DEVELOPMENT OF SENSITIVITY TO SPEECH ERRORS*

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BACKGROUND

About 10% of all children show some form of speech production difficulty. A substantial proportion of these children have related speech perception difficulties [1]. Unfortunately, little is known about the abilities of normally-developing children to distinguish correct speech from incorrect speech. This study investigated the development of children's ability to distinguish between correct pronunciations of common English words and words containing common childhood speech errors. Information obtained should contribute to improved understanding of how children acquire adult-like mastery of their native language and guide perceptual assessment and treatment procedures for children who have speech production difficulties.

OBJECTIVES

This study attempted 1) to confirm the classification of a corpus of speech samples by reference to a sample of native English-speaking adults with normal hearing and speech abilities; 2) to determine how well children aged 3;6 through 7;0 (years;months) can identify correct and incorrect pronunciations of various target sound categories; 3) to identify patterns in the development of such speech perception abilities, including how sensitivity to particular types of speech errors changes over time; and 4) to apply this information to help improve our understanding of the *process* through which children acquire adult-like speech perception abilities.

METHOD

Participants. One hundred and thirty-two children between the ages of 3 years 6 months and 7 years were tested. All participants had normal hearing and all had age-appropriate speech production. In addition, 10 adults were tested with each of the 16 target sounds used in the study.

Stimuli. Testing used high-quality digitized speech samples within a video game based format. The samples were natural speech utterances of sixteen target words containing word-initial consonants that are a source of common production errors for young children. Tokens were spoken by a range of adult male, adult female and child talkers.

PROCEDURE

Each child was tested individually in a quiet room. The digitized utterances were replayed over the computer's 16-bit DAC and presented through speakers. The child indicated whether the sound presented was a correct or an incorrect pronunciation of the target sound. Using the sample screen in figure 1, the child indicated a correct pronunciation by pointing to the picture corresponding to the target word ('cat' in the example) and indicated an incorrect pronunciation by pointing to the 'X'.
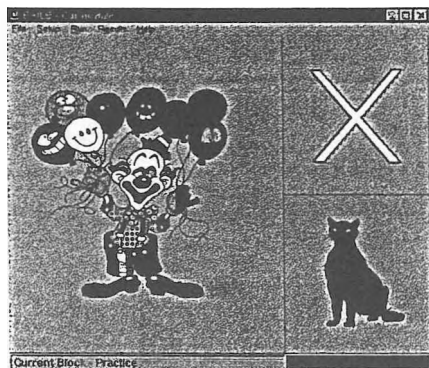

Figure 1: Sample screen showing response alternatives for the module 'cat'.

RESULTS AND DISCUSSION

The overall ability to distinguish between correct and incorrect utterances improved with increasing age (see Figure 2). Moreover, for each target word, all tokens showed an improvement in perceptual sensitivity (d') with age. However, the levels of initial and asymptotic performance and the rate of acquisition differed for different target categories.

Importantly, hit rates remained relatively constant across age groups for each target word. Rather, the improvement in performance occurred because false alarm rates decreased substantially as the age of the child increased (see Figure 3).

Different tokens were acquired at different rates, and even some adults did not distinguish certain error sounds. These data are taken as supporting the following views of the development of speech perception abilities: 1) the initial acquisition of a sound category involves the recognition that sounds with particular acoustic characteristics are linguistically distinct from other sounds; 2) the mastery of a particular sound category involves the sequential elimination of specific sound errors from membership in the sound category; 3) such perceptual mastery is a long-term process representing an interaction of specific listener experience and acoustic salience; 4) children whose speech perception abilities are developing normally show considerable variation in their abilities to distinguish correct from particular incorrect utterances.
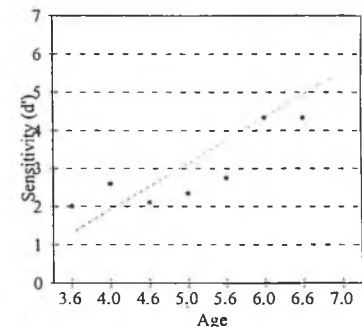

Figure 2: Change in d' (sensitivity) with age when the target sound was 'feet'.
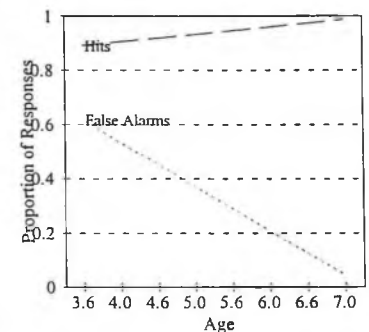

Figure 3: Hit and false alarm rates as a function of age when the target sound was 'rat'.

A child's ability to identify certain speech errors at certain ages may be particularly valuable for the early assessment of speech disorders. Overall, this study provides information about the maturation of speech perception abilities in children with normal speech production abilities. Further, the results may help to guide the interpretation and assessment procedures for use with children who have speech production difficulties.

REFERENCES

[1] **Rvachew, S. & Jamieson, D.G.** (1995). Learning new speech contrasts: Evidence from adults learning a second language and children with speech disorders. In Strange, W. (Ed.) *Speech Perception and Linguistic Experience: Theoretical and Methodological Issues in Cross-Language Speech Research.* Timonium, MD: York Press.