Chapter 1

Clinical Framework

Basic Terms and Concepts

LEARNING OBJECTIVES

When you have finished this chapter, you should be able to:

- Define communication, language, and speech.
- Define phonology, morphology, syntax, semantics, and pragmatics.
- Define communication disorder, speech disorder, and language disorder.
- Distinguish between articulation—articulation disorder, speech sound—speech sound disorder, phoneme—phonological disorders.
- Delineate phoneme and allophone.
- Compare and contrast terms that are used clinically and in research such as phonological disorder, speech sound disorder, speech delay, speech impairment, and residual speech sound disorder, for example.

Communication, Speech, and Language

Communication is central to our lives. We communicate in a number of ways—from text messaging to facial expressions. Simply defined, communication is the process of sharing information between individuals (Pence & Justice, 2008). When we think about the diversified population that we encounter within the discipline of communication disorders, a broader definition might be helpful. Communication is a process that consists of two or more people sharing information including facts, thoughts, ideas, and feelings. Early communication includes how to interact with other people and things, how to understand spoken language, and how to exchange information with others using gestures or symbols. Communication does not have to involve language and does not have to be vocalized (Justice & Redle, 2014; National Joint Committee for the Communicative Needs of Persons with Severe Disabilities, 2010). Deaf people communicate through gestures; babies communicate basic wants through crying. Communication refers to any way that we convey information from one person to another. For example, we use e-mail, text messaging, or phone calls as ways to communicate. In addition, smiling, waving, or raising your eyebrows at a comment are all examples of nonverbal communication. Sign languages, such as American Sign Language or Seeing Essential English, are nonverbal conventional linguistic systems used to communicate.
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The most widely used means of communication is speech. **Speech** is the communication or expression of thoughts in spoken words, that is, in oral, verbal communication. Speech can be further divided into **articulation**, the motor production of speech sounds, **fluency**, the flow of speaking including rate and rhythm, and **voice** including vocal quality, pitch, loudness, and resonance (American Speech-Language-Hearing Association, 1993). The term **speech** is employed in various ways. Speech can be a more formal, spoken communication to an audience. For example: *Having to give a speech to her class was always frightening for Andrea.* Speech can indicate a manner of speaking: *Her speech was marked by a distinct Australian accent.* Speech is also used together with the term **language** to indicate the mental faculty of verbal communication: *The child’s speech and language skills were tested as a portion of the diagnostic.* Based on this last example, it seems important to differentiate between speech and language. What are the distinctions between these two terms: **speech** versus **language**?

According to the American Speech-Language Hearing Association, **language** can be defined as a complex and dynamic system of conventional symbols that is used in various modes for thought and communication (American Speech-Language-Hearing Association Committee on Language, 1983). Among other variables, this definition further states that language is rule governed and is described by at least five linguistic parameters: phonological, morphological, syntactic, semantic, and pragmatic. Language is intricate and includes variability and change. In addition, all members of a language agree on the symbolic system that is used, and language is used to communicate in a variety of ways.

Within our definition of language are the terms **phonology**, **morphology**, **syntax**, **semantics**, and **pragmatics**. A brief definition of these words should be helpful in our understanding of language. One of these parameters, phonology, is of major importance in this text.

### Subdivisions of Language

**Phonology** is the study of the sound system of language and includes the rules that govern its spoken form (Parker & Riley, 2010). Therefore, phonology analyzes which sound units are within a language. The sound system of English contains different vowels and consonants than that of Spanish, for example. Phonology also examines how these sounds are arranged, their systematic organization, and rule system. According to the English phonological rule system, no more than three consonants can be at the beginning of a syllable or word, such as in “street.” In addition, certain consonant sounds cannot be arranged together. For example, an “sp” combination is acceptable in English (“spot” or “wasp”), whereas a “pf” cluster is not.

Another area of language is morphology. **Morphology** studies the structure of words; it analyzes how words can be divided into parts labeled **morphemes** (Crystal, 2010), each of which has an independent meaning. A **morpheme** is the smallest meaningful unit of a language. The word “cycle” is one morpheme meaning circular or wheel; however, the word “bicycle” contains two morphemes, “bi-” and “cycle,” “bi” indicating two. In American English, plurality is often noted with the addition of an “s,” such as “book” – “books,” and “ed” can demonstrate past tense as in “cooked” or “talked.” All of these units, “cycle,” “bi-,” “book” “-s,” “cook,” “talk,” and “-ed” are morphemes of American English.

The third area of language is syntax. **Syntax** consists of organizational rules denoting word, phrase, and clause order; sentence organization and the relationship between words; word classes; and other sentence elements (Owens, 2008). We know that certain sentences, for example, are syntactically appropriate, such as “I really like to eat chocolate.” or even “Chocolate, I really like to eat.” However, a sentence such as “I eat like to really chocolate.” would not be an acceptable sentence of American English. Within communication
disorders, we examine the development of syntactical structures in children as well as the problems that certain populations, such as students learning English as a second language, might have when expressing themselves in complex syntactical sentences.

**Semantics** is the study of linguistic meaning and includes the meaning of words, phrases, and sentences (Parker & Riley, 2010). Semantics includes the fact that certain words have more than one meaning, such as “bat,” and that words can have similar meanings, for example, “dog” and “canine.” Also certain words share more or less common characteristics. “Cat,” “dog,” and “hamster” have certain commonalities, whereas “dog” and “boy” have properties that could be compared but seem not as related as the first three words. Semantics also includes phrase meanings as in the multiple interpretations of “a hot dog” and sentence meaning as in “She dressed and washed the baby.”

The last term, **pragmatics**, refers to the study of language used to communicate within various situational contexts. Pragmatics includes, among other things, the reasons for talking, conversational skills, and the flexibility to modify speech for different listeners and social situations (Paul, 2007). Included in pragmatics would be the understanding that we talk differently to small children versus older adults; that certain situations typically dictate how and what we say (such as the communication in an interview will be quite different from a night out with your friends); and that we use certain facial expressions, body gestures, and word emphases to communicate very different meanings. For example, think of the sentence “Last night was really something” said with a smile and positive head nods versus the same sentence said with a scowl, negative head movements, and a different emphasis on “really.” Within communication disorders, pragmatics may become a central issue when working with autistic children, for example. See Figure 1.1 for an overview of the divisions of communication.

To summarize, communication is the process of sharing information between/among individuals. Communication can be broadly divided into speech and language. Speech is the expression of thoughts in spoken words; it is oral, verbal communication. On the other hand, language is a complex, dynamic, and

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**CLINICAL EXERCISES**

List two types of morphological endings that a child who deletes “s” at the end of a word might have difficulties with.

The teacher refers a child to you from first grade. Based on an informal language sample, what could you analyze to examine each of the areas of language: phonology, morphology, syntax, semantics, and pragmatics?
rule-based system of conventional symbols that is used in diverse modalities for thought and communication. However, as practitioners, we deal with communication, speech, and language disorders. What characteristics would a disordered system demonstrate?

According to the 1993 guidelines of the American Speech-Language-Hearing Association (ASHA), a communication disorder is the impairment in the ability to receive, send, process, and comprehend concepts including verbal, nonverbal, and graphic symbol systems. In addition to hearing disorders, communication disorders are categorized into speech and language disorders. A speech disorder is used to indicate oral, verbal communication that is so deviant from the norm that it is noticeable or interferes with communication. Speech disorders are divided into articulation, fluency, and voice disorders. On the other hand, a language disorder is impaired comprehension and/or use of spoken, written, and/or other symbol systems. A language disorder may involve one or more of the following areas: phonology, morphology, syntax, semantics, and pragmatics. See Figure 1.2 for the subdivisions of communication disorders.

According to this classification, an impairment of the articulation of speech sounds is one example of a speech disorder. To understand this definition, it would be important to examine the terms articulation and speech sounds. In clinical practice, important distinctions are made between articulation and speech sounds versus phonology and phonemes. The following section defines and gives examples of how these words are used in our clinical practice within communication disorders.

FIGURE 1.2 Subdivisions of Communication Disorders
Articulation and Speech Sounds: Phonology and Phonemes

The term articulation and its derivations are often used to describe an individual's speech. They might appear in a referral statement or within a diagnostic report; for example:

Sandy was referred to the clinic because her parents were concerned about her articulation skills.

Bob could articulate the sound correctly in isolation but not in word contexts.

Joe’s articulation disorder affected his speech intelligibility.

For the purpose at hand, articulation refers to the totality of motor movements involved in production of the actual sounds that comprise speech (Bauman-Waengler, 2009). The learning of articulatory skills is a developmental process involving the gradual acquisition of the ability to move the articulators (those structures that are important in forming the individual sounds) in a precise and rapid manner. Thus, learning to articulate is a specific kind of motor learning. Just as children become more adept at certain motor skills as they grow older, their articulation skills develop as well. For example, we do not expect the same level of articulatory abilities from a 2-year-old child as from a 6-year-old. Second, the definition suggests that errors in articulation result from relatively peripheral disturbances of these articulatory processes. Thus, the peripheral motor processes involved in the planning and execution of articulation are impaired; the central language capabilities of the individual remain intact. In summary, articulation is a specific, gradually developing motor skill that involves mainly peripheral motor processes.

Speech sounds are central units in any discussion of disordered speech. Although the human vocal tract is capable of producing a wide array of sounds, including coughing and burping, speech sounds are special sounds because they are associated with speech. Speech sounds represent physical sound realities; they are end products of articulatory motor processes. When talking about a child’s s-production in the context of an articulation test, for example, we refer to the speech sound production of [s].

Speech sounds then are real, physical sound entities used in speech. But in addition to their articulatory form, they also have a linguistic function. Linguistic function includes, for example, the rules that address how specific sound units can be arranged to produce appropriate words and the phoneme concept. A phoneme is the smallest linguistic unit that is able, when combined with other such units, to distinguish meaning between words (Small, 2012). For example, “tick” has three phonemes /t/, /ɪ/, and /k/. We know that these are phonemes of American English because the word they form is meaningful. In contrast, /s/ is also a phoneme of American English as can be seen in “sick,” /s/, /ɪ/, /k/, which differs from “tick” in one phoneme: /t/ versus /s/. As far as notation is concerned, speech sound productions are usually placed within brackets in phonetic transcription, whereas phoneme values are symbolized by slanted lines, or virgules. For example, [s] indicates that it was a sound someone actually pronounced in a specific manner. On the other hand, /s/ signifies the phoneme “s.”

The idea of the phoneme is considered to be an abstraction. A phoneme is not a single, concrete, unchanging entity. A phoneme is an abstraction that is based on the many variations that occur for a particular sound because it is heard in differing contexts of conversational speech. This does not necessarily make the phoneme concept complex or difficult to understand. We constantly deal with abstractions. Take, for example, the concept “cat.” A cat is not a single, unchanging entity. There are big cats and small cats, cats that are striped or solid colored of various shades. However, there are certain characteristics that we accept as being typical to the concept of “cat.” We could say that the cat concept embraces a whole family of units that are related yet somehow are distinct.
Even two cats of the same size, color, and build will have slight variations that could be detected most certainly by the owners. If we apply this to the phoneme concept, we find a similar abstraction. So when we speak of a particular phoneme, /t/ for example, we are referring to the typical “t” but we also take into consideration the varieties of “t” that are used in various contexts and by different speakers. The term allophone is used to refer to the changes that occur in a phoneme when produced by speakers in differing contexts. Allophones are variations in phoneme realizations that do not change the meaning of a word when they are produced in differing contexts. Allophones are phonetic variations of a phoneme (Crystal, 2010). Within the phonological system of American English, there are many examples of allophones.

Several allophonic variations can occur with the /p/ phoneme, for example. At the beginning of a word as a single sound unit, /p/ is typically aspirated. Aspiration is that slight puff of air that you hear if you pronounce the word “pie” or “pot.” This is transcribed as [ph], the small raised h representing the puff of air or aspiration in phonetic transcription. However, /p/ is typically unaspirated following “s” as in “spy” or “spot,” for example. If you pronounce these words, you will find that the puff of air, the aspiration that you noticed in “pie,” is not present. However, these allophonic variations exemplified by aspiration or lack of aspiration do not have phonemic value within the phonological system of American English. In other words, we can hear these differences, but both aspirated and unaspirated p-sounds are considered one phoneme, /p/.

