CHAPTER 8 Clinical Phonetics: Transcription of Speech Sound Disorders

Learning Objectives

After reading this chapter you will be able to:

1. Describe and transcribe substitution, syllable structure, and assimilation phonological processes.
2. Perform narrow (allophonic) transcription of disordered speech utilizing appropriate diacritics and non-English IPA symbols.
3. List and discuss factors you need to consider to ensure accuracy in the practice of phonetic transcription.

The purpose of this chapter is to introduce you to the application of phonetics in a clinical setting. The focus of the book thus far has been to acquaint you with the process of transcribing typically developing speech patterns (at least what is considered to be typical in Standard American English). As future clinicians, you will be faced with the task of evaluating a client's speech behavior to determine whether that client is in need of intervention. Therefore, you should have an understanding of the process of typical speech-language development. In addition, you will need to know how to evaluate your client to determine whether there is a problem with speech-language production. Ultimately, if the client is in need of intervention, you will need to know how to generate a plan for treatment. These topics will be briefly introduced in this chapter. A thorough discussion of these topics is beyond the scope of this text, however. This material will be covered in other courses in your curriculum that focus on phonological development and disorders.

The terms **articulation disorder** and **phonological disorder** both have been used by hearing and speech professionals over the years to characterize a client who experiences difficulty with speech sound production. The term *articulation disorder* usually refers to a person who has a problem producing only a few phonemes, or whose speech errors are tied to the motoric aspects of speech production. *Phonological disorder,* on the other hand, generally refers to an individual who has difficulty with the sound system of a language and utilizing the rules that govern the combination and order of phonemes in words (**Elbert & Gierut, 1986**). More recently, professionals have adopted the use of the term **speech sound disorder** to include *all* disorders involving speech sound production. In this text, the term *speech sound disorder* will be used in this manner.

Speech-language pathologists typically administer a battery of tests to assess speech production ability. Articulation tests attempt to systematically identify the correct or incorrect usage of phonemes in a child's repertoire by having the child name objects, or pictures of objects, with which they are familiar. Consonants and consonant clusters (and sometimes vowels) are evaluated in various positions of words to determine whether the individual phonemes of English can be produced correctly in differing phonetic contexts in an age-appropriate manner. Spontaneous, connected speech samples are elicited by engaging the client in conversation about hobbies, favorite activities, or a favorite TV show or movie. With very young children, spontaneous speech samples may be obtained while children describe pictures in a book or while they play with toys. The spontaneous, connected speech samples are transcribed and analyzed for age-appropriate behavior. Once testing is completed, it is possible to analyze a client's speech productions in utterances of varying lengths (i.e., syllables, words, phrases, and sentences). The results of testing will ultimately help determine the therapeutic approach selected.

Articulation tests are usually scored on a phoneme-by-phoneme basis to determine whether the client displays any speech errors, or **misarticulations** . The errors are then categorized as errors of *substitution, omission, distortion,* and/or *addition.* An example of a **substitution** would be producing the word “hello” as /hɛwoʊ/, substituting /w/ for /l/; this would be written as a w/l substitution. An example of an **omission** would be producing the word “big” as /bɪ/, leaving off the final /g/. A **distortion** would involve the production of an allophone of the intended phoneme. If a client produced the word “sit” with a *dentalized* /s/, that is [s̪ɪt] (which sounds somewhat like /θɪt/), it would be considered a distortion. An **addition** error involves the insertion of an extra phoneme in a word, as in /dɑgə/ for “dog.” Analyzing speech sound errors on a phoneme-by-phoneme basis may be appropriate when a child displays only a few phonemic errors. Should a child have several speech sound errors, other methods of analysis may prove to be more favorable. One such method would involve analyzing speech sound errors in terms of the *phonological processes* the child is exhibiting.

Phonological Processes

Over the past 80 years, many large-scale studies attempted to delineate the order of phoneme acquisition in typically developing children (**Poole, 1934**; **Prather, Hedrick, & Kern, 1975**; **Sander, 1972**; **Smit, Hand, Freilinger, Bernthal, & Bird, 1990**; **Templin, 1957**; **Wellman, Case, Mengert, & Bradbury, 1931**). These developmental studies all examined a large number of young children in order to answer a basic question: "What is the age at which children typically develop and master individual English speech sounds?"

When comparing the findings from these different developmental studies, it becomes apparent that the ages cited for typical development of individual phonemes vary. For instance, according to **Sander (1972)**, /r/ is mastered by the age of 6;0 (meaning 6 years; 0 months). However, the research of **Smit et al. (1990)** indicates that /r/ is not accurately produced until the age of 8;0. The disparity in findings between developmental studies is common and may be due to several factors including (1) differences in the socioeconomic status of the children being examined, (2) differences in the number of subjects being studied, and (3) the way in which a speech sample is obtained by the experimenter. For example, children's speech productions may be obtained spontaneously (in response to questions asked by the experimenter or by naming pictures or objects) or by imitating words spoken by the examiner.

Also, these older developmental studies are problematic in that if a child produced a sound correctly by naming a picture or object, it does not guarantee that the child can produce the same sound correctly in spontaneous speech. Also, determining a child's phonetic inventory to define the age at which individual speech sounds are developed is not the same thing as determining the status of the child's developing phonological rule system (**Bauman-Waengler, 2012**).

In analyzing typical phonological development in children, it may be more advantageous to look at the underlying patterns or processes children use in the production of speech sounds. **Stampe (1969)** proposed a theory of **natural phonology** that supports the idea that young children are born with innate processes necessary for the production of speech. Because young children are not capable of producing adult speech patterns, they often simplify the adult form. These simplifications are termed **phonological processes** . As children mature, they learn to suppress these processes. When this happens, children then are able to produce the more appropriate adult form of the articulation. If only segmental development is considered, a child who is not capable of producing a certain phoneme may be viewed as not having that sound in her phonetic inventory. When viewed in terms of phonological processes, the child may be using a phonological process that results in the

deletion or modification of that sound. Adults may have difficulty understanding the speech patterns of a young child with whom they are not familiar. This is often due not to missing sounds in the child's phonetic repertoire, but is most likely due to the fact that adults are not accustomed to the simplifications, or processes, being produced by the child (**Hodson & Paden, 1991**).

Many phonological processes are found to occur in the speech patterns of typically developing children. These processes can be divided into three general categories: **syllable structure processes** , **substitution processes** , and **assimilatory processes** (**Ingram, 1976**). Some of the more common processes associated with these subdivisions are presented in the following sections and are summarized in **Table 8.1** . Developmental data (the age when specific processes are suppressed) are from **Grunwell (1987)**. Make sure to pay particular attention to the examples given *in terms of their phonetic transcription.*

These processes, as a group, affect the production of syllables so that they are simplified, usually into a consonant–vowel (CV) pattern (**Ingram, 1976**). CV patterns are among the first syllable types to be used in the speech patterns of developing infants.

Weak Syllable Deletion

Weak syllable deletion , or simply *syllable deletion,* is a phonological process that involves the omission of an unstressed (weak) syllable either preceding or following a stressed syllable. This process may persist until a child is nearly 4;0. It is also common in some adult productions (**Hodson & Paden, 1991**). Examples include:

telephone → /tɛfon/ probably → /prɑblɪ/ or /prɑlɪ/

tomato → /meɪro/ above → /bʌv/

TABLE 8.1

Examples of Some Common Phonological Processes of Children.

Syllable Structure Processes	Example Word	Production
Weak syllable deletion	surprise	/praɪz/
Final consonant deletion	look	/lʊ/
Reduplication	baby	/bibi/
Cluster reduction	clean	/kin/
Substitution Processes		
Stopping	sand	/tænd/
Fronting	kite	/taɪt/
Deaffrication	jump	/ʒʌmp/
Gliding	lake	/weɪk/
Vocalization	help	/hɛʊp/
Assimilatory Processes		
Labial assimilation	put	/pʊp/
Alveolar assimilation	mine	/naɪn/
Velar assimilation	garden	/gɑrgən/
Prevocalic voicing	cop	/gɑp/
Devoicing	ride	/raɪt/

EXERCISE 8.1

Indicate with an “X” examples of weak syllable deletion.

Examples:

	Intended Word	Transcription
	please	/piz/
X	elephant	/ɛfənt/

_____	1. scissors	/sɪ/
_____	2. baby	/beɪ/
_____	3. banana	/nænə/
_____	4. mama	/mə/
_____	5. today	/deɪ/
_____	6. milk	/mɪk/
_____	7. mitten	/mɪt/
_____	8. lady	/di/

Final consonant deletion effectively reduces a syllable to a CV pattern, that is, to an open syllable. Typically developing children begin to use most consonants in the coda position of words by the time they reach the age of 3;0. This process is generally suppressed completely by age 3;6. Examples include:

bake → /beɪ/ mouse → /maʊ/ cat → /kæ/

EXERCISE 8.2

Which of the following words could be affected by final consonant deletion? Indicate those words with an "X" and then transcribe the word in IPA, applying the process of final consonant deletion.

Examples:

shoe		
foot	X	/fʊ/
away	1.	
cup	2.	
through	3.	
bread	4.	
say	5.	
phone	6.	
black	7.	
stop	8.	

Reduplication

Reduplication involves the repetition of a syllable of a word. Total reduplication involves a repetition of an entire syllable, as in “mommy” → /mɑmɑ/. Partial reduplication involves repetition of just a consonant or vowel, as in “bottle” → /bɑdɑ/ **(Lowe, 1996)**. Reduplication is common in the early speech development of some children. It is generally suppressed before 2;6. Other examples include:

daddy → /dædæ/ or /dɑdɑ/ doggy → /dɑgɑ/

movie → /mumu/ baby → /bibi/

EXERCISE 8.3

For the words given, indicate with an “X” the transcriptions that indicate the process of reduplication.

_____1. wagon	/wægə/	_____4. pencil	/pɛpɛ/
_____2. children	/dɪdɪ/	_____5. water	/wɑwɑ/
_____3. jacket	/dækɪ/	_____6. yellow	/jɛdo/

Cluster reduction results in the deletion of a consonant from a consonant cluster (adjacent consonants in the same syllable). If the cluster contains three consonants, one or two of the consonants may be deleted, as in "spray" → /preɪ/ or /reɪ/. Cluster reduction in typically developing children may persist until 4;0 or 5;0 (**Smit, 1993**). Other examples include:

snow → /noʊ/ play → /peɪ/ stripe → /traɪp/, /taɪp/, or /raɪp/

EXERCISE 8.4

For the words given, indicate with an "X" the transcriptions that indicate the process of cluster reduction.

