

Chapter 1

What Is Phonetics?

PURPOSE

To describe the science of phonetics and some of its applications.

OBJECTIVES

This chapter will provide you with information regarding:

1. The definition of phonetics
2. Some of the basic requirements needed to study phonetics
3. Background of the International Phonetic Association
4. Symbols used to indicate United States English sounds
5. Phonetic science today and in the future

INTRODUCTION

There are several different approaches to the study of **phonetics**. One is the approach used in this book that focuses on the articulation aspects such as the anatomy of the speech mechanism and the manner in which the airflow is modified, placement of the articulators, and whether or not **sounds** are **voiced** or **unvoiced**. This approach is referred to as articulation phonetics or **articulatory phonetics** (Stockwell & Minkova, 2001). Another approach

that has gained popularity because of the advancement of available instrumentation is referred to as **acoustic phonetics** (Kent & Read, 2002; Johnson, 1997).

As a beginning student in the study of phonetics, you may be asking yourself, “What exactly is phonetics?” The usual response is, “It is the study of the transcription of *spoken* human sounds into *written* symbols that are designated to each different sound.” For example, there are actually two different sounds for the *th* letter combination: the *voiced* /th/ [ð] in the word *the* and the *unvoiced* /th/ [θ] in the word *thin*. Say these two words while pressing your fingers against your larynx (voice box) and you can feel the difference in vibration.

Granted, that is part of the answer, but it is too simplified to justify the magnitude of the broad scope and impact that the “transcription of sounds to symbols and symbols to sound” has on the modern world. As you will learn, there are many uses for the application of this process.

Phonetic science includes an examination of the following items:

- a. Acoustical properties (sound waves) of the sounds—spectrograms
- b. Anatomic structures involved in speech sound production (e.g., tongue, teeth)
- c. Perception (hearing acuity and discrimination) of the speech sounds; accuracy in hearing the exact sound that is spoken

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Aspects of phonetic science are integral parts of many disciplines that often include both subjective (judgment by the human ear) and/or objective (analysis through instrumentation) analysis. Phonetic science has an interdisciplinary orientation, and phoneticians engage in scientific research investigations and clinical applications in the fields of ancient and modern languages, computer science, business and industry, physics, medicine, education, psychology, speech-language pathology, telecommunications, forensic science, entertainment, and for government agencies.

Phonetics is interrelated to other methods of sound analysis such as **phonology** and **phonics**. Phonology includes the analysis of the sound system as it relates to grammatical forms. For example, the “s” sound is a plural marker. If an individual omits the “s” of a plural word, it may indicate that there is not an understanding of the concept of plural rather than it being an articulation error of omission. In phonics, diacritic marks indicate long and short vowels and the pronunciation of other sounds, similar to the markings used in dictionaries.

It is hoped that the information presented here provides you with a broader perspective on the usefulness of phonetic science and motivates you to contribute your knowledge in different disciplines associated with sound-to-symbol and symbol-to-sound transcription.

BROAD NATURE OF PHONETIC SCIENCE

The following information is provided to give you a sense of the usefulness of the discipline of phonetic science. The broad nature of phonetic science can be demonstrated through a series of practical questions:

- What is the relationship between speaking, reading, and writing and each activity’s associated auditory and visual disabilities? With the current emphasis on literacy, the sound/spelling/pronunciation relationship of phonetics to speaking, reading, and writing is very significant.
- What characterizes regional varieties of a sound system of a language? The phonetic sound/symbol notation system provides a means whereby specific sounds can be identified and recorded for analyses.
- What is involved in **accent** reduction or acquisition? Elements of phonetic science are involved in the identification of the accent characteristics

of speakers. It provides a system to record and analyze the characteristics of accented sounds and words and to modify them when desirable, either to reduce or increase the accent such as in the case of actors. *My Fair Lady*, the musical based on the book *Pygmalion* about how a flower girl in London takes speech lessons from a phonetics professor to pass in high society, is a classic example of this!

- How can voice qualities (**spectrograms**) be objectified and systematically analyzed for voice identification for forensics purposes? This is a relatively new area of development. As technology becomes more valid and reliable in its ability to discriminate speech sounds, application of some of the principles of phonetic science will prove useful.
- How can speech sound disorders be corrected through application of phonetic theory? Phonetic science includes how speech sounds are made correctly. This information provides the framework to assist in the correction of speech sound errors.
- What is the relationship between speech production and speech perception, and how do they affect the deaf and hard-of-hearing populations? Speech sounds have acoustic features that distinguish them from one another. Some sounds are voiced such as the [v] sound. Others, such as the [p] sound, are voiceless (no vibration of the vocal folds). Such phonetic knowledge assists the deaf and hard-of-hearing populations in the development of their sound system.
- What effect does the way one speaks have on interpersonal communication? Aspects of phonetic science include the identification and analyses of different styles of speaking known as the sociolinguistic or pragmatic use of language. For example, you may speak in a more formal manner of precise **articulation** in one setting: “I got you,” and in a less formal manner in a different setting: “I gat cha.” Or, if you moved away from your hometown and adapted to a new dialect, on arriving back home you discover that you begin to automatically use the mannerisms and dialect of your roots. (And that pleases Grandma!)
- What are the implications for the use of computerized (digital) voices and speech production in business, commerce, government, entertainment, education, medicine, and other fields? The physics of sounds and how to replicate them through digital processing involve

