



My Client Is Using Non-English Sounds! A Tutorial in Advanced Phonetic Transcription

Part II: Vowels and Diacritics

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Part I of this tutorial on advanced phonetic transcription (Ball, Müller, Rutter, & Klopfenstein, 2009) illustrated the importance of narrow phonetic transcription using the International Phonetic Alphabet

ABSTRACT: This part of the tutorial on advanced phonetic transcription stresses the importance of being able to transcribe non-English vowels when assessing clients with articulation and/or phonological disorders of various types. The literature is referred to throughout the article to illustrate examples of the use of these non-English vowels. Bilingual clients are very likely to use non-English vowels in their own languages and possibly when speaking English as well. Included in this tutorial are typical languages in which particular vowels can be found; many of these languages are commonly encountered in the speech clinic.

Furthermore, this article describes virtually all of the diacritics on the International Phonetic Alphabet (IPA) chart, including references to the speech pathology literature that illustrate the cases in which diacritics may be needed. Sources where readers can hear these non-English sounds themselves are also provided.

KEY WORDS: phonetic transcription, non-English sounds, vowels, diacritics, disordered speech, multilingualism

(IPA; International Phonetic Association, 1999, 2005), especially with clients using non-English sounds. Part I covered non-English consonants, both pulmonic and nonpulmonic. However, the use of non-English sounds is not restricted to consonants. Research into vowel disorders has shown that vowel problems are more common than once thought, and disordered vowel systems for clients whose target language is English will not always consist solely of English vowel sounds or even sounds that are similar to English vowels (see contributions to Ball & Gibbon, 2002). Further, bi- and multilingual clients may have target languages with vowels that are very different from those found in English. Part II of this tutorial introduces the symbols needed to transcribe a range of non-English vowel sounds.

Vowels

Despite the underlying implication of many speech assessment procedures (e.g., Goldman-Fristoe Test of Articulation—Second Edition, Goldman & Fristoe, 2000; Phonological Assessment of Child Speech, Grunwell, 1985) that vowel disorders are rare, recent research has shown that a wide range of vowel disorders may present in the speech pathology clinic (see Ball & Gibbon, 2002, for several such studies). The International Phonetic Association (1999,

2005) provides a large number of vowel symbols, enabling transcribers to cover the wide variety of vowels in natural language. Further, diacritics are available that enable transcribers to mark differences in articulator position from the target value of a symbol, thereby increasing the range of vowel sounds that can be symbolized. Figure 1 shows the representation of the vowel quadrilateral that is used on the current IPA chart.

Figure 1 demonstrates symbols for two broad types of vowel: tense vowels (associated with one of the dots on the chart) and lax vowels (not linked to a dot). English has both tense and lax vowels. Examples of the former include /i, ɪ, e, ɜ, u, ɜ-/ and the diphthongs /eɪ, aɪ, ɔɪ, aʊ, oʊ/; examples of the latter include /ɪ, ɛ, æ, ʊ, ʌ, ə, ɐ/ and, in some varieties, /ɒ/. These symbols will be sufficient to transcribe the vowels of most varieties of North American English, at least in broad transcription of nondisordered speech. As noted in the first part of this tutorial (Ball, Müller, Rutter, & Klopfenstein, 2009), however, the transcription of disordered speech often requires narrow transcription to avoid misrepresenting the client's phonological abilities.

Apart from the division between tense and lax, there are other classifications of vowels illustrated by the chart in Figure 1. These are anteriority: front, central, and back (respectively, left, middle, and right on the quadrilateral); height: close, close-mid, open-mid, and open (as marked on the chart and also referred to as high, half-high, half-low, and low); and lip shape: rounded and unrounded (where vowels are in pairs on the chart, the left-most one is unrounded, the right-most is rounded).