_____1. blue	/bu/	_____5. stop	/tɑp/
_____2. spot	/spɑ/	_____6. crayon	/keɪɑn/
_____3. path	/pæt/	_____7. milk	/mɪk/
_____4. spring	/rɪŋ/	_____8. wish	/wɪs/

Substitution processes involve the replacement of one class of phonemes for another. For instance, the phonological process known as **stopping** involves the substitution of a stop for a fricative or affricate. Similarly, the process known as **fronting** involves the substitution of an alveolar phoneme for a velar or palatal articulation.

Stopping

As just mentioned, stopping involves the substitution of a stop for a fricative or an affricate. This is a commonly occurring process because stops are acquired before most fricatives in typically developing speech. The substitution is usually for a stop produced with the same, or similar, place of articulation:

Fricative/Affricate	Substituted Stop	Fricative	Substituted Stop
/s, ʃ, tʃ, θ/ →	/t/	/f/ →	/p/
/z, ʒ, dʒ, ð/ →	/d/	/v/ →	/b/

Sometimes children produce a stop for a fricative or affricate along with a change in voicing, for example, /sɪp/ → /dɪp/. The change in voicing is a phonological process called *prevocalic voicing* and will be discussed in more detail in the following text. Stopping of fricatives and affricates may continue for some phonemes until 4;0 or 5;0. Examples include:

sake → /teɪk/	(voiceless alveolar fricative → voiceless alveolar stop)
zoo → /du/	(voiced alveolar fricative → voiced alveolar stop)
fat → /pæt/	(voiceless labiodental fricative → voiceless bilabial stop)
ship → /tɪp/	(voiceless palatal fricative → voiceless alveolar stop)

The last example (“ship”) demonstrates not only stopping, but also a more forward place of production of the affected consonant phoneme. That is, place of production shifted from palatal to alveolar. This process is called *fronting* and is discussed in the next section.

EXERCISE 8.5

Place an “X” in front of the following transcriptions that represent an example of stopping.

_____1. shoe → /zu/	_____5. comb → /goʊm/
_____2. thank → /tæŋk/	_____6. summer → /tʌmə˞/
_____3. raisin → /weɪzn̩/	_____7. yellow → /wɛloʊ/
_____4. march → /mɑrt/	_____8. shop → /tɑp/

Fronting

It is common for young children to substitute velar and palatal consonants with an alveolar place of articulation. This substitution process is commonly referred to as *fronting.* The alveolar substitutions typical of fronting are given below:

Velar		Alveolar	Palatal		Alveolar
/k/	→	/t/	/ʃ/	→	/s/
/g/	→	/d/	/tʃ/	→	/ts/
/ŋ/	→	/n/	/ʒ/	→	/z/
			/dʒ/	→	/dz/

Fronting usually disappears in typically developing children's speech by the age of 2;6 to 3;0. Examples include:

cat → /tæt/ (voiceless velar stop → voiceless alveolar stop)

wash → /wɑs/ (voiceless palatal fricative → voiceless alveolar fricative)

juice → /dzus/ (voiced palatal affricate → voiced alveolar affricate)

mash → /mæt/ (voiceless palatal fricative → voiceless alveolar stop)

The affricate /dz/ (in /dzus/) is not a phoneme of English, but may occur in disordered speech patterns. Also note that the pronunciation of /mæt/ for "mash" displays both fronting and stopping of the final phoneme:

mash /mæʃ/ → /mæs/ (fronting, i.e., palatal /ʃ/ → alveolar /s/)

and

/mæs/ → /mæt/ (stopping, i.e., fricative /s/ → stop /t/)

EXERCISE 8.6

Place an “X” in front of the following transcriptions that are indicative of fronting.

_____1. candy → /gændɪ/	_____5. brush → /brʌs/
_____2. rake → /reɪt/	_____6. paper → /teɪpə˞/
_____3. bring → /brɪn/	_____7. goose → /dus/
_____4. clown → /kraʊn/	_____8. sing → /tɪŋ/

Deaffrication

Deaffrication occurs when a child substitutes a fricative for an affricate. Examples include:

chip → /ʃɪp/ (voiceless, palatal affricate → voiceless, palatal fricative)

juice → /ʒus/ (voiced, palatal affricate → voiced, palatal fricative)

ledge → /lɛz/ (voiced, palatal affricate → voiced, alveolar fricative)

The last example, ledge → /lɛz/, demonstrates two substitution processes: (1) deaffrication and (2) fronting. In addition to the substitution of the fricative for an affricate, that is, /dʒ/ → /ʒ/ (deaffrication), the palatal /ʒ/ is produced as the alveolar /z/ (fronting).

Suppose a child produced the word "June" as /dun/. How many substitution processes are occurring in this production? If you answered "three," you are correct. A change from /dʒ → d/ involves deaffrication, fronting, and stopping. Study this example to make sure you understand the three processes that are occurring:

June /dʒun/ → /ʒun/ (deaffrication)

/ʒun/ → /zun/ (fronting)

/zun/ → /dun/ (stopping)

EXERCISE 8.7

Place an "X" in front of the following transcriptions that are indicative of deaffrication.

_____ 1. shake → /seɪk/	_____ 5. gem → /tʃɛm/
_____ 2. choose → /tsuz/	_____ 6. witch → /wɪʃ/
_____ 3. Jack → /ʒæk/	_____ 7. chalk → /sɔk/
_____ 4. mesh → /mɛs/	_____ 8. chase → /ʃeɪs/

Gliding is a substitution process that involves the substitution of the glides /w/ or /j/ for the liquids /l/ and /r/. Gliding is common in children displaying typical developmental patterns as well as in those with phonological disorders. This process is overused in some cartoons to depict characters with disordered speech, for example, /wæbɪt/ for "rabbit." This phonological process is seen in children as young as 2;0, and may persist until a child is 5;0 or older. Examples include:

red → /wɛd/	blue → /bwu/
like → /jaɪk/	grow → /gwoʊ/

EXERCISE 8.8

Place an "X" in front of the following transcriptions that are indicative of gliding.

_____1. soap → /woʊp/	_____5. rice → /laɪs/
_____2. leaf → /wif/	_____6. yes → /wɛs/
_____3. ring → /jɪŋ/	_____7. grow → /gwoʊ/
_____4. lazy → /jeɪzɪ/	_____8. free → /fli/

Vocalization involves the substitution of a vowel for postvocalic /r/ or /l/, including syllabic /l/. The vowels commonly substituted include /ʊ/, /ɔ/, and /o/ (or /oʊ/). Vocalization also refers to *derhotacization* of the central rhotic vowels /ɚ/ and /ɝ/ (as discussed in **Chapter 4**) as well as derhotacization of postvocalic /r/ when it loses its r-coloring due to a vowel substitution. (Recall from **Chapter 5** that some speakers from the South and East derhotacize postvocalic /r/—"here" /hɪə/ and "square" /skwɛə/.) Vocalization of postvocalic /r/ and the rhotic vowels will be discussed in more detail in relation to dialects in **Chapter 9** . Some examples of vocalization include:

	Substitution
tiger → /tigʊ/	ʊ/ɚ *
turn → /tɔn/	ɔ/ɝ *
third → /θʊd/	ʊ/ɝ *
bear → /bɛʊ/	ʊ/r *
help → /hɛʊp/	ʊ/l
fell → /fɛo/	o/l
little → /wɪro/ or /wɪrol/	o/l̩ *or* ol/l̩
*Examples of derhotacization.	

Note that the last example (little → /wɪro/) demonstrates both vocalization of the final /l/ *and* gliding of the initial /l/.

Some children may still produce the final /l/ following the vowel as in /wɪrol/. You will have to listen carefully to determine if the /l/ was maintained in the child's articulation. This is a production especially prone to transcription error (see **Louko & Edwards, 2001**).

EXERCISE 8.9

Place an “X” in front of the transcriptions that are indicative of *vocalization.*

_____1. middle → /mɪdo/	_____5. belt → /bɛʊt/
_____2. answer → /ænsʊ/	_____6. telephone → /tɛfon/
_____3. work → /wɔk/	_____7. curtain → /kʊʔn̩/
_____4. could → /kɔd/	_____8. bark → /bɑk/

Assimilatory processes involve an alteration in phoneme production due to phonetic environment (see **Chapter 7** for a review of assimilation). Assimilatory processes involve labial, velar, nasal, and/or voicing assimilation. The assimilation in any of these instances may be either progressive or regressive. These processes are not present in all typically developing children. When they occur, they usually disappear before the age of 3. The assimilation processes associated with consonant production are also referred to as *consonant harmony*.

Labial assimilation occurs when a non-labial phoneme is produced with a labial place of articulation. This is due to the presence of a labial phoneme elsewhere in the word. For example:

book → /bʊp/	(progressive assimilation)

(In this case, the non-labial /k/ is produced with a labial articulation due to the presence of the /b/ phoneme at the beginning of the word.)

mad → /mæb/	(progressive assimilation)
cap → /pæp/	(regressive assimilation)
swing → /ɸwɪŋ/	(regressive assimilation)

/ɸ/ is a voiceless bilabial fricative, a phoneme found on the IPA chart, but not common to English. It is found in African languages such as Hausa and Ewe. To produce /ɸ/, place your lips together and blow out so air escapes (but don't whistle). Pretend you are softly blowing out a candle. (Don't push air from the glottis, otherwise you will produce /h/.) Another way to produce /ɸ/ is to say the word "whew." When producing the word "swing" as /ɸwɪŋ/, the alveolar fricative /s/ undergoes labial assimilation due to the presence of /w/.

EXERCISE 8.10

Place an "X" in front of the words that correctly indicate the process of labial assimilation.

_____1. pie → /baɪ/	_____5. boat → /boʊp/
_____2. tap → /pæp/	_____6. train → /preɪn/
_____3. lip → /lɪb/	_____7. cause → /pɔz/
_____4. numb → /mʌm/	_____8. big → /bɪb/

Alveolar assimilation occurs when a non-alveolar phoneme is produced with an alveolar place of articulation due to the presence of an alveolar phoneme elsewhere in the word. Examples include:

time → /taɪn/	(progressive assimilation)
shut → /sʌt/	(regressive assimilation)
bat → /dæt/	(regressive assimilation)

EXERCISE 8.11

Place an "X" in front of the words that correctly indicate the process of alveolar assimilation.