Written Versus Spoken Language

phonetic science. Knowledge and application of the uses of “artificial” voice are becoming more and more popular. Most of us have experienced talking on the phone to a “nonhuman.” For example, I was walking through a parking structure in a shopping mall and noticed a group of people hovering around an expensive Italian sports car. As I approached them, I heard the following emitted from the car, “You are violating my space. My alarm will go off in 10 seconds if you do not back away!” That is an example of how creative the application of phonetic science is becoming.

Phoneticians throughout the world are engaged in research and development of phonetic science data to answer these questions and other inquiries regarding the usefulness of knowledge in the transmission of sound to symbol and symbol to sound.

CHARACTERISTICS OF SPEECH SOUNDS

Following are some of the characteristics of a speech sound:

1. Each sound has *no meaning* in and of itself. A [t] or [p] sound has no meaning until combined into a recognizable series, such as t-o-p.
2. A speech sound is *maneuverable*. It can occur in different positions within a word such as the [p] in *pie*, *pepper*, and *stop*.
3. Each sound can be identified by its *physical anatomy*. You will learn how the involvement of the tongue, lips, hard and soft palates, teeth, and alveolar ridge (gum ridge) are used in the production of speech sounds. For example, the upper and lower lips are used to produce the bilabial [p] and [b] sounds. The lower lip and the upper teeth are “articulated” to produce the [f] and [v] sounds.
4. Each sound can be identified by its *acoustic sound waves* that produce a “voice” print displayed on a spectrogram. Such sound properties as frequency, duration, and amplitude can be analyzed. This information is particularly valuable in a **clinical setting** for accent reduction of the vowel sounds.
5. Each speech sound can be *discriminated* in such words as *pet* and *set* for the listener to understand the auditory message. And at a higher cognitive level,

listeners can process homonyms that sound alike but have different meanings, such as *blue-blew*.

6. A speech sound can have a slight **allophonic variation** and still be recognized as the same sound. These similar sounds are referred to as allophones. Notice how the stop and release action of air pressure is slightly different in the production of the two [p] sounds in the word *pop*. The beginning [p] has a greater release of air pressure than does the final [p] sound. However, they are both recognized as the [p] sound and therefore are considered allophones.

WRITTEN VERSUS SPOKEN LANGUAGE

Written language (**orthography**) such as that used in writing and reading consists of printed symbols that represent various combinations of alphabet letters that are sequenced into words. Spoken language consists of the sounds used to speak different words and verbal utterances.

Ball and Lowry (2001) indicate that there are two important problems with English orthography: (1) a symbol does not always represent the same pronunciation: the *c* in *city* and *come*; and (2) a pronunciation can be represented by a range of different symbols, for example, the /f/ sound in *fine* and *phone*.

Both written and spoken language forms convey meaning and serve similar purposes in human communication, but there is a major difference in how each is recorded. Let’s use the word *through*, for example. We have learned to spell the word t-h-r-o-u-g-h using seven alphabet letters. However, the number of sounds spoken are only three, th-r-u. These speech sounds are recorded in phonetic symbols: [θru]. Notice that the /th/ in the word *through* represents only *one* sound and the letters *o*, *g*, *h* are silent.

You will discover that there are many exceptions to the rules when it comes to consistency in written language versus the uniform rule that there is a distinct phonetic symbol to represent each of the spoken sounds of words. Take a minute and think of all of the different sounds for the alphabet letter *a*.

Let’s analyze just one other difference. For example, consider the words *cat* and *city*. Both begin with the letter *c*, but does that letter have the same sound in each word? You are going to learn a lot about the discrepancies of the English spelling system as you

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become aware of the phonetic sound/symbol method used to identify the spoken words of United States English. You will discover that there is very little similarity between the written forms of words versus the recorded form of spoken words.

Written language (orthography) consists of groups of alphabet letters arranged in a certain order whereas spoken English consists of a succession of constantly varying noises or speech sounds organized into words. They both convey meaning: One consists of written shapes and the other speech sounds.

These speech sounds are transcribed as phonetic symbols. The symbols for a speech sound might have a different shape from the letter/sound it represents or it might be omitted from the written English alphabet. For example, sh-o-p includes four alphabet letters, *s* and *h*, *o*, *p*, but the word has only three sounds: [ʃɑp].

