

# PHONEMICS

A Technique for Reducing Languages to Writing

*by*

KENNETH L. PIKE

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## FOREWORD

In 1943, at the time of the publication of Kenneth Lee Pike's Phonetics, two other books by him were announced as in preparation. The pressure of a variety of special demands arising from the national war effort has delayed the completion of these books. Important for these demands was the contribution Dr. Pike made to the materials for the teaching of English as a foreign language produced by the English Language Institute of the University of Michigan. The basic research he carried forward as part of this program resulted in his book Intonation of American English, published by the University of Michigan Press in 1945.

In spite of heavy practical duties the work upon the two books announced in 1943 went steadily forward and they have developed and matured with the delay. Both books provide necessary supplements to the earlier volume, Phonetics, if one would grasp with some completeness the approach of modern linguistics to the study of vocal sounds. Tone Languages, now in press, deals with the nature of tonal systems and provides a technique for the analysis of significant tonal contrasts. The new material here on two languages never before reported provides, not a sampling, but a thoroughgoing dealing with all the pertinent evidence, including an extensive analysis of tone sandhi and tone fusion.

Phonemics is more directly the counterpart of Phonetics. In Phonetics the end sought was the establishing of a technique of description which could deal with the nature and formation of all sounds whether these sounds are used in language or not. Practically it sought a means to describe sounds in terms of movements of the "vocal apparatus," in terms of articulatory formulas. In Phonemics the end sought is the establishing of a satisfactory technique for discovering the pertinent units of sound in any language and organizing them for an alphabet writing.

Much discussion has centered upon the nature of the "phoneme" and many have attempted to define it - some as a "psychological unit," others as a "class of sounds." Dr. Pike furnishes a very practical and scientifically sound approach by carefully stating the assumptions upon which he proceeds and then leading the reader step by step through the intricate problems involved in arriving at the phonemes of a language. Practically, then, "a phoneme is one of the significant units of sound arrived at for a particular language by the analytical procedures developed from the basic premises...." Phonemic analysis thus seeks to arrive, not simply at the phonetic character of the separate sound units, but at the structure of the sound system of a language. Phonemic analysis is a fundamental step in the modern structural approach to linguistic study.

This book has grown out of more than a decade of experience investigating, in the field, a great variety of diverse languages. The premises underlying the phonemic procedures here set forth rest upon that experience. They are assumptions concerning general characteristics of language; but the generalizing is based upon an unusually wide range of firsthand observation.

In addition to these years of experience in various linguistic communities, Dr. Pike has devoted part of each year to training other field workers to make structural analyses of languages. The validity of his premises and the usefulness of his procedures have been constantly put to the test of practical application. This book, therefore, with its step by step approach and many specific illustrations, brings the materials of one of the most important divisions of modern linguistic study within the grasp of the reader without special technical training.

Charles C. Fries

## PREFACE

The present volume is a revision and expansion of one of the same title which appeared in mimeographed form in 1943. The book has gone through successive revisions each year and been tested in the classroom<sup>1</sup> with about 1000 students since that time. The purpose of the material has been to give to the student a methodology for reducing languages to writing, and to do so by means of graded exercises in language analysis. It appeared to me that phonemic theory was in an advanced state but that the actual teaching presentation of these theories to beginners was handicapped by lack of drill material for classroom use. In order to supply this need, the book was so arranged that presentation of theory was accompanied by data to which these principles could be applied. The student who has worked through exercises of this type is much better prepared to solve actual difficulties which he meets in the field than he would be if he had heard about such solutions but had not had an opportunity to try to work them out in miniature.

The choice of material for the phonemic exercises was not an easy one. If, for example, an investigator states that such and such a sound occurs in certain positions in words whereas a different but phonetically similar sound never occurs in these same positions, the reader assumes that the investigator has studied all the data before asserting the absence of the second of these sounds from the environments mentioned. In essence then, the phonemic procedures demand the presentation of all the data of the language being examined before valid conclusions can be drawn. This principle came into conflict with the desire to have a wide variety of problems included. It was impossible to present a great number of different languages and at the same time to guarantee that all the phonemic data for each were presented, since too few languages have been adequately described phonemically and since the bulk of the volume would then have exceeded the limits of practicality, while the amount of time required for a student to work out the distributions of sounds of complete problems is so great that the actual practical limitations of classroom time would prevent him from solving many such problems. Nevertheless, one of the aims of the book was to present a large enough number of problems that by the time the student had worked them all

he would have a fair idea of the range of sound systems which might be encountered.