_____1. pat → /tæt/	_____5. knife → /naɪs/
_____2. short → /sɔrt/	_____6. that → /zæt/
_____3. Tom → /mɔm/	_____7. phone → /soʊn/
_____4. tune → /dun/	_____8. vat → /væp/

It is not always easy to determine whether a child's speech productions are a result of assimilation or of a substitution process. For instance, a child who produces the word "cat" as /tæt/ might be demonstrating alveolar assimilation or may be fronting the /k/ phoneme. To determine whether a child is using assimilatory processes, it is necessary to evaluate several productions from the child's speech sample. In this manner, a particular phonological pattern may emerge. Examine two different children's productions of the following six words. What phonological pattern do you see?

Child #1		Child #2	
kite	/taɪt/	kite	/taɪt/
dog	/dɑd/	dog	/dɑd/
should	/sʊd/	should	/sʊd/
push	/pʊs/	push	/pʊʃ/
go	/doʊ/	go	/goʊ/
bike	/baɪt/	bike	/baɪk/

Child #1's productions of "kite," "dog," and "should" could be suggestive of either alveolar assimilation or fronting. However, productions of the words "push," "go," and "bike" reflect only fronting because no alveolar phonemes exist in these words. Therefore, this child appears to be demonstrating the process of fronting. Contrast this pattern with child #2, who mispronounces only the first three words, words with alveolar phonemes. Child #2 appears to be demonstrating alveolar assimilation.

Velar assimilation occurs when a non-velar phoneme is produced with a velar place of articulation due to the presence of a velar phoneme elsewhere in the word. Examples include:

cup → /kʌk/	(progressive assimilation)
gone → /gɔŋ/	(progressive assimilation)
take → /keɪk/	(regressive assimilation)

EXERCISE 8.12

Place an "X" in front of the words that correctly indicate the process of velar assimilation.

_____1. turkey → /kɝkɪ/	_____5. bang → /gæŋ/
_____2. kill → /gɪl/	_____6. shook → /ʃʊg/
_____3. grass → /kræs/	_____7. cap → /kæk/
_____4. fake → /keɪk/	_____8. brag → /græg/

Voicing Assimilation

There are two types of voicing assimilation. The first type, **prevocalic voicing** , involves voicing of a normally unvoiced consonant. This occurs when the consonant precedes the nucleus of a syllable. That is, the unvoiced consonant assimilates to the (voiced) nucleus. Examples include:

pig → /bɪg/	(regressive assimilation)
cup → /gʌp/	(regressive assimilation)

Another type of voicing assimilation involves the **devoicing** of syllable-final voiced phonemes that either precede a pause or silence between words, or occur at the end of an utterance. That is, the final phoneme "assimilates to the silence" following the word (**Ingram, 1976**, p. 35). Examples include:

bad → /bæt/	(regressive assimilation)
hose → /hos/	(regressive assimilation)

EXERCISE 8.13

Indicate whether the transcriptions of the following words involve prevocalic voicing (P) or devoicing (D). Write P or D in the blanks. If neither process is demonstrated, leave the item blank.

_____1. pear → /bɛr/	_____5. gone → /kɔn/
_____2. led → /lɛt/	_____6. flag → /flæk/
_____3. fair → /vɛr/	_____7. shoe → /ʒu/
_____4. card → /kɑrt/	_____8. chair → /ʃɛr/

Complete Assignment 8-1 .

Not all of the processes outlined previously necessarily occur in the speech patterns of all typically developing children. The processes that are most common in typical children's speech patterns include weak syllable deletion, final consonant deletion, gliding, and cluster

reduction (**Stoel-Gammon & Dunn, 1985**). Also, suppression of a particular process does not happen all at once. Suppression may initially occur for only certain phonemes in a class. For instance, children who demonstrate stopping may suppress the process for /f/ and /s/ before they suppress it for the fricatives /v, z, ʃ, ð, and θ/ and also for the affricates /tʃ/ and /dʒ/ (**Grunwell, 1987**).

Suppose you just evaluated a 7-year-old child using a picture-naming task, and you transcribed the following responses for seven of the words presented:

Picture	Child's Production	Picture	Child's Production
stove	/toʊb/	zipper	/dɪpʊ/
bird	/bʊd/	blue	/bu/
bath	/bæt/	drum	/dʌm/
sun	/tʌn/		

A phoneme-by-phoneme analysis would reveal several errors, including the following:

omission	/s/	(stove)
	/l/	(blue)
	/r/	(drum)

substitution	d/z	(zipper)	ʊ/ə˞	(zipper)
	t/θ	(bath)	ʊ/ɜ˞	(bird)
	t/s	(sun)	b/v	(stove)
distortions	none			
additions	none			

Because there are several speech sound errors present, a clearer picture of this child's phonological system may emerge if the speech productions are scrutinized in terms of phonological processes the child is demonstrating:

Picture	Child's Production	Phonemic Substitution	Phonemic Process(es)
stove	/toʊb/	st → t; v → b	cluster reduction; stopping
bird	/bʊd/	ɝ → ʊ	vocalization
bath	/bæt/	θ → t	stopping
sun	/tʌn/	s → t	stopping
zipper	/dɪpʊ/	z → d; ɚ → ʊ	stopping; vocalization
blue	/bu/	bl → b	cluster reduction
drum	/dʌm/	dr → d	cluster reduction

Upon analysis of the child's responses, it now becomes evident that the child still has not suppressed the processes of *vocalization, stopping*, and *cluster reduction*. These process are suppressed in typical children by age 5. Therefore, therapeutic remediation most likely would be indicated for this 7-year-old child.

Children with Phonological Disorders

Children with speech sound disorders often display some of the same types of phonological processes as typically developing children. However, the processes would be suppressed *later* than typically observed, as in the previous example. The phonological processes used most consistently by children with speech sound disorders include cluster reduction, stopping, and liquid simplification (a combination of gliding and vocalization) (**Stoel-Gammon & Dunn, 1985**). These specific processes are among those consistently seen in typically developing children as well.

Children with disordered phonology also display several processes not usually found in the speech of typically developing children. These processes are called **idiosyncratic processes** . Several idiosyncratic processes include (from **Stoel-Gammon & Dunn, 1985**):

1. *Glottal replacement*—the substitution of a glottal stop for another consonant.
   pick → /pɪʔ/ butter → /bʌʔʊ/ (with vocalization) lip → /ʔɪp/

   When the initial sound of a word is replaced with a glottal stop, it may sound as if the intial sound is simply deleted. You will need to listen carefully to make sure.
2. *Initial consonant deletion*—the omission of a single consonant at the beginning of a word.
   cut → /ʌt/ game → /eɪm/

   In the case of initial consonant deletion, you will need to determine whether the initial consonant truly is being deleted or is being replaced with a glottal stop.
3. *Backing*—the substitution of a velar stop consonant for consonants usually produced more anterior in the oral cavity. Backing usually involves alveolars and palatals; however, labial sounds may be affected.
   time → /kaɪm/ zoom → /gum/ push → /pʊk/

4. *Stops replacing a glide*—the substitution of a stop for a glide.
   yes → /dɛs/ wait → /beɪt/

5. *Fricatives replacing a stop*—the substitution of a fricative for a stop (frication).
   sit → /sɪs/ doll → /zɔl/

EXERCISE 8.14

For each of the given transcriptions, fill in the blank with the name of the appropriate idiosyncratic process just described. There may be more than one answer for each item.

Example:

cat → /kæʔ/	glottal replacement
1. chairs → /ɛrz/ _____	
2. letter → /lɛsɚ/ _____	
3. witch → /dɪtʃ/ _____	
4. tape → /keɪp/ _____	
5. bunny → /ʌʔɪ/ _____	
6. bad → /gæʔ/ _____	

Another method of phonological assessment, quite different from phonological process analysis, is known as **nonlinear phonology** . Nonlinear phonology involves performing an inventory of a child's speech sound system on *multiple levels* (hence the name *nonlinear)*, including production of individual speech sounds, syllables, stress patterns, and words. In nonlinear phonology, the child's speech sample can come from both administration of phonological tests (naming pictures) and/or from elicitation of spontaneous speech (e.g., telling a story). The clinician then takes the recorded sample and transcribes each word the child produces. Some of the information the clinician can gather from a nonlinear analysis includes:

1. A complete inventory of the individual consonants and vowels the child produces.
2. An inventory of syllable shapes used by the child; in other words, whether a child produces open and/or closed syllables and consonant clusters at the beginning and/or end of syllables.
3. The combination of consonants (C) and vowels (V) the child uses to produce various syllable types: CV, VC, CVC, CCVC, CVCC, and so on.
4. The word shapes the child produces—the number and types of syllables in a word. (That is, can a child produce only one-syllable words, or can he also produce two-,

three-, and four-syllable words?)

5. The stress patterns the child produces in bisyllabic and multisyllabic words with varying stress patterns, such as lion, giraffe, elephant, orangutan.

This type of analysis is important because the child's sound system is evaluated not just in terms of the phonemes that are produced correctly or incorrectly relative to the adult model, but it is also analyzed independently, as a functional system in its own right in terms of phoneme production in words varying in phonetic composition, stress, and number of syllables. In other words, phonemes are identified without consideration of what is phonemic or contrastive in the target language (adult system), but rather which consonants and vowels are used contrastively in particular contexts in the child's system.

How does nonlinear phonology help in remediation of a child with a phonological disorder? A simple example may help answer this question. Suppose a child produces the word "cat" as /kae/. At first glance, it appears that she may have problems producing the final /t/ phoneme (final consonant deletion). However, does she really have problems with final /t/, or does she generally have problems producing a coda in all CVC words? Because nonlinear phonology looks at phoneme production at several levels, the answer may become more evident by analyzing the child's speech sample and looking for patterns of production across a number of words. If it is determined that the child cannot produce final consonants in words, it could be considered a *constraint* on a particular level or tier of her phonological system, whereas the absence of /t/ in "cat" but the presence of other consonants in coda position would be a constraint on a different tier. In order for the child's phonology to improve, therapy would need to consider what constraints exist and how remediation aimed at different tiers would improve her ability to produce the adult pattern.

Complete Assignments 8-2 and 8-3 .

