

GENERAL PHONETICS

R-M. S. HEFFNER

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By

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With a Foreword by

W. F. TWADDELL

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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 signaling, 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 Grangent. 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

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CONTENTS

Foreword

PAGE
vii

I	Introduction	1
0.1	What is Phonetics?	1
0.2	The Sounds of Speech	1
0.3	Genetic or Gennemic	2
0.4	Phonemes	3
0.5	Phonetics—Science and Art	3
0.6	Descriptive, Historical, Comparative	4
0.7	General Phonetics	4

PART ONE: FUNDAMENTALS

II	The Physiology of Speech	9
1.01	The Problem	9
1.011	The Sensory Basis of Speech	9
1.02	The Lungs	9
1.03	Breathing Movements	10
1.031	Rest-breathing or Speech-breathing	12
1.04	The Trachea	14
1.05	The Larynx	15
1.051	The Conus Elasticus	16
1.052	The Vocal Bands	16
1.06	The Epiglottis	18
1.07	The Intrinsic Muscles of the Larynx	19
1.071	Exhalation	19
1.072	Inhalation	19
1.073	Whisper	20
1.074	Voice	21
1.08	The Function of the Larynx	23
1.09	Voice	23
1.10	The Pharynx	24
1.11	The Hyoid Bone	25
1.12	The Laryngeal Pharynx	25
1.13	The Oral Pharynx	28
1.14	The Nasal Pharynx	29
1.15	The Nasal Cavities	29
1.16	The Nasal Sinuses	30

	PAGE
1.17 The Isthmus Faucium	30
1.18 The Tongue	32
1.19 The Mouth	34
1.20 The Mandible	34
1.201 Movements of the Jaw	35
1.21 The Teeth	36
1.22 The Roof of the Mouth	37
1.23 The Lips	37
1.24 Controlled or Ballistic Movements	38
1.25 The Motor Unit	39
1.26 All or None	40
1.27 The Motor Nerves of Speech	41
 III The Physics of Speech Sounds	 42
2.01 Sound Waves	42
2.02 Vibrations	42
2.03 Pitch	46
2.04 Consonance and Dissonance	47
2.05 Harmonics, Overtones, Partial	47
2.06 Free Vibrations, Forced Vibrations, Resonance	49
2.07 Energy, Intensity, Loudness	50
2.08 Quality, Timbre	51
2.09 Noises	52
2.10 How Sounds Are Heard	53
 PART TWO: THE SOUNDS OF SPEECH	
 IV Criteria of Analysis	 61
3.01 Is There a Norm?	61
3.02 Speech Sounds as Events	64
3.03 Speech Sounds and Orthography	67
3.04 A Phonetic Alphabet	69
3.05 Classification of Speech Sounds	72
3.06 The Syllable	73
3.07 Sonority	74
 V The Syllabic Sounds	 76
4.01 Vowel or Consonant	76
4.02 The Vowels Considered Genetically	76
4.021 Synthesis	78
4.022 Summary	80
4.023 Diagrams	80

	PAGE
4.03 The Vowels Considered Genetically	85
4.031 The Vocal Bands, Whispered Vowels	85
4.032 The Vocal Bands, Voiced Vowels	86
4.033 The Vocal Bands, Half-Voice, <i>Sotto Voce</i> , Murmured Vowels	86
4.04 Vocal Resonators	87
4.05 Three Typical Vowel Positions	88
4.06 The Classification of Vowels	95
4.07 Vowels of the Type [i]: High Front Vowels	99
4.08 Vowels of the Type [e]: Mid Front Vowels	101
4.09 Vowels of the Type [a]: Low Front Vowels	102
4.10 Vowels of the Type [ɑ]: Low Back Vowels	103
4.11 Vowels of the Type [o]: Mid Back Vowels	104
4.12 Vowels of the Type [u]: High Back Vowels	106
4.13 Vowels of the Type [ə]: Central Vowels	107
4.14 Centralized Vowels	109
4.15 Diphthongal Vowels, Diphthongs	110
4.16 Nasal Vowels	112
4.17 The Syllabic Consonants	114
VI The Nonsyllabic Sounds	116
5.01 Definition	116
5.02 The Consonants, Considered Genetically	116
5.03 The Consonants, Considered Genetically	117
THE STOP CONSONANTS	118
5.11 The Occlusion	118
5.12 The Release	120
5.13 Voiceless or Voiced	121
5.14 Intermittent Stops	123
5.15 Criteria of Description	123
THE SIMPLE STOPS	125
5.21 The Laryngeal Stop [ʔ]	125
5.22 Velar Stops [k], [g], [kx], [q], [g]	125
5.23 Mediopalatal Stops [c], [ɟ], [ɟ], [cx]	126
5.24 Palatal Stops [ç], [j], [t], [d], [tʃ], [dʒ]	127
5.25 Alveolar, Gingival, Dental Stops [t], [d], [tʃ], [dʒ]	129
5.26 Labial Stops [p], [b], [pʰ], [bʱ], [pf], [bv]	131
5.27 Simple Stops with Palatalization [pʲ], [bʲ], [tʲ], [dʲ], [kʲ], [gʲ]	133
5.28 Simple Stops with Labialization [pʲ], [bʲ], [tʲ], [dʲ]	133
5.29 Simple Stops with Velarization [p̠], [b̠], [t̠], [d̠]	134

