Introduction to
Speech Sound Disorders
Second Edition

Françoise Brosseau-Lapré, PhD, CCC-SLP
Susan Rvachew, PhD, S-LP(C), ASHA Fellow

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PREFACE

The motivation and inspiration for *Introduction to Speech Sound Disorders* comes from our work as pediatric speech-language pathologists, as instructors and mentors of students in communication sciences and disorders, and as researchers in the assessment and treatment of speech sound disorders. This comprehensive textbook was written for undergraduate students in speech, language, and hearing sciences as well as their instructors. Children with speech sound disorders form the largest part of the speech-language pathologist's caseload in child-focused settings. A course on speech sound disorders is often among the first courses with a clinic focus offered in the curriculum of programs in our discipline. However, this does not mean that speech sound disorders is an easy subject or that treating children with speech sound disorders is easy to do—in fact, phonological development is a complex process, speech sound disorders are varied and challenging, and competent treatment of children requires a broad range of domain-specific and domain-general skills.

With this book, we aimed to introduce undergraduate students to foundational concepts and procedures that will prepare students for graduate-level study of speech sound disorders and early supervised clinical practice with children. The text and associated companion website are intended to support new and experienced instructors as they strive to facilitate novice-level clinical competencies in their speech-language pathology students. The book is organized in a coherent manner to ensure that all new terms are defined. Furthermore, important concepts are reintroduced repeatedly in new contexts to enrich learning. The flow of the chapters was carefully developed to ensure that students can build on previous knowledge and proceed from introduction to practice.

One challenge for instructors of courses on speech sound disorders is the varied range of knowledge that students bring to this course—some will remember all concepts covered in their prerequisite phonetics course and speech and hearing science course, and some students will have forgotten most of the information they learned 1 or 2 years earlier. For this reason, Chapter 1 defines the major concepts and constructs in phonetics and phonology currently framing the study of speech sound disorders in children that we wish every undergraduate student would remember. This chapter can be covered in the course or not—it could be assigned as independent work for students who need to review this material, and the instructor could begin the course with Chapter 2. The second chapter provides a thorough description

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of typical and atypical development of speech perception and speech production in infants, toddlers, preschoolers, and school-age children. Subsequent chapters cover assessment, interpretation and diagnosis, treatment planning, and the selection and implementation of an appropriate intervention. Chapters 6, 7, and 8 describe input-oriented, output-oriented, and phonological approaches. Chapter 9 addresses assessment and treatment for multilingual children with speech sound disorders. Detailed examples, illustrations, tables, and figures increase comprehension throughout each chapter. Key point boxes encourage review of important concepts at the end of each section. In addition, practice activities that students can complete in class individually or in small groups, along with answer keys, are provided for each chapter in the instructor materials to encourage interactive learning. Example syllabi, PowerPoint slides, a test bank, video links, and case studies are also provided in the instructor materials, while quizzes are available in the student materials.

It is our hope that this book will raise the standard for undergraduate instruction in the field of speech sound disorders and that we will inspire students to pursue careers dedicated to improving the communication abilities of children.



Concepts in Phonetics and Phonology

Learning Objectives

- Explain the difference between phonetics and phonology.
- Determine the phonetic repertoire from the transcription of a child's speech sample.
- Evaluate the advantages and disadvantages of phonetic transcription.
- Define categorical perception and differentiate identification and discrimination tasks.
- Define phoneme, allophone, and phonotactic rule.
- Describe the three primary components of prosody and identify words with trochaic and iambic prosodic patterns.
- Diagram the internal components of syllables (onset, nucleus, coda).
- Identify common phonological patterns in child speech.

There is great power in being able to communicate effectively, which requires at a minimum being understood by our communication partner. However, the value of producing speech accurately is often taken for granted. Most of us use speech to communicate without difficulties and do not reflect on the way in which speech sounds are produced and combined to produce language. Speech-language pathologists (SLPs) must be able to describe the child's ability to produce speech sounds clearly, perceive speech sounds accurately, and combine speech sounds into words that other listeners will understand. Although the child's knowledge of these aspects of phonetics and phonology is implicit, the SLP's knowledge must be explicit. That is, the SLP must not only be able to say a word but also must be able to explain why that is the appropriate word to use in that context, describe the sounds that make up the word, and show how those sounds are produced. The first part of this chapter

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presents basic concepts in phonetics, and the second portion focuses on basic concepts in phonology.