In the face of this dilemma I early began (about 1937) to dictate to the class various Hypothetical Language Problems with the statement to the student that he was to assume that these problems represented all the data of these "languages" and that he must arrive at phonemic solutions of those data and of those data alone, since no other information was known about these languages. This allowed him to make statements of the absolute distribution of sounds and reach conclusions even where arguments from silence were necessary. At the same time it made it possible to keep the problems short so that many types of language situations could be presented in the space and time available. These hypothetical languages were so constructed that each reflected in condensed form some kind of actual or potential language situation. Each was treated as a separate hypothetical language. Soon they were called Dialects of Kalaba.<sup>1</sup>

Repeatedly during succeeding years the attempt was made to utilize actual language material. In each case, however, the effort proved abortive because of the difficulty mentioned, namely, that all of the data could not be presented in a brief space and yet make a simple, brief, accurate exercise. In 1946, however, a modified type of problem was worked out which partially overcame this difficulty. Rather than asking the student to handle the full procedure for the analysis of all the phonemes of the language, the directions required the student merely to analyze some one or more parts of the phonemic system. Any data which he needed for this purpose were supplied him. The material for one of these problems was chosen from an actual language and presented in an abbreviated form. Since, however, the data were essentially incomplete, a thorough phonemic analysis applied to them would not yield a true picture of the structure of the entire phonemic system of the language. The conclusions derived from the data were claimed to be valid only for those parts of the material for which directions were supplied.

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<sup>1</sup>The name grew out of simple dictation exercises in which the teacher would pronounce syllables such as [ka], [la], [ba], versus [k'a], [l'a], [m'ba], and so on, in which the student had to find the phonetic or phonemic contrast. After a sufficient number of problems of this nature were utilized, the name followed almost inevitably. No such label is essential, of course, but it has proved helpful in simulating a field atmosphere in the classroom.

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<sup>1</sup>In the sessions of the Summer Institute of Linguistics at the University of Oklahoma in Norman, Oklahoma, and at Caronport, Saskatchewan, Canada, as well as (1945) at the Linguistic Institute sponsored jointly by the Linguistic Society of America and the University of Michigan at Ann Arbor, Michigan.

Items of this kind were called Restricted Language Problems. Several different restricted language problems could be chosen from any one actual language and could be presented in different parts of the volume. In order that the student might not be confused by an apparently different system for the same language found in different parts of the book, these items were called Restricted Chontal A, Restricted Chontal B, Restricted Chontal C, and so forth. Furthermore, care was taken that in any one of the problems none of the data would lead to erroneous analysis of any of the phonemes in the language. Restricted Problem C might, for example, contain further phonemes or types of phonemic problems which were not encountered in Restricted Problem A of the same language, but the solution of Problem C would not contradict the analysis of Problem A nor violate conclusions which one would have reached on the field. In this way actual language material has been presented within the graded sequence of the volume without violating phonemic procedures or the data of these languages. A few problems are also presented which attempt to give in condensed form, but in exercises much more involved than the ones earlier in the book, samples of all of the most important data concerning the phonemic systems of a few languages as complete units.

In order for the procedures to be applied to the material, the data in this volume had to be written accurately. On the field, however, the student's first notes would be certain to contain many errors and omissions. The procedures had to be so designed that these errors would be discovered in the normal course of the investigation. In this respect then, it was difficult to make the phonemic exercises parallel the field procedures. To solve this difficulty, problems here are first assumed to be without error in phonetic recording; with them the student learns the handling of accurate phonetic data. After these problems a different type is presented in which the data are assumed to be incomplete and inaccurate. In these latter cases the student is expected to discover items which appear suspicious and which he would, were he in the field, double-check with his informant. It is assumed that the student who is able to discover suspicious items in his data will, upon checking them with the informant, be able to ascertain with some certainty whether or not he actually heard correctly. By finding these errors he can then correct his data and apply the regular procedures to them.

