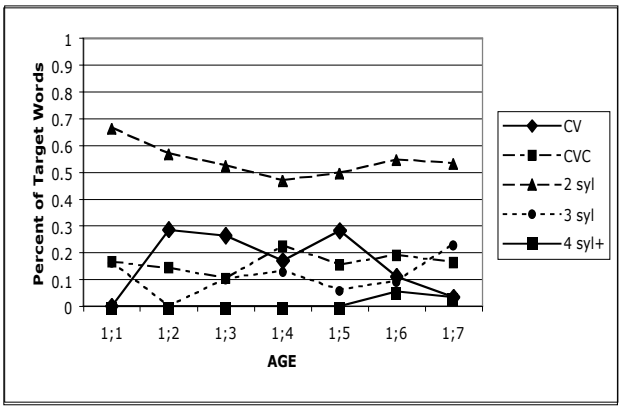

Figure 1. Percent of Target Word Shapes Attempted

3.2 PROSODIC SHAPE OF WORDS PRODUCED

Figure 2 gives the relative frequency with which Suzanne produced different prosodic word shapes. Most of Suzanne's early prosodic words are either CV or 2 syllables. Both CVC forms and words longer than 2-syllables only begin to appear at 1;6 months. Many of her CV productions are truncations of CVC or CVCV targets.

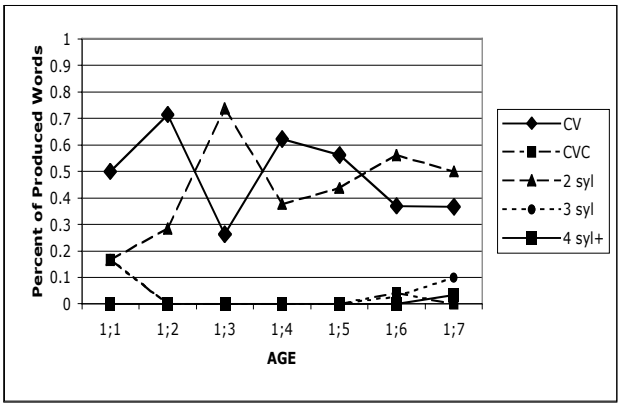

Figure 2. Percent of Word Shapes Produced

(1) Subminimal truncations of monosyllabic targets

/pɛɲ/	[pɛ]	peigne	'comb'	1;3
/bʀɔs/	[bɔ]	brosse	'brush'	1;3
/pɔm/	[pɔ]	pomme	'apple'	1;3
/sabl/	[ta]	sable	'sand'	1;4
/taʀ/	[ta]	tard	'late'	1;4
/lim/	[pi]	lime	'file'	1;4
/fʀɛz/	[tɛ]	fraise	'strawberry'	1;5
/vɛʀ/	[vɛ]	verre	'glass'	1;5
/vaʃ/	[va]	vache	'cow'	1;6
/vɛʀ/	[vɛ]	vert	'green'	1;6

(2) Subminimal truncations of disyllabic targets

/ʃosɔ̃/	[tɔ̃]	chausson	'slipper'	1;3
/balɛ/	[ba]	balai	'broom'	1;3
/ʒypɔ̃/	[po]	jupon	'petticoat'	1;3
/basɛ̃/	[ba]	bassin	'basin'	1;3
/buʒi/	[bi]	bougie	'candle'	1;3
/madam/	[da]	madame	'Mrs.'	1;3
/kylɔt/	[tɔ]	culotte	'pants'	1;3
/frɔmaʒ/	[ma]	fromage	'cheese'	1;4
/salad/	[da]	salade	'salad'	1;4
/ʃifɔ̃/	[tõ]	chiffon	'rag'	1;5
/sɔlda/	[da]	soldat	'soldier'	1;6

Suzanne's early word shapes therefore differ significantly from the early word shapes reported for English and Dutch, where children's early words tend to take the form of binary feet, even if this leads to epenthesis. Why is this not the case for Suzanne? What is the status of feet in early French?

4. THE STATUS OF FEET IN FRENCH

Binary feet therefore play an early role in many languages, including English, Dutch, Spanish, and even Sesotho [7]. Subminimal words are rarely produced for targets that are a binary foot. What, then, makes French different?

Given the theory of *prosodic constraints*, where children's reranking of constraints is sensitive to the statistical properties of the input, Suzanne's early word shapes lead us to expect that 1) coda consonants are infrequent in French, and 2) CV subminimal words are more frequent than originally thought.

Like Spanish, coda consonants in French are found on only 24% of syllables [4]. This compares with 60% for English. The fact that Spanish codas are later acquired than English codas [23] is therefore attributed to the lower frequency of codas in Spanish [31]. We suggest that the same is true for French, thus contributing to an extended period of time where CVC target words are realized as only CV. But why don't French-speaking children reduplicate or epenthesize CVC forms like English and Dutch children often do, thereby producing well-formed CVCV minimal words?

It turns out that, unlike English and Dutch, French not only permits a wide range of subminimal open class words, including many derived words truncated to CV, but many of these are used in everyday speech of the type a child is likely to hear [34].

(3) Some Common French Subminimal Words

[lɛ]	lait	'milk'
[kle]	clé	'key'
[o]	eau	'water'
[ry]	rue	'street'
[fø]	feu	'fire'
[sã]	sang	'blood'
[nõ]	nom	'name'

How frequent are subminimal words in the input French-learning children hear? We are currently collecting child-directed speech in order to assess this issue. In the meantime, some support for the notion that subminimal words are frequent in everyday spoken French comes from the fact that 15% of the Suzanne's attempted target words were CV subminimal words. This, combined with the fact that her coda consonants only begin to appear around 1;7 years (again due to relative low frequency), leads to the prolonged truncation of CVC words to CV. Since 18% of Suzanne's target words were CVC in shape, this combines to yield 34% overall production of CV minimal words.

Alternative analyses of the data fall short. Only the perceptual account might be valid if the child were mapping the final stressed syllable into her output forms on perceptual grounds. Coda consonants tend to have fewer acoustic cues [37], and might therefore be omitted, yielding CV subminimal words. However, the perceptual account cannot explain why it is sometimes a non-final CV syllable that is actually preserved in some of the CVCV target forms. Thus, we suggest that the low frequency of codas in French plus the high frequency of subminimal words leads Suzanne to produce CV truncations. She is sensitive to the statistical properties of the input, and this plays a role in shaping her early words.

4. THE STATUS OF FEET IN FRENCH

The French-speaking child in this study exhibits an extended period of development where half her early words are a binary foot and the other half subminimal CV forms. Foot binarity is therefore a maximal, but not a minimal constraint. This goes counter to proposals that children's early utterances will be composed of unmarked minimal words.

What, then, is the status of feet in early acquisition? Early word development in other French children would need to be examined before drawing strong conclusions [32]. However, this study provides additional support for the notion that children's early prosodic words reflect the statistical properties of the input: subminimal words are common in French, and words of 3 or 4 syllables are rare, accounting for only 8.5% of the child's target words. Even at 2;4-3;0 years French-speaking children in other studies have shown a tendency to truncate 4-syllable nonce words to binary feet [30].

The results of this study are therefore consistent with the theory of *prosodic constraints*, where early word shape is influenced by the frequency of language-specific prosodic structures [7]. These French findings also provide additional evidence that children are sensitive to the statistical properties of the ambient language, and that this is reflected in both perception and production [21], [22]. Feet, then, are merely an epiphenomenon of children's awareness of language-specific structure.

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