were evaluated for their effects upon the perception of speech over the telephone when used with a hearing aid microphone. The telephone receiver and hearing aid microphone were acoustically coupled and recordings made using a dummy head. These recordings were later presented to three subject groups (normally hearing, moderately impaired, and severely impaired). The data suggest that the frequency response of conventional hearing aids may be inappropriate for the acoustic coupling of hearing aids and telephone receivers, especially in backgrounds of noise. Additionally, it was demonstrated that subjects do not reliably select the test conditions which give them maximum objective scores when given the opportunity to personally manipulate frequency response and signal level.

3:20

S6. Telephone listening ability in hearing impaired subjects. Alice E. Holmes (Department of Speech, University of Florida, Gainesville, FL 32611) and Thomas Frank (Department of Communication Disorders, The Pennsylvania State University, State College, PA 16801)

The purpose of this study was to investigate telephone listening ability of the hearing impaired. Forty-five subjects with bilateral sensorineural hearing losses were divided into three groups ($N = 15$/group) based on the audiometric configuration of their test ear. The subjects were evaluated using conventional and alternative telephone listening strategies by assessing their discriminations of word lists presented at 86-dB SPL (simulating the output of a standard telephone handset) and at their Most Comfortable Loudness (simulating the output of a telephone amplifier handset). The results indicated that subjects with precipitous drop hearing losses had similar word discriminations across the listening modes which included a TDH-39 earphone, unaided telephone, and their hearing aids acoustically coupled to a telephone handset and at both 86-dB SPL and their Most Comfortable Loudness (MCL). Subjects with gradual slope or flat hearing losses had similar word discriminations across the listening modes at either 86-dB SPL or MCL. However, these subjects with gradual slope and flat hearing losses had better word discriminations in the listening modes when the word lists were presented at MCL compared with 86-dB SPL.

3:35

S7. The feasibility of deriving an articulation index based scheme for assessing residual auditory function in listeners with sensorineural hearing impairment. Chaslav V. Pavlovich (Department of Communicative Disorders, University of Mississippi, University, MS 38677)

In the first experiment the AI theory was applied to audiograms of normal and sensorineural hearing impaired individuals in order to predict speech discrimination under various conditions. Good predictions were found for the normal and the lesser impaired subjects, but not for those with greater impairments. Also, poor correlation was obtained between the reduction in the AI for everyday speech and different subjective estimates of auditory handicap. In the second experiment it was investigated whether the AI predictions for presbyacusic individuals could be improved by making use of the frequency unspecific proficiency factor concept as suggested by Fletcher [J. Acoust. Soc. Am. **24**, 490 (1952)] and Dugal *et al.* [in *Acoustical Factors Affecting Hearing Aid Performance*, edited by G. A. Studebaker and I. Hochberg, (University Park Press, Baltimore, 1978), Chap. 17]. The results indicate that the proficiency factor is not frequency independent. It assumes the value of 1 at those frequencies where hearing sensitivity is normal and it is substantially reduced for frequencies where hearing threshold is elevated.

3:50

S8. Recognition of selected French vowels and consonants by deaf children: lipreading and coarticulation. Michèle Gentil (IBM–France, Centre Scientifique, 36 Avenue Raymond Poincaré, 75116 Paris, France)

The visual recognition of selected French vowels and consonants by deaf children was studied. Thirteen vowels were associated with [l] in the final position and/or placed between [p] and [l]. Sixteen consonants were combined with the extreme vowels on the vocalic triangle [i–a–u] in nonsense words of consonant–vowel type. Two speakers were chosen for this investigation. This research determined confusion matrices. Concerning vowels, the extreme vowels on the vocalic triangle were the most easily recognized visually. Concerning consonants, the results of visual confusions revealed four basic homophenous categories or viseme groups. Three of these categories were based on lip movement [p–b–m] [f–v] [ʃ–ʒ]. The fourth category consisted of consonants produced inside the mouth [t–d·n–s–z–k–g–ɲ–R]. Besides in this study emphasis was placed on coarticulatory effects which make lipreading difficult. The difficulty of recognizing depended on the vocalic environment: most difficulty when followed by [u], intermediately difficult when followed by [i], least difficult when followed by [a]. Inter-speaker variability was evident.

4:05

S9. Development changes in perceived stimulus structure in consonant–vowel and vowel stimuli. Lynne E. Bernstein, David Talkin, Rosemary Condino, and Rachel E. Stark (Communication Sciences Research Laboratory, John F. Kennedy Institute, Baltimore, MD 21205)

It was hypothesized that developmental changes take place in the ability to extract acoustic–phonetic structure from the speech signal. In order to demonstrate developmental change, Garner's two-choice, speeded-classification paradigm was adapted for use with children [Am. Psych. **25**, 350–358 (1970)]. In this paradigm, two stimulus dimensions are presented under control, correlated, and orthogonal experimental conditions. Patterns of results across conditions are interpreted as indicative of certain perceptual structures, viz., integral versus separable processing. Stimulus dimensions being tested with adults and eight-year-olds are (1) consonant identity (/bɑ/ versus /dɑ/) and pitch (125 vs 165 Hz F_0) [cf. Wood, Percept. Psychophys. **15**, 501–508 (1974)]; and (2) vowel identity (/ɑ/ versus /i/ and pitch (125 vs 165 Hz F_0). It was hypothesized that adults process these two stimulus sets in terms of, respectively, integral and separable structures, but that children process both sets in terms of similarity structure (integrally). Preliminary results confirm predictions for children but suggest that adults process pitch integrally for both stimulus sets. Implications from a larger group of subjects will be discussed in terms of a theory of speech perceptual development. [Work supported by MCH Training Grant Project #917 and March of Dimes Grant #12–84.]

4:20

S10. Emergence of vocants in infant utterances. R. E. Stark, D. Talkin, J. M. Heinz, and J. Bond (Communication Sciences Research Laboratory, John F. Kennedy Institute, Baltimore, MD 21205)

This preliminary study was designed to determine if the point vowels /ɑ/, /i/ and /u/ emerge in a particular order and within specific age ranges in the productions of infants. Vowel-like sounds (vocants) were selected randomly within certain general criteria from the cooing, expansion, and babbling periods of vocal development in two normal female infants. The formant frequencies of these vocants were estimated, at several points, by inspecting the wideband spectrogram, a 32-ms spectral section, an inverse LPC spectrum, and the frequencies and bandwidths obtained by finding the roots of the denominator polynomial of the LPC model. The order of the LPC model was chosen adaptively to provide frequency resolution consistent with the fundamental frequency of voicing for each frame in order to minimize the interaction between harmonic and resonance locations. The results indicated (1) only modest changes in formant structure from the cooing to the expansion period and (2) a frequent lowering of the first formant and raising of the second in the babbling period, suggesting that an /i/-like vocant does not emerge until the babbling period. Perceptual data for these vocants will be reported. [Work supported by NICHD grant HD11970.]

4:35

S11. Effects of mild hearing loss and age on speech recognition in noise. Judy R. Dubno, Donald D. Dirks, and Donald E. Morgan (Division of Head/Neck Surgery, UCLA School of Medicine, Los Angeles, CA 90024)

Previous investigations have established that, under identical test conditions, hearing-impaired listeners have more difficulty than normal-