In order to have a volume of exercises which could be worked successfully by students, it is evident also that the exercises must be graded in difficulty and that the theory must be introduced gradually in such a way that the student can tackle a problem with the assurance that it is solvable within the theory as it has been so far presented to him. These requirements demand a Step-by-Step Procedure which combines acceptable phonemic theory with a progressive

presentation of it. A procedure first presented must not be dependent for its application upon principles given later on. Such a progression can by no means be taken for granted in an analysis which in some respects must be circular; that is, many phonemic conclusions are based, not upon absolute data as such, but upon the correlation and interrelationships of data or upon the observation of the effect of a total structure exerting a pressure upon the interpretation of some one point of that system. Nevertheless, a step-by-step procedure was a prerequisite to the usefulness of the volume. Over a period of several years various types of sequences of presentation of material were attempted and those discarded which were not effective. Their more successful characteristics have been retained as subdivisions of the present order of materials.

Thus in 1941 the approach centered around extensive charting in order to locate segments in mutually exclusive positions; now the charting is utilized in substantiating hypotheses of distribution--yet the early list of positions is preserved at the Working Outline for Determining Distribution of Phonemes in Phonological and Grammatical Units (pp. 182-184). In 1942 the approach emphasized that every phone was a phoneme unless it was accounted for in one of various ways; the progression no longer centers on this attack on the data, but it is preserved as part of the procedure for handling nonsuspicious segments (p. 71). In 1943 procedures were classified as to techniques which either separate the segments into distinct phonemes, or unite them into single phonemes, or interpret them as phonetically complex single phonemes, and so on. This type of division still can be seen as it is reflected in the subdivision of the longer procedures (see, for example, p. 84), or in chapter headings (compare Chapter 12).

It became evident, however, that the procedures needed to be explained in terms of the reasonable assumptions underlying them if the students were to understand them readily. Otherwise, they appeared to be utterly arbitrary and without legitimate cause for usage, with no practical goal or justification. This was especially true for those students who had already been working in the field and had been utilizing certain types of alphabets which were in part nonphonemic. If these students were to be persuaded of the validity of phonemic procedures, they had to have some type of explanation which would appear to them to be valid. It was with people of this background in mind that the initial presentation of the three or four phonemic premises as given in the present revision was developed in 1945. To be sure, these premises do not cover all possible assumptions under which phonemic procedures operate, and the careful reader will see various sub-assumptions contained tacitly or explicitly in them. Nevertheless, as a practical device they proved sufficiently comprehensive to serve as a point of reference for



explaining and justifying the procedures and to serve as a point of departure from which all the procedures might be developed in a progressively graded series. In this way the student has to remember only a very few general principles; in terms of these basic principles he can be made to understand the entire course. As an actual classroom procedure this presentation in terms of initial premises with procedures springing from them has proved much more teachable than earlier editions of the volume which worked directly from the procedures without such an orientation.

One of the goals of the procedures is to have them so arranged that they would serve to solve the problems in the book but, further, that this procedure could also be followed point by point on the field with a probable measure of success resulting therefrom. As a part of the course of the Summer Institute of Linguistics for the past several years, there has been a ten-day field investigation for each of the students. During this time he is expected to apply the procedures as they are given here and to present the materials gathered in that way. Data obtained in this fashion is, of course, incomplete, but the experience so gained has demonstrated that the procedures presented here are applicable in the order presented. Further observation of some of the graduates of earlier years has been possible over extended periods of time; here again it appears that the procedures, though by no means capable of working themselves, are nevertheless helpful.

Even though the statement and sequence of the assumptions have been freshly worked out here for the special purpose of building procedures upon them, it will be seen that many of the phonemic premises are not in essence new: the modification of sound types by their environment, the free fluctuation of material, and the interpreting of sound types in sequences in various ways, have all been pointed out by earlier writers.<sup>1</sup> It is to be regretted that we do not have a statement of the history of phonemic theory,

or that a critical review of the literature can not be given here. However, it is scarcely pertinent to the purpose of this volume. Nevertheless, in various places throughout the discussion conflicting theories of analysis have been referred to; at some later date it may be possible to add a separate chapter surveying the literature.

Even though most of the principles of phonemics utilized in this book can already be found in the technical literature, certain contributions are here made to the field. Since they had to occur along with the practical presentation for the beginner, some of these are not written in such a way that they are convenient of access to the technician. Nevertheless, the phonemic theorist will be especially interested in Chapter 4, in which much of the theory is gathered together. In that chapter he should notice the discussion of phonetic versus phonemic syllables; close-knit syllable nuclei; suprasegmental phonemes; grammatical prerequisites to phonemic analysis; the source of phonemic premises; and relative quality. A certain amount of hitherto unpublished research data appears also in the Restricted Language Problems.

