tive abilities with and without the aid in his native language, Russian, as well as in English and Hebrew. When Dr. Kanievski was tested with the De Filippo–Scott tracking technique, the aid provided for a considerable improvement in performance over unaided lipreading scores. The degree of improvement, however, was a function of several factors, in particular his unaided lipreading rate for the different languages. Plotting the ratio of aided to unaided performance against unaided tracking rate yielded a power function. [Work supported by NIH Grant NS-04775.]

3:45

H6. Speech reception in deaf adults using vibrotactile aids or cochlear implants. Paul Milner and Carole Flevaris-Phillips (Audiology and Speech Pathology Section, V. A. Medical Center, West Haven, CT 06516)

Many post-lingually deafened adults rely heavily upon speechreading as the primary source of speech information. Vibrotactile aids or cochlear implants may help augment the limited visual cues of speechreading, especially the ones which permit voiced/voiceless and nasality distinctions. Measures of the apprehension of voicing and nasality, as well as other attributes of speech reception, were obtained using the Diagnostic Rhyme Test [W. D. Voiers, in *Benchmark Papers in Acoustics*, Vol. 11, edited by M. Hawley, pp. 374–387 (1977)] with candidates for possible cochlear implantation. Results using vibrotactile aids or cochlear implants either individually or in combination with speechreading indicated that both vibrotactile aids and cochlear implants provided improvements in the perception of nasality, but voiced/voiceless distinctions were not as clearly recognized. [Work supported by Veterans Administration Rehabilitation Research and Development Service.]

4:00

H7. Pitch detection on a programmable vibrotactile aid for the deaf. Silvio P. Eberhardt (Sensory Aids Laboratory, Department EECS, Johns Hopkins University, Baltimore, MD 21218)

A vibrotactile aid capable of real-time speech processing has been developed. Three microprocessors are used for, respectively, speech sampling and data reduction, pattern matching, and generation of vibrator drive signals. Data reduction is performed by generating data records at each zero crossing of the speech signal. Records consist of the interval since the last zero crossing (ZCI) and average amplitude during that interval. A pitch detector has been implemented on the aid. The algorithm is based on the observation that consecutive pitch periods have similar ZCI and amplitude structures. Pattern matching is performed by comparing adjacent strings of ZCI and amplitude values. Sum-of-difference correlation values are low when the strings correspond to actual adjacent pitch periods. The pitch search window is adaptively narrowed after voicing has been detected. The detector shows no tendency to lock onto other harmonics or formants. Results of comparisons with other pitch detectors in several white and babble noise conditions will be presented. [Work supported by NIH, NSF, NIHR.]

4:15

H8. Vibrotactile sensitivity thresholds of hearing children and of profoundly deaf children. Lynne E. Bernstein, Miriam B. Schechter, and Moise H. Goldstein, Jr. (Sensory Aids Laboratory, Department of Electrical Engineering and Computer Science, Johns Hopkins University, Baltimore, MD 21218)

We investigated sensitivity thresholds for 1-s sinusoidal stimuli of 20, 40, 80, and 160 Hz with hearing 5- to 6- and 9- to 10-year-olds and adults. Stimuli were presented in a two-interval forced choice procedure according to an adaptive rule to estimate the 70.7% threshold [H. Levitt, J. Acoust. Soc. Am. **49**, 467–477 (1971)]. Results showed that young children were somewhat less sensitive than older children and adults. The present results are not in complete agreement with published reports [R. T. Verrillo, Bull. Psychonomic Soc. **9**, 197–200 (1977) and R. D. Frisina and G. A. Gescheider, Percept. Psychophys. **22**, 100–103 (1977)]. Previously, we found no effect of age with haversine pulse trains. To explore whether hearing status might affect sensitivity, two prelingually profoundly deaf children were tested with 1-s haversine stimuli at 10, 50, 100, 160, and 250 pulses per second. The deaf children were at least as sensitive as previously tested normally hearing adults and children. [Work supported by NSF and NINCDS.]

4:30

H9. Effects of aging on vibrotactile temporal resolution. Clayton L. Van Doren, Grace L. Lanni, Preeti Verghese, Ronald T. Verrillo, and George A. Gescheider (Institute for Sensory Research, Syracuse University, Syracuse, NY 13203)

Psychophysical thresholds for detecting a temporal gap centered in a background stimulus were measured by two-interval forced-choice tracking. The 16- to 256-ms gaps were flanked by 350-ms bursts of either 250-Hz sinusoidal vibration or bandpass noise. In each trial the threshold intensity was measured for detecting a gap of a fixed duration. This threshold decreased as gap duration increased and could be approximated by a power function of the form $I = A(G/G_0)^{-B} + C$. In this expression, I is the gap-detection threshold in dB SL, G is the gap duration in ms, G_0 equals 1 ms, A and C are constants in dB SL, and B is a dimensionless constant. A, B, and C increased with subject age. The primary effect of increasing age was a reduced temporal resolution for gaps smaller than 64 ms. This reduced sensitivity may effect tactile perception of some speech features such as voiced and unvoiced stop consonants in older subjects. [Work supported by NIH Grant NS-09940.]

4:45

H10. Field tests of a wearable 16-channel electrotactile sensory aid in a classroom for the deaf. Frank A. Saunders (Smith–Kettlewell Institute of Visual Sciences, 2232 Webster Street, San Francisco, CA 94904) and Barbara Franklin (Department of Special Education, San Francisco State University, San Francisco, CA 94132)

Field testing of a wearable electrotactile sensory aid began in February 1985 at the Jackson Hearing Center, an oral program for deaf children in Palo Alto, CA. Six children, 3 to 8 years of age, participated in the study. Each had a profound congenital binaural sensorineural hearing loss in excess of 105 dB. The wearable sensory aid, the Tacticon model 1600, presents 16 channels of frequency information via a tactile belt worn around the abdomen. Wearing time for each child was gradually increased from half-hour daily lessons to 4 h of use per day. Environments included the classroom, outside recess with physical education activities, and field trips. Receptive training was directed at recognition of both suprasegmental and segmental features of speech. Suprasegmental features included duration, number of syllables, rhythm, and stress. Segmental features included the recognition of specific speech sounds in isolation, beginning with the Ling 5 sound test of /a/, /e/, /u/, /s/, and /sh/. The assessment procedure was conducted in three modes: (a) aided residual hearing alone, (b) aided hearing plus lipreading cues, and (c) aided hearing plus lipreading plus tactile cues from the sensory aid. The addition of tactile cues results in a significant increase in the discriminability of both suprasegmental and segmental features. The children also received experience with the sensory aid during speech training, attending to the tactile patterns resulting from different speech features such as nasality, voicing, frication, and plosion, comparing their utterances with those of the teacher. Their performance indicated that the tactile feedback supported an improvement in speech production, as well as reception. [Work supported by SBIR/NIH: 2 R44 AG/NS04817.]

TUESDAY PM