The alphabet letter *c* is used in words like *city* and *car* and represents two different sounds. You will learn that the *c* letter is omitted from the phonetic inventory and is replaced with the [s] and the [k] symbols.

Sound/Symbol Identification

Although some of the *phonetic* symbols for the consonant sounds are the same as the *alphabet* letters such as [p] and [v], several are not. Also, most of the vowel sounds require a different symbol that is not an alphabet letter. For example, the alphabet letter *a*, as you discovered earlier, represents several different sounds as in *sofa* [sofə], *any* [ɛni], *ask* [æsk], and *take* [tek]. Consequently, a different phonetic symbol needs to be written (transcribed) to represent the differences in the sounds.

INTERNATIONAL PHONETIC ASSOCIATION

There was a need to develop a system assigning a different symbol to represent each of the sounds of human speech. What method was used to develop a “phonetic alphabet” and who was responsible for it?

The origin of the International Phonetic Association dates back to 1886. This association promotes the study of the science of phonetics and the application of that science. The membership is worldwide and consists of phoneticians who collaborate on research and issues related to the identification of the human sounds used throughout the world.

The most widely known aspect of its work has been the development and revision of the **International Phonetic Alphabet (IPA)**. The IPA consists of unique

symbols assigned to each of the sounds identified by the association. It even includes a different symbol for the *clicking* and *lip smacking* sounds made in some African and Asian languages that convey meaning. Ball and Lowry (2001) note that speech sounds not only include vowels and consonants but also other aspects such as intonation, rhythm, loudness, and tempo.

As it pertains to United States English, the IPA contains a different symbol for each of the vowels and consonants. Although some of the phonetic symbols for the consonant sounds are the same as the alphabet letters, such as the [p] and [f], several are not. Also, most of the vowels and diphthongs (combinations of two sounds) require a different symbol that is not an alphabet letter.

ANALYSIS OF SPEECH SOUNDS

Some of the methods used to analyze speech sounds include the following:

1. *Acoustic properties*: Duration, frequency, and amplitudes of speech sound waves are analyzed and imprinted on spectrograms. This is particularly useful when working with individuals and their accents. It also produces voice prints that can be individualized.
2. *Structures of articulation*: Structures involved in the production of sounds are evaluated for normal structure, absence of structure, deformity of structure, nerve damage such as in dysarthria, and other articulation disorders such as dyspraxia.
3. *Perceptual interpretation*: The listener’s ability is accessed in **perceptual phonetics**. Analysis of the listener’s acuity (how well he or she hears) and discrimination (the ability to discriminate one sound from another, such as *fin* and *thin*) are analyzed.

BROAD AND NARROW TRANSCRIPTION

Diacritic markings are used for more finite descriptions of speech sound production. For example, the [n] and [d] sounds that are normally *voiced* (the vocal folds vibrate) may be produced with more of a voiceless quality and would thus be transcribed with a small circle under the sound symbol, [n̥] and [d̥]. Transcription using such diacritic markings is referred to as **narrow transcription**. Transcription without these markings is referred to as **broad transcription**.

BASIC COMPETENCY REQUIREMENTS

To become competent in the science of phonetics, you need to acquire knowledge and skills in the following basic areas:

1. *Speech production*: The neuroanatomy and physiology (nerves, bones, muscles) of the articulation process of speech sounds and the interdependency of the speech organs (e.g., lungs, vocal folds, lips, jaws).
2. *Speech acoustics*: The “noises” and human or artificial sounds that produce the acoustic energy that results in the translation of the articulatory (human or mechanical) processes into acoustic vibrations and transmissions.
3. *Speech perception*: The perception and processing of the speech/sound signals by the ear and the brain: listening skills.
4. *Transcription*: The identification of the sound/symbol representation (phonetic symbols) and the accurate transcription of what is spoken into the phonetic symbols that represent the spoken utterance.

The application of this information through study and drill work can result in your becoming proficient in these requirements.

PSYCHOLOGICAL AND SOCIOLOGICAL IMPLICATIONS OF PHONETICS

Although phonetics is defined as the study of the sound system of human speech including its anatomic structures, acoustic energy, and listener’s perception, it encompasses much more. In communication, phonetics interfaces with the psychological and sociological aspects of humankind, such as the following:

1. The dialect and speaking style differences of different speakers perceived by different listeners. These styles are determined by the *wh-* factors of who is speaking and listening, what is being said, where it is being said, when, and why it is said in the communication setting. In conjunction with this, you should realize that not all parents desire their children to “speak like everyone else.” Speech affects personal identity.

Technological Implications of Phonetics

2. The social context and relationships of speaker/listener exhibited in the use of formal, informal, casual, intimate, and threatening relationships. All elements of speech production may change:

“Do you want bread and butter?”