1.1 PHONETIC CONCEPTS

Phonetics is concerned with the physical characteristics of speech sounds as produced by the speaker to transmit meaning and as received by the listener to understand what was said (Ohala, 1999). A **phone** is the smallest unit of speech; any sound that is used for speech in any of the languages of the world is a phone. Phonetics is therefore the study of speech sounds, or the study of phones. By convention, speech sounds that are produced by a speaker (phones) are represented between square brackets [ ]. These square brackets are differentiated from slashes / /, which are used to identify **phonemes**, a more abstract representation of speech sounds that will be discussed in Section 1.4.

Different tools and scientific specializations are required to study speech sounds as they are produced, as they are transmitted through the air, and as they are received by the listener (Pierrehumbert, 2003). **Articulatory phonetics** is concerned with the way that speech sounds are produced with the articulators. **Articulators** are the parts of the human body involved in speech production, as will be described further in this chapter. **Acoustic phonetics** is the study of speech sounds as transmitted through the air in the form of sound waves. Acoustic phonetics may also be concerned with the relationship between the acoustic properties of sound waves and the way that the listener perceives different speech sounds. This process is called **phonetic encoding**. Figure 1–1 presents a simple schema of the speaking and listening process as related to these branches of phonetics. In the figure, the speaker wants to transmit a message about the cat. In order to do so, the speaker must access a semantic representation ("cat") that contains information about the meaning of this word and a phonological representation (/kæt/), shown in the figure as a series of phonemes for convenience but actually containing more abstract information about the phonology of this word, as will be discussed in more detail later in this chapter. Once having accessed these abstract

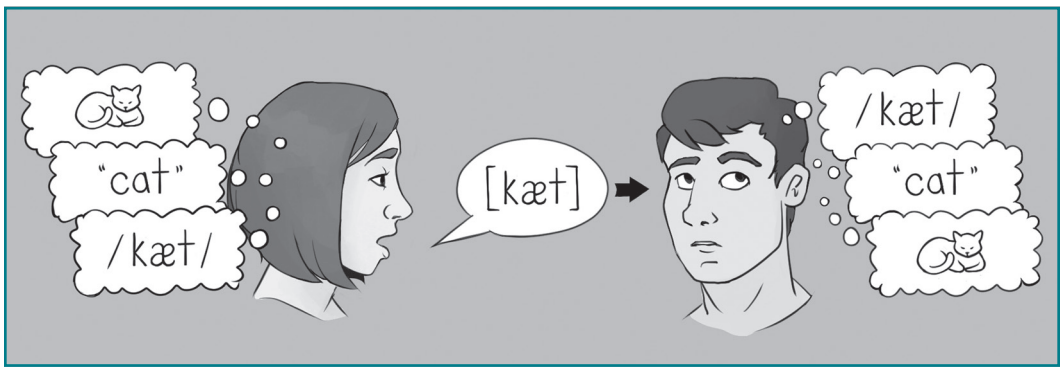


Figure 1–1. *Phonetics is concerned with the production, transmission, and encoding of speech sounds (see text for explanation). Used with permission of Olen Bowen-Graham.*

representations, the speaker retrieves and sequences **articulatory-phonetic representations** [k], [æ], [t] and sends the corresponding motor commands to the articulators to produce the word. The acoustic signal is transmitted through air and reaches the listener's outer ears, the eardrum vibrates, the vibrations are carried through the middle ear to the inner ear, and the cochlea provides auditory input to the central auditory system in the brain. The listener must now reverse the speaker's process to abstract the sequence of sounds ([kæt]), this time in the form of an **acoustic-phonetic representation**, and link the result to the corresponding phonological (/kæt/) and semantic ("cat") representations to understand the speaker's intended meaning.