Phonology is the study of how phonemes are organized and function in a language. Phonology includes the inventory of phonemes of the language in question, thus a list of all the vowels and consonants that function in American English to differentiate meaning. However, phonology also focuses on how these phonemes are organized to convey meaning within a language system. Such a description would include how the phonemes can and cannot be arranged to form meaningful words. Phonotactics refers to the description of the allowed combinations of phonemes in a particular language. A more complete discussion of the phonotactics of American English will be presented in Chapter 2.

If one wants to refer to the physical reality, to the actual production, the term speech sound is used. From early to contemporary publications, such phoneme realizations have also been labeled phonetic variations. Speech sounds or phonetic variations can be

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### CLINICAL EXERCISES

Examples are given of allophonic variations with /p/. Can you think of similar allophonic variations with /t/ and /k/?

Say the word “leap” and then the word “cool” slowly. Concentrate on the production of [l]. Do you notice any differences between the first and the second [l] production? These two different productions are termed light “l” (leap) and dark “l” (cool) to denote the different types of productions. Discuss why this would be an allophonic variation in American English. In Russian, these two types of [l] productions have phonemic value.

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Phonotactics of General American English include the fact that some phoneme combinations do not occur in American English words. An example would be /ʃ/ + /v/. General American English does have other /ʃ/ combinations, such as /ʃ/ + /r/ (e.g., shrink) or /ʃ/ + /t/ (e.g., wished). The /ʃ/ + /v/ combination does, however, occur in the phonological system of German. Words such as Schwester (/ʃvɛstə/ “sister”) document this as a phonotactic possibility in German.

Phonotactics also restricts some consonant clusters occurring in General American English to their use in certain word positions, for example, the clusters /sk/ and /ks/. Words or syllables can begin or end with /sk/ (e.g., skate, risk), however, this is not the case with /ks/. This cluster can occur only at the end of a syllable or word (e.g., kicks). This is a phonotactic characteristic of the phonological system of General American English.
examined without reference to a given language system. This is not the case with phonemes. When using the term phoneme, we refer exclusively to the function of the sound in question: to its ability to signify differences in word meaning within a specific language (see Table 1.1). Two words that differ in only one phoneme value are called minimal pairs. Examples of minimal pairs are dog versus log and dog versus dot.

How do these terms relate to our clinical decision making? Speech sounds as end products of articulatory motor processes are the units we are describing when we use phonetic transcription to capture an individual’s actual productions on an articulation test or spontaneous speech sample. Speech sounds and speech sound errors relate to articulatory deviations. However, what if we notice that a child’s productions of swing, sing, ring, and wing all sound the same, for example, that they all sound like wing? The child is not using the necessary phonemic contrasts to signal differences between these words. Both listener and speaker will probably not be able to differentiate between these words because they sound identical. Now we are analyzing the child’s phoneme system, the child’s ability to use phonemes to establish and distinguish between word meanings. If this occurs consistently throughout the child’s speech, we could conclude that the child’s phoneme system is limited—that is, restricted when compared to the norm. Difficulties in using phonemes contrastively to distinguish meanings relate to linguistic abilities, to the individual’s phonological system as one subcategory of language.

Speech sounds, then, are related to our motor, articulatory skills. On the other hand, phonemes represent our understanding of the phonological system of our particular language. Table 1.1 summarizes the differences between the phoneme and speech sound.

Table 1.1  Phoneme versus Speech Sound

<table>
<thead>
<tr>
<th>Phoneme</th>
<th>Speech Sound</th>
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<tbody>
<tr>
<td>The smallest unit within a language that is able, when combined with other units, to establish word meanings and distinguish between them</td>
<td>Actual realizations of phonemes; referred to as allophonic variations or phonetic variations</td>
</tr>
<tr>
<td>Linguistic unit, an abstraction</td>
<td>Concrete, produced, transmitted, and perceived</td>
</tr>
<tr>
<td>Used in reference to a particular language system</td>
<td>Can be examined without referring to a specific language system</td>
</tr>
<tr>
<td>Basic unit within phonology</td>
<td>Basic unit within phonetics</td>
</tr>
<tr>
<td>Notation is within virgules / / (e.g., “the /s/ phoneme”)</td>
<td>Notation is within brackets (e.g., “the [f] speech sound”)</td>
</tr>
</tbody>
</table>

Speech Sound Disorders: Articulation and Phonological Disorders

Depending on the age of the child, most make some sound errors as they learn to say new words. A speech sound disorder occurs when difficulties making certain sounds continue past a certain age. Every sound has a different range of ages when a child should produce the sound accurately. If an individual’s articulation deviates significantly from the norm, it may be diagnosed as an articulation disorder. An articulation disorder, as a subcategory of a speech disorder, is the atypical production of speech sounds characterized by substitutions, omissions, additions, or distortions that may interfere with intelligibility (American Speech-Language-Hearing Association, 2014). Articulation errors are typically
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According to ASHA (2008), the term **phonological disorder** is a subset of a language disorder. In a different document, which is information for the public, ASHA states that a speech sound disorder includes problems with articulation (making sounds) and phonological processes (sound patterns) (2014). It appears that the present nomenclature has shifted slightly to include phonological difficulties under the category of speech sound disorders. This can be aptly summarized by Strand & McCauley (2008), who state that the term **phonological disorder** is used to refer to the entire range of developmental communication disorders in which sound production is primarily affected. In addition they add that more recently this broad range of disorders is referred to as **speech sound disorders**. However, this usage reserves the term **phonological disorders** to refer to a linguistic level of impairment. For the purpose at hand, these terms will be separated with the understanding that both terms could be under a broad terminological umbrella of speech sound disorder.

classified relative to a child’s age, which translates into stages within this developmental process. Younger children are at an earlier stage in this development, whereas older children are at a later stage or may have completed the process. Depending on the age of the child, certain articulation errors may be considered to be typical (age-appropriate errors) or atypical (non–age-appropriate errors). When assessing an individual, we often gather information on the inventory of speech sounds used. The phonetic inventory is a list of all the speech sounds including their variations.

On the other hand, the term **phonology** is basic to the understanding of phonological disorders. When an individual’s phonology deviates enough from the norm, this could lead to a phonological disorder. A **phonological disorder** refers to impaired comprehension of the sound system of a language and the rules that govern the sound combinations (ASHA, 2008; ASHA Ad Hoc Committee on Service Delivery in the Schools, 1993).

Phonology is closely related to other constituents of the language system, such as morphology, syntax, semantics, and pragmatics. A child’s phonological system, therefore, can never be regarded as functionally separate from other aspects of the child’s language growth. Several studies (e.g., Cummings, 2009; Edwards, Beckman, & Munson, 2004; Edwards, Fox, & Rogers, 2002; Morrisette & Gierut, 2002; Mortimer, 2007; Munson, Edwards, & Beckman, 2005a; Roberts, 2005; Storkel, 2001, 2003, 2004; Storkel & Rogers, 2000) have documented that delayed phonological development occurs concurrently with delayed lexical and grammatical development. Although the direct relationship between phonological and grammatical acquisition remains unclear, interdependencies certainly exist between these areas.

Assessment of a child with a phonological disorder would include gathering information about all phonemes that the child uses to distinguish meaning—the phonemic inventory. The **phonemic inventory** is the repertoire of phonemes used contrastively by an individual. When compared to the phonemic inventory of General American English, we might find that certain phonemes are not present in the child’s speech—that is, the child’s phonemic inventory is restricted.

In addition, we might analyze the child’s phonotactics by examining the position in the word in which these phonemes occur—at the beginning, middle, or end of the word. Children who have

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**CLINICAL EXERCISES**

Assume that a child produces the following variations: An s-sound produced with the tongue tip too far forward, transcribed as [s], an s-production with the tongue too far back, a so-called palatalized [s], [ʃ], and a lateral production of [s], [ɬ]. These three variations would be a portion of the phonetic inventory. What would be in the phonemic inventory?

Be careful to examine whether something is a variation of the same speech sound or a different phoneme when you construct the phonemic inventory.
difficulties with the organization of their phoneme system might not realize the phonotactics that are typical for American English. Their speech may demonstrate phonotactic constraints; in other words, the phoneme use is restricted, so the phonemes are not used in all possible word positions. The distinction between a speech sound/articulation disorder versus a phonological disorder remains decisively important. It keeps definitions clear and is applicable to diagnostic and intervention procedures. Therefore, for the purpose at hand, a distinction is made between articulation disorders, those in which the peripheral motor processes are disturbed, and phonological disorders, those in which the organization and function of the phonological system is impaired. This delineation is not without problems; delineating articulation from phonological difficulties is clinically not an either/or proposition. Often, a child will seem to display characteristics of both disorders. Although this division between articulation and phonological disorder may remain at times unclear, a systematic attempt to distinguish between them is one important aspect of clinical decision making. This dichotomy is used throughout this text and more fully developed in later chapters. Table 1.2 outlines several different terms that are used clinically and in the research in reference to speech sounds and speech sound disorders.

### TABLE 1.2  Speech Sounds and Speech Sound Disorders: Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulation</td>
<td>The totality of motor processes involved in the planning and execution of speech.</td>
<td>Describes the speech sound production of individuals (e.g., “The articulation of [s] was incorrect.”). Describes tests that examine the production of speech sounds (e.g., “The clinician administered an articulation test.”).</td>
</tr>
<tr>
<td>Articulation disorder</td>
<td>Difficulty with the motor production aspects of speech or an inability to produce certain speech sounds.</td>
<td>A diagnostic category that indicates that an individual's speech sound productions vary widely from the norm (e.g., “Tony was diagnosed as having an articulation disorder.”).</td>
</tr>
<tr>
<td>Phonology</td>
<td>The study of the sound system of a language, examines the sound units of that particular language, how these sounds are arranged, their systematic organization, and rule system.</td>
<td>Describing the inventory and arrangement of sound units (e.g., the Spanish phonological system has fewer vowels than American English. The phoneme /s/ is present in Spanish, but not /z/).</td>
</tr>
<tr>
<td>Phonological disorder</td>
<td>Impaired comprehension and/or use of the sound system of a language and the rules that govern the sound combinations.</td>
<td>The inventory of phonemes may be restricted (e.g., “Jonathan used the phoneme /t/ for /d, k, g, s, z, j, ʒ, tj, dʒ/. He was diagnosed as having a phonological disorder.”).</td>
</tr>
<tr>
<td>Persistent speech sound disorders</td>
<td>Errors that persist past the typical age of acquisition (i.e., 8 or 9 years old).</td>
<td>Children with this disorder show little spontaneous improvement, and their response to intervention is poor. There is commonly no known cause (Wren, Roulstone, &amp; Miller, 2012).</td>
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### TABLE 1.2 (Continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech sound delay</td>
<td>Speech sound errors that are often noted as “normal” errors found in young children as they acquire specific sounds. A “delay” usually has the premise that the child will catch up and achieve normal development.</td>
<td>A category that is typically used in young children to denote a mismatch between the child’s speech sound acquisition and what is considered to be a norm reference.</td>
</tr>
<tr>
<td>Deviant speech sound development</td>
<td>Speech sound errors that are not typically observed in the development of most young children.</td>
<td>A term that typically indicates a process that is not delayed but different. For example, Lindsey demonstrated substitutions, such as [s] for [p, b, t, d]. Her speech sound development appeared deviant.</td>
</tr>
<tr>
<td>Speech or phonological or disability</td>
<td><em>Disability</em> is a complex phenomenon, reflecting the interaction between features of a person’s body and features of the society in which he or she lives (World Health Organization, 2014). <em>Disability</em> is an umbrella term including impairments.</td>
<td>In reference to speech phonology, this would indicate a serious speech sound/phonological difficulty that impacts the child’s or person’s functioning in society.</td>
</tr>
<tr>
<td>Speech or phonological impairment</td>
<td>An impairment is any loss or abnormality of physiological or anatomical structure or function (WHO, 2014).</td>
<td>In reference to speech or phonology, impairment is typically used synonymously with disorder. The anatomical/physiological basis for the term is typically not a primary consideration.</td>
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### CLINICAL APPLICATION

#### Inventory and Phonotactics

Jeff was referred to the school speech-language pathologist by his kindergarten teacher, who was worried about the lack of intelligibility of his speech. The clinician noted that Jeff’s phonemic inventory was very restricted. The following phonemes were present in Jeff’s speech: /p, b, t, d, k, g, m, n, ŋ, f, v, h, w/. Jeff’s phonemic inventory did not include the following phonemes: /s, z, ʃ, ʒ, θ, ð, j, l, r, tʃ, dʒ/. In addition, certain phonotactic constraints were noted. At the beginning of a word, Jeff realized the above noted speech sounds. However, at the end of a word or syllable, he used only voiced sounds. Jeff’s phonotactics did not employ voiceless sounds to terminate a word or syllable. Not only was Jeff’s phonemic inventory limited but phonotactic constraints were also discovered.