Transcription of Speech Sound Disorders: Diacritics

So far in this text we have been using *broad transcription* as a method of transcribing phonemes in words and sentences; we have paid little attention to allophonic variation in phoneme production. In this chapter, we will turn our attention to the use of *narrow transcription* in order to more accurately describe the utterances of individuals who exhibit speech sound disorders. In the last chapter, you were introduced to some diacritics used in the transcription of some suprasegmental aspects of speech, including those for timing of phonemes, i.e., [ː], and for juncture, i.e., [ǀ] and [ǁ]. This chapter will introduce diacritics used in the transcription of *segmental* aspects of speech, that is, for transcribing vowels and consonants. It is important that you become familiar with allophonic transcription of individual phonemes. Often, when transcribing individuals with speech sound disorders, the use of broad transcription will not suffice because broad transcription does not allow for transcription of allophonic variation in phoneme production. If a child pronounces the word "red" as /wɛd/ (gliding), broad transcription would be adequate in capturing the production on paper. Now consider the speech patterns of a child who has difficulty with velopharyngeal closure and has a concomitant problem with nasal emission (air escaping through the nasal cavity). Broad transcription of the child's production of the word "smile," /smaɪl/, would not indicate the occurrence of nasal emission. Narrow transcription of this word, [s̪maɪl], reveals that nasal emission occurred during production of /s/. (The symbol [̪] represents an allophone of [s], [s] with nasal emission.)

In the following section, several diacritics will be introduced as they relate to allophonic variants of speech sounds associated with (1) stop consonant production, (2) nasality, (3) voicing, and (4) changes in place of articulation. Only some of the more commonly used diacritics will be discussed on the following pages. The diacritic markings adopted in this text are from the 2005 revision of the IPA. Refer to **Figure 2.1** for the complete list of the IPA diacritics.

Some of the diacritics can be used in transcribing typical pronunciation patterns. As you know, all voiceless stop consonants are aspirated when they occur in the initial position of a syllable. Narrow transcription of the word "teen" [tʰin] shows a raised "h" indicating that it has been produced with aspiration. In transcribing individuals with speech sound disorders, it might not be necessary to show the occurrence of aspiration in contexts where aspiration is expected to occur, as in the word "teen." Instead, you would need to indicate aspiration in transcription of phonetic contexts where it is not expected to occur. Also, you would need to indicate missing aspiration when it is expected to occur.

In **Chapter 6** you learned that stop consonants are composed of an articulatory closure, an increase in intraoral pressure, and a release burst at one of three points of articulation: bilabial, alveolar, or velar. The manner in which stop consonants are produced (released, unreleased, aspirated, unaspirated) varies as a function of phonetic environment, dialect, and whether a person has a speech sound disorder.

Unreleased Stops [p̚]

An **unreleased** stop consonant is one that has no audible release burst associated with it. Unreleased stops occur quite often in English at the ends of words as in “leak,” “put,” “map,” “hog,” and “red.” Contrast the production of the word “stop” first by releasing the final /p/ and then by not releasing it. The transcription of the unreleased production would be [stɑp̚]. Likewise, contrast the two productions of the word “bid,” that is, [bɪd̚] and [bɪd]. When two voiceless stop consonants occur one after the other in the same syllable, the first one is not released, as in the words “stacked” [stæk t̚] and “reaped” [rip t̚].

Aspiration of Stops [pʰ]

Recall from **Chapter 6** that *aspiration* is a frictional noise burst associated with the release of *voiceless* plosives. Aspiration occurs only in stops in the initial position of stressed syllables. Examples of aspiration occur in the words “pass” [pʰæs], “torn” [tʰɔrn], “kiss” [kʰɪs], “atone” [ətʰoʊn], and “repay” [rəpʰeɪ]. Released voiceless stops at the ends of words may be aspirated as well, as in “leap” [lipʰ], “snake” [sneɪkʰ], and “right” [raɪtʰ]. Aspiration does *not* normally occur when a voiceless stop follows the fricative /s/, as in “spoon,” “scat,” or “stood.” If an aspirated stop does occur in this phonetic environment due to a speech sound disorder, it should be marked appropriately, as in “spoon” [spʰun].

Unaspirated Stops [p̚]

The symbol [̚] is placed above and to the right of unaspirated voiceless stops. Unaspirated stops are most common when they occur immediately following the fricative /s/ as in the words “spin” [sp̚ɪn] or “escape” [əsk̚eɪp̚]. Although stops may be unaspirated, they may still be released. Both of the unaspirated stops in “spin” and “escape” are released.

Young children and children with phonological disorders may not aspirate initial stop consonants at the beginning of words as expected. When an aspirated stop is produced without aspiration, it may sound to a listener as a voiced stop. For instance, “pan” [p̚æn] might sound like “ban” /bæn/. Therefore, it is important to listen carefully to make sure your transcription is adequate. This is a misperception quite prone to transcription error (**Louko & Edwards, 2001**). Additionally, unaspirated stops are typically seen in the initial position of voiceless stops in some Asian languages such as Vietnamese and Filipino. This will be discussed further in **Chapter 9** .

EXERCISE 8.15

Place an “X” next to each of the following words that normally contain an unaspirated phoneme.

1. _____slack	5. _____excuse
2. _____praised	6. _____surprise
3. _____scorn	7. _____stripe
4. _____despite	8. _____smooth

EXERCISE 8.16

Place an “X” next to the words that are *possible* transcriptions for the words given, using the diacritics for unreleased, unaspirated, and aspirated productions. If a transcription is given that is not typical in a particular phonetic context, correct it.

Examples:

X	licked	[lɪk ˺tʰ]	
_____	cap	[kæp ˺]	[kʰæp ˺]

1. _____skunk	[sk˭ʌŋkʰ]_____	
2. _____snacked	[snæk ˺tʰ]_____	
3. _____target	[tɑrgət ˺]_____	
4. _____brave	[bʰreɪv]_____	
5. _____toga	[tʰoʊgʰə]_____	
6. _____guarded	[gɑrdəd ˺]_____	
7. _____person	[pɝsʰən]_____	
8. _____carefully	[kʰɛrfʊlɪ]_____	

Nasality

Several diacritics are used in narrow transcription to indicate changes in nasality associated with speech production. These include nasalization, nasal emission, and denasality.

Nasalization [æ̃]

Recall from **Chapter 6** that vowels may become nasalized in the presence of nasal consonants. For example, in the word “mean,” the vowel /i/ is surrounded by two nasal phonemes. The velum lowers during the production of the initial consonant /m/ and remains lowered throughout the word (for articulatory efficiency) because the final phoneme /n/ also is a nasal. The result is a nasalized vowel, as in [mĩn]. The following words also have nasalized vowels due to the nasal environment provided by /m/, /n/, or /ŋ/: “hang” [hæ̃ŋ], “in” [ĩn], “mom” [mɑ̃m], and both vowels in “roomy” [rũmĩ] and “any” [ɛ̃nĩ]. The effects of nasalization can also be seen across word boundaries as in “I can eat” [aɪ kæn ĩt]. Note that nasalization can be regressive, progressive, or a combination of both (as in the word “mom”). Some children with cochlear implants will show vowel nasalization preceding a nasal consonant, as predicted, but delete the consonant, as in “comb” [kʰo͡ʊ̃] (**Teoh & Chin, 2009**).

In the transcription of disordered speech, this diacritic is also used to indicate the presence of excessive nasality associated with the production of non-nasal phonemes. This condition is known as hypernasal resonance or **hypernasality** . Hypernasality may be due to improper velopharyngeal closure. The presence of hypernasality may be evident throughout an entire production of a word or an utterance.

Some individuals with severe or profound hearing loss may display hypernasality in their speech. In fact, deaf speech is often described as sounding “nasal.” The problem in this case is not a physical one, because there is no structural deviation in the speech organs associated with velopharyngeal closure. Improper use of nasality is more likely due to faulty learning associated with the hearing loss. The auditory cues associated with nasality are difficult for deaf individuals to hear (**Erber, 1983**). Without having an appropriate auditory model of how oral versus nasal consonants should sound, it is difficult for some deaf individuals to produce nasality correctly.

EXERCISE 8.17

Place an “X” next to the words where you might expect nasalization based upon the given phonetic context.

1. _____mean [m̃in]	4. _____strung [strʌ̃ŋ]
2. _____boon [bũn]	5. _____slam [s̃læm]
3. _____buddy [bʌdĩ]	6. _____thong [θɑ̃ŋ]

Nasal Emission [˭]

Nasal emission is the audible escape of air through the nares due to improper velopharyngeal closure. Airflow may escape through the velopharyngeal port itself or may escape through a cleft in the palate or velum. Individuals with cleft palate may exhibit nasal emission especially during the production of stops and fricatives (which require greater intraoral pressure) even if the cleft has been repaired. This is usually due to speaking habits learned prior to the surgery (**Trost-Cardemone, 2009**). The diacritic [˭] is used when nasal emission accompanies a phoneme that is *not* normally nasalized. Examples include “snail” [s̊neɪl], “nice” [naɪs̊], “zoo” [z̊u], and “pie” [p̊aɪ]. Keep in mind that nasal emission is not the same as nasalization. Nasalization of speech results when the velum is lowered in production of oral sounds, resulting in nasal resonance. Nasal emission is a process in which air escapes through the nares.

Denasality [ˇ]

Another condition related to nasality is **denasality** , also known as **hyponasality** . Denasality results when the nasal phonemes /m, n, and ŋ/ are produced *without* nasalization. Denasality is most often associated with the speech patterns of a person with a cold or upper respiratory tract infection. The utterance “My name is Matt” would sound like “By dabe is Batt” when spoken denasalized. Using the diacritic [ˇ] to indicate denasality, this utterance would be transcribed as [m̌aɪ ñeɪm̌ɪz m̌æt]. Children who do not have a cold but consistently sound like they do should probably be evaluated by a physician to determine whether a structural abnormality exists that may interfere with the production of nasal phonemes.

Voicing

These diacritics indicate a change in the manner of vocal fold vibration during the production of consonants and vowels. These changes include voicing and devoicing.

Voicing [t̬]

This diacritic is used when a voiceless phoneme is produced with partial voicing. A good example of voicing occurs when using the tap [ɾ] in the transcription of words such as “better” [bɛɾɚ] and “kitty” [kɪɾɪ]. In these words, the voiceless /t/ becomes partially voiced due to the voiced environment provided by the surrounding phonemes. However, the assimilation does not result in production of the voiced phoneme /d/. Some people use the diacritic for voicing instead of a tap when transcribing words such as “better” [bɛt̬ɚ] or “kitty” [kɪt̬ɪ]. Another example of partial voicing may occur in some pronunciations of the words “pester” [pɛs̬tɚ], “mister” [mɪs̬tɚ], and “Leslie” [lɛs̬lɪ].