1.1.1 Articulatory Phonetics

Articulatory phonetics focuses on how speech sounds are produced and how these sounds can be classified based on aspects of their production. **Articulation** usually refers more broadly to the general production of speech by a talker, such as whether the individual articulates speech sounds clearly and precisely or mumbles.

Three physiological subsystems contribute to speech production: the respiratory system, the phonatory system, and the articulatory/resonating system. Figure 1–2 shows a simplified schema of these three subsystems. First, the respiratory system provides airflow, the required energy source to produce speech sounds. Second, the larynx (also called "voice box") is the main component of the phonatory system. The vocal folds are situated in the larynx and vibrate very rapidly, setting the airflow into vibration, creating sound. Third, the articulatory/resonating system is composed of the pharyngeal, oral, and nasal cavities. These three cavities form the vocal tract. The cavities of the vocal tract resonate the vibrating sound waves as they pass through from the larynx to the outside air. Specifically, when the speaker varies the size and shape of the vocal tract, the sound waves are modified to create all the vowels and consonants (Kent, 1997). The human vocal tract is shown in Figure 1–3. The shape and size of the vocal tract are primarily modified by movements of the tongue, although the lips, teeth, hard palate, and velum also impact speech production.

Practice 1–1



Articulators are the parts of the body that you move to produce speech. Produce the words "key," "me," "see," "bee," and "boot." Notice that changes in the larynx and in the manner of airflow through the vocal tract also result in different speech sounds. Try to sense how changes in the position of the tongue and the lips impact speech production. The shape of your lips when saying [b] in "bee" and "boot" was probably different because of **coarticulation**.

While producing speech, the stages of respiration, phonation, and articulation do not each have a clear and distinct beginning. Speech is continuous, and the articulators are in constant motion when the air is flowing. **Coarticulation** occurs when articulators are moving at the same time to produce two different but overlapping phones. In the words "bee" and "sheep," the lips will be spread even before speaking, whereas the lips will be rounded at

