THE REDUPLICATIVE BABBLES OF FRENCH- AND ENGLISH-LEARNING INFANTS: EVIDENCE FOR LANGUAGE-SPECIFIC RHYTHMIC INFLUENCES

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ABSTRACT

The reduplicative babbling of five French- and five English-learning infants produced between the ages of five and thirteen months was examined for evidence of language-specific rhythmic patterns. The babbling of the French infants showed a significantly greater percentage of final-syllable lengthening than that of the American infants. The French babbling showed more regularly timed nonfinal syllables than that of the Americans, although only in the later stage of the infants' reduplicative babbles. The French infants also produced significantly more reduplicative babbles that were four or more syllables in length.

1. INTRODUCTION

Jakobson's [6] famous proposal of discontinuity between babbling and early speech has not found much support in current research on child language acquisition. Instead, many have found evidence of continuity between babbling and early speech (e.g., [7]). The child's babbling thus seems to "drift" [4] in the direction of the phonetic characteristics of the ambient language.

The question of how early the child's productions reflect the segmental properties of the native language has been much debated, with some finding evidence for such effects during the first year of life (e.g., [2]) while others do not (e.g., [9]). Very little attention has been devoted to the early stages of prosodic development, although some have suggested (e.g., [5,10]) that infants may begin to imitate the prosodic patterns of their language earlier than they imitate the segments. In a recent investigation [15], we found evidence for language-specific effects in the F0 contours of the reduplicative babbles of French- and English-learning infants. In the present investigation we extended our study to the rhythmic properties of those reduplicative babbles, in particular phrase-final lengthening, the timing of individual syllables within each utterance, and the number of syllables per utterance.

Both French and English exhibit final syllable lengthening (breath-group final lengthening in French), but because French nonfinal syllables are not typically lengthened due to word stress, final-syllable lengthening is a more salient feature of French, which is "trailer timed," according to Wenk and Wioland [14]. There has been some indication that French and American infants may develop final-syllable lengthening fairly early on. In examining the babbling of a group of French-learning infants, Konopczynski [7] found that final syllables were longer on average than nonfinal syllables, from the age of eight months on, although this difference did not become significant until the children were 16 months old. Oller and Smith [12], in examining the babbling of six or English-learning infants ranging in age from 8 to 12 months, found evidence for such lengthening in the babbling of some but not all of their American infants. To see whether the onset of such lengthening might differ between the two groups, our study looks at French and English babbling both longitudinally and cross-linguistically.

In terms of nonfinal syllable timing, French has been classified as syllable-timed (e.g., [13], but cf. [14]), with a rhythmic structure known as isosyllabicity, which is characterized by nonfinal syllables generally equal in length. Because variable word stress in English tends to lengthen nonfinal stressed syllables, English does not exhibit isosyllabicity. If French nonfinal syllable timing has an effect on the infants' productions, then we would expect the French infants to exhibit more regularly-timed nonfinal syllables.

Finally, in keeping with the possibility for stress-delimited breath groups in French to contain as many as four to six syllables, whereas intervals between stressed syllables in English rarely contain more than four syllables, we expected that our French infants might produce longer reduplicative utterances than our American infants. Indeed, Boysson-Bardies [3] reported a similar effect of utterance length for somewhat older children.

2. PROCEDURE

2.1 Subjects

The babbling of five English-learning infants (three male and two female) and five French-learning infants (four male and one female) was recorded weekly by their parents at home. The French-learning infants were recorded in Paris and the English-learning infants were recorded in the northeastern United States. The average age of the infants at the first recording used was 7;3 and the last was 11;1 months (ranging from 5 to 13 months).

2.2 Method

The infants were recorded on cassette tape recorders using high quality microphones. Home recording sessions lasted between 10 and 20 minutes. Parents were instructed to choose a time when their child was alert and unlikely to cry. They could elicit babbling by talking and gesturing, but they were told to be sure to stop speaking as soon as the infant began vocalizing. The microphone was to be held about 20 cm from the baby. The parents identified each individual taping by recording the date at the beginning of each session. A comment sheet was also filled out for each tape and included the date, time, and situation (e.g., "in bath") of each recording.

Each tape was transcribed, and all infant vocalizations (except for squeals, growls, emotive sounds, and vegetative noises) were digitized at 10 kHz via the Haskins Laboratories PCM system [16]. The vocalizations were divided into utterances, or breath groups, which were defined as a sequence of syllables that were separated from other utterances by at least 750 ms of silence and which contained no silent periods longer than 450 ms in length. From the phonetically transcribed and digitized utterances, we selected all the reduplicative babbles according to our transcriptions. Using these criteria, we obtained 208 reduplicative utterances, approximately half (102) from the English-learning children and half (106) from the French-learning infants. Reduplicative babbles consist of two or more repetitions of the same syllable, which in the case of our ten infants, were all open CV syllables. Because phonetic segments are of inherently different lengths (e.g,. fricatives are typically longer than stops), we analyzed only reduplicative babbles, where all the consonants and vowels in a single utterance are the same, in order to eliminate syllable duration variations due to inherent differences in segment length.