EXERCISE 8.18

Transcribe the following words, using the diacritic for voicing instead of a tap (when necessary).

1. kettle _______	4. attempt _______
2. written _______	5. baton _______
3. water _______	6. battled _______

Devoicing [r̥]/[ʒ̊]

In certain phonetic environments, phonemes that are normally voiced become less voiced. This phenomenon is known as *devoicing.* Phonemes that become devoiced still have some voicing associated with them; they are not completely voiceless. The concept of devoicing is not really new to you. Recall that a word such as "ladder" is transcribed with the tap /ɾ/, indicating devoicing of the /d/ phoneme. You may recall that this assimilation results when /t/ or /d/ is intervocalic.

Devoicing also occurs when one of the approximants /w, l, r, or j/ follows a voiceless consonant. Examples include "fray" [f̥reɪ], "pew" [p̊ju], "slip" [sl̥ɪp], and "queen" [kw̥in]. Devoicing also may occur across word boundaries as in "thank you" [θæŋk̊ju]. (Note that the devoicing diacritic is placed *above* descending IPA symbols such as /j̊/ and /ʒ̊/.)

Words ending with a voiced fricative or affricate may become devoiced if silence follows the word, that is, if they are at the end of an utterance (**Cruttenden, 2008**). Examples include [bædʒ̊], [wʌz̥], and [lʌv̥]. In connected speech, when a word that ends with a voiced fricative is followed by a word that begins with a voiceless consonant, the fricative also may become devoiced (**Cruttenden, 2008**). For instance, the phrase "has seen" may be pronounced as [həz̥sin]. Other examples include "of course" [əv̥kɔrs], "she's sorry" [ʃiz̥sɑrɪ], and "I've passed" [aɪv̥pæst].

If a client is devoicing phonemes in contexts that are not expected, make sure to indicate that in your transcription using the [̥] diacritic. For example, in cleft palate speech, voiceless plosives and fricatives may be produced as *voiceless* nasals (**Grunwell & Harding, 1996**) such as "sun" [n̥ə̃n] or "pan" [m̥æ̃n].

EXERCISE 8.19

Using the diacritic for devoicing [̥], transcribe the following utterances.

1. pewter _____	5. he does _____
2. clearly _____	6. Ridge Street _____
3. he's stubborn _____	7. I lose _____
4. bathe Pam _____	8. they've played _____

Several IPA diacritics are used to indicate allophonic variants related to changes in place of articulation of consonants and vowels. Some of these changes occur as a result of assimilation processes. Others occur as a result of dialect or phonological disorder.

Advanced/Retracted [k̟]/[t̠]

These two symbols are used to indicate a variation in tongue position associated with phoneme production. For example, when a consonant is produced with the tongue more forward in the oral cavity than normal (advanced), the symbol [̟] is used. Narrow transcription of the word “key” would be [k̟i] because the /k/ (normally produced with the body of the tongue in the velar region) is produced closer to the palate due to the environment provided by the front vowel /i/ (regressive assimilation).

When a consonant is produced with the tongue farther back than normal (retracted), the symbol [̠] is used. When the alveolar stops /t/ or /d/ precede /r/, their place of articulation becomes postalveolar (closer to the palate) because /r/ is a palatal phoneme. Some examples include “true” [t̠ru] and “dry” [d̠raɪ] (regressive assimilation). Because of the backed articulation of these consonants, the words “true” and “dry” may appear to sound like /tʃru/ and /dʒraɪ/, respectively.

These two symbols may also be used to indicate a variation in tongue advancement associated with vowel production. The change in articulation may be due to dialectal variation or a speech sound disorder. The change would involve the front/back dimension. For example, a retracted production of /æ/ would be transcribed as [æ̠], indicating that the vowel is farther back than would be expected, but not so far back as to result in the production of the vowel /ɑ/. Similarly, an advanced production of /ɑ/, that is [ɑ̟], would be farther forward than normal, but not enough to result in production of /æ/.

EXERCISE 8.20

Place an “X” by the words that have a correct transcription using the diacritics [̟] and [̠].

_____1. could [k̟ʊd]	_____3. drop [d̠rɑp]	_____5. keep [k̟ip]
_____2. kiss [k̟ɪs]	_____4. clam [k̠læm]	_____6. comb [koʊm̟]

Raised, Lowered [̝ , ̞]

These diacritics can be placed beneath a vowel when there is a change in the height dimension associated with that vowel. The change in tongue height may be the result of a particular dialectal pronunciation of a vowel or as a result of a speech disorder. The symbol [̝] indicates that a vowel is produced with the body of the tongue raised more than expected for that particular vowel. For instance, if an adult attempts to produce the vowel /ɛ/, but raises the tongue higher than expected (but not so high as to produce /ɪ/), the transcription would be [ɛ̝]. Likewise, production of /ʊ/ with a lowered tongue position would be transcribed as [ʊ̞], as long as the production does not result in articulation of the vowel /o/.

EXERCISE 8.21

Examine each of the following vowels and their transcriptions. Then indicate which vowel would result if the articulation was raised, lowered, advanced, or retracted (depending on the diacritic used).

Examples:

vowel produced:	resultant vowel is closer to:
[i̝]	/ɪ/
[ɑ̞]	/æ/

1. [ɛ̠]	5. [ʊ̟]
2. [æ̟]	6. [ɛ̝]
3. [o̟]	7. [ɪ̠]
4. [o̞]	8. [u̟]

Labialized [ʷ]

A consonant that is not normally produced with lip rounding may become rounded in the presence of certain phonemes, for example, /u/, /ʊ/, or /w/. This phenomenon can be seen in the initial consonantal phoneme of “quick,” “good,” “zoo,” and “rude.” The additional articulation of lip rounding, associated with consonant production, is called **labialization** . The diacritic commonly used for a labialized phoneme is a “w” placed to the right of the normally unrounded phoneme as in [kʷwɪk], [gʷʊd], [zʷu], and [rʷud]. These transcriptions all represent regressive, or right-to-left, assimilation because the normally rounded phoneme follows the phoneme undergoing assimilation. Labialization may also occur in some cases of speech sound disorder when it is not expected to occur (not due to phonetic context).

EXERCISE 8.22

Transcribe these words, using the [ʷ] diacritic if the initial phoneme is labialized due to the phonetic environment. If the word does not have a labialized initial phoneme, leave the item blank.

Examples:

swim	[sʷwɪm]_
wood	*_
1. hood _____	
2. shock _____	
3. roof _____	
4. thin _____	
5. wool _____	
6. plus _____	
7. _____sweet	
8. _____dune	
*/w/ is already a labialized consonant.	

More Rounded/Less Rounded [i̜]/[u̜]

One variation in vowel production, sometimes seen in disordered speech, is the production of unrounded vowels as “more rounded” and the production of rounded vowels as “less rounded.” The IPA symbol for an unrounded vowel produced with “more rounding” would be [i̜]. In the case where a normally rounded vowel becomes “less rounded,” the appropriate IPA symbol (i.e., [u̜]) would be used.

Ball and Müller (2005) recommend the use of existing IPA vowel symbols when transcribing vowel rounding errors. For instance, if a child produces a rounded version of /i/, it would be appropriate to use the IPA symbol /y/, which is the symbol for a rounded, high front vowel (see **Figure 2.1**). This phoneme is not found in English, but can be found in other languages such as German and French. Similarly, the IPA symbol for an unrounded version of the high back vowel /u/ would be /ɯ/, a vowel common in Korean. Because these IPA symbols are not common in English, you will need to refer to the IPA vowel chart in order to determine the rounded/unrounded counterparts of the English vowels.

EXERCISE 8.23

Use the appropriate IPA symbol for more or less lip rounding for each of the following vowels.

Example:

/ɪ/ [ɪ̜]

1. /e/ _____	4. /ɛ/ _____
2. /o/ _____	5. /ɔ/ _____
3. /ʊ/ _____	6. /æ/ _____

EXERCISE 8.24

Using the IPA chart (**Figure 2.1**) as your guide, select the appropriate IPA vowel symbol for transcription of each of the following vowel conditions.

Example:

rounded /i/ /y/

1. unrounded /o/ _____	4. unrounded /u/ _____
2. rounded /ɛ/ _____	5. rounded /e/ _____
3. rounded /ɑ/ _____	6. unrounded /ɔ/ _____

Dentalization [t̪]

Alveolar consonants sometimes may be produced with a dental, instead of an alveolar, articulation. The tongue tip makes contact with the upper front teeth (central incisors) during production. This process is termed **dentalization** . In the word “ninth,” /n/ becomes dentalized in typical speech production. The alveolar /n/ has a dental articulation brought about by the final phoneme /θ/ in “ninth.” It would be possible to transcribe this word as [naɪn̪θ], given that the articulation is more forward than usual. However, when an alveolar phoneme is produced with a dental articulation, the dentalization symbol [̪] is preferred. Other words with dentalized alveolar consonants include “filth” [fɪl̪θ] and “month” [mʌn̪θ]. These examples show regressive or right-to-left assimilation. The effect of dentalization crosses word boundaries as well. For instance, in the phrase “with Terry,” the /t/ becomes dentalized, that is, [wɪθt̪̪ɛrɪ]. Notice that the plosive /t/ is released between the teeth. This is an example of progressive or left-to-right assimilation.

Dentalization occurs in some instances of disordered speech. Some young children produce dentalized /s/ and /z/ in words, such as “shoe” [s̪u] and “zoo” [z̪u] with the tongue tip touching the upper incisors during production of /s/. This is sometimes referred to as a *frontal lisp.* Some individuals transcribe this particular speech production as a /θ/ for /s/, or a /ð/ for /z/ substitution, as in “suit” /θut/ or “zebra” /ðibrə/. It is suggested that the correct transcription for this particular production should be [s̪] or [z̪], not /θ/ or /ð/, as long as the articulation retains a sibilant quality (**Hodson & Paden, 1991**).

Some children with phonological disorders also produce the affricates /tʃ/ and /dʒ/ as [t̪θ] and [d̪ð], respectively, as in “rich” [rɪt̪θ] and “jam” [d̪ðæm] (**Powell, 2001**). In this case, the articulation for the plosive portion of the affricate is no longer alveolar, it is dental, with the tongue tip between the front teeth. Also, note the substitution of the dental fricatives /θ/ and /ð/ for the palatal fricatives /ʃ/ and /ʒ/.