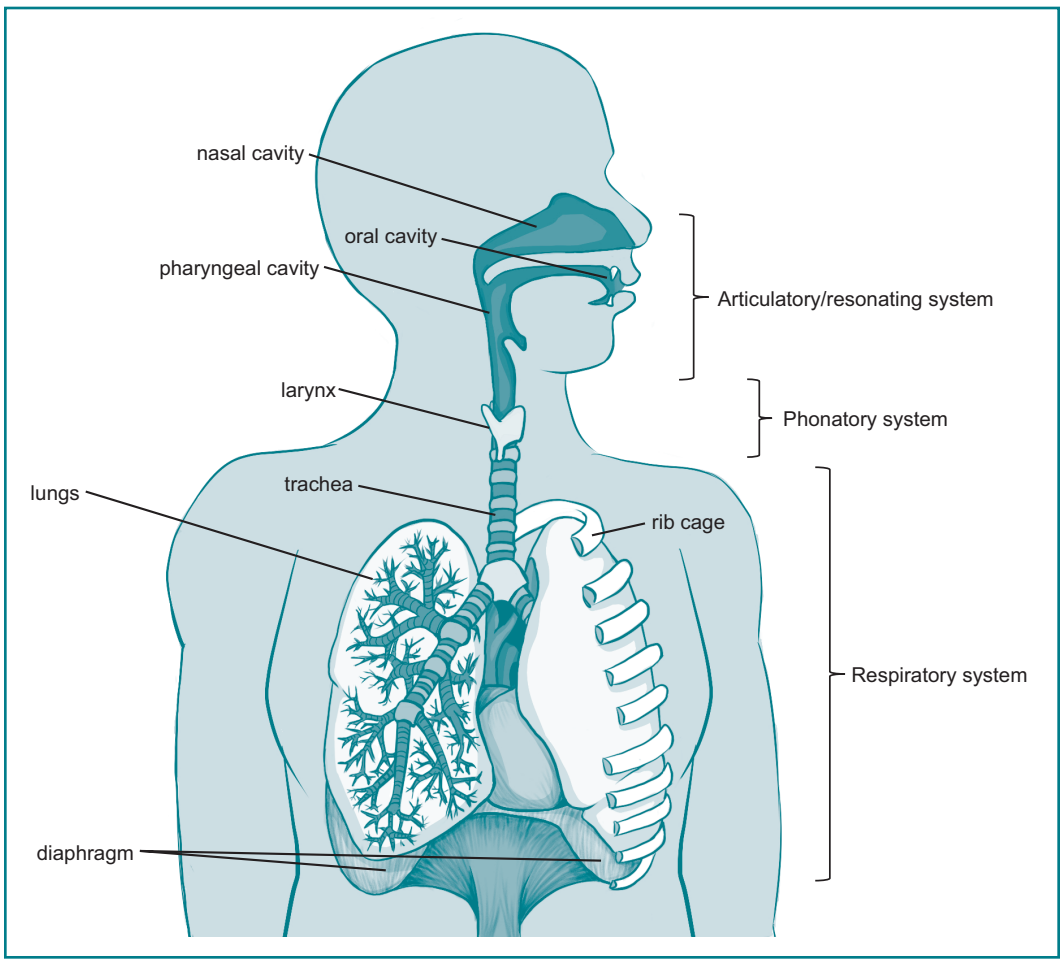


Figure 1–2. *Simplified schema of the speech production system. Used with permission of Olen Bowen-Graham.*

the beginning of the words "boot" and "shoe," anticipating the upcoming vowels in these words. **Assimilation** refers to the articulatory changes that occur when one phone becomes more like an adjacent (neighboring) phone or another phone in the word that is not directly adjacent. Assimilation is the reason that the word "pumpkin" is often pronounced [ˈpʌŋkɪn] and not the way it is spelled. This is because the [k] at the beginning of the second syllable makes it easier to end the first syllable with the tongue raised at the back of the mouth. In normal speech production, the movement of the articulators will be modified depending on preceding or following phones to reduce effort and increase the efficiency of speech production. Therefore, coarticulation and assimilation occur very frequently in adult and child speech.

Given the importance of articulatory phonetics to the competent practice of speech-language pathology, a brief overview of the articulatory characteristics of English vowels and consonants

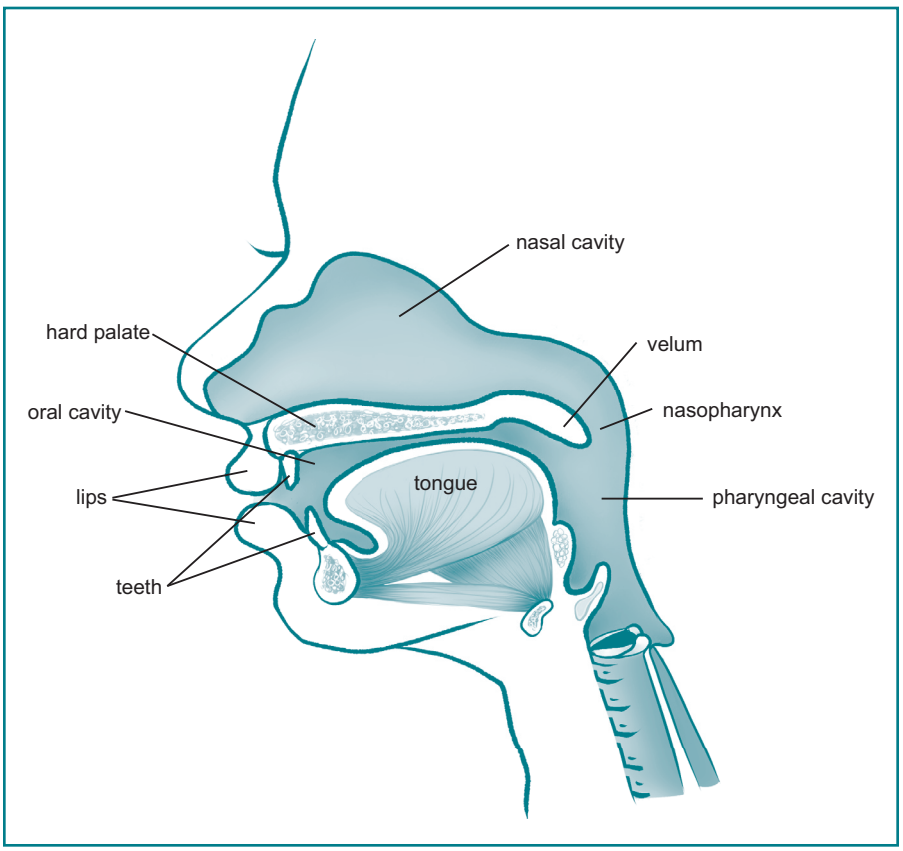


Figure 1–3. *The adult human vocal tract with articulators labeled. Used with permission of Olen Bowen-Graham.*