Many valuable data have never reached technical periodicals, even though they are in the files of investigators, simply because certain observers were untrained in the written presentation of scientific materials. It is hoped that the discussion of Descriptive Procedures will result in a higher percentage of such facts being made available. If many lay workers in the field should but learn the rudiments of linguistics and the essentials of a routine description of the results of their investigations, they could provide accurate and adequate surveys of sounds, sound types, sound sequences, and record texts in the vernacular.

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"Anthropological Limits of Language," Proceedings of the Indiana Academy of Science, XLVI (1937), 57-64; Bernard Bloch, and George Trager, Outline of Linguistic Analysis (Baltimore: Linguistic Society of America, 1942). In the article by Sapir, the argument and demonstration are handled in terms of two hypothetical phonetic systems which have similar sounds but a different systematic arrangement of these sounds into phonemes; for hypothetical language problems constructed on these data, see p. 156. Apart from the examples in the present volume this is the only treatment I have seen which makes large use of hypothetical languages for phonemic analysis. For teaching morphological analysis similar types of problems are used by my colleague, Eugene A. Nida, in his Morphology: The Descriptive Analysis of Words, University of Michigan Publications in Linguistics, II (Ann Arbor: University of Michigan Press, 1946).

<sup>1</sup>Some of the materials which are the most helpful for the understanding of phonemic principles are Edward Sapir, "Sound Patterns in Language," Language, I (June, 1925), 37-51; Leonard Bloomfield, Language, Chapters V-VIII (New York: Henry Holt and Company, 1933); Morris Swadesh, "The Phonemic Interpretation of Long Consonants," Language, XIII (January-March, 1937), 1-10; also, the same author, "The Phonemic Principle," Language, X (June, 1934), 117-29. For procedures of phonemic analysis--somewhat distinct from the theory of analysis as such--one should see also Morris Swadesh, "A Method for Phonetic Accuracy and Speed," American Anthropologist, XXXIX (October, 1937), 728-32; also Jules Henry, "A Method for Learning to Talk Primitive Languages," American Anthropologist, XLIII (October-December, 1940), 635-41; and Carl Voegelin,

Those persons who expect to utilize phonemic techniques for reducing to writing languages which have hitherto been unwritten will find that the material presented, though appearing to them to be highly technical, is prepared with practical goals in view. The section on Orthographical Procedures is designed to show them the specific application of phonemic theory to the formation of alphabets to be used in the preparation of vernacular literatures.

Before the student can adequately handle a phonemic analysis he needs to be able to hear, produce, and transcribe sounds. A phonemic book, therefore, must have as a prerequisite a study of phonetics. In order to furnish some of these data within the confines of the present volume, a section on phonetics has been given which is designed chiefly to allow the student to produce, hear, and transcribe the sounds utilized later in the problems. It does not give illustrations of these sounds in various languages nor discuss the particular shades of sounds which occur in any particular language. For these the student can consult other texts. If, however, he can handle the material given here he should be prepared to understand the phonemic procedures and to carry on work in the field. The theory of the phonetic data presented is based upon my volume, Phonetics: A Critical Analysis of Phonetic Theory and a Technic for the Practical Description of Sounds.<sup>1</sup>

The exercise material in phonetics is based upon experience in the classroom. Various new drill types are given, in addition to many old ones which may be found in current phonetic literature. The drills on tone should be preceded by practice in intonation since the analysis and control of one's own intonation is the best approach to a study of tone. For this material one may see The Intonation of American English.<sup>2</sup> If one wishes further details for the theoretical analysis of tone than are presented in this volume, one may consult Tone Languages.<sup>3</sup>

<sup>1</sup>University of Michigan Publications in Language and Literature, XXI (Lithographed Edition, Ann Arbor: University of Michigan Press, 1944).

<sup>2</sup>Kenneth L. Pike, University of Michigan Publications in Linguistics, I (Ann Arbor: University of Michigan Press, 1945). For supplementary classroom material, designed to be used with these volumes, see Eunice V. Pike, Dictation Exercises in Phonetics (Glendale: Summer Institute of Linguistics, 1946).

<sup>3</sup>Kenneth L. Pike, (Mimeographed edition, Glendale: Summer Institute of Linguistics, 1943, 1945. Printed edition now in process of publication by the University of Michigan Press).