“Day a wan brea ’n budder?”

“Do **you** want bread and butter?”

“Do you want **bread** and butter?”

You can appreciate the role that listening skills play in the perception of the spoken sounds and words that may vary depending on the aspects listed previously.

TECHNOLOGICAL IMPLICATIONS OF PHONETICS

These are exciting times for you as a beginning phonetician for several reasons. Three of these reasons follow:

1. Enhancement of instructional materials
2. Increased level of sophistication in research
3. Prescriptive clinical applications

You should make it a goal to become familiar with the basics associated with these three reasons, and then develop knowledge and skills in the areas of technology and phonetics to be used in your future professional settings.

Also, phoneticians have opportunities to be employed as consultants or employees in the research and development of new products that have aspects related to phonetic science.

Instructional Materials

First, as a benefit to you as a beginning student in phonetics, there is a variety of new electronic teaching aids available at the self-tutoring level. Presently, an abundance of computer programs are user friendly and effective. Some of these programs are instructor produced while others are commercially available. Many include an interactive component with both printed and synthesized voice exercises. You simply need to enter the key word *phonetics* in a search engine on the Web and several options will appear. You are encouraged to search these websites and benefit from such resources.

Hoffman and Buckingham (2000) recognize the need for and value of a computerized laboratory for students. They developed a set of digital videos that

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allows more flexibility for students to select transcription exercises to practice. They indicate that the advanced technological equipment provides students with improved clinical performances during their beginning clinical practicum experiences.

Research and Technology

Computers have become available for research in voice production related to speech perception, reception, and expression. Because computers are used for research, you should learn their applications in phonetic science so as to assist in future academic and clinical needs.

The computerized methods used to analyze the characteristics of human speech have greatly enhanced the quality and quantity of data acquired in phonetic science. Research results from computerized analyses have increased validity and reliability.

Clinical Application

To reach the level of competency required in clinical interventions, you must become proficient in the use of available electronic equipment. The widespread availability and use of computers continue to affect the manner in which clinicians analyze phonetic production.

Phonetic science has a *subjective* aspect that is determined in a speaker–listener relationship. But as significant and valuable is the *objective* aspect that can be measured by instrumentation. Both the subjective and objective aspects are needed in clinical evaluation and treatment. You will learn more about the relationship between the clinical application of phonetics and the diagnosis and treatment of articulation disorders in your studies.

A Word of Caution

In this age of technology where the tendency may be to shift attention to more objective analyses, you need to keep things in balance. True, aspects of phonetic science lend themselves to instrumentation and you should vigorously pursue competency in these areas. However, there are also essential skills that are subjective in nature. You should be sure to engage in human interaction.

Nothing can replace the experiences of group participation where speakers and listeners gain insight from their dialogue regarding the *spoken sounds* and the *transcription* recorded from listening to one another's speech. You are encouraged to form small study groups and to participate both as the speaker

and the listener/transcriber as you practice the drill work.

Always keep in mind that the *sound system (dialects)* that we use may be different but still meet the definition of a *correct standard* for any given linguistic geographic region.

SUMMARY

You should not view phonetic science from a narrow perspective of phonetic symbols and sounds but realize that it has great diversity in use both in scientific and nonscientific areas. Basic elements of the characteristics of the sounds and symbols are unique, but once that foundation has been acquired, the application of such knowledge provides many opportunities in a wide variety of settings, including education, industry, medicine, speech-language pathology, linguistics, anthropology, psychology, and more.

Phonetic science includes the study of speech sounds, their acoustic (sound waves) and physical (articulation structures) properties, and the perception of these speech sounds by listeners. Phonetics does not concentrate on the *meaning* of sounds in words but rather on the *features* of the sounds and their influence on one another.

Enhanced listening skills are a requirement to be a successful transcriber of the spoken word. You need to avoid “re-auditorizing” a word spoken by another because there may be a difference between the way the two of you might speak it.

The International Phonetic Association (IPA) developed a set of symbols and other markings to represent the sounds of languages spoken worldwide. Among these sounds/symbols are those used to represent the sounds of United States English. This method of recording is referred to as broad transcription. Narrow transcription is the use of designated marks to indicate variation in pronunciation of sounds within words, primary and secondary syllable stress, and intonation.

Phonetic science has many different disciplines that focus on different aspects of the production and reception of human speech. Two of the more recently involved disciplines include forensic phonetics and synthetic and computerized (digital) phonetics. Other fields of study include phonology and phonics. Each approaches the study of sounds differently and for different purposes; however, much of the theoretical foundation is closely related to phonetics.

The need to incorporate phonetic skills in the teaching of literacy is expanding, and the use of voice-activated technology will continue to increase to meet needs in many consumer and clinical settings.

Good luck to you in your pursuit of competency in transcription of the sounds and symbols of phonetics!

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