Greetings to the Speech Science Section of the Research Institute of Logopedics and Phoniatrics

Research Staff of the Haskins Laboratories*

It is a privilege to welcome a new laboratory devoted to speech science, especially when it is headed by a known and valued colleague who has already made outstanding contributions to our knowledge and understanding of speech processes. The plans for future research hold every prospect of further gains to speech science, the more so since the basic research on speech is to be conducted in an environment devoted to applications of this knowledge to human welfare, and with the able assistance of colleagues knowledgeable in these areas.

In responding to the invitation to share in the first report from the Research Institute of Logopedics and Phoniatrics, it may perhaps be most appropriate to indicate our thoughts about significant areas in speech research, as attested by our own research commitments. These have many areas in common with the program of the Speech Sciences Section; thus, in describing our own research program, we may be able to indicate those areas in which exchanges of information will be most rewarding.

The long-term goal of the research on speech at Haskins Laboratories has been to gain some understanding of the nature of speech, its perception, and its uses in human communication. The work on speech had its origins some twenty years ago in the practical problems of devising an efficient acoustic code for use in reading machines for the blind. Since only speech appeared to meet this need, we were led to enquire into the special properties of the speech code, the perceptual mechanisms by which it is processed and the reasons why the sounds of speech are so distinctive and so effective for communication.

The initial phases of the research were concerned with finding the acoustic cues for speech perception, i.e., those minimal aspects of the total acoustic signal that enable a listener to understand what was said. The use of synthetic speech, generated from simplified sound spectrograms, made it possible, over the course of a few years, to isolate and catalogue most of the acoustic cues for American English, and for some other languages as well; further, these studies provided the essential information for reversing the process, i.e., for making synthetic speech by rule from any desired phonemic sequence.

Much remains to be done in this area, and we look forward to the active participation of the Speech Science Section in the further search for acoustic cues and in their utilization in speech synthesis. The present focus of the work on acoustic cues at Haskins Laboratories is on the cues in " real " speech or, rather, on the relations between the cues that are capable of carrying the information (as

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demonstrated by their efficacy in synthesis from highly schematic patterns) and the cues and combinations of cues that actually operate in the speech of different speakers and in different spoken contexts. We have found it necessary to build new research tools for this work, and have taken that opportunity to make a general conversion from analog to digital methods. While this change to digital methods and the use of a small computer is far from complete, we are already finding that it opens new opportunities for stimulus manipulation as well as for data reduction. We think the Speech Science Section is wise in moving toward computer methods as rapidly as opportunity permits.

The earlier research on acoustic cues had had other consequences for our own research program. One of these has been a study of the perceptual characteristics of cues, with special attention to the factors that make speech sounds so remarkably distinctive. A notable characteristic of speech is the categorical nature of the perception of some classes of sounds (including the stop consonants) though not of others (the vowels). This finding has led to other studies of the perceptual process, with special emphasis at the moment on the relative performance of right and left ears in dealing with competitive signals. Here, again, the differences between classes of speech sounds, and between speech and nonspeech, are most suggestive.

Other studies also were prompted by the work on acoustic cues, though the experimental emphasis shifted from how speech is perceived to how it is produced. The nature of the cues had indeed suggested a close link between linguistic element and articulatory gesture. The experiments on the dynamics of speech production employ electromyography, cineradiography, and other physiological techniques to identify the muscles that are primarily concerned with the articulation of speech sounds. It may be, at least for some phonemes or features, that single muscles are involved directly and invariably in the articulation, regardless of context. This has proved to be a useful working hypothesis; thus far, some of the data are consistent with so uncomplicated a model, and some are not. We are able, in any case, to get reliable measures of what is happening (in a motor sense) when a person speaks.

In this area of speech dynamics, we look forward with the keenest interest to the research results from the Speech Science Section. Professor Fujimura has made notable contributions in this area already; hence, we are particularly pleased that research on speech dynamics constitutes a major part of the proposed program.

In conclusion, we should like again to extend greetings to a new laboratory, headed by an esteemed colleague. The research program of the Speech Science Section appears to put major emphasis on the very areas that we feel to be most important; we are, therefore, assured of research results of great value to us, and of stimulating interchanges whenever the opportunity for discussion arises. We hope that it may be often.