The presentation of the earlier editions of the volume was made possible by funds supplied by the Summer Institute of Linguistics of Glendale. In 1946 a complete rewriting of the manuscript was accomplished as part of the work undertaken as Lloyd Post-Doctoral Fellow of the University of Michigan. The phonetic and phonemic staffs of the Summer Institute of Linguistics have provided material for the Restricted Language Problems; each of these contributions is acknowledged in the appropriate place in the text. Miss May Morrison contributed greatly to the volume by typing various drafts of it and influencing the mechanical features of presentation of the problems. Donald Stark constructed a large percentage of the Kalaba Problems. It has been from my wife, however, that I received the initial stimulus to commit to writing these problems and procedures, and from her I have received much searching and helpful criticism; the attempt to build these procedures around a limited number of phonemic axioms was initiated by her.

K.L.P.

Norman, Oklahoma  
August 22, 1947

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Part I

ANALYSIS AND PRODUCTION  
OF PHONETIC UNITS



## Chapter 1

### PHONETIC SYMBOLISM

#### THE VALUE AND BASIS OF FORMULAS FOR SOUND PRODUCTION

Language consists of systematized vocal noises. These noises are made in the mouth, nose, and throat, and are organized into words and phrases for communication. In order to study a language that is new to him, an investigator must study the vocal noises.

These vocal sounds are produced by movements of parts of the mouth, nose, throat and lungs. Within the vocal apparatus there are only a few parts such as lips and tongue which can move. If one can master the general types of movement which these parts can undergo, and the combinations of their movements, one can then pronounce the sounds of any language since sounds of all languages are produced by combinations of these variables.

Similarly if one can create formulas to represent these movements it follows that one can with them represent graphically the sounds of any language since the sounds are caused by the movements of the vocal parts. A phonetic alphabet constitutes a series of such formulas. For example, the letter "b" represents a movement of the lungs which thrusts air upward and outward through the throat, past the vibrating vocal cords, into the mouth; the symbol shows further that in the mouth the air stream is temporarily but completely interrupted by a closure of the passage through the nose, and by a closure at the lips of the passage through the mouth.

Courses in practical phonetics are designed to study the several variables of movement in terms of their effect upon the production of sounds. Students listen to various kinds and sequences of sounds and learn to reinterpret them in terms of the vocal mechanisms which produce them, and to symbolize them in formulas which consist of letters of the alphabet.

#### PRODUCTIVE AND CONTROLLING MECHANISMS FOR SOUNDS

It proves difficult or impossible to describe the flavor of a pumpkin pie in such a way that one who has never eaten that kind of a pie may know what it tastes like. One must content oneself with comparing it to other similar flavors, or one must describe it by means of a recipe in which the description is not one of taste as such, but of the raw materials entering into the pie, plus the procedure for combining and cooking them. In practical phonetic work one must follow a similar procedure. Frequently the most

adequate available description of a sound, for the purpose of learning to produce it, is a definition which tells a student how to make that sound, rather than telling him what constitutes its acoustic properties. It is this type of definition which will appear most frequently throughout succeeding sections of this material.

Although sounds may be made by percussion, or by vibrating strings, or by other means, the large majority of vocal sounds are made by a moving column of air passing through a narrow orifice in the mouth, nose, or throat. An air column to be set in motion within the vocal cavities must have something pushing or pulling it, but once it is moving it can be controlled at its outlet, just as a stream of water from a hose may be controlled by a nozzle. In addition, there may be further interferences with the air stream between its point of origin and its point of escape.

There are several ways in which an air column may be set in motion. The walls of the lungs may contract so as to force air outward. In this event the lungs may be called an INITIATOR of the air stream. All normal English sounds are produced in this way. There can be, however, other places at which an air stream is begun. The tongue can be pressed against the top of the mouth and then, while retaining its contact, moved backwards so as to create a suction in the mouth, and to cause air to rush inward to fill in the partial vacuum; this is the same mechanism which one uses in sucking water up into a straw. If the vocal cords are made to close the passage to the lungs, and the larynx is raised, the air in the throat is compressed and forced out through the mouth or nose. Air columns set in motion by each of these initiators are found in speech, so the student of languages should be ready to recognize which initiator is the source of the air stream for any particular sound. The quality of the sound will be affected by the manner in which its air stream is initiated.