We must also consider the difference between steady state vowels (monophthongs), where the tongue remains relatively still during vowel production, and glide vowels (diphthongs), where the tongue moves from one position to another during vowel production but within a single syllable.³ Some transcribers like to show that a combination of vowel symbols is in fact a diphthong by employing the IPA "tie-bar," as in /aɪ/. It is not usually necessary to adopt that convention for broad transcription of normal English, as we know which vowel combinations are diphthongs. For disordered speech, however, it can be useful to do so in order to distinguish diphthongs from sequences of two vowels in separate syllables.⁴

Vowel Disorders

As noted in the various contributions to Ball and Gibbon (2002) and the articles referred to therein, studies of vowel

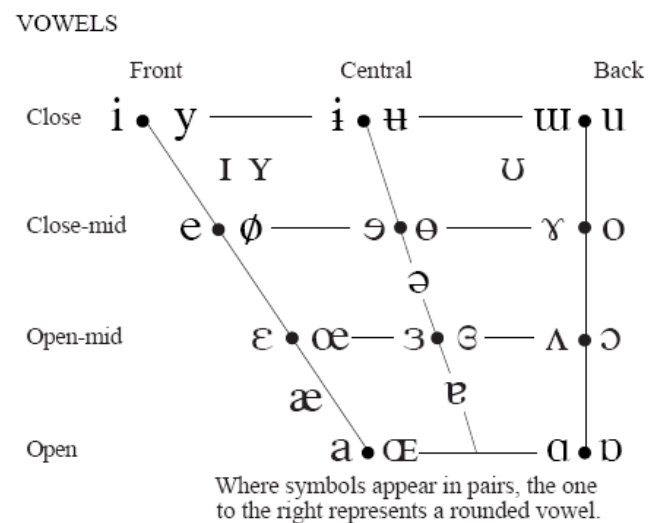
¹This last will be /ɜ/ in nonrhotic accents of English (i.e., accents where postvocalic /r/ is not pronounced).

²This last will be replaced by /ə/ in nonrhotic accents of English.

³One may also encounter triphthongs, where the tongue moves from one position to another after changing direction at an intermediate point, and within a single syllable. An example from some nonrhotic accents of English would be *fire* pronounced /faɪə/ as a single syllable.

⁴Showing that two vowel symbols do not represent a diphthong can be done by using a period as a syllable division sign. Thus, *reinact* can be transcribed as /ri.i.n'ækt/.

Figure 1. The International Phonetic Alphabet (IPA) vowel quadrilateral.



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disorders in English suggest that many of the patterns encountered in vowel disorders involve the replacement of one target English vowel unit by another. For example, we can find processes such as tensing and laxing⁵ (Donegan, 2002), whereby either lax vowels become tense or tense vowels become lax; lowering, fronting, and diphthong reduction/monophthongization (Reynolds, 2002); and raising and cornering (Ball, 2002). These processes will normally result in the merging of two target vowels of English. For example, tensing of /ɪ/ results in [i]; lowering of /ɛ/ results in [æ]; monophthongization of /ɔɪ/ results in [ɔ]; and vowel cornering results in mid and lax vowels moving to [i], [u], or [a].

Currently, however, there is insufficient evidence on vowel disorders for us to know which realizations are natural processes and which are idiosyncratic rules (in Stampe's 1979 terms). The literature provides examples of vowel disorders in clients whose target language is English that result in realizations that are not part of the English vowel system. Further, we may encounter multilingual clients whose language contains vowels other than those found in English. In both instances, transcribers will need to become familiar with vowels outside the English system. These can be classified into three main groups: front rounded vowels, back unrounded vowels, and non-English central vowels. We will also briefly consider the open back rounded vowel as well as a range of non-English diphthongs, as there is some evidence that these occasionally occur in disordered speech (see later).

