GENERAL PHONETICS

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By

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With a Foreword by

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FOREWORD

THE WRITING OF A GENERAL BOOK on phonetics is becoming a more formidable undertaking with each passing year. For phonetics, the study of the sound-continua habitually produced in human speech, is being blessed with additions of data through startling new techniques and devices (electronics, high-speed X-ray photography) and through an increased number of languages under observation. Lively controversies as to the classification and formulation of such data lend piquancy to the work of the phonetician.

Today, in the middle of the twentieth century, we have left the Eden of phonetic innocence. Our predecessors could postulate as self-evident a repertory of "sounds," of more or less complexity, and describe how they and their fellows produced these sounds by putting such and such vocal organs into this and that position. Today we know that setting up a repertory of sounds is itself a complex analytic operation. We know further that human speech is not a succession of sounds, each characterized by its specific position of the vocal organs; on the contrary, we recognize an act of human speech as a continuum, characterized by movements; and only by an artifice (a necessary artifice, to be sure) can a "position" be isolated for study. Even these isolated sounds and their positions, we now know, represent ranges of variation rather than fixed entities. Increasing intimacy of observation and increasing precision of measurement have shown how inconstant are the productions of "the same sound," and what very different sounds can result from "the same articulation." The corollaries are two: impressionistic description of a sound and of its production is unreliable; no small number of instrumental observations can be trusted as typical or average. The instrumental phonetician of today and tomorrow is in scientific conscience committed to the wide sampling and statistical integration which is the method of all biometric study.

Nor can the modern phonetician ignore the hierarchy of variations in the ranges he discovers and studies. The work which began, substantially, with Troubetzkoy and Sapir, has focussed attention upon speech as signalling, and constitutes a body of data and theory now known, with varying degrees of classical learnedness, as phonology, phonemics, or phonematics. Phonemic studies have occasionally added to the gaiety of life for the phonetician through their phonetic naïveté; but they have also added to the earnestness of his task. They have laid upon the phonetician the obligation to distinguish between "significant" and "merely positional" differences within and among the ranges of variations; the phonetician is finding himself forced to operate with significant phonemes and positional allophones. An act of speech is a physiological performance and an acoustic event, but

it is also a socially effective signal; and the phonetician can neglect the signalling nature of the acts of speech he studies only at the peril of triviality and irrelevance.

Such are the vexations confronting the writer of a general book on phonetics. The task calls for a common-sense eclecticism rather than an attempt at universal completeness. This book is addressed to the serious student of human speech; it assumes an interest in phonetics (and an ability to read), but no specialized competence. The physiological apparatus is described in some detail, as is fitting; for the phonetician or phonemicist who isn't sure whether the vocal bands are 10 mm. or 50 mm. long can scarcely trust his inferences as to their behavior. The principal types of sound are described, with their variations and the occurrence of these in various languages. Considerable attention is given to the continuum of speech, with its essential durations and fluctuations in intensity and pitch.

This book is a picture of the state of phonetic knowledge today, valuable and interesting as much for its indication of the sources and methods and aims of phonetic study as for its descriptions and explanations. The seasoned phonetician who reads it can be promised a refreshing account of the noises people make when they talk, and how they make them. Lovers of adventure among phoneticians will find some excitement in suggested connections between the physiological production of sounds and their acoustic nature. And the beginner who studies it can be assured that he will know what phonetics is about.

W. F. T.

ACKNOWLEDGEMENTS

FIFTY-FOUR YEARS AGO Charles Hall Grangent, with the active and extensive collaboration of Karl Friedrich Richard Hochdoerfer, published in Boston the little book called *German and English Sounds*. Thirty-eight years ago I first came under the tutelage of Richard Hochdoerfer, and seven years later I first studied under Grandgent. Both men were great teachers and loyal friends. I learned much from each, and dedicating this book to their memory affords me some satisfaction, although it comes too late to gladden the heart of either.

In the nature of the case, some sections of this essay are in part compilations. I hope I have, in the notes, fully acknowledged every obligation, however slight, in that respect.