### SUMMARY

This chapter introduced the reader to several terms that are fundamental to the assessment and treatment of articulatory and phonological disorders. As an introduction, the terms *communication, speech,* and *language* were provided as well as the five subcategories of language: *phonology, morphology, syntax, semantics,* and *pragmatics.* Definitions and clinical applications were noted for *articulation, phonology,* *speech sound,* and the *phoneme* as a foundation for this understanding. Speech sound forms versus linguistic function were used to distinguish between the speech sound and the phoneme. Based on these definitions, differentiations between speech sound, articulation, and phonological disorders were presented as well as nomenclature that is widely used in clinic and research relative to these terms.
Speech Sound Disorder: Articulation

Sandy is a 6-year-old child who was seen in a diagnostic session at the speech and hearing clinic. Her parents were concerned about her inability to produce [s]. Based on an analysis of a spontaneous speech sample and an articulation test, it was found that Sandy misarticulated [s] and [z] in all transcribed situations because her tongue placement was too far forward during the productions. The child was able to differentiate her mispronunciations from norm productions of [s] and [z]. No other speech sounds were in error, and language skills were found to be within normal limits. Sandy used her distorted realizations in every position in which [s] and [z] should occur. Thus, she seemed to understand the organization of /s/ and /z/ within the language system. The clinician hypothesized that this child was having difficulties with the actual production level only, with the speech sounds [s] and [z], whereas the understanding of their phoneme function was intact.

Phonology: Phonological Disorder

Travis, a 6-year-old first-grader, was referred by his classroom teacher to the speech-language pathologist. The teacher said that although Travis’s speech was fairly intelligible, she was concerned about speech and language problems she had noticed in class. Her second concern was that these difficulties might be impacting Travis’s emerging literacy skills. According to the teacher, Travis was having difficulty distinguishing between certain sounds and words as the class progressed with elementary reading tasks.

An articulation test and a spontaneous speech sample were analyzed with the following results: Travis had difficulties with s-productions. At the end of a word or syllable, [s] was always deleted. At the beginning of a word or syllable, [s] was produced as [ʃ]. Interestingly enough, when the clinician analyzed other words, she found that Travis could produce [s], but not in its proper context. Thus, several words that contained [ʃ] were articulated with normal sounding [s] realizations. Testing of minimal pairs containing /s/ and /ʃ/ revealed that Travis was having difficulty distinguishing between the phonemic values of the two sounds.

On language tests and in spontaneous conversation, Travis deleted the plural -s in the third person singular -s (e.g., “He, she, it walk”). Comprehension of these grammatical forms was often in error.

The clinician hypothesized that Travis had a phonological disorder—that he had difficulties with the phoneme function and the phonotactics of /s/. This problem was impairing his morphological development. Because of the noted problems in discrimination, this could also have an effect on his beginning reading skills.

THINK CRITICALLY

The following small speech sample is from Tara, age 7;7.

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</thead>
<tbody>
<tr>
<td>rabbit</td>
<td>[wæbət]</td>
<td>ready</td>
</tr>
<tr>
<td>feather</td>
<td>[fɛdə]</td>
<td>arrow</td>
</tr>
<tr>
<td>green</td>
<td>[ɡwɪn]</td>
<td>toothbrush</td>
</tr>
<tr>
<td>this</td>
<td>[ðɪs]</td>
<td>thinking</td>
</tr>
</tbody>
</table>

(Continued)
12  CHAPTER  I  Clinical Framework

(Continued)

Rope [wʊp]    Bridge [brɪdʒ]    Boat [boʊt]
Rooster [ˈwʊəstə]    Street [stɹɪt]    Bath [bæt]
Bath [bæt]    Breathe [bɹeθ]

Which speech sound errors are noted in this sample?
Which sounds are substituted for the sounds in error?
Can any phonotactic restraints be noted in the correct productions of “th” and “r”?
Based on this limited information, do you think the child has an articulation disorder or a phonological disorder? Why?

TEST YOURSELF

1. The definition of articulation includes which one of the following?
   a. describes the systems and patterns of phonemes in a particular language
   b. includes phonotactics
   c. refers to the totality of motor processes involved in speech
   d. all of the above

2. The definition of articulation disorder reflects
   a. peripheral motor processes
   b. gradually developing motor skills
   c. the totality of motor processes involved in the planning and execution of speech
   d. all of the above

3. Which one of the following could be considered a portion of morphology?
   a. the multiple meanings of the word “trunk”
   b. that “un” could be added to “happy” to change its meaning
   c. that children know from a fairly early age that we talk to babies somehow differently
   d. that sentences can be combined with the word “and”

4. Which one of the following could be considered a portion of semantics?
   a. the multiple meanings of the word “trunk”
   b. that “un” could be added to “happy” to change its meaning
   c. that children know from a fairly early age that we talk to babies somehow differently
   d. that sentences can be combined with the word “and”

5. Which one of the following would not be considered a portion of phonology?
   a. linguistic function of phonemes
   b. addition of -s can indicate plurality
   c. phonotactics
   d. knowledge of the sound system of a language

6. Oral, verbal expression of language into words is
   a. phonology
   b. articulation
   c. speech
   d. pragmatics

7. The definition of phonology includes
   a. the description of the system and patterns of phonemes within a language
   b. the classification and description of how speech sounds are produced
   c. the oral, verbal expression of language
   d. the relatively peripheral motor processes involved in speech

8. The allowed combinations of phonemes in a particular language refer to the
   a. phonetic inventory
   b. phonemic inventory
   c. phonotactic constraints
   d. minimal pairs

9. Which one of the following is not included in the definition of phonological disorder?
a. problems in the language-specific function of phonemes
b. disturbances in the relatively peripheral motor processes that result in speech
c. disturbances represent an impairment of the understanding and organization of phonemes
d. phonemic errors

10. What is the smallest linguistic unit that can be combined with other such units to establish word meanings?
   a. allophonic variation
   b. speech sound
   c. phoneme
   d. phonotactic constraint

**FURTHER READINGS**


Phonetics—Articulatory Phonetics

Speech Sound Form

LEARNING OBJECTIVES

When you have finished this chapter, you should be able to:

■ Define phonetics and the branches of phonetics.
■ List the differences in production and function of vowels versus consonants.
■ Identify the three descriptive parameters that are used for vowel articulations, and classify the vowels of General American English using those three parameters.
■ Differentiate between the various types of vowels.
■ Identify and define the four parameters that are used to describe the articulation of consonants.
■ Classify the consonants of American English according to their active and passive articulators, manner, and voicing characteristics.
■ Define coarticulation and assimilation, and describe the different types of assimilatory processes.
■ Identify the various types of syllable structures including the phonotactic restraints of General American English.

Phonetics: Definitions and Classification

The description and classification of speech sounds is the main aim of phonetics. Sounds may be identified with reference to their production (or “articulation”), their acoustic transmission, or their auditory reception. The most widely used description is articulatory, which is the main emphasis of this chapter.

Generally stated, phonetics is the science of speech. However, it might be useful to delineate speech in its entirety while also indicating the various divisions of phonetics. Thus defined, phonetics is the study of speech emphasizing the description and classification of speech sounds according to their production, transmission, and perceptual features. These three branches of phonetics are labeled articulatory phonetics, exemplifying speech production; acoustic phonetics, the study of speech transmission; and auditory phonetics, which examines speech perception.

Articulatory phonetics deals with the production features of speech sounds, their categorization, and classification according to specific details of their production. Central aspects include the way speech sounds are actually articulated, their objective similarities, and their differences. Articulation is typically used as a more general term to describe the overall speech production of individuals. Articulatory phonetics as a field of study attempts to document these processes according to specific parameters, such as the manner or
voicing of the speech sound. Articulatory phonetics is closely aligned with speech sounds and speech sound disorders and is the main emphasis of this text.

**Acoustic phonetics** deals with the transmission properties of speech. Here, the frequency, intensity, and duration of speech sounds, for example, are described and categorized. If you have ever analyzed speech sounds according to their frequencies, this would be classified as one aspect of acoustic phonetics.

Within **auditory phonetics**, investigators focus on how we perceive sounds. Our ears are not objective receivers of acoustic data. Rather, many factors, including our individual experiences, influence our perception. Such factors are examined in the area of auditory phonetics.

In the context of this book, we are primarily interested in articulatory phonetics. This specialty area deals with the actualities of how speech sounds are formed. Directly related to this area of phonetics is, of course, articulation. An integral portion of articulatory phonetics is the description and classification of speech sounds. This knowledge is important for both the assessment and the treatment of speech sound/articulation disorders. Knowledge of the production features of speech sounds guides clinicians when they are evaluating the various misarticulations noted in a clinical evaluation. Thus, one important step in our diagnostic process involves gathering phonetic information on the exact way an individual misarticulates sounds.

Thus, articulatory phonetics **categorizes** and **classifies** the production features of speech sounds. A thorough knowledge of how vowels and consonants are generated remains essential for successful assessment and remediation of speech sound disorders. Although contemporary phonological theories have provided new ways of viewing the diagnosis and intervention of these disorders, knowledge of the speech sounds’ production features secures a firm basis for using such procedures. Without this knowledge, phonological process analysis, for example, is impossible.

This chapter discusses articulatory-phonetic aspects of the speech sounds of General American English. The specific goals are to:

1. Provide a review of the production features of vowels and consonants
2. Introduce the concepts of coarticulation and assimilation as a means of describing how sounds change within a given articulatory context
3. Examine the structure of syllables including the phonotactics of General American English

The production of vowels and consonants as well as their subsequent language-specific arrangements into syllables and words depends on articulatory motor processes. If these processes are impaired, speech sound production will be disordered. Articulatory motor processes depend in turn on many anatomical-physiological prerequisites, which include respiratory, phonatory, or resonatory processes. For example, the speech problems of children with cerebral palsy often originate in abnormal respiratory, resonatory, and/or phonatory prerequisites for articulation. Therefore, the proper function of these basic systems must first be secured before any articulatory improvement can be expected. Articulatory motor ability is embedded in many different anatomical-physiological requisites, which are of fundamental importance to speech-language pathologists.

Basic knowledge in these areas is typically gained from courses and textbooks covering anatomy and physiology of the speech and hearing mechanisms rather than those directly related to impaired articulation and phonology. The anatomical-physiological aspects of such disorders are not
within the scope of this chapter. Box 2.1 offers references as an incentive for the reader to rediscover the wealth of information essential to the clinical assessment and remediation of articulatory and phonological impairments.

**Box 2.1**

**Selected Readings in Anatomy and Physiology of the Speech and Hearing Mechanisms**


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**Vowels versus Consonants**

Speech sounds are commonly divided into two groups: vowels and consonants. Vowels are produced with a relatively open vocal tract; no significant constriction of the oral (and pharyngeal) cavities is required. The airstream from the vocal folds to the lips is relatively unimpeded. Therefore, vowels are considered to be open sounds. In contrast, consonants have significant constriction in the oral and/or pharyngeal cavities during their production. For consonants, the airstream from the vocal folds to the lips and nostrils encounters some type of articulatory obstacle along the way. Therefore, consonants are considered to be constricted sounds. For most consonants, this constriction occurs along the sagittal midline of the vocal tract.

