EXAMINATION OF LANGUAGE-SPECIFIC INFLUENCES IN INFANTS' DISCRIMINATION OF PROSODIC CATEGORIES

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ABSTRACT
Language-specific effects in perception of segmental contrasts appear by 10-12 months. Recent studies with connected speech suggest earlier emergence of sensitivity to some language-specific prosodic properties; however, these have not been examined in prosodic contrasts. We tested 6-8 and 10-12 month olds on a discourse prosody contrast (question vs answer) in native and non-native sentences. Across age, category discrimination was significant for native, nearly so for non-native, speech. Separate analyses found younger infants discriminate in both languages; older infants in neither, failing to support language-specific perception of the prosodic contrast.

1. INTRODUCTION
To acquire language, the infant must learn to recognize that certain sound patterns recur in native speech, whereas others do not. Adults show language-specific attunement in perception of phonemic contrasts, often finding it initially difficult to discriminate non-native segmental distinctions (10, 11, 13). But infants under 8 months discriminate both native and non-native contrasts. Difficulty distinguishing non-native contrasts appears by 10-12 months (2, 7, 14).

Infants must also learn the prosodic characteristics of their native language. Indeed, it has been argued that infants become attuned earlier to prosodic than to segmental properties (7, 9). Numerous recent findings appear consistent with this claim. Infants from 5 months to as young as 1-2 days prefer infant-directed speech (IDS) over adult-directed speech (6), and can discriminate native from non-native connected speech (1, 12), even when segmental content is removed from the IDS contours. Other language-specific effects on prosodic perception appear by 6-11 months (5, 6, 8). Even in utterance-by-mother's voice condition, native infants prefer for familiar patterns in her speech (4, 9).

Thus, many experience-based effects on prosodic perception are found earlier than the 10-12 month reorganization for segmental contrasts. Yet direct comparision of the prosodic and segmental findings is problematic. Whereas the segmental studies found discrimination of phonemic contrasts, the prosodic studies have examined responses to broad prosodic patterns and have not tested linguistic contrasts. Therefore, we examined infants' discrimination of a prosodic contrast in native vs. non-native speech.

The question-answer contrast is a discourse distinction whose prosodic patterns may be within the infant's reach. Discourse prosody may help infants discover certain pragmatic distinctions without lexical knowledge. The young listener may not expect a final F0 rise; yet declarative information indicates a comment directed toward the listener. Although questions are often marked by final F0 rise, and statements by final fall, these characteristics are not entirely consistent, particularly in IDS (7). For example, Spanish questions show fairly consistent final rise, whereas English questions show an earlier pitch peak and a later fall. Thus, recognition that these utterances converge or contrast on discourse categories requires detecting abstract, language-specific commonalities among varying F0 patterns. For this reason, we tested infants' recognition of native vs. non-native prosodic contrasts across multiple questions and statements.

2. METHOD
2.1 Subjects
Monolingual English-learning American 6-8 and 10-12 month olds were tested on prosodic contrasts in English and Spanish. At each age, eight infants completed a categorical-change condition, eight an arbitrary-change condition.

2.2 Stimulus Materials
Three questions and three statements (exclamatory in IDS), all seven syllables long, were matched for content in English and Spanish: What a beautiful baby! (Qtd nifia mal Linda); You are such a great, big boy! (Eres un niño grand'e!); My beautiful little doll! (Mi querida Linda); Who is this little fellow? (Quién es este niño?); How are you doing today? (Y como estás hoy?); And whose baby are you? (De quién es este bebé?); A female speaker of American English, and one of Mexican Spanish, produced multiple IDS tokens as though to a young infant. One token per sentence was selected to provide comparable between-sequence duration, loudness, F0 level and range. Within-language differences in duration and loudness were reduced by waveform editing. Figures 1 and 2 show the F0 contours for the final set in each language. F0 range was larger for questions than statements; the difference was more extreme for English. Only the Spanish questions showed final rise.