I cannot too warmly state my gratitude to my colleague W. F. Twaddell for his sympathetic and incisive criticism of my work as it took the form it now has. He has prevented a number of those slips which human frailty imposes upon us; and he has given freely of constructive suggestions which have led to improvements, notably in the interests of the readers of the book. My obligation to him for his Foreword will be apparent to all who read it. For all this my earnest thanks.

R-M. S. HEFFNER

Madison, Wisconsin
December 20, 1945.

GENERAL PHONETICS

By Roe-Merrill S. Heffner

A detailed explanation of the physiology of speech and the physics of speech sounds. The principal types of speech sound are described with their variations and their occurrence both as individual phenomena and as speech sounds in context. For the scientific linguist and the practical teacher of speech, with the emphasis on observed fact rather than on theory.

This book has been so well received that the University of Wisconsin Press has been able to bring out this special Students' Edition.

Quarterly Journal of Speech: "Throughout, this work is a conservative, thoughtful presentation of the basic data and techniques of the phonetician. Each major and minor section is based upon previously presented or self-contained evidence; conclusions of the author follow logically from the facts and arguments which precede."

The Book Exchange: "An excellent general text book presenting a comprehensive picture of the state of phonetic knowledge at the present time. The English Honors student reading phonetics as part of his course will find the work invaluable as a basic text book, whilst the interested lay reader will glean much from these pages."

Journal of Speech and Hearing Disorders: "For the speech correctionist the most valuable aspect of the book is the outlining of the large variety of sounds from which the foreign or defective student may draw his idiosyncratic pronunciations. This material, together with the sections on physiology and physics, should make the book indispensable."

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INTRODUCTION

0.1 *What is Phonetics?*

Phonetics as a science is an integral part of linguistics; phonetics as an art proceeds from the basic data of scientific phonetics. Linguistics is the scientific study of a language, or of languages; that is, linguistics strives to discover general truths and to formulate general laws relating to the growth and structure of its object, be this one or several languages. A language is commonly, and grossly, thought of as the sum-total of words and constructions, or combinations of words, used and understood by members of a considerable community. However, the only phenomenal existence which a language has, and therefore the only form in which it can be observed, is in the speech of individual members of the community, either as this is heard and understood or as it is more or less imperfectly recorded, for example, in the written word. The introspective contemplation of remembered language experiences is the contemplation of the speech of individual members of the community recorded in the memory rather than on paper.

Linguistics therefore has to study one kind of human behavior: namely, the systematic use of sound signals for the purpose of evoking appropriate or desired responses from the hearers thereof. Such sound signals can be shown to consist of individual sounds, or of sounds recognizable as recurrent, produced singly or in configurations. The fundamental task of the phonetician and the primary business of phonetics is to identify and to describe these recurrent sounds of speech. Phonetics, then, is the study of the sounds of speech: as a science it seeks to discover general truths and to formulate general laws relating to these sounds and their production; as an art it uses the basic descriptive data of scientific phonetics to facilitate the recognition and reproduction of speech sounds.

0.2 *The Sounds of Speech*

Suppose yourself to overhear the following conversation: Mr. A. "Oh, hello, John! Could you tell me where I can find a good dentist?" Mr. B. "Why yes, Henry, I find Dr. X a very good dentist." Mr. A has uttered a complex sound signal, or a sequence of sound signals, to which Mr. B has responded with a different set of noises which probably represent an adequate response to Mr. A's stimulating question. When we compare the two utterances we discover in the sound sequences a number of configurations which seem to be alike as we hear them and also in the manner in which

they are produced. These "sames" are (I), (find), (a), (good dentist). If we knew nothing at all about the English language we should not be able immediately to divide utterances into segments representing "sames" in this way. But by comparing these utterances with many other utterances and responses, we could ultimately make out the identity of the signal (I) and its distinctiveness from (find); and if we persevered we might discover that (good dentist) is compounded of two units (good) and (dentist).[1] These configurations or segments of utterances which recur in approximately the same physical forms and with the same values as stimulus-response (i.e., with the same "meanings") are called words, and there are a great many of them in any language.