This constriction for consonants can be exemplified by the first sound in *top*, [t], or *soap*, [s]. For [t], the contact of the front of the tongue with the alveolar ridge occurs along the sagittal midline, whereas the characteristic s-quality is made by air flowing along this median plane as the tongue approximates the alveolar ridge. By contrast, during all vowel productions, the sagittal midline remains free. In addition, under normal speech conditions, General American English vowels are always produced with vocal fold vibration; they are voiced speech sounds. Only during whispered speech are vowels unvoiced. Consonants, on the other hand, may be generated with or without simultaneous vocal fold vibration; they can be voiced or voiceless. Pairs of sounds such as [t] and [d] exemplify this relevant feature. Pairs of similar sounds, in this case differing only in their voicing feature, are referred to as cognates. Voicing features constitute the main linguistically relevant differences that separate the consonant cognates such as [s] from [z] and [f] from [v]. The transcription of various vowels and consonants with examples of words in which these sounds could be used are in Table 2.1. Please note that various phonetic texts might transcribe sounds in somewhat different ways. Examples are provided to guide you with the transcription that is used in this textbook. See Appendix 2.1 for a list of how several textbooks vary in the transcription of vowels.
Vowels can also be distinguished from consonants according to the patterns of acoustic energy they display. Vowels are highly resonant, demonstrating at least two formant areas. Thus, vowels are more intense than consonants; in other words, they are typically louder than consonants. In this respect, we can say that vowels have greater sonority than consonants. Sonority of a sound is its loudness relative to that of other sounds with the same length, stress, and pitch (Ladefoged & Johnson, 2010). Because of the greater sonority of vowels over consonants, vowels are also referred to as sonorants. In English, the sonority scale from highest to lowest is the following: vowels → glides [w, j] → liquids [r] → [l] → nasals [m, n, ŋ] → voiced fricatives [z, v, θ] → voiceless fricatives [s, f, θ] → voiceless stop-plosives [p, t, k] (O’Grady & Archibald, 2012). Because of the production features of a special group of consonants and their resulting sonority, certain consonants are also labeled sonorants. Sonorant consonants are produced with a relatively open expiratory passageway. When contrasted to other consonants, sonorant consonants demonstrate less obstruction of the airstream during their production. The sonorant consonants include the nasals ([m, n, ŋ]), the liquids ([l, r]), and the glides ([w, j]). The sonorants are distinguished from the obstruents, which are characterized by a complete or narrow constriction between the articulators hindering the expiratory airstream. The obstruents include the stop-plosives ([p, b, t, d, k, ɡ]), the fricatives ([f, v, s, z, θ, j, ʒ, h), and the affricates ([ʧ, ʤ]).

There are also functional distinctions between vowels and consonants. In other words, vowels and consonants have different linguistic functions. This has often been referred to as the phonological difference between vowels and consonants (Crystal, 2010). The term consonant indicates this relationship: con meaning “together with” and sonant reflecting the tonal qualities that characterize vowels. Thus, consonants are those speech sounds that function linguistically together with vowels. As such, vowels serve as the center of syllables, as syllable nuclei. Vowels can constitute syllables by themselves as, for example, in the first syllable of a-go or e-lope. Vowels can also appear with one or more consonants, exemplified by blue, bloom, or blooms. Although there are many types of syllables, the vowel is always the center of the syllable, its nucleus. A small group of consonants can serve as the nuclei of syllables. A consonant that functions as a syllable nucleus is referred to as a syllabic. These form and functional differences are summarized in Table 2.2.

### Table 2.1 IPA Symbols

<table>
<thead>
<tr>
<th>Consonants</th>
<th>Vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>Commonly Realized In</td>
</tr>
<tr>
<td>[p]</td>
<td>pay</td>
</tr>
<tr>
<td>[b]</td>
<td>boy</td>
</tr>
<tr>
<td>[t]</td>
<td>toy</td>
</tr>
<tr>
<td>[d]</td>
<td>doll</td>
</tr>
<tr>
<td>[k]</td>
<td>goat</td>
</tr>
<tr>
<td>[ɡ]</td>
<td>goat</td>
</tr>
<tr>
<td>[m]</td>
<td>moon</td>
</tr>
<tr>
<td>[n]</td>
<td>not</td>
</tr>
<tr>
<td>[ŋ]</td>
<td>sing</td>
</tr>
<tr>
<td>[θ]</td>
<td>think</td>
</tr>
<tr>
<td>[ð]</td>
<td>those</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>far</td>
</tr>
<tr>
<td>[ʒ]</td>
<td>vase</td>
</tr>
<tr>
<td>[z]</td>
<td>gun</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>zoo</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>shop</td>
</tr>
<tr>
<td>[ʒ]</td>
<td>beige</td>
</tr>
<tr>
<td>[ʧ]</td>
<td>chop</td>
</tr>
<tr>
<td>[ʤ]</td>
<td>job</td>
</tr>
<tr>
<td>[j]</td>
<td>yes</td>
</tr>
<tr>
<td>[w]</td>
<td>win</td>
</tr>
<tr>
<td>[ʍ]</td>
<td>when²</td>
</tr>
<tr>
<td>[l]</td>
<td>leap</td>
</tr>
<tr>
<td>[r]</td>
<td>red</td>
</tr>
<tr>
<td>[h]</td>
<td>hop</td>
</tr>
</tbody>
</table>

¹May be regional or individual pronunciation.

²Historically, the /ʍ/ was used in “wh” words such as “where” and “when” and was a voiceless sound. It has now merged with /w/ throughout much of the United States (Wolfram & Schilling-Estes, 2006).

When transcribing, syllabic consonants need a special notation. This is discussed in Chapter 3.
Chapter 2  Phonetics—Articulatory Phonetics

American English Vowels

Vowels are commonly described according to certain parameters (Abercrombie, 1967; Crystal, 2010; Heffner, 1975; Kantner & West, 1960; Shriberg & Kent, 2013):

1. The portion of the tongue that is involved in the articulation. Example: front versus back vowels.
2. The tongue’s position relative to the palate. Example: high versus low vowels.
3. The degree of lip rounding or unrounding.

The four-sided form called a vowel quadrilateral is often used to demonstrate schematically the front–back and high–low positions. The form roughly represents the tongue position in the oral cavity (Figure 2.1).

The terms tense/lax and open/close are also used to describe vowels. Tense and lax refer to the degree of muscular activity involved in the articulation and to the length of the vowels in question (Shriberg & Kent, 2013). Therefore, tense vowels are produced with relatively more muscular activity and are longer in duration than lax vowels. The vowel [i] is considered to be a tense vowel, whereas [ɪ] is lax. When contrasting tense versus lax, one has to keep in mind that these oppositions refer to pairs of vowels that are productionally similar, i.e., to vowel cognates. For example, [i] and [ɪ] are considered to be “ee” type vowels, and [u] and [ʊ] are “oo” type vowels.

The terms close and open refer to the relative closeness of the tongue to the roof of the mouth. Again, only vowel cognates are usually characterized with these terms. Using the previous examples, [i] is more close - [ɪ] more open, [u] close - [ʊ] open.

There are two types of vowels: monophthongs and diphthongs. The quality of monophthongs remains the same throughout their entire production. They are pure vowels (Abercrombie, 1967). Diphthongs are vowels in which there is a change in quality during their production (Ladefoged & Johnson, 2010). The

![Vowel Quadrilateral of General American English Vowels](image-url)
initial segment, the beginning portion of such a diphthong, is phonetically referred to as the onglide and its end portion as the offglide. Using this notation system, the following descriptions for the most common vowels of General American English are offered.

**Front Vowels**

- [i] A high-front vowel, unrounded, close, and tense.
- [ɪ] A high-front vowel, unrounded, open, and lax.
- [e] A mid-front vowel, unrounded, close, and tense. In General American English, this vowel is typically produced as a diphthong, especially in stressed syllables or when articulated slowly.
- [ɛ] A mid-front vowel, unrounded, open, and lax.
- [æ] A low-front vowel, unrounded, open, and lax.

All front vowels show various degrees of unrounding (lip spreading) with the high-front vowels showing the most. The lip spreading becomes less as one moves from the high-front vowels to the mid-front vowels, finally becoming practically nonexistent in the low-front vowel.

**Back Vowels**

- [u] A high-back vowel, rounded, close, and tense.
- [ʊ] A high-back vowel, rounded, open, and lax.
- [o] A mid-back vowel, rounded, close, and tense. This vowel is typically produced as a diphthong, especially in stressed syllables or when articulated slowly.
- [ɔ] A low mid-back vowel, rounded, open, and lax (Heffner, 1975). The use of this vowel depends on regional pronunciation.
- [ɑ] A low-back vowel, unrounded, open, and lax (Kantner & West, 1960). There seems to be some confusion in transcribing [ɔ] and [ɑ], although acoustic differences certainly exist. One distinguishing feature: The [ɔ] shows some degree of lip rounding, whereas [ɑ] does not.

Back vowels display different degrees of lip rounding in General American English. The high-back vowels [u] and [ʊ] often show a fairly high degree of lip rounding, whereas the low-back vowel [ɑ] is commonly articulated as an unrounded vowel.

**Central Vowels**

- [ɻ] A central vowel, rounded, tense with r-coloring. Rounding may vary, however, from speaker to speaker. [ɻ] is a stressed vowel. It is typically acoustically more intense, has a higher fundamental frequency, and has a longer duration when it is compared to a similar unstressed vowel such as [ɜ].

(Continued)
[ə] A central vowel, rounded, lax with r-coloring. Again, lip rounding may vary from speaker to speaker. This lax vowel is an unstressed vowel.

[ɜ] A central vowel, rounded, tense. [ɜ] is very similar in pronunciation to [ɝ], but it lacks any r-coloring. This vowel is heard in certain dialects. For example, [ɜ] might be found in a Southern dialect pronunciation of *bird* or *worth*. Also, it could be heard in the speech of children having difficulties producing the “r” sound.

[ʌ] A lax, unrounded central vowel. It is a stressed vowel.

[ə] A lax, unrounded central vowel. It is an unstressed vowel.

**Diphthongs.** As previously defined, a diphthong is a vowel sound that demonstrates articulatory movement resulting in a qualitative change during its production. Its initial portion, the onglide is acoustically more prominent and usually longer than the offglide. Common diphthongs in General American English are **rising diphthongs**. This means that when producing these diphthongs, essential portions of the tongue move from a lower onglide to a higher offglide position; thus, relative to the palate, the tongue moves in a rising motion. This can be demonstrated on the vowel quadrilateral as well (Figure 2.2).

Certain diphthongs are referred to as **centering diphthongs**. In this case, the offglide, or less prominent element of the diphthong, is a central vowel. Common in General American English is the use of the central vowel with r-coloring [ɚ] as an offglide. Thus, *fear* is often pronounced as [fɪɚ], *far* as [fɑɚ], and *bear* as [bɛɚ] (Ball & Rahilly, 1999). Theoretically, any vowel may be combined with [ə] or [ɚ] to form a centering diphthong; however, in General American English, certain centering diphthongs are more common than others. Thus, [ɪɚ], [ɛɚ], and [ɑɚ], which can be heard in *dear* [dɪɻə], *bear* [bɛɚ], or *farm* [fɑm], are far more prevalent than [iɚ] or [uɚ]. Lowe (1994) refers to the diphthongs that are paired with [ɚ] as **rhotic diphthongs**. Centering diphthongs are also seen transcribed with [r]. Thus, *dear* is transcribed as [dɪɻɹ], *bear* as [bɛɹ], or *farm* as [fɑmɹ].

There are several ways to characterize diphthongs as single phonemic units in contrast to two separate vowels. Some transcribers use a bar or bow either above or below the two vowel symbols—[ɛɻ], [ɛɻ], or [ɛɻ], for example. The author has chosen to use the transcription that elevates the offglide portion of the diphthong to indicate less intensity and length associated with it.

Discrepancies may be noted between the transcriptions of diphthongs offered in this text and the ones in other books. Because phonetic transcription is purely
descriptive, never prescriptive, any transcription will, of course, vary according to the actual pronunciation. See Shriberg and Kent (2013) for a thorough discussion of the various ways diphthongs have been transcribed.

<table>
<thead>
<tr>
<th>[e̯]</th>
<th>A nonphonemic diphthong.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonphonemic diphthongs are those that the meaning of the word would not change if the vowel were to be pronounced as a monophthong [e] versus a diphthong [e̯]. Therefore, no change in meaning would result if just the onglide were realized. Words pronounced [be'k] or [bek], for example, would be recognized as the same word.</td>
</tr>
<tr>
<td>[o̯]</td>
<td>A nonphonemic diphthong.</td>
</tr>
<tr>
<td>[a̯]</td>
<td>A phonemic diphthong.</td>
</tr>
<tr>
<td></td>
<td>Phonemic diphthongs are those in which the meaning would change in a particular word if only the vowel onglide were produced; in other words, if the vowel was realized as a monophthong. A realization of [a] instead of [a̯] will change the meaning in General American English as the words sod [sɒd] versus sighed [saɪd] demonstrate.</td>
</tr>
<tr>
<td>[ɔ]</td>
<td>A phonemic diphthong.</td>
</tr>
<tr>
<td></td>
<td>The opposition [ʤɔ], jaw, versus [ʤɔɪ], joy, exemplifies its phonemic value as a meaning-differentiating sound feature of English.</td>
</tr>
<tr>
<td>[a̯]</td>
<td>A phonemic diphthong.</td>
</tr>
<tr>
<td></td>
<td>Oppositions such as [mas], moss, versus [ma̯s], mouse, exemplify its phonemic value.</td>
</tr>
</tbody>
</table>

See Appendix 2.1 for various ways the diphthongs and the rhotic diphthongs are transcribed in various current phonetic textbooks.

