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, but they have not examined linguistic prosodic contrasts. We tested 6-8 and 10-12 month olds on a discourse prosody contrast (question-statement) 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 discriminated in both languages, older infants in neither, failing to support language-specific perception of this 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 phoneme contrasts, often finding it initially difficult to discriminate non-native segmental distinctions [10, 11, 15]. But infants under 8 months discriminate both native and non-native contrasts. Difficulty distinguishing non-native contrasts appears by 10-12 months [2, 3, 14].

Infants must also learn the prosodic characteristics of the native language. Indeed, it has been argued that infants become attuned earlier to prosodic than 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 F0 contours. Other language-specific effects on prosodic perception appear by 6-11 months [5, 6, 8]. Even in utero exposure to mother's voice can affect newborn preferences for familiar patterns in her speech [4, 5].

Thus, many experience-based effects on prosodic perception are found earlier than the 10-12 month reorganization for segmental contrasts. Yet direct comparison of the prosodic and segmental findings is problematic. Whereas the segmental studies tested 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-statement 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. That is, interrogative intonation indicates some response is expected *from* the listener, while declarative intonation 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, but English wh-questions show an earlier pitch peak and final F0 decline, while Spanish and French continuation statements show final rise. Thus, recognizing that diverse 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! (Qué niñita más linda!); You are such a great, big boy! (Eres un niño grande!); My beautiful little doll! (Mi muñequita linda!); Who is this little fellow? (Quién es este niñito?); How are you doing today? (Y como estas tú hoy?); And whose sweet baby are you? (De quién es este bebe?). 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-sentence 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 1st 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 categorical shift should be discriminated better than the arbitrary shift if infants show perceptual constancy for prosodic properties shared by the diverse items within

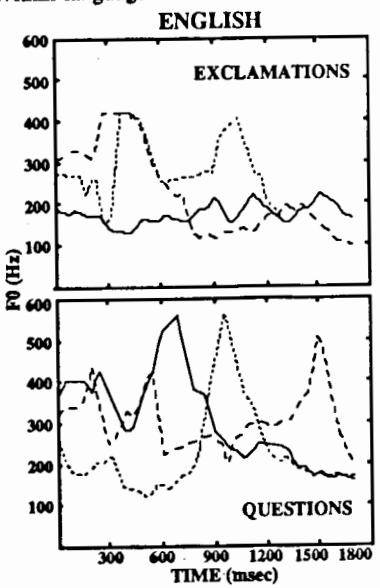

Figure 1. F0 contours (7% smoothing) of English statements (exclamations) and questions.

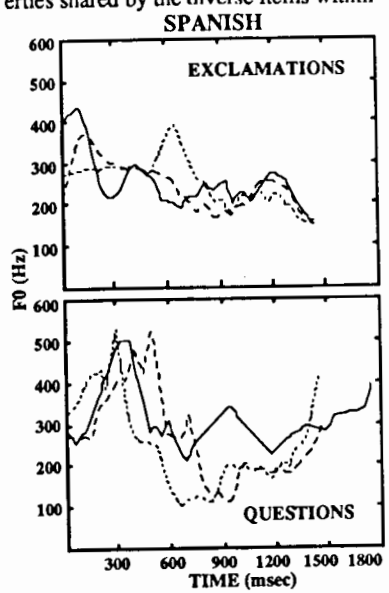

Figure 2. F0 contours (7% smoothing) of Spanish statements (exclamations) and questions.

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 fixations in the first two trials following the shift, in an Age x Language x Condition (categorical vs. arbitrary) x Shift (pre vs. post) ANOVA.

Fixations were longer at post-shift than pre-shift [$F(1,28) = 15.04$, $p < .006$], indicating overall discrimination. Simple effect tests found discrimination only in the categorical condition [$F(1,30) = 10.17$, $p < .001$], which was significant for English [$F(1,14) = 10.96$, $p < .005$] and nearly so for Spanish [$p = .058$]. The Language x Condition effect [$F(1,28) = 4.66$, $p < .04$] found that fixation times were highest in the English categorical condition, lowest in the English arbitrary condition. A nearly-significant Age x Condition 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 [$F(1,7) = 8.209$, $p < .024$] and Spanish [$F(1,7) = 14.42$, $p < .007$]. 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 suggested 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 F0 contours, all showing final rise, which differed from the consistent F0 decline of the statements. But the F0 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 rise/fall was not the critical perceptual feature for them. Both languages showed greater F0 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.

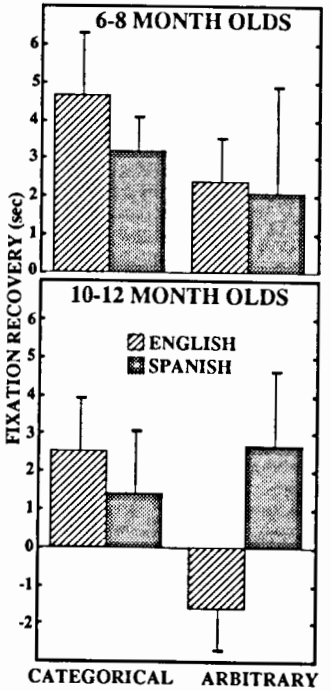

Figure 3. Discrimination in each age and condition, displayed as mean post-shift fixation minus mean pre-shift fixation (bars show s.e.).

This pattern was qualified, however, by the results of separate analyses on each age group. Paradoxically, 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 language-specific 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 comments primarily on the infant's state or activities without emphatic 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 attentive 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 non-native segmental contrasts does not appear to be preceded or even paralleled by analogous reorganization in the perception of this linguistic prosodic contrast.

5. ACKNOWLEDGMENT.

Supported by NICHD grant HD-01994 to Haskins Laboratories and NIDCD grant DC-00403 to the first author.

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