is provided here. Consultation with a detailed phonetics text is advised for all SLPs, however (e.g., Shriberg et al., 2025; Small & Lee, 2025). Phone classes are first determined by the **manner of articulation**, that is, the manner or type of constriction that is made in the vocal tract. Phone classes are further distinguished by **place of articulation**, that is, the location of the constriction in the vocal tract. Finally, phones may be **voiced** or **voiceless**, in other words, produced with or without vibration of the vocal folds.

Beginning with the manner classes, summarized in Table 1–1, **vowels** are produced with an open vocal tract. Vocal fold vibration is usually maintained throughout the production of the sound, but otherwise, the airflow through the vocal folds to the lips is mostly unblocked. In English, the airflow is directed through the oral cavity during most vowels, although there may sometimes be nasal airflow due to assimilation. Oral airflow is accomplished by raising the velum to close the passage between the pharyngeal and nasal cavities. This passage, shown in Figure 1–3, is called the **nasopharynx** or the velopharyngeal port. The position of the lips impacts the length of the vocal tract—retracting the lips shortens the tract, while rounding and protruding

them lengthens the tract. The position of the tongue will modify the size of the pharyngeal cavity (shown in Figure 1–3), such that the pharyngeal cavity will enlarge when the tongue is moved forward and will diminish when the tongue is moved toward the rear of the mouth. Each shape of the vocal tract will have different resonance characteristics, resulting in the production of a different vowel. For example, the vowel in "bee" is produced with a constriction near the front of the mouth, which shapes the vocal tract into two parts—a large back cavity joined to a small front cavity. In contrast, the vowel in the word "boot" is produced with a constriction near the back of the mouth so that the front and back cavities are both large. The front cavity can be made larger still by lowering the jaw, as in words like "bad" and "bought." When the configuration of the vocal tract changes during the production of the vowel, there is a change in the resonance quality within the same

Table 1–1. *Articulatory Characteristics of Major Classes of Phones in English by Manner of Articulation*

Manner Class	Articulatory Characteristic	English Phones
Vowels	Transmit air through vibrating vocal folds and open vocal tract; constrictions made by movements of the tongue do not impede airflow between vocal folds and lips.	Monophthongs: [i,ɪ,ʊ,u,e,o,ɛ,ə,ʌ,ɔ,æ,a,ɑ] Diphthongs: [aɪ,aʊ,oɪ,oʊ,eɪ] Rhotics: [ɚ,ɝ]
Consonants	Produced with partial or complete closure of the vocal tract and with the vocal folds open or vibrating.	Voiceless: [p,t,k,ʔ,f,θ,s,ʃ,tʃ,h] Voiced: [b,d,g,m,n,ŋ,v,ð,z,ʒ,dʒ,w,j,ɹ,l]
Plosives (stops)	Briefly close vocal tract to build up air pressure behind the constriction; then release the pressure in the oral cavity.	[p,b,t,d,k,g,ʔ]
Nasals	Close oral cavity but permit airflow through nasal cavity.	[m,n,ŋ]
Fricatives	Close nasopharynx forcing air through narrow constriction in the oral cavity, creating turbulent air flow.	[f,v,θ,ð,s,z,ʃ,ʒ,h]
Affricates	Rapidly release a stop into a narrow constriction that permits a prolonged fricative sound.	[tʃ,dʒ]
Approximants	Approximate the articulators more closely than in the case of vowels but without creating a constriction narrow enough to produce turbulent noise.	Glides: [w,j] Liquids: [ɹ,l]