### CLINICAL APPLICATION

**Analyzing the Vowel System of a Child**

Occasionally, the vowel system of a client may be restricted or show deviant patterns. In this case, a more in-depth analysis of the vowel productions may be necessary. Vowel systems can be analyzed using the vowel quadrilateral and knowledge of the diphthongs as guiding principles. Front, back, and central vowels as well as diphthongs can be checked in relationship to their accuracy and their occurrence in the appropriate contexts.

George, age 5;3, is a child with a deviant vowel system. George was being seen in the clinic for his phonological disorder. He was a gregarious child who loved to talk and would try to engage anyone who would listen in conversation. The only problem was that George was almost unintelligible. This made dialogue difficult, possibly more so for those who would patiently and diligently try to understand his continuing attempts to interact.

In addition to his many consonant problems, the following vowel deviations were noted:

<table>
<thead>
<tr>
<th>Vowels Errors</th>
<th>Norm Production</th>
<th>Actual Production</th>
<th>Word Examples</th>
<th>Transcriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>[e̯]</td>
<td>→</td>
<td>[ɛ]</td>
<td>grapes</td>
<td>[gre'ps] → [de]</td>
</tr>
<tr>
<td>[e̯]</td>
<td>→</td>
<td>table</td>
<td>[te'bI]</td>
<td>[tebɔ']</td>
</tr>
<tr>
<td>[i]</td>
<td>→</td>
<td>[ɪ]</td>
<td>feet</td>
<td>[fit] → [fI]</td>
</tr>
<tr>
<td>[i]</td>
<td>→</td>
<td>teeth</td>
<td>[tiθ]</td>
<td>[tu]</td>
</tr>
<tr>
<td>[ɛ]</td>
<td>→</td>
<td>three</td>
<td>[θri]</td>
<td>[dɪ]</td>
</tr>
<tr>
<td>[ɛ]</td>
<td>→</td>
<td>bed</td>
<td>[bɛd]</td>
<td>[bæt]</td>
</tr>
<tr>
<td>[ɛ]</td>
<td>→</td>
<td>feather</td>
<td>[fɛθə]</td>
<td>[fævə]</td>
</tr>
</tbody>
</table>

(Continued)
American English Consonants

Four phonetic categories are used to transcribe consonants: (1) active articulator (organ of articulation), (2) passive articulator (place of articulation), (3) manner of articulation, and (4) voicing features. Most textbooks state that only place, manner, and voicing are used to characterize individual consonants (Edwards, 2003; Shriberg & Kent, 2013). However, they nevertheless often include the active articulator. For example, the term lingual as in *lingua-* or *lingua-palatal* designates the active articulator. However, when contrasting the *lingua-dental* sounds [θ] and [ð] to the *lingua-palatal* sounds [ʃ] and [ʒ], it becomes clear that different portions of the tongue are actively involved in the articulation. The term lingual alone does not specify these differences. This text emphasizes the detailed knowledge of production features for specific therapy goals. By adding a category specifically designating the active articulator, valuable clarification of consonant articulation is achieved.

**Active Articulator/Organ of Articulation.** Consonants are sounds characterized by the articulators creating a partial or total obstruction of the expiratory airstream. There are active and passive articulators. Active articulators, or what has been termed organs of articulation, are the parts within the vocal tract that actually move to achieve the articulatory result (Crystal, 2010). In describing the consonants of General American English, we are referring specifically to the movements of the lower lip and portions of the tongue. The structures actively involved in the articulation of the consonants of General American English and the resulting phonetic descriptors can be found in Table 2.3. Figure 2.3 is a display of the divisions of the tongue.

**Passive Articulator/Place of Articulation.** The passive articulator or the place of articulation denotes the area within the vocal tract that remains motionless during consonant articulation. It is the part that the active articulator approaches or contacts directly (Crystal, 2010). The upper lip and teeth, the palate, and the velum are the main places of articulation when describing the consonants of General American English. See Table 2.4 for the passive structures of articulation and their resulting phonetic descriptors. Figure 2.4 is a display of the structures of the oral cavity as active (organ of articulation) and passive articulators (places of articulation).

**Manner of Articulation.** The manner of articulation refers to the type of constriction that the active and passive articulators produce for the realization of a particular consonant. There are various manners of articulation, ranging from complete closure for the production of stop-plosives to a very limited constriction of the vocal tract for the
Chapter 2  Phonetics—Articulatory Phonetics

production of glides. The following manners of articulation are used to account phonetically for the consonants of General American English.

**Stop-Plosives** During the production of stop-plosives, complete occlusion is secured at specific points in the vocal tract. Simultaneously, the velum is raised so that no air can escape through the nose. The expiratory air pressure builds up naturally behind this closure (stop); compression results, which is then suddenly released (plosive). Examples of stop-plosives are [p] and [b].

**Fricatives** Fricatives result when active and passive articulators approximate each other so closely that the escaping expiratory airstream causes an audible friction. As with the stops, the velum is raised for all fricative sounds. Two examples of fricatives are [f] and [v]. Some fricatives, referred to as sibilsants, have a sharper sound than others because of the presence of high-frequency components. In General American English [s], [z], [ʃ], and [ʒ] belong to the sibilants.

**Nasals** These consonants are produced with the velum lowered so that the air can pass freely through the nasal cavity. However, there is complete occlusion within the oral cavity between the active and passive articulators. These sounds have been called nasal stops because of the occlusion of the active and passive articulators and the ensuing free air passage through the nasal cavity (Ball & Rahilly, 1999). The nasals of General American English are [m], [n], and [ŋ].
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**Affricates.** For affricate sounds, two phases can be noted. First, a complete closure is formed between the active and passive articulators, and the velum is raised. As a consequence of these articulatory conditions, expiratory air pressure builds up behind the blockage formed by the articulators—the stop phase, which is considered the first portion of the affricate. Second, the stop is then slowly (in comparison to the plosives)
The rhotic “r” is officially transcribed by the International Phonetic Association as [ɹ], an upside down “r” to indicate, as mentioned above, an “r” production where the tongue tip is raised toward the alveolar ridge. The retroflexed is characterized by [ɻ], an upside-down r with a retroflexed diacritic. According to the International Phonetic Alphabet the [r] symbol is officially reserved for the alveolar trilled “r” sound, which can be heard in Spanish, for example. Because trilled “r” sounds do not exist in General American English and to prevent complicating matters unnecessarily, it is customary to use the [ɹ] symbol for both the bunched and the retroflexed “r” sounds. However, you will see in some textbooks that the General American English rhotic is transcribed as [ɹ]. In reference to General American English, [r] and [ɹ] typically indicate the same sound, the “r” as in “rabbit.”

released orally, resulting in the friction portion of the speech sound. Affricates should not be viewed as a stop plus fricative combination similar to consonant blends or clusters, such as [ks], in which the stop portion is formed by active and passive articulators, which differ in their placement. Rather, affricates are single uniform speech sounds characterized by a slow release of a stopping phase into a homorganic (hom = same) friction element. The two most prominent affricates of General American English are [ʧ] and [ʤ].

Glides. For the realization of glides, the constriction between active and passive articulators is not as narrow as for fricatives. In addition to this relatively wide articulatory posture, glides are also characterized by a gliding movement of the articulators from a relatively constricted into a more open position. The sounds [w] and [j] are considered glides. According to the classification of the International Phonetic Alphabet, [w] and [j] are considered approximants. Approximants are consonants in which there is a much wider passage of air, resulting in a smooth (as opposed to turbulent) airflow for these voiced sounds.

Laterals. These sounds are established by a midline closure but lateral openings within the oral cavity. Consequently, the expiratory airstream can pass around one or both sides of the tongue. [l] is the only lateral consonant of General American English. The laterals together with the rhotics are collectively referred to as liquids. According to the classification system of the International Phonetic Alphabet [l] is considered a lateral approximant.

Rhotics. The phonetic characteristics of the rhotics are especially difficult to describe. First, there are at least two types of rhotic productions: retroflexed and bunched. Second, the actual forming of rhotics is highly context dependent. Thus, the production easily changes, depending on the features of the surrounding sounds. In addition, the positioning of the tongue for individual speakers is highly variable. Generally, the retroflexed rhotics are produced with the
Chapter 2  Phonetics—Articulatory Phonetics

**TABLE 2.5 Phonetic Description: Manner of Articulation**

<table>
<thead>
<tr>
<th>Manner of Articulation</th>
<th>Phonetic Descriptor</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete blockage</td>
<td>Stop-plosive</td>
<td>[p], [b], [t], [d], [k], [g]</td>
</tr>
<tr>
<td>Partial blockage</td>
<td>Fricative</td>
<td>[f], [v], [s], [z], [ʃ], [ʒ], [θ], [ð]</td>
</tr>
<tr>
<td>Nasal emission</td>
<td>Nasal</td>
<td>[m], [n], [ŋ]</td>
</tr>
<tr>
<td>Release of stop portion to a homorganic fricative portion</td>
<td>Affricate</td>
<td>[tʃ], [dʒ]</td>
</tr>
<tr>
<td>G lidsing motion from a more closed to a more open position</td>
<td>Glide</td>
<td>[w], [ʍ], [j]</td>
</tr>
<tr>
<td>Lateral airflow</td>
<td>Lateral</td>
<td>[l]</td>
</tr>
<tr>
<td>Retroflex blade or bunched dorsum</td>
<td>Rhotic</td>
<td>[r]</td>
</tr>
</tbody>
</table>

**Clinical Exercises**

The child you are working with has a [w] for [r] substitution. At first, why might you avoid words with [r] + high-back vowels, such as “root” or “roof”? Reflect on the production of [w] with its high-back tongue placement.

**Manner of articulation:** If a child produces [t] for [s], what does the child need to understand to achieve [s]? Can you think of any ways to demonstrate this to the child?

**TABLE 2.6 Phonetic Description: Voicing**

<table>
<thead>
<tr>
<th>Voicing</th>
<th>Phonetic Descriptor</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>With vocal fold vibration</td>
<td>Voiced</td>
<td>[b], [d], [ɡ], [m], [n], [ŋ], [v], [z], [ʒ], [θ], [w], [j], [l], [r]</td>
</tr>
<tr>
<td>Without vocal fold vibration</td>
<td>Voiceless</td>
<td>[p], [t], [k], [f], [s], [ʃ], [j], [θ], [u], [h]</td>
</tr>
</tbody>
</table>

1. The active and passive articulators, manner, and voicing features are based on the phonetic descriptions provided by Bronstein (1960) and Kantner and West (1960). These features are seen as descriptive and may, therefore, vary somewhat from speaker to speaker.

Voicing. Voicing is the term used to denote the presence or absence of simultaneous vibration of the vocal cords, resulting in voiced or voiceless consonants. The voiced and voiceless consonants of General American English are summarized in Table 2.6.

Far more precision may be necessary to describe how specific consonants are produced. However, this framework of active articulator (organ of articulation), passive articulator (place of articulation), manner of articulation, and voicing provides a fairly accurate description of General American English consonants.

