

XVII. SPEECH ANALYSIS

Prof. M. Halle
G. W. Hughes
J-P. Radley

The question that we are trying to answer is: "Why and how do we understand people who speak?"

When displayed on a cathode-ray tube, speech normally shows neither breaks between words (corresponding to the spaces of written language) nor sharp border lines between segments that are usually transcribed by different letters. Repetitions by different speakers of utterances judged to be the same, resemble each other no more than do transcriptions of the same sentence made by different people with quite illegible hand-writings. This highly varied, continuous acoustical stimulus is received by a human being who reacts to it in a multitude of ways (that is, understands the message), one of which consists in writing down the received message. In our work we take "understand" to mean "able to write down under conditions of minimal redundancy."

Writing may be thought of as a process of coding the continuous acoustical input in a discrete code containing but a small number of units (the 26 letters of the alphabet). Our problem thus reduces to finding those properties in the speech wave which make this coding process possible.

The method of solution focuses upon "distinctive differences" rather than upon properties common to all examples of a given sound unit (phoneme). It may be illustrated by referring to the analogous problem of identifying letters in an illegibly written message. Suppose that it is necessary to determine whether a certain letter is *l* or *e*. An answer can be attempted by measuring many *l*'s and *e*'s, to obtain standard patterns against which the letter under investigation could then be matched. The method of distinctive differences starts by noting the obvious fact that there is a constant difference between the letters, namely, size. Under conditions of minimal redundancy, where we cannot make guesses based on our understanding of the context, this difference in size must be present if we are to identify the letter correctly. Other distinctive differences distinguish *l* from *t*, *f*, *h*, and so on. Knowledge of all distinctive differences enables us to identify all letters in the alphabet — it amounts to solving the problem we have set ourselves.

M. Halle