might be responsible for the difference. Finally, George Washington Pierce (1872–1956), who is perhaps best known for his work on piezoelectric and magnetostrictive devices, used an acoustic interferometer to measure dispersion in gases, particularly carbon dioxide. He also measured sound transmission over reflective surfaces. His results confirm the at-first surprising result that at grazing incidence even a very hard boundary seems to act as a pressure release surface.

THURSDAY MORNING, 4 NOVEMBER 1999 MARION ROOM, 9:00 TO 11:15 A.M.

Session 4aPP

Psychological and Physiological Acoustics: Binaural and Sound Field

Raymond H. Dye, Chair
Parmly Hearing Institute, Loyola University, 6525 North Sheridan Road, Chicago, Illinois 60626

Contributed Papers

9:00

4aPP1. Identification and localization of sound sources in the median sagittal plane. Brad Rakerd, William M. Hartmann, and Timothy L. McCaskey (Michigan State Univ., East Lansing, MI 48824)

The ability of human listeners to identify broadband noises having different spectral structures was studied for multiple sound-source locations in the median sagittal plane. The purpose of the study was to understand how sound identification is affected by spectral variations caused by directionally dependent head-related transfer functions. It was found that listeners could accurately identify noises with different spectral peaks and valleys when the source location was fixed. Listeners could also identify noises when the source location was roved in the median sagittal plane when the relevant spectral features were at low frequency. Listeners failed to identify noises with roved location when the spectral structure was at high frequency, presumably because the spectral structure was confused with the spectral variations caused by different locations. Parallel experiments on source localization showed that listeners can localize noises that they cannot identify. The combination of identification and localization experiments leads to the conclusion that listeners cannot compensate for directionally dependent filtering by their own heads when they try to identify sounds. [Work supported by the NIDCD.]

9:15

4aPP2. Contribution of spectra of input signals to two ears to sound localization in the sagittal plane. Kazuhiro Iida (AVC Res. Lab., Matsushita Communication Ind. Co. Ltd., 600 Saedo, Tsuzuki, Yokohama, 224-8539 Japan, kiida@adl.mci.mei.co.jp), Eigo Rin, Yasuko Kuroki, and Masayuki Morimoto (Kobe Univ., Nada, Kobe, 657-8501 Japan)

The previous studies show that the amplitude spectra of input signals to two ears contribute to sound localization in the sagittal plane [e.g., M. B. Gardner, J. Acoust. Soc. Am. **54**, 1489–1495 (1973)]. Furthermore, it is known that the ear on the source side has more influence than the ear on the opposite side on localization [M. Morimoto, Dissertation, Univ. of Tokyo (1982); R. A. Humanski and R. A. Butler, J. Acoust. Soc. Am. **83**, 2300–2310 (1988)]. It is, however, not clarified how each ear spectrum contributes to localization. The present paper builds up some hypotheses on this issue and examines them for their validity by some psychoacoustical experiments.

9:30

4aPP3. The influence of later arriving sounds on the ability of listeners to judge the lateral position of a source. Raymond H. Dye, Jr. (Parmly Hearing Inst. and Dept. of Psych., Loyola Univ., 6525 N. Sheridan Rd., Chicago, IL 60626)

This investigation focuses on the effect that later sounds have on the ability of humans to report the spatial location of earlier sounds. Two dichotic pulses were presented (via headphones), separated by an echo delay between 4 and 64 ms. Listeners were asked to judge whether the first click appeared to the left or right of the intracranial midline. The interaural delay of each pulse was independently selected from a Gaussian distribution (μ, $\sigma = 0$, 100 μs). The level of the echo relative to the source was 0, -6, -12, -18, -24, -30, or -36 dB. The effect of the echo was determined by measuring proportion correct and by deriving a normalized source weight. For echo delays of 16, 32, and 64 ms, the source and echo click were weighted equally when presented at the same level, and weights barely changed until the echo was attenuated by 18 dB. As the level of the second click was further reduced, the source weight approached 1.0 and the percentage correct approached that obtained in the ''no echo'' condition. For shorter echo delays, source weight and proportion correct increased more quickly as the echo was attenuated. [Work supported by NIDCD & AFOSR.]

9:45

4aPP4. Low-frequency ILD elevation cues. V. Ralph Algazi, Carlos Avendano (CIPIC, UC Davis, Davis, CA 95616, algazi@ece.ucdavis.edu), and Richard O. Duda (San Jose State Univ., San Jose, CA 95192)

It is well known that the binaural ITD (interaural time difference) and ILD (interaural level difference) are the primary cues for azimuth, while monaural spectral features due to pinna diffraction are the primary cues for elevation. Pinna cues appear above 3 kHz, where the wavelength becomes comparable to pinna size. However, it is shown that there are also important low-frequency ILD elevation cues primarily due to torso diffraction. In the experiments reported, random noise bursts were filtered by individualized head-related transfer functions, and four subjects were asked to report the elevation angle. Eight conditions were tested, depending on whether the source was in front or in back, in the median plane or on a 45-deg cone of confusion, and had wide bandwidth or was band limited to 3 kHz. For the band-limited signal, localization accuracy was at chance level in the median plane, and was poor in front. However, at 45-deg azimuth in the back, the accuracy was close to that for a wideband source, the average correlation coefficient being approximately 0.75 for the narrow-band source and 0.85 for the wideband source. A physical explanation for the cues is presented. [Work supported by NSF under Grant No. IRI-9619339.]

10:00

4aPP5. The effect of frequency modulation of the ability to judge dynamic changes in interaural level differences. William M. Whitmer and Raymond H. Dye, Jr. (Parmly Hearing Inst., Loyola Univ., Chicago, 6525 N. Sheridan Rd., Chicago, IL 60626, wwhitme@luc.edu)

The cues for apparent auditory motion include dynamic interaural temporal differences, level changes, and frequency modulation (FM) [Rosenblum, Perception **16**, 175–186 (1987)]. The manner in which these cues interact was examined in a task in which listeners judged the point at

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