The following phonetic descriptions classify the consonants of General American English according to the parameters of voicing, active and passive articulators, and manner of production.1
<table>
<thead>
<tr>
<th>Sound</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[p]</td>
<td>Voiceless bilabial stop-plosive</td>
</tr>
<tr>
<td>[b]</td>
<td>Voiced bilabial stop-plosive</td>
</tr>
<tr>
<td>[t]</td>
<td>Voiceless coronal-alveolar stop-plosive</td>
</tr>
<tr>
<td>[d]</td>
<td>Voiced coronal-alveolar stop-plosive</td>
</tr>
<tr>
<td>[k]</td>
<td>Voiceless postdorsal-velar stop-plosive</td>
</tr>
<tr>
<td>[g]</td>
<td>Voiced postdorsal-velar stop-plosive</td>
</tr>
<tr>
<td>[f]</td>
<td>Voiceless labio-dental fricative</td>
</tr>
<tr>
<td>[v]</td>
<td>Voiced labio-dental fricative</td>
</tr>
<tr>
<td>[s]</td>
<td>Voiceless apico-alveolar or predorsal-alveolar fricative</td>
</tr>
<tr>
<td>[z]</td>
<td>Voiced apico-alveolar or predorsal-alveolar fricative</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>Voiceless coronal-prepalatal or coronal-postalveolar fricative with lip rounding</td>
</tr>
<tr>
<td>[ʒ]</td>
<td>Voiced coronal-prepalatal or coronal-postalveolar fricative</td>
</tr>
<tr>
<td>[θ]</td>
<td>Voiceless apico-dental or interdental fricative or glottal fricative (International Phonetic Alphabet, 2005) with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[ð]</td>
<td>Voiced apico-dental or interdental fricative or glottal fricative (International Phonetic Alphabet, 2005) with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[m]</td>
<td>Voiced bilabial nasal</td>
</tr>
<tr>
<td>[n]</td>
<td>Voiced coronal-alveolar nasal</td>
</tr>
<tr>
<td>[ŋ]</td>
<td>Voiced postdorsal-velar nasal</td>
</tr>
<tr>
<td>[w]</td>
<td>Voiced labial-velar glide or approximant with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[ʍ]</td>
<td>Voiceless labial-velar fricative (International Phonetic Alphabet, 2005) with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[ʃ]</td>
<td>Voiceless coronal-prepalatal or coronal-postalveolar fricative with lip rounding</td>
</tr>
<tr>
<td>[ʒ]</td>
<td>Voiced coronal-prepalatal or coronal-postalveolar fricative</td>
</tr>
<tr>
<td>[θ]</td>
<td>Voiceless apico-dental or interdental fricative or glottal fricative (International Phonetic Alphabet, 2005) with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[ð]</td>
<td>Voiced apico-dental or interdental fricative or glottal fricative (International Phonetic Alphabet, 2005) with lip rounding. The velar passive articulator refers to the body of the tongue being raised toward the velum.</td>
</tr>
<tr>
<td>[h]</td>
<td>Voiceless unlocalized open consonant (an aspirate) or glottal fricative</td>
</tr>
<tr>
<td>[ʧ]</td>
<td>Voiceless coronal-alveolar stop portion followed by a voiceless coronal-postalveolar fricative portion</td>
</tr>
<tr>
<td>[ʤ]</td>
<td>Voiced coronal-alveolar stop portion followed by a voiceless coronal-postalveolar fricative portion</td>
</tr>
</tbody>
</table>

**CLINICAL EXERCISES**

Which type of [s] do you use, the tongue tip up (coronal-alveolar) or the tip down (predorsal-alveolar)? Say a few words with [s] and note the position of your tongue. Try producing both types of [s] productions.

Some clinicians use only the tongue tip down version of [s] to remediate [s] difficulties. Why might this be the [s] production of choice if the child produces [θ] as a substitution and always goes back to this sound if you try to achieve a coronal-alveolar [s] production?
Chapter 2  Phonetics—Articulatory Phonetics

Sounds in Context: Coarticulation and Assimilation

Until now, this textbook has discussed articulatory characteristics of speech sounds as discrete units. However, the articulators do not move from sound to sound in a series of separate steps. Speech consists of highly variable and overlapping motor movements. Sounds within a given phonetic context influence one another. For example, if the [s] production in see is contrasted to the one in Sue, it can be seen that [s] in see is produced with some spreading of the lips, whereas there is lip rounding in Sue. This difference results from the influence of the following vowel articulations: [i], a vowel with lip spreading, facilitates this feature in the [s] production in see, whereas the lip rounding of [u] influences the production of [s] in Sue. These types of modifications are grouped together under the term coarticulation. Coarticulation describes the concept that the articulators are continually moving into position for other segments over a stretch of speech. The result of coarticulation is referred to as assimilation. The term assimilation refers to adaptive articulatory changes by which one speech sound becomes similar, sometimes identical, to a neighboring sound segment. Such a change may affect one, several, or all of a sound's phonetic constituents; that is, a sound may change its active and passive articulators, manner, and/or voicing properties under the articulatory influence of another sound. Assimilation processes are perfectly natural consequences of normal speech production and are by no means restricted to developing speech in young children. Because the two segments become more alike, assimilatory processes are also referred to as harmony processes.

<table>
<thead>
<tr>
<th>Rhotics</th>
<th>Actual Production</th>
<th>Word Example</th>
<th>Transcriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>[tr] → [tw]</td>
<td>tree</td>
<td>[tri] → [twi]</td>
<td></td>
</tr>
<tr>
<td>[br] → [bw]</td>
<td>bridge</td>
<td>[brɪdʒ] → [bwɪŋ]</td>
<td></td>
</tr>
<tr>
<td>[r] → [w]</td>
<td>ring</td>
<td>[rɪŋ] → [wɪŋ]</td>
<td></td>
</tr>
<tr>
<td>[br] → [bw]</td>
<td>zebra</td>
<td>[zɪbra] → [zɪbwə]</td>
<td></td>
</tr>
<tr>
<td>[r] → [w]</td>
<td>garage</td>
<td>[ɡɑrə] → [dʒəwa]</td>
<td></td>
</tr>
<tr>
<td>[θr] → [θw]</td>
<td>thread</td>
<td>[θred] → [θwɪd]</td>
<td></td>
</tr>
<tr>
<td>[tr] → [tw]</td>
<td>treasure</td>
<td>[trɪzə] → [twɛzə]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Vowels with R-Coloring</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct</td>
</tr>
<tr>
<td>correct</td>
</tr>
<tr>
<td>correct</td>
</tr>
<tr>
<td>correct</td>
</tr>
</tbody>
</table>

On the one hand, Latoria has a [w] for [r] substitution ([r] → [w]) for the rhotic consonant [r]. On the other, she can produce the central vowels with r-coloring accurately.

**CLINICAL APPLICATION**

Rhotic Errors versus Central Vowels with R-Coloring

Children with “r” problems, thus, rhotic consonant difficulties, often produce the central vowels with r-coloring ([ɜ] and [ɚ]) in error. However, that is not always the case. Note the following patterns seen in Latoria’s speech.

<table>
<thead>
<tr>
<th>Norm Production</th>
<th>Actual Production</th>
<th>Word Example</th>
<th>Transcriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhotics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[tr]</td>
<td>→ [tw]</td>
<td>tree</td>
<td>[tri] → [twi]</td>
</tr>
<tr>
<td>[br]</td>
<td>→ [bw]</td>
<td>bridge</td>
<td>[brɪdʒ] → [bwɪŋ]</td>
</tr>
<tr>
<td>[r]</td>
<td>→ [w]</td>
<td>ring</td>
<td>[rɪŋ] → [wɪŋ]</td>
</tr>
<tr>
<td>[br]</td>
<td>→ [bw]</td>
<td>zebra</td>
<td>[zɪbra] → [zɪbwə]</td>
</tr>
<tr>
<td>[r]</td>
<td>→ [w]</td>
<td>garage</td>
<td>[ɡɑrə] → [dʒəwa]</td>
</tr>
<tr>
<td>[θr]</td>
<td>→ [θw]</td>
<td>thread</td>
<td>[θred] → [θwɪd]</td>
</tr>
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<td>[tr]</td>
<td>→ [tw]</td>
<td>treasure</td>
<td>[trɪzə] → [twɛzə]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Central Vowels with R-Coloring</th>
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<tbody>
<tr>
<td>correct</td>
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</tr>
<tr>
<td>correct</td>
</tr>
<tr>
<td>correct</td>
</tr>
</tbody>
</table>

On the one hand, Latoria has a [w] for [r] substitution ([r] → [w]) for the rhotic consonant [r]. On the other, she can produce the central vowels with r-coloring accurately.
There are different types and degrees of assimilatory processes. In regard to the different types of assimilatory processes, the following should be noted:

1. Assimilatory processes modifying directly adjacent sounds are called contact (or contiguous) assimilations. If at least one other segment separates the sounds in question, especially when the two sounds are in two different syllables, one speaks of remote (or noncontiguous) assimilation.

The following assimilation processes were noted in the results of children’s articulation tests:

**Contact**

“jumping” [ʤʌmpɪŋ], typical transcription → [ʤʌmbɪŋ] with assimilation

If the two segments are contrasted, the [mp] in [ʤʌmpɪŋ] becomes [mb] in the assimilated production [ʤʌmbɪŋ]. In this case, the voiced [m], a voiced nasal, impacts the normally voiceless [p], the result is a voiced [b].

“skunk” [skʌŋk], typical transcription → [stʌŋk] with assimilation

If the two segments are contrasted, the [sk] in [skʌŋk] becomes [st] in the assimilated production [stʌŋk]. The articulatory placements of the active and passive articulators for [s], a coronal-alveolar, influence the stop-plosive [k], a postdorsal-velar, moving the production forward to a coronal-alveolar [t].

**Remote**

“yellow” [jɛlʊ], typical transcription → [lɛlʊ] with assimilation

The position of the active and passive articulators are impacted when the [j] at the beginning of the word (a mediodorsal-mediopalatal) becomes identical to the following [l]. This is a very common assimilation process in children. In this context, the influence of the [l] impacts the [j]. They are both glides, and only the active and passive articulators differentiate the two.

“telephone” [tɛləfoʊˈn], typical transcription → [tɛdəfoʊˈn] with assimilation

The [t] at the beginning of the word is the driving force for this assimilation. If the two words are compared, the [l] has changed to a [d] from a lateral to a stop-plosive, similar to the [t] at the beginning of the word. However, the voicing of the [l] has been maintained so that the resulting sound is a voiced stop-plosive, a [d].

2. Assimilations can be either progressive or regressive. In progressive assimilation, a segment influences a following sound in a linear manner. This is also referred to as perseverative assimilation (Crystal, 2010; Ladefoged & Johnson, 2010). The previously noted contact assimilations for jumping and skunk and the remote assimilation for telephone are examples of progressive assimilation. A previously articulated sound influenced a following sound.

[ʤʌmpɪŋ] becomes [ʤʌmbɪŋ]

[skʌŋk] becomes [stʌŋk]

[teləfoʊˈn] becomes [tedəfoʊˈn]
In regressive assimilation, a sound segment influences a preceding sound. If “is she” [ɪz ʃi] is pronounced [ɪʒ ʃi], changing [s] into [ʒ], regressive assimilation is noted. The [ʃ] has impacted the articulation of the [z] so that it is changed to a fricative similar to [ʃ] but with voicing [ʒ]. Regressive assimilations are also known as anticipatory assimilations (Crystal, 2010; Ladefoged & Johnson, 2010).

The following are examples of progressive and regressive assimilation processes:

**Progressive**

“ice cream” [aɪskrim], typical pronunciation → [aɪstrim] with assimilation

The [sk] is assimilated to [st]. In the typical pronunciation, there is articulatory movement from [s] to [k]. The tongue moves, first towards the front of the mouth (apico-alveolar for [s]), and then the back of the tongue becomes active for the postdorsal-velar [k]. The second production [aɪstrim] is much simpler in movement. The forward placement of the [s] articulation moves the stop-plosive from a back production to a more fronted one. This is progressive contact assimilation.

“television” [tɛləvɪʒən] → [tɛdəvɪʒən]

In this example, [l] is assimilated to [d] because of the influence of the beginning [t] in “television.” The lateral [l] is now articulated very similarly to the beginning [t]; however, the voicing of the [l] is maintained, thus [d]. This is progressive remote assimilation.

**Regressive**

“pumpkin” [pʌmˈkɪn] → [pʌŋˈkɪn]

Here the [m] is assimilated to a [ŋ] because of the impact of the [k]. Again, ease of production has changed the nasal [m], a front sound, to a nasal that is very close in production to the [k]. Both the [k] and [ŋ] are back sounds (postdorsal-velar). This is regressive contact assimilation.

“bathtub” [bæθtʌb] → [bæθtʌb]

Active, passive articulators and manner are impacted as [θ] influences the previous segment [b]. The result is that [b] is replaced by [θ]: This is regressive remote assimilation.