	PAGE
THE INTERMITTENT STOPS	
5.31 The Laryngeal Trill	134
5.32 The Uvular Trill [R]	135
5.33 The Dental, Gingival, Alveolar Trill, or Tap [r], [ɾ], [ɽ], [ɽ]	135
5.34 The Labial Trill [ɹ]	136
THE COMPOUND STOPS	136
5.4 Glottalized Stops	136
5.41 Glottalized Pressure Stops	136
5.42 Glottalized Suction Stops	137
5.5 Velaric Stops	138
5.51 Velaric Pressure Stops	138
5.52 Velaric Suction Stops	138
THE OPEN CONSONANTS	139
6.1 General Features of Open Consonants	139
6.11 Classification	141
6.2 The Nasal Consonants	141
6.21 The Bilabial Nasal [m]	142
6.22 The Dental Nasal [n]	142
6.23 The Palatal Nasal [ɲ], [ɳ]	143
6.24 The Velar Nasal [ŋ], [ŋ]	143
6.3 The Lateral Consonants	143
6.31 The Dental Lateral [l]	144
6.32 The Palatal Lateral [ʎ], [ʎ]	145
6.4 The Fricative or Spirant Consonants	146
6.41 The r-Sounds	146
6.411 The Dental Fricative [ɹ]	147
6.412 The Retroflex [ɻ]	148
6.413 The Mediopalatal [ɹ]	148
6.414 The Velar [ɻ]	148
6.415 Labialized [ɻ]	149
6.416 Fricative or Frictionless	149
6.42 The Laryngeal Open Consonants [h], [ɦ], [ħ]	150
6.43 The Pharyngeal Open Consonants [ħ], [ʕ]	152
6.44 The Velar Fricatives [x], [χ], [χ], [ɣ]	153
6.45 The Palatal Open Consonants [ç], [j]	153
6.46 The Prepalatal Open Consonants [ç], [ʝ]	155
6.47 The Dental Open Consonants [f], [ɸ], [s], [z], [ʃ], [ʒ], [θ], [ð]	156

	PAGE
6.471 Sounds of the Type [ʃ], (ʒ)	156
6.472 Sounds of the Type [s], [z]	157
6.473 Sounds of the Type [θ], [ð]	158
6.48 The Labiodental Open Consonants [f], [v]	159
6.49 The Bilabial Open Consonants [ɸ], [β], [w], [ɥ]	160
6.491 The Bilabial Slit Fricatives [ɸ] [β]	160
6.492 The Bilabial Hole Fricatives [w], [ɥ]	160
VII Speech Sounds in Context	
7.1 Introductory Considerations	163
7.11 Ballistic Movements	164
7.12 Modifications in Context	165
7.2 Initial Elements	165
7.21 Vowel Beginnings	166
7.22 Consonant Beginnings	167
7.3 Final Elements	168
7.31 Vowel Endings	168
7.32 Consonant Endings	171
7.4 Speech Units, Linguistic Forms	173
7.5 Fusion	175
7.51 Dynamic Displacement	175
7.52 Doubling	176
7.53 Reduction	177
7.54 Omission	178
7.55 Glides and Intrusive Sounds	180
7.551 From Consonant to Vowel	182
7.552 From Vowel to Consonant	183
7.553 From Vowel to Vowel	184
7.554 From Consonant to Consonant	184
7.56 Linking	186
7.57 Adaptive Changes	188
7.571 Assimilative Changes of Release	189
7.572 Assimilative Changes as to Voicing	190
7.573 Assimilation of Place of Articulation	191
7.574 Assimilation of Manner of Articulation	192
7.575 Assimilation of Contiguous Stops	193
7.576 Assimilation in Clusters	195
7.577 Vowel Adaptations	196
7.578 Dissimilation	198
7.6 Boundary Marks	200
7.7 Allegro and Lento Forms	202
8.1 Duration and Tempo	204

	PAGE
9.1 Pitch, Intonation, Melody	213
9.11 Chinese Tones	214
9.12 Word Pitch Patterns	216
9.13 Phrase Patterns, Speech Melody	217
9.131 Finished or Unfinished	217
9.132 Declarative, Imperative, Interrogative	220
9.133 Implications	222
10.1 Quality	223
11.1 Stress	224
11.2 Word Stress	226
11.3 Group Stress	227
12.1 Rhythm	227
12.2 Accentuation	228
 <i>Epilogue</i>	 231
<i>Bibliographical Notes and Commentary</i>	232
<i>Index</i>	247

ILLUSTRATIONS

	PAGE
1 Lungs, Bronchi, Bronchioles	10
2 Thorax, Rib Cage, Diaphragm	11
3 Trachea and Larynx	14
4 The Larynx from Behind	15
5 Larynx Section, Conus Elasticus	17
6 Larynx Section, Vocal Bands	18
7 Muscles of the Larynx from Behind	20
8 Muscles of the Larynx from the Side	21
9 Positions of the Vocal Bands	22
10 Pharyngeal Cavities	26
11 Muscles of the Neck	27
12 Muscles of the Pharynx	28
13 Mouth Cavity	31
14 Extrinsic Muscles of the Tongue	33
15 Mandible	35
16 Muscles of the Face and Lips	39
17 Vibrations	44
18 Inner Ear	54
19 Vowel Formants: Paget, Somerville	82
20 Vowel Formants: Coustenoble, Composite American	83
21 Vowel Diagrams	84
22 Three Vowel Articulations	89
23 Two Articulations of [u]	93
24 Points of Articulation	124
25 Intonation Patterns	219

CHAPTER I

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*, *vined*, 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 striking 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 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