2.3 Procedure
Discrimination was tested in a habituation procedure that employed a conditioned visual fixation response [3]. Subjects in each condition received two tests, one per language. In the categorical condition, infants were initially presented with randomly-ordered repetitions of either the questions or the statements in a given language, contingent on their fixation of a target slide. Once fixations fell below the habituation criterion (two consecutive trials at less than 50% of the mean for the first two trials), audio presentations were shifted to the opposing discourse category in the same language. Infants in the arbitrary condition received a change from one within-language mixture of questions and statements to another. The categopical shift should be discriminated better than the arbitrary shift if infants show perceptual constancy for prosodic properties shared by the diverse items within

ENGLISH

SPANISH

Figure 1. F0 contours (% smoothing) of English statements (exclamations) and questions.

Figure 2. F0 contours (% smoothing) of Spanish statements (exclamations) and questions.
each discourse category. A language-specific influence would be evident if categorical discrimination were better for native than for non-native sentences.

3. RESULTS

Mean fixation times in the last two trials before the stimulus shift were compared to mean fixation times in the first two trials following the shift, in an Age x Language x Conditions (categorical vs. arbitrary) x Shift (pre vs. post) ANOVA. Fixation times were longer at post-shift than pre-shift (F(1,28) = 13.04, p < .006), indicating overall discrimination. Simple effect tests found discrimination only in the categorical condition (F(1,30) = 10.17, p < .003), which was significant for English (F(1,14) = 10.96, p < .005) and nearly so for Spanish (p = .058). The Language x Conditions effect (F(1,28) = 4.66, p < .05) found that fixation times were higher in the English categorical condition, lowest in the English arbitrary condition. A nearly-significant Age x Conditions x Language interaction (p = .057) suggested differences in younger and older infants' response patterns.

We therefore tested the possibility that language-specific effects were reliable for only one age group, as in previous findings that language-specific effects in perception of segmental contrasts appear around 10-12 months. However, separate analyses failed to support language-specific effects for the prosodic contrast at either age. The 6-8 month olds discriminated the category change, but not the arbitrary change, in both English (F(1,7) = 2.09, p < .05) and Spanish (F(1,7) = 14.42, p < .005). The 10-12 month olds failed with both individual languages, showing marginal categorical discrimination overall (p > .08). Figure 3 shows these post-shift recovery patterns.

4. DISCUSSION

The present task required that the infants detect abstract commonalities among the diverse sentences within each category. The overall ANOVA indicated that, across ages, infants distinguished between the discourse categories of question vs. statement, but not between arbitrary groupings of the same sentences. Further research will be needed to determine the prosodic properties that guide infants' perception of these categories. The Spanish questions were quite similar in their FO contours, all showing final rise, which differed from the consistent FO decline of the statements. But the FO contours in each English category were quite variable, and were not distinguished by final rise vs. fall. Nonetheless, across ages the infants discriminated the English with better reliability than the Spanish categorical change, suggesting that final (un)fall was not the critical perceptual feature for them. Both languages showed greater FO range in questions than in statements; this property may have been more salient to the infants, either in both languages or at least in English.

6 MONTH OLDS

6-12 MONTH OLDS

CATEGORICAL ARBITRARY

English

Spanish

Figure 3. Discrimination in each age and condi-
tion, displayed as mean post-shift fixation ratio near pre-shift fixation (bars show ±2 SD).

This pattern was qualified, however, by the results of separate analyses on each age group. Paradigmically, 10-12 month olds were less able than the younger infants to recognize and discriminate the prosodic categories than were the 6-8 month olds. Nor did the performance of either group reflect significant prosodic language-reorganization, in perception of prosodic contrasts. The younger infants discriminated the categorical change in both languages, but the older infants' discrimination was marginal across languages. The IDS properties of the sentences themselves suggest a possible clue to the older infants' difficulty: they were addressed to much younger infants. Speech to infants near the end of the first year often contains redundant, highly-emphasized references to objects and people, whereas that to very young infants consists primarily on the infant's state or activities without emphasis or references to objects (13). Perhaps 10-12 month olds would discriminate this prosodic contrast if it were carried in age-appropriate utterances. Alternatively, older infants may be less attuned to prosodic properties and more focused on segmental and/or lexical information, than are younger infants.

This study provided little evidence for earlier attunement to native prosodic contrasts than to segmental contrasts. On the contrary, the 10-12 month reorganization in perception of prosodic contrasts does not appear to be preceded or even parallelized by analogous reorganization in the perception of this linguistic prosodic contrast.

5. ACKNOWLEDGMENT

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6. REFERENCES