In regard to the different degrees of assimilatory influence, one distinguishes between phonemic assimilation and phonetic similitude (Ball & Rahilly, 1999). An altered segment that is perceived to be a different phoneme altogether is termed phonemic assimilation. Phonetic similitude occurs when the change in the segment is such that it is still perceived by speakers of a language as nothing more than a variation of the original segment. A phonemic assimilation could be exemplified by the change in ten girls [ten ɡɜlz] to [tɛn ɡɜlz]; the [n] completely changes to [ŋ] because of the influence of the following postdorsal-velar stop-plosive [ɡ]. An example of a phonetic similitude would be the lip rounding of [s] in soup [sʊp] (the “w” denotes lip rounding) as the [s] is influenced by the lip rounding of the following [u]. This would still be perceived as [s], not another sound value; the [s”] is an allophone of /s/.

Assimilation processes can also be total or partial. Total assimilation occurs when the changed segment and the source of the influence become identical. Partial assimilation exists when the changed segment is close to, but not identical to, the source segment.
The following are examples of total and partial assimilation processes:

**Total “window”**

[\textit{window}] \rightarrow [\textit{wino}]

“Pontiac” \rightarrow [\textit{pəntiək}]

In these two examples, the [d] and [t] are gone, the only remaining sound is the [n], and, thus, there is total assimilation.

**Partial “handkerchief”**

[\textit{hæŋkətʃɪf}] \rightarrow [\textit{hæŋkətʃɪf}]

In this example, the nasality of the sound is present, but the placement of the active and passive articulators has changed from a coronal-alveolar [n] to a postdorsal-velar [ŋ].

The term \textit{coalescence} is used when two neighboring segments are merged into a new and different segment. An example of coalescence would be the realization of \textit{sandwich} [sæn\textit{wɪntʃ}] as [sæm\textit{tʃ}]. The [n] and [w] have fused into the resulting [m]. This assimilation demonstrates the bilabial features for the articulation of [w] with the nasality of the [n]. The result is a bilabial nasal [m].

Children at different stages of their speech-language development tend to use assimilation processes in systematic ways. This is of obvious interest to clinicians whose task is to separate normal from impaired phonological development. In normally developing children and those with disordered phonology, syllable structure can also impact their production possibilities. This is discussed in the next section.

## CLINICAL APPLICATION

### Assimilation Processes and Articulation Testing

Assimilatory or harmony processes often occur during an articulation test. It is important to recognize these processes so that the test scoring will not be negatively impacted. The author has frequently observed the following assimilation processes:

<table>
<thead>
<tr>
<th>Word</th>
<th>Expected Response</th>
<th>Child’s Response</th>
<th>Impact on Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa</td>
<td>[sæntə]</td>
<td>[sæntə]</td>
<td>total assimilation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[sæntə] total assimilation</td>
<td>Could be scored as an omission of [t]</td>
</tr>
<tr>
<td>sandwich</td>
<td>[sænwɪtʃ]</td>
<td>[sæmtʃ]</td>
<td>total assimilation (coalescence)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[sæmtʃ] total assimilation (coalescence)</td>
<td>Could be scored as an omission of [w] and an [m]/[n] substitution</td>
</tr>
<tr>
<td>presents</td>
<td>[præzənts]</td>
<td>[præzənts]</td>
<td>total assimilation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[præzənts] total assimilation</td>
<td>Could be scored as an omission of [t]</td>
</tr>
<tr>
<td>bath</td>
<td>[bæθ]</td>
<td>[θæθ]</td>
<td>[θ]/[b] substitution</td>
</tr>
<tr>
<td>bathtub</td>
<td>[bæθtʌb]</td>
<td>[θæθtʌb]</td>
<td>[θ]/[b] substitution</td>
</tr>
</tbody>
</table>
| A less common example was observed for Danny, age 4;3:
| bath     | [bæθ]             | [θæθ]            | [θ]/[b] substitution                                    |
| bathtub  | [bæθtʌb]          | [θæθtʌb]         | [θ]/[b] substitution                                    |

However, Danny could produce [b] correctly in all other contexts. Note the correct production of [b] at the end of \textit{bathtub}. This was an example of a regressive remote assimilation.

## Syllable Structure

If we are asked to break words down into component parts, syllables seem to be more natural than sounds. For example, speakers of unwritten languages characteristically use syllable, not sound, divisions. They may even resist the notion that any further breakdown
is possible (Ladefoged & Johnson, 2010). Also, preschool children use syllabification if they try to analyze a word. It is only after children are exposed to writing that they begin to understand the possibility of dividing words into sounds. Thus, syllables appear to be easily recognizable units.

Counting the number of syllables in a word is a relatively simple task. Probably all will agree on the number of syllables in the word away or articulation, for example. What we might disagree on are the beginning and end points of the syllables in question. To arrive at a consensus, it is first necessary to differentiate between written and spoken syllables.

A dictionary has written syllabification rules. We learn that the word cutting is to be divided cut-ting. However, differences may, and often do, exist between written and spoken syllables. The written syllabification rules for cutting do not reflect the way we would syllabify the word when speaking. The divisions [kə ɪŋ] would be more probable during normal speech. An awareness of existing differences between spoken and written syllable boundaries is important for speech-language specialists.

Determining spoken syllables can be especially problematic because a dictionary of rules for the boundaries of spoken syllables does not exist. Thus, two competent speakers of a given language may syllabify the same word in different ways. Words such as hammer and window would probably not cause problems. However, how should one syllabify telephone, as [tɛ lə foʊ’n] or as [tɛl ə foʊ’n]? That is, does [l] belong to the second or to the first syllable? Variations in the syllabification of spoken words do indeed exist between speakers. To understand this, a look at the syllable structure might be a good way to begin.

Structurally, the syllable can be divided into three parts: peak, onset, and coda. The peak is the most prominent, acoustically most intense part of the syllable. Although vowels are clearly more prevalent as syllable peaks, consonants are not strictly excluded. Consonants that serve as the syllable peak are referred to as syllabics. A peak may stand alone, as in the first syllable of the word a-way, or it can be surrounded by other sounds, as in tan or bring.

The onset of a syllable consists of all the segments prior to the peak, whereas the coda is made up of all the sound segments of a syllable following its peak. The segments that compose the onset are also termed syllable releasing sounds, and those of the coda are termed syllable arresting sounds. Thus, the onset of meet [mit] is [m]; that is, [m] is the syllable releasing sound. The coda, or syllable arresting sound, of meet is [t]. This applies also to consonant blends within one syllable. The onset of scratched is [skr], its peak is [æ], and the coda is [tʃt]. Not all syllables have onsets or codas. Both syllables of today [todeɪ] lack a coda, whereas off [ɑf] does not have an onset. The number of segments that an onset or a coda may contain is regulated by the phonotactic rules of the language in question. General American English syllables can have one to three segments in an onset (ray, stay, stray) and one to four segments in a coda (sit, sits, sixth [sɪksθ], sixths [sɪksθs]).

The peak and coda together are referred to as the rhyme. Therefore, in the word sun, the onset is “s” and the rhyme is “un.” Syllables that do not contain codas are called open or unchecked syllables. Examples of open, unchecked syllables are do [du], glee [gli], or the first syllable of rebound [rɪ bɔːnd]. Syllables that do have codas are called closed or checked syllables, such as in stop [stɑp] or the first syllable in window [wɪn].

The words “sheep” and “keep” have the same rhyme. Therefore, these words “rhyme.” Every language has its own syllable structure rules, its own set of phonotactic restraints. The sonority scale highly influences the syllable structure rules. The general rule is that more sonorous elements are closer to the syllable nucleus, whereas less
sonorant elements are farther away. The rules of phonotactics in General American English operate around this sonority hierarchy. The nucleus or peak of the syllable has maximal sonority, the sonority decreasing as you move away from the nucleus. Recall the sonority hierarchy from most sonorous (vowels) to the least [p, t, k]:

vowels → [w, j] → [r] → [l] → [m, n, ŋ] → [v, z, ð] → [f, s, θ] → [b, d, ɡ] → [p, t, k]

This sonority hierarchy explains why the combination [sl] occurs only at the onset, whereas [ls] is only at the coda of a syllable. The [l] has more sonority than the [s]; therefore, it needs to be closer to the nucleus, which results in words such as [slip] and [palš] but not [lsip] or [pasl]. It should be noted that the [s] violates this principle often in General American English and in other languages (O’Grady & Archibald, 2012). Therefore, the combination [st] does occur as an onset in the word “stop,” for example. The following represents a list of the phonotactic constraints of General American English

1. All syllables have a nucleus.
2. No /h/ is in the syllable coda. Although a word ends in the letter “h” such as “sigh” there is no /h/.
3. Complex onsets (those containing more than one element) cannot contain affricates (/tʃ/ or /dʒ/).
4. The first consonant in a complex onset must be an obstruent (stop-plosive or fricative).
5. The second consonant in a complex onset cannot be a voiced obstruent (no voiced stop-plosives or fricatives).
6. If the first consonant in a complex onset is not an /s/, the second must be a liquid (/l, r/) or glide (/w, j/), for example, “flower” or “twin.”
7. No glides are in codas of syllables. Words may end with the letter “w” for example, “cow” but that is spelling, not pronunciation.
8. If there is a complex coda, the second consonant cannot be /ŋ/, /ʒ/, or /ð/.
9. If the second consonant in a complex coda is voiced, so is the first.
10. Non-alveolar nasals /m, ŋ/ must be homorganic with the next segment (e.g., in “singer” /sɪŋɡə/, the /ŋ/ and /ɡ/ are homorganic).
11. Two obstruents in the same coda must share voicing (e.g., “bets” /ts/ and “beds” /dz/). (Haspelmath & Sims, 2010)

These phonotactic rules vary in every language. It is important to remember when working with individuals who are learning English as a second language. The phonotactics of their native language may influence their pronunciation patterns in English. For example, Cantonese has no consonant combinations (if the labialized /k/, /kʷ/ is counted as a consonant); therefore, no complex onsets or codas exist (except for colloquial Cantonese). This may impact the speaker’s production capabilities in General American English.

The use of specific syllable structures is often neglected when analyzing the speech characterist-tics of children. However, they do seem to play an important developmental role. A child’s first words consist typically of open or unchecked syllables, such as [ba] for ball or [mi] for milk. If children start to produce closed syllables, they usually contain only single-segment

---

**CLINICAL EXERCISES**

Johnny has an [s] problem and is beginning to work on two-syllable words (see page 34). Can you make up a list of 10 words that order the principles from easy to hard for type of syllables (5 words) and the degree of syllable stress (5 words)?

Now Johnny is working on consonant clusters with [s] at the beginning of a word. According to the principle of the number of consonants in a cluster, order the following words from easy to hard: spot, street, scratch, slide, stop, skunk, swim, spring. Based on production features of [s] and the other consonants in the cluster, try to state a rationale for further ordering the words.
coda. Similarly, two-syllable words at this stage of development consist usually of open syllables (e.g., Ingram, 1976; Menn, 1971; Velten, 1943). Productions such as [beɪ bi] for baby or [ti pa] for teapot are examples.

The ease of syllable production can be affected by at least three circumstances: (1) the number of syllables in an utterance, (2) the type of syllable (open versus closed), and (3) the degree of syllable stress (stressed or unstressed). Generally, fewer syllables, open syllables, and stressed syllables facilitate accurate productions of specific target sounds. Another concept that could be included is (4) the number of consonants that are grouped together. Single consonants (singletons) are easier to produce than consonant clusters. Therefore, a word with just a single consonant is easier to produce than a similarly structured word with consonant clusters. The diagram above represents these four factors based on ease of production.

### SUMMARY

This chapter presented a broad definition of phonetics and three subdivisions: articulatory, acoustic, and auditory phonetics. Within articulatory phonetics, an overview of vowels and consonants was given, and the form and function of vowels and consonants of General American English were discussed. Both vowels and consonants were classified according to their articulatory production features and their linguistic functions. Phonetic descriptors were given to provide the clinician with a detailed account of articulatory action during normal production of vowels and consonants. These features can later be contrasted to those noted in the impaired sound realizations of children and adults with speech sound disorders.

In the second portion of this chapter, coarticulation, assimilation processes, and syllable structure were defined and examined. Coarticulation and resulting assimilatory processes were described as normal articulatory consequences that regularly occur in the speech of individuals. Assimilatory processes were defined according to the type and degree of sound modification. Examples were
given of assimilatory processes in children and of the possible impact these processes could have on articulation test results. The last section, on syllable structure, defined the parts of the syllable and examined the phonotactic rules for syllable structure in General American English. It was suggested that an analysis of syllable structures could provide the clinician with additional knowledge when evaluating individuals with speech sound disorders.

