Temporal resolution in normal and hearing-impaired listeners

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FRIDAY AFTERNOON, 15 JUNE 1979

SALA DE PUERTO RICO, STUDENT CENTER, 2:00 TO 5:00 P.M.

Session ZZ. Psychological Acoustics IV and Speech Communication XI: Impaired Hearing, Impaired Speech Reception, and Aids for the Impaired (Poster Session)

M. J. Osberger, Chairman

City University of New York, Graduate School, 33 W. 42 Street, New York, New York 10036

Contributed Papers

All posters will be displayed from 2–5:00 P.M. To allow all contributors an opportunity to see other posters, contributors of odd-numbered papers will be at their posters from 2–3:30 P.M., and contributors of even-numbered papers will be at their posters from 3:30–5:00 P.M.

ZZ1. Psychometric functions for frequency discrimination in spectral regions of normal and impaired sensitivity. C. W. Turner and D. A. Nelson (Hearing Research Laboratory, Department of Otolaryngology, University of Minnesota, 2630 University Ave. S.E., Minneapolis, MN 55414)

Both normal-hearing listeners and listeners with abrupt high-frequency sensorineural sensitivity losses were trained to asymptotic performance in a 2AFC pure-tone frequency discrimination task. Stimulus presentation levels were 80 dB SPL and base frequencies for Δf measurements were 300, 1200, and 3000 Hz. A method of constant stimuli was used to obtain psychometric functions and Δf was specified as the 75% correct performance level. Results from the normal-hearing listeners were consistent with other results recently reported [Wier, *et al.*, J. Acoust. Soc. Am. **61**, 178–184 (1977)]. Sensorineural hearing-loss listeners exhibited frequency discrimination deficits, relative to the normal-hearing listeners, in frequency regions of sensitivity loss and also in frequency regions of normal sensitivity, even after asymptotic performance levels had been attained. The psychometric functions from the impaired listeners exhibited slope values that were less than those obtained from normal-hearing listeners. Practice effects were observed to be considerable in all listeners. [Work supported by NIH Grant No. NS12125.]

ZZ2. Intensity discrimination and loudness matches in observers with sensorineural hearing loss. M. Florentine, C. Reed, N. I. Durlach, and L. D. Braida (Room 36-747, Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA 02139)

Intensity discrimination and loudness matches were determined as a function of level in observers with sensorineural hearing loss of primarily cochlear origin. For observers with unilateral impairments, tests were made at the same frequency in the normal and impaired ear. For observers with bilateral-sloping losses, tests were made at different frequencies in the same ear. The stimuli were 500-ms tones with a rise–fall time of 25 ms and interstimulus interval of 200 ms. The results suggest that hearing loss (even with recruitment) does not reduce the difference limen provided the comparison is made at the same sound pressure level. In general, the difference limens in normal and impaired hearing appear more similar at equal loudness levels than at equal sound pressure levels or at equal sensation levels. Also, the loudness matching data appear to be at least roughly consistent with the predictions derived from the discrimination data using the proportional-jnd theory of loudness matching [J. S. Lim, W. M. Rabinowitz, L. D. Braida, and N. I. Durlach, J. Acoust. Soc. Am. **62**, 1256–1267 (1977)]. [Work supported by NIH.]

ZZ3. Temporal resolution in normal and hearing-impaired listeners. Peter J. Fitzgibbons and Frederic L. Wightman (Auditory Research Laboratory, Northwestern University, Evanston, IL 60201)

Temporal resolution, defined as the minimum detectable temporal gap (Δt ms) separating equal intensity noise bursts, was investigated with normal-hearing and cochlear-impaired listeners. In separate conditions, octave-band noise signals of 400–800 Hz, 800–1600 Hz, and 2000–4000 Hz were presented against a background of band-reject broad spectrum noise designed to eliminate the influence of spectral artifact in threshold measures. Gap resolution for both listener groups showed systematic improvement with increased signal frequency, though performance of hearing-impaired subjects was significantly poorer than normal at each octave-band region. These findings were evident for listener group comparisons made on the basis of both equivalent sound-pressure-level and sensation-level signal intensities. Results are compared to previous gap resolution estimates reported for wide-band stimuli, and are discussed in terms of peripheral filter mechanisms thought to influence resolution performance. Implications for temporal processing in the presence of cochlear damage are also considered. [Work supported by NIH Grant No. NS12045.]

ZZ4. Sound localization with impaired hearing. R. Hausler, E. M. Marr, and H. S. Colburn (Eaton–Peabody Laboratory, Massachusetts Eye and Ear Infirmary, Boston, MA 02114, and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA 02139)

Discrimination tests were made on persons with hearing impairments and on patients with multiple sclerosis. Results include estimates of horizontal minimum audible angle (MAA) at eight azimuths, vertical MAA straight ahead, and just-noticeable differences in interaural time delay (time JND) and interaural amplitude ratio (amplitude JND). The standard stimulus was broadband (0.25–10 kHz), pulsed (1 s) noise. Conductive cases (>35-dB loss) gave abnormal values in almost all tests. Symmetric sensorineural cases with speech discrimination scores above 90% gave roughly normal values in all tests, while the corresponding group with scores below 80% gave elevated values for the vertical MAA and the horizontal MAA on the sides. Meniere's cases had normal MAAs and time JNDs and an amplitude JND that was normal only at high levels. Neurinoma cases gave abnormal values in at least one measurement each, with large inter-subject variability. Persons with only one functional ear showed no ability to discriminate interaural parameters but some gave MAAs within the normal range. For multiple sclerosis patients, time JNDs, amplitude JNDs, and vertical MAAs were affected independently. [Work supported by NIH and Hopital Cantonal, Geneva, Switzerland.]