Certain Aspects of the Development of Speech Production and Perception in Children

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language are specifically innate. (1) In 1–3-month olds, the relative amount of orientation to vowel–vowel transitions suggest that /a/ is the most basic vowel, /u/ the next most basic, and /i/ the least basic. (2) In 1–2-year olds, the notion of actor–action–object is present. There is no obvious explanation for the development of these universal features of adult language to be found either in the child's nonlinguistic behavior or in his experience.

3:00

S3. Studying Children's Acquisition of Phonology. PAULA MENYUK (nonmember), *Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.*—Most children by age 4 are communicating effectively with sentences that contain all the basic syntactic structures in the language. It, therefore, would seem reasonable to suppose that the phonological features and rules of the language are acquired at an early age as well. We have, however, very little information about either the actual facts of this acquisition and development or the psychomotor mechanisms that underlie the process. Several studies have been undertaken to examine the child's use of the suprasegmental, segmental, and sequential features of the sound system of his language at various stages of development. The results of these studies and some previous research will be discussed in terms of various models of phonological acquisition and use. [Work supported by National Institutes of Health grant.]

3:30

S4. Certain Aspects of the Development of Speech Production and Perception in Children. MALCOLM S. PRESTON, *Haskins Laboratories, New York, New York,* and *The Neurocommunications Laboratory, The Johns Hopkins University, School of Medicine, Baltimore, Maryland,* GRACE H. YENI-KOMSHIAN, RACHEL E. STARK, *Neurocommunications Laboratory, The Johns Hopkins University, School of Medicine, Baltimore, Maryland,* AND DIANE K. PORT, *Haskins Laboratories, New York, New York.*—This paper reviews the results of several research projects that have examined the developing capabilities in children for producing and perceiving speech sounds. Most of this work has been carried out with children between the ages of 1 and 5. Particular attention has been directed toward the development of stop consonants as they occur in syllable initial position. Such sounds occur early in the vocalization of infants and are characterized by easily identifiable acoustic features critical for differentiating stops along the dimensions of voicing (voice–onset time). The projects to be reported in detail include a longitudinal study of productive capabilities in normal and hearing-impaired children, and a cross-language study (English and Arabic) of perceptual capabilities in normal-hearing children. [Research supported in part by the National Institute of Child Health and Human Development.]

WEDNESDAY, 9 APRIL 1969 CLOVER ROOM, 2:00 P.M.

Session T. Underwater Acoustics I: Signal Processing

JAMES L. STEWART, *Chairman*

Contributed Papers (20 minutes)

2:00

T1. Two-Dimensional Sampling in Acoustics. I. D. TRIPATHI, *Electrical Engineering Department, University of Houston, Texas 77004.*—The importance of acoustics as a vehicle of transmission of information about certain characteristics of a surface is increasing with our increasing curiosity about the inner space. This is much more appreciated in the situations where neither optics nor electromagnetic radiation in microwave region is of much help. The concepts of Fourier analysis and synthesis have played a very dominant rôle in advancing electrical communication. It is desirable that possible application of these concepts in the area of acoustics be looked into. Acoustic pressure over a plane surface is a function of two dimensions. Intuitively, it is apparent that if we sample the pressure closely enough over the surface, the entire pressure distribution can be obtained with considerable accuracy by simple interpolation. For a band-limited function in one dimension, if the maximum interval of sampling is the Niquist interval, the function can be reconstructed exactly. A similar criterion is extended for a class of pressure variations over a surface whose two-dimensional Fourier transforms are nonzero over only a finite region. The sampling criterion is obtained by using the properties of two-dimensional Fourier transformation and sampling property of two-dimensional delta function.

2:20

T2. Representation and Analysis of Time-Limited Data Samples Using a Complex Exponential Algorithm. AZIZUL H. QUAZI, *U. S. Navy Underwater Sound Laboratory, New London, Connecticut,* AND FRANK R. SPITZNOGLE, *Texas Instruments Incorporated, Dallas, Texas.*—A complex exponential algorithm developed for the representation and analysis of time-limited signals is defined, and its evaluation with respect to conventional discrete Fourier techniques is discussed. It is shown that for a given length of a signal containing discrete frequency information, sampled at least to the Nyquist criterion, the complex exponential algorithm can often provide increased frequency resolution over standard Fourier techniques. It will also be shown that the complex exponential algorithm provides an improved mechanism over Fourier techniques for interpolation between points in a sampled signal containing discrete frequency components in the presence of broad-band noise. The effects of noise