Further analysis of English utterances would reveal that the segment (find) is itself a configuration, the constituent parts of which recur in other arrangements. We can isolate the first part by comparing the effects of substitutions made in utterances. If we substitute for (find) any of the words, *bind, hind, kind, mind, rind, wind, lined, pined, signed, tined,* the stimulus-response value of the utterance is changed each time, although these words are identical except for differences in the way they begin. Each of the initial portions or segments is therefore distinctive—that is, associated with differences of meaning. Similarly, if we substitute for (find) any of the words, *fanned, fend, fiend, phoned, fond, fund, found,* we produce a change in the meaning of the utterance. In these cases the initial and the final portions of the configuration are constant, while an intervening segment is different and distinctive in each instance. By repeating the process of contrasting meanings we can discover in the end of the word (find) two distinctive components which we call [n] and [d]. When we apply this kind of analysis more widely we discover that multitudinous observations of speech forms reveal only a limited number of distinctive components which recur repeatedly in many different configurations. Scientific phonetics begins by gathering the components distinguished by means of such analytical observation into classes; and it is a remarkable fact that no one language yields more than a few dozen discrete groups of distinctive constituent sounds.

0.3 *Genetic or Gennemic*[2]

The stimulus-response behavior which we call speech consists typically of a series of physical movements, initiated by patterned nervous impulses and performed in sequence by the vocal organs, so-called, in such a way that these movements result in audible agitations of the surrounding air. That is, speech movements produce sound waves. These sound waves in turn displace, in intricate and minute movement patterns, the tympani of the ears and the displacements ultimately produce nervous impulses which act as sound-sign l stimuli and, when uninhibited, lead to a response. Such

behavior can be studied in various ways. The phonetician, in his effort to delimit and to describe the several distinct constituent speech sounds, can examine the movements of the speech organs which produce the sounds (genetic investigation), or he may examine the sounds as acoustic phenomena after they have been produced (gennemic investigation). For some purposes genetic investigation is indicated, while for others gennemic study yields better results. Neither approach may properly be ignored.

0.4 *Phonemes*

The phonetician must first, by processes of analysis applied to the speech continua which are his raw material, identify, delimit, and describe, either genetically or gennemically, or in both ways, the three or four dozen recurrent segments which are recognizable as distinctively different from one another. Of course, in the reduction of these primary data to a limited number of classes he must neglect nondistinctive differences, although he should observe them. He may observe, for example, that the first portion of the word *keel* is different from the first portion of the word *cool;* but he will discover that the substitution of the one sound for the other never occurs as the sole cause of a change in the stimulus-response value of the sound signal, in the way in which such a substitution as that of [v] for [f] in *vine* for *fine*, *five* for *fife*, changes it. Hence the phonetician must include the two different initial elements of *keel* and *cool* in a single basic class. As soon as he has established a number of basic classes he is constrained to find a name for each, so that he may think about them effectively. It is inconvenient to speak or to think always in terms of the genetic or the gennemic descriptions of the classes. It is correct to say that the word *keel* begins with a voiceless, mediopalatal, moderately aspirated stop (the genetic description), but it is more convenient to say that it begins with [k]. In like manner, it is convenient to say that *cool* begins with [k], though this [k] sound is not identical with the [k] sound in *keel*. Thus [k] becomes the name or indicator for a class of observed behavior patterns. Some scholars, in order to keep the class, as such, distinct in their thinking from the phenomenal occurrence which would be subsumed under it, speak of the phoneme /k/ when they mean the class, and the sound [k] when they mean the phenomenal occurrence or event which would belong to the class. In this sense, one may say that the phonetician's first task is to sort out the recurrent sound segments of phenomenal speech and to assign each to one of a limited number of categories called phonemes.[3]

0.5 *Phonetics—Science and Art*

Science arrives at general truths concerning its object by the processes of analysis, classification, and synthesis. Scientific phonetics proceeds from