CASE STUDY

The following sample is from Tina, age 3;8.

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>dig</td>
<td>[dɛɡ]</td>
</tr>
<tr>
<td>house</td>
<td>[haʿo]</td>
</tr>
<tr>
<td>knife</td>
<td>[naf]</td>
</tr>
<tr>
<td>duck</td>
<td>[dʊt]</td>
</tr>
<tr>
<td>fan</td>
<td>[vɛn]</td>
</tr>
<tr>
<td>yes</td>
<td>[wɛt]</td>
</tr>
<tr>
<td>boat</td>
<td>[bot]</td>
</tr>
<tr>
<td>cup</td>
<td>[tʊp]</td>
</tr>
<tr>
<td>lamp</td>
<td>[wæmp]</td>
</tr>
<tr>
<td>goat</td>
<td>[dɒt]</td>
</tr>
<tr>
<td>cat</td>
<td>[tæt]</td>
</tr>
<tr>
<td>bath</td>
<td>[bæt]</td>
</tr>
<tr>
<td>red</td>
<td>[led]</td>
</tr>
<tr>
<td>ship</td>
<td>[sɪp]</td>
</tr>
<tr>
<td>ring</td>
<td>[wɪŋ]</td>
</tr>
<tr>
<td>thumb</td>
<td>[dʌm]</td>
</tr>
<tr>
<td>that</td>
<td>[zæt]</td>
</tr>
<tr>
<td>zip</td>
<td>[wɪp]</td>
</tr>
<tr>
<td>key</td>
<td>[di]</td>
</tr>
<tr>
<td>win</td>
<td>[jm]</td>
</tr>
</tbody>
</table>

Compare the typical vowel productions to those noted in the sample according to

1. The portion of the tongue that is involved in the articulation (front, central, back).
2. The tongue’s position relative to the palate (high, mid, low). For example:
   - dig [dɛɡ] a high-front vowel changed to a mid-front vowel

Compare the typical consonant productions to those noted in the sample according to voicing, active/passive articulators, and manner characteristics.

- house [haʿo] a voiceless apico-alveolar (predorsal-alveolar) fricative [s] is changed to a voiceless interdental (apico-dental) fricative [θ]

Continue to analyze the vowel and consonant changes for the other words contained in this sample.

THINK CRITICALLY

1. Some young children have trouble producing [s] and [z]; they substitute [θ] and [ð] for these sounds. Thus, the word Sue would be pronounced [θu] and zoo as [ðu]. Compare the two articulations and see whether you might be able to describe to a child of age 6 what he or she would have to do to change the articulation from [θ] and [ð] to [s] to [z].
2. Children often have trouble with the lip rounding associated with the sh-sounds ([ʃ] and [ʒ]). Which type of vowel contexts would promote lip rounding? Can you find five words that you could use to assist in the lip rounding of [ʃ]?

3. Identify the following assimilation processes according to the parameters: contact versus remote, progressive versus regressive, phonemic assimilation, phonetic similarity, or coalescence.

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
<th>Phonetic Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>news</td>
<td>[nuz]</td>
<td>newspaper [nuspeɹ]</td>
</tr>
<tr>
<td>panty</td>
<td>[pænti]</td>
<td></td>
</tr>
<tr>
<td>did you</td>
<td>[did ju]</td>
<td>[did ʒu]</td>
</tr>
<tr>
<td>incubate</td>
<td>[ɪnkjubeɪt]</td>
<td></td>
</tr>
<tr>
<td>misuse</td>
<td>[mɪʃuz]</td>
<td></td>
</tr>
</tbody>
</table>

4. Identify the following syllable structures according to (a) onset, peak, and coda and (b) closed or open syllables. For example:

- **win.dow** → [wɪn.doʊ]  
  1st syllable: onset-peak-coda, closed syllable  
  2nd syllable: onset-peak, open syllable

- **telephone**
- **wagon**
- **shovel**
- **banana**
- **pajamas**

5. You are testing [k] sounds in the initial, medial, and final positions with a child who is 4 years old with a [t] for [k] substitution. You would like to keep the syllable structure and the stress consistent for all the words used. Therefore, all words should be two syllables in length, stress should be on the same syllable, and syllable structures should be comparable. Find six words that could be used for a 4-year-old child which would test [k] under these conditions.

### TEST YOURSELF

1. Which one of the following is *not* included in the definition of phonetics?
   - a. the production features of speech sounds
   - b. the organizational system of speech sounds
   - c. the transmission properties of speech sounds
   - d. the perceptual bases of speech sounds

2. Which one of the subdivisions of phonetics would examine the frequency, intensity, and duration of speech sounds?
   - a. articulatory phonetics
   - b. acoustic phonetics
   - c. auditory phonetics

3. If you were studying how foreign students perceive various speech sounds of General American English, which branch of phonetics would you be studying?
   - a. articulatory phonetics
   - b. acoustic phonetics
   - c. auditory phonetics
4. If you were studying how the production of [s] varies in General American English versus Spanish, which branch of phonetics would you be studying?
   a. articulatory phonetics
   b. acoustic phonetics
   c. auditory phonetics

5. Vowels are defined as having
   a. no simultaneous vocal fold vibration under normal conditions
   b. articulatory constriction along the sagittal midline of the vocal tract
   c. relatively unimpeded airstream from the vocal folds to the lips
   d. relatively less acoustic intensity than consonants

6. Which consonants are considered to be sonorant consonants?
   a. fricatives and affricates
   b. stop-plosives
   c. all voiced consonants
   d. nasals, liquids, and glides

7. The vowel [i] is described phonetically as a
   a. high-front vowel that is unrounded and lax
   b. mid-front vowel that is unrounded and tense
   c. high-front vowel that is unrounded and tense
   d. high-back vowel that is unrounded and tense

8. The consonant [l] is described phonetically as a
   a. voiced apico-alveolar lateral approximant
   b. voiced coronal-alveolar glide
   c. voiced predorsal-alveolar lateral-approximant
   d. voiced postdorsal-velar lateral-approximant

9. A very young child says [ɡɑɡ] for dog. This is which type of assimilation process?
   a. regressive phonemic assimilation
   b. progressive phonemic assimilation
   c. regressive phonetic similitude
   d. coalescence

10. A young child says [nɔˈni] for noisy. This is which type of assimilation process?
    a. progressive contact phonemic assimilation
    b. regressive contact phonemic assimilation
    c. progressive remote phonemic assimilation
    d. progressive remote phonetic similitude

11. Which one of the following words has an unchecked syllable structure?
    a. cupcake
    b. tomato
    c. jumping
    d. bathtub

12. What is the rhyme of “reached”?
    a. [i]  b. [itʃ]
    c. [itʃt]  d. [it]

FURTHER READINGS

# APPENDIX 2.1 Phonetic Symbols Used in Current Phonetic Transcription Textbooks

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>buy, my</td>
<td>[aɪ] or [aɪ] diphthong</td>
<td>[aɪ]</td>
<td>[aɪ]</td>
<td>[aɪ]</td>
<td>[aɪ]</td>
</tr>
<tr>
<td>cow, loud</td>
<td>[au]</td>
<td>[au]</td>
<td>[au]</td>
<td>[au]</td>
<td>[au]</td>
</tr>
<tr>
<td>boy, hoist</td>
<td>[ɔɪ]</td>
<td>[ɔɪ]</td>
<td>[ɔɪ]</td>
<td>[ɔɪ]</td>
<td>[ɔɪ]</td>
</tr>
<tr>
<td>Word Examples:</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Rhotic Diphthongs</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>fear, beer</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
</tr>
<tr>
<td>bear, mare</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
<td>[ɛr]</td>
</tr>
<tr>
<td>more, floor</td>
<td>[ɔr] or [ɔr] diphthong</td>
<td>[ɔr]</td>
<td>[ɔr]</td>
<td>[ɔr]</td>
<td>[ɔr]</td>
</tr>
<tr>
<td>bar, far</td>
<td>[ar]</td>
<td>[ar]</td>
<td>[ar]</td>
<td>[ar]</td>
<td>[ar]</td>
</tr>
</tbody>
</table>
The concept for this book grew out of a perceived need to create a bridge between theoretical issues in speech-language pathology and their clinical application. The goal for the fifth edition has remained the same: to tie strong academic foundations directly to clinical applications. To this end, every chapter contains suggestions for clinical practice as well as clinical examples and clinical applications. These features will assist the reader in developing an understanding of how basic concepts and theoretical knowledge form the core for clinical decision making in the assessment and remediation of speech disorders. Learning aids located at the end of every chapter include case studies, further readings, critical thinking, and multiple-choice questions.

New to This Edition

The fifth edition of *Articulation and Phonology in Speech Sound Disorders: A Clinical Focus* has several significant changes.

- **A modified title.** The title has changed somewhat to reflect the current use of “speech sound disorders,” which is a new umbrella term that is critical to the field of articulation- and phonemic-based speech disorders.
- **Expanded topics of study.** In our constantly changing population, far more clinicians are dealing directly with individuals with varying dialects and children/adults who speak English as a second language. This edition includes updated research that reflects the changing landscape of the field, including expanded coverage on phoneme information in dialects in the United States as well as the needs of learners of English as a second language.
- **New clinical exercises.** This text includes a number of new, revised, or expanded clinical exercises to allow the student to master theoretical concepts by applying them to real-life situations. The eText edition of this text also contains embedded videos that can be used in conjunction with these clinical exercises, allowing for additional analysis or transcription opportunities.
- **Refined chapter organization.** A new chapter order has been developed so that Chapter 7 on Diagnosis now follows Chapter 6 on Assessment: Appraisal—Collection of Data. This change has been made to aid in the flow of concepts.
- **Categorical learning objectives.** These have been fine-tuned in each chapter so that the reader begins each chapter with a set of easily identifiable goals for his or learning. Each set of learning objectives provide the scaffolding to prepare readers for tests and quizzes and compartmentalize key concepts.
- **Chapter 1.** This has been revised to include a section on phonotactics of General American English. In addition, Chapter 1 reviews the most recent guidelines and definitions of the American Speech-Language-Hearing Association (ASHA) for establishing communication, language, articulation, and what is now considered to be “speech sound disorders.” These definitions provide a more basic foundation for understanding later concepts, and the guidelines will be helpful in later clinical practice.
• Chapter 8. This chapter outlines several new features pertaining to dialects and English as a second language. First, Appalachian and Ozark English are detailed and contrasted. Second, the statistics on limited English proficient students have been updated, and new content on the Filipino/Tagalog phonemic system has been added. It is one of the five most frequently spoken languages by limited English proficient students.

• Chapter 10. The treatment of phonemic-based speech sound disorders has been expanded to include the concepts of the matrix for predicting phonological generalization. This concept is a radical departure from the traditional, phonetic-based treatment approaches and has much to offer children with a severe speech sound disorder.

• Chapter 11. This chapter is devoted to disorders that are traditionally considered speech sound disorders. Although a summary of assessment and remediation procedures appears in the text, each section contains updated references to lead the reader to additional possibilities.

• Updated references. References in each chapter have been updated to reflect the most recent research in the field.

• The new DSM-5. The nomenclature in this book reflects DSM-5 updates.

The eText edition of this text offers interactive digital features, including

• Digital functionality. The digital eText version of this title provides interactive tools to enhance students’ experience with the material, including tools that allow students to search the text, make notes online, print important activities, and bookmark passages for later review.

• Video links in each chapter. Videos have been added to the eText edition. They give students an inside look at the world of communication disorders. These videos, chosen specifically for this text, illustrate critical concepts in easily digestible 2- to 3-minute clips.

Videos in each chapter offer opportunities for students to transcribe words and sounds in children and adults that demonstrate multiple dialects and disorders. Additionally, students are exposed to real-life speech therapy lessons and dynamic interviews with professionals who specialize in articulation and phonology.

• Linked glossary. Key terms throughout the text are linked, giving students one-click access to crucial definitions.

Instructor’s Resource Manual

To help instructors in preparing their courses, we have provided an Instructor’s Resource Manual. This supplement is available online or can be obtained by contacting a Pearson sales representative. To download and print the Instructor’s Resource Manual, go to www.pearsonhighered.com and then click on “Educators.”

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