Some hearing-impaired children who wear cochlear implants may produce interdental fricatives as dentalized alveolar stops, as in “thumb” [t̪ʰʌm] and “mother” [mʌd̪ə˞], and labiodental stops may be produced in place of labiodental fricatives, as in “fish” [p̪ʰɪʃ] and “vase” [b̪eɪs] (**Teoh & Chin, 2009**). (Try producing /p/ with a labiodental articulation [instead of bilabial] by bringing your lower lip and upper incisors together.)

EXERCISE 8.25

Transcribe the following utterances, using the diacritic [̪] when necessary. Leave the item blank if it is not necessary to use the diacritic.

1. anthem	
2. moth	
3. either	
4. bathroom	
5. math time	
6. wealth	
7. rhythm	
8. panther	

Labiodental [ɱ]

In words in which the nasal consonants /m/ or /n/ are followed by /f/, the place of articulation is altered, due to the influence of the labiodental place of articulation for /f/ (regressive assimilation). Although English does not have a labiodental nasal phoneme, other languages do. The IPA symbol for this phoneme is /ɱ/. Because English does not make use of /ɱ/ phonemically, this assimilation may be considered an allophonic variant, not a phonemic change. Words in which this labiodental nasal occurs (depending on an individual speaker's pronunciation) include "comfort" /kʌɱfɚt/, "conference" /kɑɱfrəns/, "unfair" /əɱfɛr/, "emphasis" /ɛɱfəsəs/, and "symphony" /sɪɱfənɪ/. The diacritic for dentalization also may be used to transcribe labiodental assimilation—"comfort" /kʌm̪fɚt/.

EXERCISE 8.26

Transcribe the following words using /ɱ/ where appropriate. If not appropriate, leave the item blank.

1. inferential ____________	
2. sphinx ____________	
3. Memphis ____________	
4. perform ____________	
5. unfriendly ____________	
6. sunflower ____________	
7. pharynx ____________	
8. kinfolk ____________	

Velarized [ɬ]

Velarization occurs when the alveolar consonant /l/ is produced in the velar region of the vocal tract. This production of /l/ is said to be *velarized* or "dark." /l/ becomes velarized in the postvocalic position of most words, as in "ball" and "eagle." The diacritic commonly used for velarization is a tilde through the middle of the phoneme, as in [bɑɬ] and [igɬ]. The velarized [ɬ] is found in all occurrences of syllabic [l̩], as in "little" [lɪrɬ] and "bagel" [beɪgɬ]. Keep in mind that [ɬ] and [l̩] are separate allophones of /l/.

Velarized [ɬ] is sometimes found to occur at the beginning of words. This may occur as a matter of speaking style, or it may be associated with a speech sound disorder. Some hearing-impaired children produce [ɬ] at word onset as in "leave" [ɬiv] or "leg" [ɬɛg]. Word-initial [ɬ] may sound as if it is preceded by /g/ due to the velarized /l/, as in "love" [gɬʌv] (**Teoh & Chin, 2009**).

EXERCISE 8.27

Place an "X" next to the words that normally would *not* have a velarized /ɬ/ in their transcriptions.

1. _____ lake	5. _____ scalding
2. _____ mingle	6. _____ liked
3. _____ loop	7. _____ hilly
4. _____ beagle	8. _____ lady

The extIPA and the VoQS

In 1994, an extension to the IPA was adopted by the International Clinical Phonetics and Linguistics Association (ICPLA) as the official set of diacritics to be used in the transcription of disordered speech. This extended version of the IPA is titled the **extIPA** (pronounced / ɛkstaɪpə/) (**Duckworth, Allen, Hardcastle, & Ball, 1990**). The complete set of extIPA diacritics (revised to 2008) is located in **Figure 8.1** . You will notice that you are already familiar with some of these symbols including the symbols for denasality [˜] and nasal emission (escape) [˞]. Some of the extIPA symbols represent phonemes produced with a place of articulation not seen in typically developing speech. These include *dentolabial* (upper teeth and lower lip), *labioalveolar* (lower lip and alveolar ridge), *linguolabial* (tongue and upper lip), *interdental* (tongue tip or blade protruding between the teeth), and *bidental* (constriction formed by the upper and lower teeth). Other symbols include those for *whistled articulation* (/s/ or /z/ produced with a very narrow tongue groove that creates a whistled fricative), *nareal fricatives* (nasal phonemes produced with accompanying nasal emission due to velopharyngeal incompetency), *labial spreading* (excessive lip spreading), and for *reiterated articulation* (a repeated articulation as is seen in stuttering).

The extIPA also has several additional diacritics for indicating variations in intensity and tempo of connected speech as well as a notation system for indicating duration of pauses. As an example, normal intensity speech followed by very loud speech would be transcribed in the following manner:

[ðɪs ɪz nɔrməl ɪntɛnsɪtɪ spitʃ {ff fɑlod baɪ spitʃ ðæt iz vɛrɪ laʊdff}]

Note that *braces* are used to indicate the stretch of speech that is louder. The symbol *ff* stands for *fortissimo,* an Italian term used in music to denote a passage of music that is to be played very loudly. Similarly, very soft speech would be indicated with the notation *pp,* from the Italian *pianissimo* for “very soft.”

Diacritics are also provided in the extIPA to indicate variations in voicing patterns. The voicing diacritics allow for transcription of phonemes that are produced with pre-aspiration, as well as pre-, post-, or partial voicing.

Another extension to the IPA is the *Voice Quality Symbols,* or **VoQS** (**Ball, Esling, & Dickson, 1995**) (see **Figure 8.2**). This extension was developed in order to provide speech pathologists with a more in-depth system of transcribing disorders associated with voice production, such as breathiness. Breathiness occurs when the vocal folds do not make sufficient contact during voicing, allowing audible air to escape through the glottis. Causes of breathiness include growths, such as polyps or nodules, on the vocal folds.

Some deaf speakers also display breathiness due to improper valving of air by the vocal folds, as air flows through the glottis from the lungs. The IPA diacritic [V̤] is used beneath specific phonemes that are produced with a breathy voice quality. If an entire utterance is breathy, it may be transcribed by using the symbol [V̤] preceding and following the breathy utterance. For example:

[{V̤ aɪ hæv nɑdʒl̤z ɑn maɪ voʊkl̤ foldz V̤}]

VoQS: Voice Quality Symbols

Airstream Types

Œ	œsophageal speech	ʬ	electrolarynx speech
ʞ	tracheo-œsophageal speech	↓	pulmonic ingressive speech

Phonation types

V	modal voice	F	falsetto
W	whisper	C	creak
V̤	whispery voice (murmur)	V̰	creaky voice
V^{ʰ}	breathy voice	C̰	whispery creak
V!	harsh voice	V!!	ventricular phonation
V̰!!	diplophonia	V̤!!	whispery ventricular phonation
V̪	anterior or pressed phonation	W̲	posterior whisper

Supralaryngeal Settings

L̝	raised larynx	L̞	lowered larynx
V^{œ}	labialized voice (open round)	V^{w}	labialized voice (close round)
V͍	spread-lip voice	V^{ʋ}	labio-dentalized voice
V̺	linguo-apicalized voice	V̻	linguo-laminalized voice
V^{ʂ}	retroflex voice	V̪	dentalized voice
V̼	alveolarized voice	V^{ʲ}	palatoalveolarized voice
V^{ʲ}	palatalized voice	V^{ɣ}	velarized voice
V^{ʁ}	uvularized voice	V^{ʕ}	pharyngealized voice
V̰^{ʢ}	laryngo-pharyngealized voice	V^{ʱ}	faucalized voice
Ṽ	nasalized voice	Ṽ	denasalized voice
J̞	open jaw voice	J̝	close jaw voice
J̹	right offset jaw voice	J̜	left offset jaw voice
J̟	protruded jaw voice	Θ	protruded tongue voice

USE OF LABELED BRACES & NUMERALS TO MARK STRETCHES OF SPEECH AND DEGREES AND COMBINATIONS OF VOICE QUALITY:

[ˈðɪs ɪz ˈnɔɹməl ˈvɔɪs {3V! ˈðɪs ɪz ˈveɹi ˈhɑɹʃ ˈvɔɪs 3V} ˈðɪs ɪz ˈnɔɹməl ˈvɔɪs wʌns ˈmɔɹ {L̞ 1V! ˈðɪs ɪz ˈlɛs ˈhɑɹʃ ˈvɔɪs wɪð ˈloʊəd ˈlæɹɪŋks 1V!L̞}]

