INTRODUCTION

It has been suggested that the strategies used to perceive speech change as a function of age. When listening to nonsense syllables that contain fricatives for example, young normal-hearing (NH) children attend more to the dynamically changing vocalic transitions while NH adults attend more to the steady-state noise segments (Nittouer & Crowther, 1999). Nittouer, Crowther, & Miller, (1998). The perceptual strategies of children become adult-like as they age and gain experience with speech.

Differences in perceptual strategies also have been found between NH and hearing-impaired (HI) adults. Specifically, HI adults are less able than NH adults to use the information provided by vocalic transitions in a nonsense syllable (Zeng & Turner, 1990). Given the differences in perceptual strategies due to age and hearing loss, it is possible that these factors combine to alter the perceptual strategies of HI children. To date, there are no data describing the perceptual strategies of this group. The purpose of the present study was to 1) determine the perceptual weighting strategies of HI children relative to age-matched NH children as well as NH and HI adults, and 2) determine the audibility required by each group to achieve a criterion level of performance.

METHODS

Subjects

Participants were eleven listeners in each of four groups: NH adults (22-42 years), NH children (8-11 years), HI adults (54-69 years), and HI children (8-11 years). All the HI listeners had moderate to moderately severe hearing losses and were congenital for the children and acquired in the adults.

Stimul and Procedures

The nonsense syllables /s/ /u/ /f/ and /fl/ were spoken by an adult male, an adult female, and an 11-year old child and digitized at a sampling rate of 20 kHz. The vowel, transition and fricative segments of each syllable were identified so that the amplitude of each could be varied randomly on a trial-by-trial basis. That is, each nonsense syllable was presented in its entirety, but the relative amplitude of each segment was varied randomly in 10 dB steps for the NH listeners and in 5 dB steps for the HI listeners. The syllables were presented to each listener via an insert earphone. The short-term auditory (STA) of each segment (vowel, transition and fricative) was calculated. Specifically, the sensation level of each segment (vowel, transition and fricative) was calculated. Specifically, the sensation level of each segment (vowel, transition and fricative) was
determined. That is, each nonsense syllable was presented in its entirety, but the relative amplitude of each segment was varied randomly in 10 dB steps for the NH listeners and in 5 dB steps for the HI listeners. For /fl/, performance was found to correlate with increases in STA of the transition segment for the HI listeners, whereas lower correlations were found across all three segments for the HI listeners. In general, these results suggest that the perception of /s/ and /fl/ was not influenced by either age or hearing loss. The weighting functions for /fl/ and /fl/ on the other hand, suggest that the children and adults within each hearing category perform similarly although differences in terms of hearing status were observed.

Audibility Criteria

To facilitate comparison across groups, the quadratic functions of STA were used to confirm the STA required to achieve > 90% performance. The data were dichotomized into categories of ≥ 90% and < 90% performance (dashed and solid lines, respectively). For each STA value, hit, miss, correct rejection, and false alarm (FA) rates were calculated. The vertical line in each panel represents the STA value resulting in equal miss and FA rates. For example, the miss rate for the NH adults for /s/ is 11%, indicating that 89% of the observations of poor performance (< 90%) fell below an STA level of 0.21. Again, these minimum STA levels suggest both hearing and age effects. Specifically, the adults required lower levels of audibility than the children in their respective hearing categories. Also, the HI groups required lower levels of audibility than their NH counterparts.

RESULTS

The performance-STA functions revealed that maximum performance was reached at lower audibility levels in the HI listeners relative to the NH listeners. Likewise, the adult listeners required lower levels of audibility than the children to achieve similar levels of performance, although these differences were larger for the NH listeners than for the HI listeners. The decision theory analysis confirmed both hearing sensitivity and age effects.

CONCLUSIONS

There were no apparent differences in perceptual weighting strategies between the groups when listening to the phonemes /s/ and /fl/. Small differences were observed within and between the NH and HI groups for the phonemes /fl/ and /fl/.

REFERENCES


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