The direction of the air stream likewise affects the sound. If suction is created, causing an ingressive air stream, the acoustic results are considerably different from those produced when an egressive air stream is caused by pressure from one of the initiators. In Figure 1 notice that an arrow indicates that the tongue is moving inward, causing an ingressive air stream.

The parts which modify and control the air stream are either movable or stationary. The movable parts include the lips, jaw, tongue, velum (i.e., soft palate, uvula,

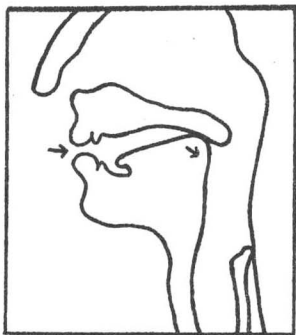


Fig. 1. Ingressive  
Air Stream to the  
Mouth

velic (i.e. nasal side of the soft palate), vocal cords, and other less important items. The tongue is so very flexible, however, that it is convenient to describe it in several parts: the tip, the blade (i.e. the part directly behind the tip), the middle part, the upper back part of the tongue, and the root of the tongue (facing the back wall of the throat). When these movable parts affect the air stream they may be called **ARTICULATORS**:

Stationary parts of the vocal apparatus serve as convenient points of reference for indicating the movement of the flexible ones. The stationary parts include the teeth, the alveolar arch (which is behind the upper teeth), the hard palate, and the back wall of the pharynx. When an articulator in controlling the air stream touches another articulator or one of these stationary parts, it is convenient to call the junction or near junction of the two a **POINT OF ARTICULATION** and to describe sounds containing such productive characteristics as bilabial, velar, uvular, glottal, and so on, or labiodental, interdental, dental. Usually the articulator is flat from side to side, but it may be slightly grooved or with the air escaping centrally over the center of the tongue, or laterally over the sides of the tongue. For these different articulators and certain pertinent stationary parts of the vocal mechanism see Figure 2.

The moving air stream may be affected by the movable parts in various ways. The two escape cavities (the mouth and the nose) may be closed off so that the air stream is completely dammed up, or stopped, as in [p] and [t], or less frequently the air stream may be completely interrupted by a single closure in the throat. On the other hand, one of the two escape cavities may be closed off and the air diverted out the other in a continuous stream. Even while the air is escaping outward through one of the cavities, some articulator may reduce the opening partially, so that the air stream is considerably impeded and audible friction is created at that point. In [f], for example, the friction is noticeable

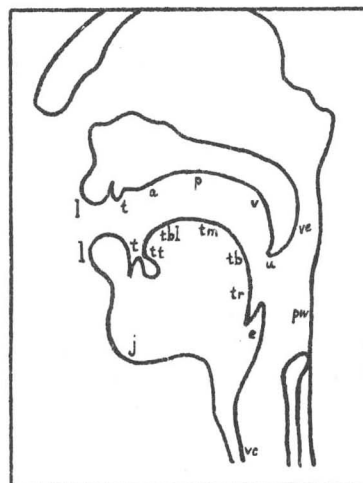


Fig. 2. Points of Reference  
in the Vocal  
Apparatus

l, lips; t, teeth; a, alveolar arch; p, palate; y, velum; u, uvula; ve, velic; tt, tongue tip; tbi, tongue blade; tm, tongue mid; tb, tongue back; tr, tongue root; j, jaw; pw, pharynx wall; vc, vocal cords; e, epiglottis.

at the junction of the upper teeth and lower lip. The interruption of the air stream, however, may be less severe so that there is little or no audible friction at the point of partial closure.

One of the most important types of interruption occurs in the throat and is caused by the rapid opening and closing of the vocal "cords" (somewhat like two lips) in such a way that a characteristic vibration called **VOICING** is added to sounds like [e], [v], and [b], in contrast with the voiceless sounds [h], [f], and [p]. In the voiced sounds the contrast between those which have a strong local friction, such as [v], and those with no audible friction, such as [e], is very great, and usually is easy to recognize. In voiceless sounds this difference is less easy to hear, because even in the most open types a very light friction may be heard, as of the air blowing through an open tube. However, it is convenient to speak of the voiceless ones as frictionless when they have no strong local friction, even though a little of this cavity friction may be present.

One of the most important distinctions in sound types is that between sounds which have the air escaping from the mouth over the center of the tongue but with no strong local friction in the mouth (even though friction may at times occur elsewhere during the sounds) and those sounds which do not. The former sounds, such as [o], [e], [u], [w], and [r] may be called conveniently