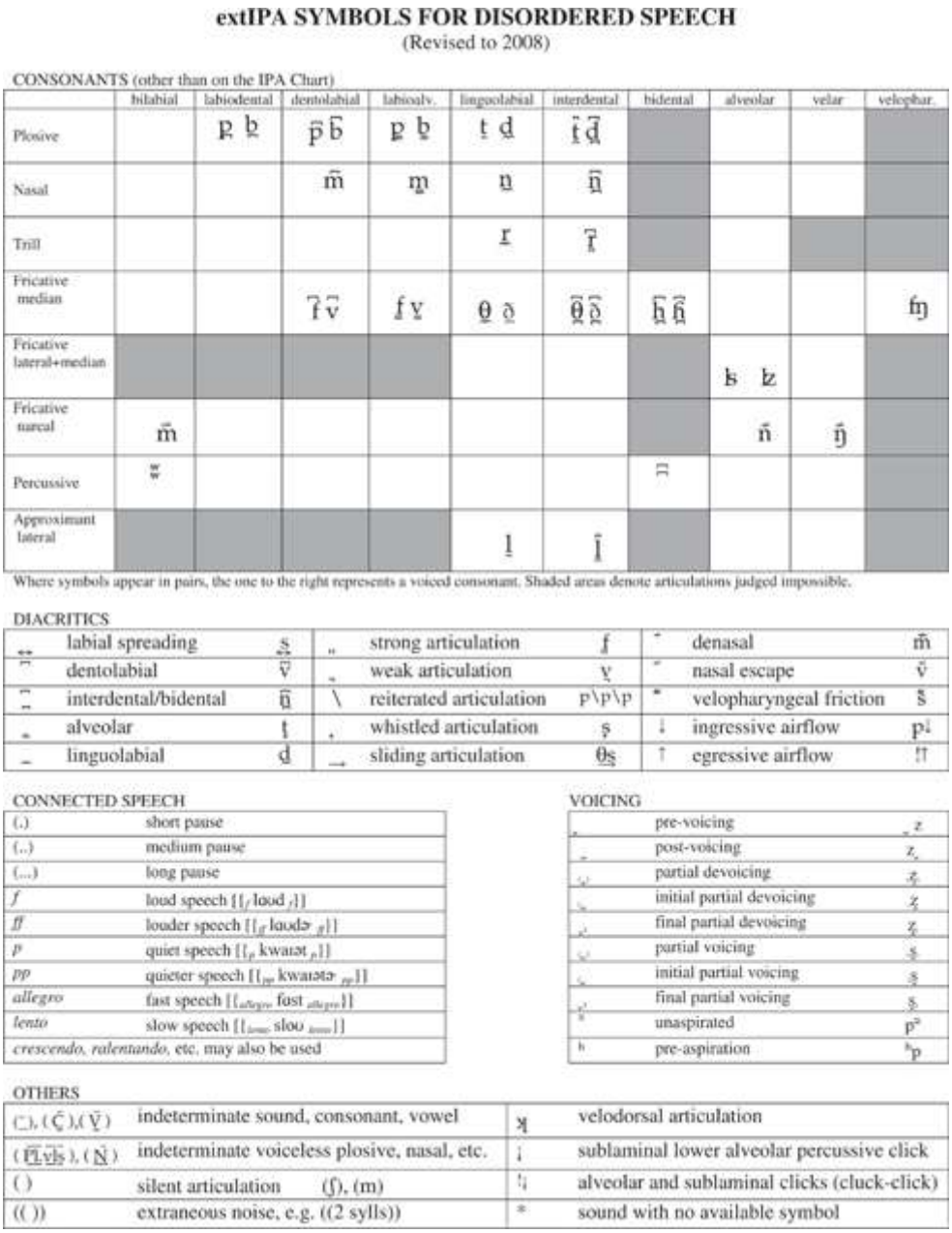
FIGURE 8.2

The VoQS. © 1994 Martin J. Ball, John Esling, Craig Dickson. Reproduced with permission.

It is beyond the scope of this text to describe other conditions of the larynx that result in an alteration of voice quality. That material will be covered in coursework examining voice production (most likely at the graduate level).

Transcription of Speech Sound Disorders: Non-English Phonemes

Inspection of the IPA chart (**Figure 2.1**) indicates there are many consonant phonemes that do not appear in spoken English. Of the 58 pulmonic consonants listed (those produced with an egressive airstream from the lungs), only 22 occur in English. These do not include /w/ or the affricates /tʃ/ and /dʒ/. A couple of the IPA pulmonic consonants are produced only as allophones in English, namely, the glottal stop /ʔ/ and the alveolar tap /ɾ/. The lateral alveolar fricatives /ɬ/ (voiceless) and /ɮ/ (voiced) usually occur in English only in reference to disordered speech (see the following). Although English has only two affricates, others such as /ts/, /dz/, and /pf/ do occur in other languages. The IPA chart also lists several non-pulmonic consonants (those not requiring an airstream from the lungs in their production), none of which are found in English. Finally, of the 28 vowels listed in the IPA chart, only 12 are produced in English (not counting /ɚ/, /ɝ/, or the diphthongs). Recall that some non-English IPA vowel symbols can be used when transcribing changes in lip rounding associated with vowel production.



extIPA SYMBOLS FOR DISORDERED SPEECH
(Revised to 2008)

CONSONANTS (other than on the IPA Chart)

	bilabial	labiodental	dentolabial	labioalv.	linguolabial	interdental	bidental	alveolar	velar	velophar.
Plosive		p̪ b̪	p̄ b̄	p̪ b̪	t̼ d̼	t̪͡θ̪ d̪͡ð̪				
Nasal			m̄	m̪	n̼	n̪͡θ̪				
Trill					r̼	r̪͡θ̪				
Fricative median			f̄͡v̄	f̪ v̪	θ̼ ð̼	θ̪͡θ̪ ð̪͡ð̪	ʜ̄ ɦ̄			ɸ̝ β̝
Fricative lateral+median								ɬ ɮ		
Fricative narcal	m̃							ñ	ŋ̃	
Percussive	ʬ						⩲			
Approximant lateral					l̼	l̪͡θ̪				

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

DIACRITICS

̪	labial spreading	s̪	̎	strong articulation	f̎	̃	denasal	m̃
̪	dentolabial	v̪	̗	weak articulation	v̗	̃	nasal escape	ṽ
̪	interdental/bidental	n̪	\	reiterated articulation	p\p\p	̽	velopharyngeal friction	s̽
̼	alveolar	t̼	ˌ	whistled articulation	sˌ	↓	ingressive airflow	p↓
̺	linguolabial	d̺	͢	sliding articulation	θ͡s	↑	egressive airflow	t↑

CONNECTED SPEECH

(.)	short pause
(..)	medium pause
(...)	long pause
f	loud speech {[$_f$ loud $_f$]}
ff	louder speech {[$_{ff}$ loudə $_{ff}$]}
p	quiet speech {[$_p$ kwaɪət $_p$]}
pp	quieter speech {[$_{pp}$ kwaɪətə $_{pp}$]}
allegro	fast speech {[$_{allegro}$ fast $_{allegro}$]}
lento	slow speech {[$_{lento}$ sloʊ $_{lento}$]}
crescendo, ralentando, etc. may also be used	

VOICING

̬	pre-voicing	ᵇz	
̥	post-voicing	zᵖ	
̥˒	partial devoicing	z̥˒	
̥˒	initial partial devoicing	z̥˒	
̥˒	final partial devoicing	z̥˒	
̬˒	partial voicing	s̬˒	
̬˒	initial partial voicing	s̬˒	
̬˒	final partial voicing	s̬˒	
ʰ	unaspirated	pʰ	
ʰ	pre-aspiration	ʰp	

OTHERS

(͡), (ç̃), (ɣ̃)	indeterminate sound, consonant, vowel	ɻ	velodorsal articulation
(p͡f̄v̄s̄), (ñ)	indeterminate voiceless plosive, nasal, etc.	ǃ	sublaminal lower alveolar percussive click
( )	silent articulation (ʃ), (m)	ǃ͡ǂ	alveolar and sublaminal clicks (cluck-cluck)
(( ))	extraneous noise, e.g. ((2 sylls))	*	sound with no available symbol

FIGURE 8.1
The extended IPA. © ICPLA 2008. Reproduced with permission.

When transcribing disordered speech, it often becomes necessary to use some of the non-English phonemes represented in the IPA chart. This is because in some speech sound disorders, phonemes are produced with a place of articulation different from the intended target phoneme, such as substituting the voiceless velar fricative /x/ for the voiceless palatal fricative /ʃ/. Speech sound errors that require the use of non-English IPA characters in transcription generally involve changes in place of articulation of stops and fricatives. Also, some hearing-impaired speakers produce non-pulmonic implosive and ejective phonemes. **Table 8.2** lists all of the non-English IPA symbols discussed in the following sections.

Glottal Stop [ʔ]

By now, you should be familiar with the use of the glottal stop in English, as in production of the word “button” /bʌʔn̩/. The glottal stop also appears in the speech of some children with phonological disorders, including those with hearing impairment (**Levitt & Stromberg, 1983**; **Stoel-Gammon, 1983**; **Teoh & Chin, 2009**). For instance, glottal stops may replace other stops or fricatives as in “puppy” /ʔʌʔɪ/, “sister” [ʔɪʔʊ], or “maybe” [meʔɪ]. The glottal stop also may occur at the ends of words, as in “cat” /kʰæʔ/ or “caught” [kʰɔʔ]. You must learn to listen carefully to determine whether a glottal stop is being produced. For instance, in the word “cat,” you would need to determine whether the final sound is /ʔ/, an omitted /t/ as in [kæ] or is being produced as an unreleased consonant, as in [kæt̚]. It should be noted that the presence of a glottal stop at the end of a word does not always signal the presence of a speech sound disorder. Glottal stops do occur naturally at the ends of words in some dialects of spoken English.

TABLE 8.2

Common Non-English IPA Symbols Used in Transcription of Speech Sound Disorders.

	IPA Symbol			
Manner of Articulation	**Voiceless**	**Voiced**	**Example**	
Glottal Stop	[ʔ]		puppy	[ʔʌʔɪ]
Fricatives				
Bilabial	[ɸ]	[β]	fat	[ɸæʔ]
Velar	[x]	[ɣ]	game	[ɣem]
Pharyngeal	[ʢ]	[ʕ]	sheep	[ʢip]
Lateral	[ɬ]	[ɮ]	zoo	[ɮu]
Affricates				
Bilabial	[pf]	[bv]	face	[pfes]
Alveolar	[ts]	[dz]	juice	[dzus]
Velar	[kx]	[gɣ]	ghost	[gɣos]
Approximant		[ʋ]	run	[ʋʌn]
Ejectives (voiceless)	[p', t', and k']		keep	[kip']
Implosives (voiced)	[ɓ, ɗ, and ɠ]		big	[ɓɪʔ]

Cleft palate speakers also may produce glottal stops as substitutes for obstruents. In addition to possible problems with nasal emission and hypernasal resonance, cleft palate speakers may have difficulty producing stops due to decreased intraoral pressure in the oral cavity caused by the cleft. Substitution of a glottal stop assists in proper plosion with a place of articulation posterior to the cleft (so that no air escapes). Some examples include "top" [ʔɑ̃ʔʰ], "guess" [ʔɛ̃ʔ], and "comb" [ʔõm] (**Trost-Cardemone, 2009**). Glottal stop substitution may occur, even following surgery for the cleft, due to learned speaking habits.

Fricatives [ɸ, β, x, ɣ, ħ, ʢ, ʕ]

There are several IPA symbols for non-English fricatives that may be used in transcription of speech sound disorders. For example, *bilabial* and *velar* fricatives may be produced by some children with phonological disorders, including children with hearing loss (**Louko & Edwards, 2001**; **Stoel-Gammon, 1983**; **Teoh & Chin, 2009**). The bilabial fricatives [ɸ] (voiceless) and [β] (voiced) may be substituted for the labiodental fricatives /f/ and /v/, respectively. Similar to the labiodental fricatives, /f/ and /v/, the bilabial fricatives are non-strident (low intensity) and have a similar acoustic structure. Examples of bilabial fricative substitutions include “giraffe” [dəwæɸ] and “shovel” [dʌβoʊ] (**Louko & Edwards, 2001**).