The duration of each syllable was measured using a wave form editing and display program. A conservative criterion for measuring syllable length was adopted, such that duration measurements only included the visibly voiced portion of each syllable. This criterion was adopted because the home recording environments were occasionally noisy, and the noise could serve to obscure, in some cases but not in others, the breathy release of certain syllables. Although nonfinal syllables could be considered to extend to the onset of the following syllable, such an alternative measure was not available for final syllables, making comparisons between nonfinal and final syllable lengths problematic. Thus, in order to avoid such difficulties, breathy releases and intersyllabic silences were not included in the syllable measurements.

3. RESULTS

We measured final syllable lengthening by comparing the length of the final syllable of each reduplicative utterance to that of the penultimate syllable. For each infant, we calculated the percentage of utterances showing final syllable lengthening. The French infants showed final syllable lengthening in 63% of the utterances on average, whereas the American infants showed final syllable lengthening in 42% of their utterances. This difference was significant [t(8)=2.37, p=.0227, one-tailed].

In order to see whether this pattern was evident throughout the period during which reduplicative babbling was detected for each child, we divided each infant's utterances into two groups. The first group, the "early" stage of reduplicative utterances, was produced during the first half of the time period and the second group of "late" reduplicative utterances was produced in the second half of the time period. We again calculated the mean percentage of final syllable lengthening for each infant during the early and during the late period. The results of an ANOVA with repeated measures indicated again an overall group effect of language background [F(1,8)=7.48, p=.0256], but no effect of early vs. late utterances and no interaction of language background and early vs. late utterances.

We measured isosyllabicity, i.e. the relatively regular timing of nonfinal syllables within each utterance, by calculating the standard deviation of the nonfinal syllables for each utterance and determining the mean standard deviation for each infant. Although the French infants did show lower standard deviations on average (54.5), indicating more regularly timed utterances, than the English (65.4), the difference was not significant.

In order to see whether there was a significant shift in this tendency over the period during which reduplicative babbling was detected for each child, we again divided the utterances by time period into two groups, the early and the late. The mean standard deviation was again calculated for each infant during the early and the late time periods. The results of an ANOVA with repeated measures showed no main effect of group (language background) and no main effect of early vs. late utterances. However, there was a significant interaction of language background and early vs. late utterances [F(1,8)=8.402, p=.0199]. As can be seen from Figure 1, the standard deviations of the utterances produced by the French infants decreased in the later stage whereas those of the American infants increased, indicating that whereas the French infants were developing more regularly timed utterances, the American infants were developing more irregularly timed productions.

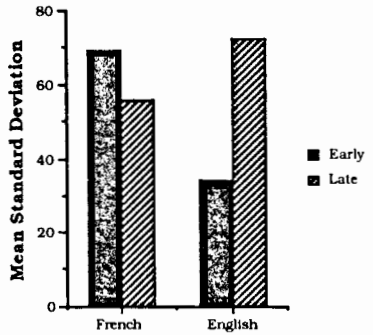

Figure 1

The mean standard deviations for nonfinal syllables produced by the French and American infants during the early and late stages of reduplicative babbling.

The percentage of "long" (four or more syllables) reduplicative babbles was calculated for each of the French and American infants. The French infants produced more long utterances (44%) than the American infants (17%). This difference was significant [t(8)=2.901, p< .01, one-tailed).

In order to see if the pattern varied over the babbling period, we recalculated the percentage of long utterances in the early and the late period of babbling for each infant. An ANOVA with repeated measures (early vs. late percent of long utterances) was conducted on the results. Again, there was a significant main effect of language background [F(1,8)=6.379, p=.0355], but there was no significant main effect of early vs. late percent of long utterances nor any significant interaction of language background and early vs. late percent of short utterances.

4. DISCUSSION

We found acoustic evidence for language-specific prelinguistic rhythmic effects in the reduplicative babbling of French and English infants. In particular, French infants produced a higher percentage of final-syllable lengthening and of utterances four or more syllables in length. In addition, French infants produced more regularly timed nonfinal syllables, although only in the later stage of their reduplicative babbles.

However, whereas our study of the F0 properties of our infants' reduplicative babbles [15] revealed both acoustic and perceptual effects, the rhythmic differences that we have discerned here do not appear to be sufficiently robust to be detectable by adult listeners. Nonetheless, just as Macken and Barton [11], through acoustic analysis, discovered that children learning the voicing distinction in English went through a stage during which they produced the contrast in a manner that was not perceptible to adults, we believe that our effects represent a similar stage in the acquisition of prosody. Indeed, as Allen [1] has shown, French children exhibit many of the prosodic characteristics of their language in a more robust fashion by two years of age.

Thus, our results, along with those of Boysson-Bardies and her colleagues [2,3] suggest that the babbling of infants younger than one year of age may reveal language-specific vocalic and prosodic influences when analyzed acoustically.

5. ACKNOWLEDGMENT

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