Similarly, the velar fricatives /x/ (voiceless) and /ɣ/ (voiced) may be produced as a substitute for the velar stops /k/ and /g/. This is a substitution also seen in cleft palate speech. The velar fricatives are produced when full closure for the stops does not occur (**Louko & Edwards, 2001**). Some examples of velar fricative substitutions include “cat” /xæt/ or /ɣæt/, “game” /ɣem/, and “lecture” [lɛɣʒu].

In some cleft palate speakers, the fricatives /s, z, ʃ, or ʒ/ are backed and produced as pharyngeal fricatives (**Trost-Cardemone & Bernthal, 1993**). The IPA symbols for the pharyngeal fricatives are [ħ] (voiceless) and [ʕ] (voiced). **Trust-Cardemone (2009)** recommends the use of the symbol [ʢ] instead of [ħ] for the voiceless pharyngeal fricative. Some examples include “sheep” [ʢĩp] (or [ħĩp]) and “measure” [mɛ̃ʕə˞].

Lateral Fricatives [ɬ, ɮ]

Lateralization of the fricatives /s/ or /z/ occurs when the constricted airflow is diverted over the sides of the tongue, instead of being able to flow centrally. To produce a lateralized /s/, place your tongue in position for the initial phoneme in the word “let.” Now, holding your tongue in place, try to produce an /s/ phoneme. Notice how the air flows over the sides of the tongue because it cannot escape anteriorly. This lateral production of /s/ or /z/ is sometimes referred to as a *lateral lisp* and is seen in some children with phonological disorders.

The IPA diacritic for a lateralized phoneme is a raised /l/, placed to the right of the indicated phoneme, as in [jɛsˡ]. There are other IPA symbols specifically used for transcription of a *lateral fricative.* The symbol [ɬ] represents a lateralized /s/, and [ɮ] represents a lateralized /z/. Examples include “yes” [jɛɬ] and “zoo” [ɮu]. Sometimes lateral fricatives are substituted for an affricate (deaffrication), as in “witch” [wɪɬ] and “jelly” [ɮɛlɪ].

The extIPA also lists two symbols for lateralized fricatives, [ls] (voiceless) and [lz] (voiced). These symbols are to be used when a fricative is produced with both a lateral *and* a central airstream.

Affricates [pf, bv, ts, dz, kx, gɣ]

Some individuals with phonological disorders may produce non-English affricates such as /pf/, /bv/ (bilabial), /ts/, /dz/ (alveolar), and /kx/, /gɣ/ (velar) (**Louko & Edwards, 2001**; **Powell, 2001**). The affricates /ts/ and /dz/ often replace /tʃ/ and /dʒ/ as in “watch” [wɑts] and “Jim” /dzɪm/. Other examples of non-English affricates include “fun” [pfʌn], “van” [bvæn], “ski” [kxi], and “go” [gɣo].

Approximant [ʋ]

Earlier in this chapter we discussed the fact that some children substitute /w/ for /r/ in a process commonly known as *gliding.* In some instances, however, the production is not truly a /w/, but somewhere between an /r/ and a /w/. What may occur in this case is the substitution of the voiced labiodental approximant [ʋ] for /r/ (**Ball, 2008**; **Bauman-Waengler, 2012**). This approximant is similar to /w/ but it is labiodental, not labiovelar; there is no constriction of the tongue in the velar region. Instead, the lower lip and teeth are used in production of this sound. Because this phoneme is an approximant, the lower lip and teeth do not touch as would be the case for the labiodental fricative /v/.

Implosives [ɓ, ɗ, ɠ] and Ejectives [p', t', k']

An interesting phenomenon observed in the speech of some hearing-impaired speakers is the use of non-pulmonic **ejective** and **implosive** stop consonants. Both ejectives and implosive consonants rely on a *glottalic* airstream, as opposed to a pulmonic airstream. Both implosive and ejective consonants occur in some African and Native American languages. An ejective is produced in a manner similar to a pulmonic stop consonant. However, during its production, the vocal folds close and then are *raised,* causing a decrease in the area between the closed vocal folds and the constriction in the oral cavity formed by the tongue. This results in a greater amount of intraoral pressure than would be typical of a pulmonic stop. Then, when the stop is released, there is a large burst of air due to the increased intraoral pressure. Conversely, implosives are produced by *lowering* the vocal folds, thereby increasing the area of the vocal tract and decreasing the intraoral pressure between the vocal folds and the constriction in the oral cavity. When the stop is released, air flows *into* the vocal tract (an *ingressive* airstream).

It is not completely clear why hearing-impaired individuals produce ejectives and implosives. It is believed that these behaviors develop either due to the provision of increased tactile/kinesthetic feedback (**Higgins, Carney, McCleary, & Rogers, 1996**) or as a result of faulty learning while developing the ability to produce voiced and voiceless stops (**Monsen, 1983**). The IPA symbols for the implosive and ejective stops (at the bilabial, alveolar, and velar places of articulation) are given below. The remaining implosive and ejective IPA symbols can be found in **Figure 2.1** .

	Implosive	Ejective
Bilabial	/ɓ/	/p'/
Dental/alveolar	/ɗ/	/t'/
Velar	/ɠ/	/k'/

Implosives and ejectives have also been known to occur in individuals who stutter and in people with phonological disorders not related to hearing impairment (**Ball & Müller, 2007**).

EXERCISE 8.28

Write the intended IPA symbol for each description given.

1. voiceless velar fricative	_____
2. voiceless bilabial affricate	_____
3. voiced pharyngeal fricative	_____
4. voiced bilabial fricative	_____
5. voiceless lateral fricative	_____
6. velar ejective	_____
7. labiodental approximant	_____
8. alveolar implosive	_____
9. voiced velar fricative	_____
10. labiodental nasal	_____

Complete Assignment 8-4 .

Suggestions for Transcription

The complete set of combined diacritics from the revised 1996 IPA symbols, the extIPA, and from the VoQS seems extraordinarily overwhelming at first. The combined diacritic sets allow for the transcription of virtually all possible allophonic variants of English as well as most typical speech sound errors. Obviously, not all of these symbols would be used routinely in the transcription of disordered speech. This raises an interesting question. Which symbols should be used routinely when transcribing disordered speech? This is not an easy question to answer. Undoubtedly, every speech-language pathologist would have a different answer to this question. The most important consideration is the accuracy of the transcription being performed. It is not necessarily important to indicate normal allophonic variations of phonemes if they do not disrupt the production of speech. For instance, there would be no need to indicate nasalized vowels, as long as the nasalization was appropriate. If, however, a client had inappropriate nasalization of speech, the appropriate diacritic [̃] would then need to be indicated in the transcription.

When you begin transcribing both live and recorded samples of your clients, there are several factors you will need to consider so that your transcriptions will be as accurate as possible. Keep in mind that your clients' speech patterns often will be difficult to understand. This means that a good recording is necessary so that you will be able to replay the speech sample at a later time. Modern digital recorders are quite good at capturing your clients' speech. However, no matter how good the recording, certain phonemes may not always be audible during playback because some English phonemes are naturally low in intensity, especially the voiceless fricatives /f/, /θ/, and /ɸ/. This is one reason why it is extremely important for you to transcribe face-to-face during testing. Of course, wearing headphones (attached to your recorder) will aid in your transcription accuracy by reducing any background noise that might be present. Also, when you are performing a live transcription, you will be able to visually focus on the clients' articulators, especially in reference to lip rounding and tongue placement for certain phonemes. Although it is possible to make a video recording of your clients' diagnostic session, facial features may not always be clearly represented because video images provide only a two-dimensional view of the client.

Stoel-Gammon (2001, p. 15) suggests the following before beginning a transcription session:

1. Work in a quiet area.
2. Spend no more than 2 to 3 hours transcribing at any one time; take a 5- to 10-minute break every 45 minutes.

3. Before beginning, listen to an extended sample to become used to the speech patterns you will be transcribing.
4. Avoid being influenced by knowledge of the target words you are transcribing.
5. Listen to the vocalizations as many times as needed.

When listening to a recorded sample of a client's speech, it will become immediately apparent that certain speech segments will be easier to transcribe than others. Begin with the speech segments of which you are sure. You also may want to transcribe phonemes first, adding the diacritics later. **Ohde and Sharf (1992**, pp. 351–352) offer several beneficial suggestions to help the clinician focus on speech patterns that are particularly difficult to transcribe. Their transcription techniques include the following:

1. Count the number of syllables in each produced utterance and determine if it agrees with the number in the target utterance.
2. Identify the vowels, diphthongs, or syllabic consonants that constitute the nucleus of each syllable, using the minimal contrasts of front-back, high-low, tense-lax, and rounded-unrounded to zero in on the vowel.
3. Transcribe the syllable nuclei you are certain of, leaving space for preceding and following consonants.
4. Determine whether each vowel nucleus is initiated and terminated by a consonant or consonant cluster and if a target consonant is deleted.
5. Identify the consonants, using manner, voicing, and place feature analysis to zero in on them, and transcribe those you are certain of.
6. Decide which features of the remaining consonants you are uncertain about and how they differ from the target consonants.
7. Transcribe the consonants, using appropriate diacritics to indicate deviations from targets, if necessary.

Of course, it may not be possible for you to identify *every* phoneme that your client produces. When this happens, it may be necessary to use the appropriate symbols from the extIPA to indicate indeterminate sounds, that is sounds of which you are unsure. For instance, if you know a particular phoneme is a vowel, but you are not sure of the exact vowel, you would write V with a circle around it (i.e., Ⓥ to represent the phoneme in question). Or if you knew the phoneme was a voiceless plosive, but were not sure if it was /p, t, or k/, you would transcribe the phoneme as Pl, vls with a circle around it (i.e., Pl, vls).

During transcription, you should be careful about "second-guessing" or having expectations about what your client is attempting to say. In some instances, knowing what your client is

saying may help you get a more accurate transcription. However, it is possible your expectations may be wrong and cause you to transcribe your client incorrectly. **Louko and Edwards (2001)** report a case where a child was shown a picture of "twins" and the child responded [ˈtʰoːˌwĩn]. In reality, the child was attempting to say "children," *not* "twins." Upon additional exploration, the clinician did get the child to say [tʰɪnz], proving the child's first response was not at all a production of the word "twins." Had the clinician not investigated further, her transcription of "twins" as [ˈtʰoːˌwĩn] and not [tʰɪnz] could have turned out to be problematic when determining the specific phonological errors the child was exhibiting.