Front rounded vowels. The front rounded vowels are rounded equivalents of [i, ɪ, e, ɛ, a], and are denoted with

⁵Cowie and Douglas-Cowie (1983) noted that in clients with hearing impairment, laxing is common in those with prelingual hearing impairment, whereas tensing is common in those with postlingual hearing impairment.

the following symbols [y, ʏ, ø, œ, æ] (see Figure 1). The first three of these vowels have been reported in several cases of child speech disorders. Reynolds (2002), for example, reported on Child M realizing *purple* as [pɒpy] (where it is assumed that the final [y] is a replacement for [u] as a result of l-vocalization). This same child was recorded with other uses of this vowel:

book	[byʔ]	wool	[ʔy:] ⁶
wolf	[ʔyç]	two	[ty:]
school	[sy:]	flute	[syk]

The lax vowel [ʏ] was reported by Chin (2003, pp. 854, 857), who described three children as using the vowel for some examples of target /u/. Examples include *boot* [bʏt] and *booty* [bʏri], and *juice* [ʃy] and *juicy* [ʃy:xi].

The mid-open vowel [ø] was reported by Reynolds (2002). His Child M used this vowel in one realization of the target word *book*: [ød]. She also used it as the final point of a diphthong, as in *cow* [kɒø].

As well as occurring in disordered speech for target English vowels, front rounded vowels are also found as target forms in a variety of languages. We concentrate here on those languages that may be used by multilingual clients likely to be encountered clinically by speech-language pathologists (SLPs) in English-speaking countries. French, for example, has front rounded vowels: *tu* “you (singular)” [ty], *peu* “a little” [pø], and *peur* “fear” [pœʁ]. German is another example: *Rübe* “turnip” [ʁybə], *Müller* “miller” [ˈmʏlɐ], *Röhre* “pipe” [ʁøʁə], and *können* “be able to” [ˈkœnən]. Other commonly encountered languages that have at least some front rounded vowels include Dutch, Swedish, Danish, Norwegian, Finnish, Hungarian, Turkish, Korean, and Chinese (International Phonetic Association, 1949, 1999).⁷

Back unrounded vowels. The back unrounded vowels are the unrounded equivalents of [u, o, ɔ, ɒ] and are denoted by the symbols [ʉ, ɤ, ʌ, ɑ] (see Figure 1). Before considering these vowels in disordered speech, we need to comment briefly about two of them. The symbol [ʌ] is used in transcriptions of English to represent an unrounded central vowel. In many varieties of English, this is a fairly open central vowel that would be better represented in IPA terms with the symbol [ɐ]. However, in North American varieties, the vowel is often a midcentral vowel, differing from [ə] mainly in that it is found in stressed syllables. At the time that IPA symbols were being chosen for the phonemes of English (at the end of the 19th century), this vowel was pronounced with the tongue higher and further back than it is today, and so the choice of /ʌ/ for its symbol was not inappropriate. Also, the full range of central vowel symbols shown in Figure 1 had not been adopted at that time, so the choice of possible symbols was limited. This does mean, however, that it is not always clear what value

⁶[:] denotes that the vowel is long in duration; [ː] denotes that the vowel is half long.

⁷The vowel [œ] has been recorded only rarely in natural language. This may be due to the fact that it is difficult to maintain lip rounding with a fully open jaw and low tongue placement.

the symbol [ʌ] represents. In transcriptions of languages other than English, it should be taken to stand for a back unrounded vowel with the tongue at the same height as for [ɔ]. In transcriptions of normal or disordered English, we must assume that it represents the value of a stressed central vowel normal for the variety in question, unless the author states otherwise.

The open back unrounded vowel [ɑ] is, of course, found in all varieties of English (though in some it may be advanced quite considerably). We do not, therefore, include it in our list of disordered vowels for the reasons stated earlier for the other vowels that are normally found in English.

Reynolds (2002) recorded usage of the close back unrounded vowel [ʊ] in disordered speech. For example, his Child M produced the following as variable realizations of the target words listed:

book	[guʔ]	shoes	[tsu:z]
boots	[buʔs]	out	[əʊʔ]

Bates, Watson, and Scobbie (2002, quoting Fudge, 1969) gave the example of *doggie* realized as [gʌgu] by a normally developing child age 1;4 (years;months).

The close-mid back unrounded vowel [ɤ] is rare in the disordered data. Reynolds (2002) recorded it as a realization of vocalized dark-l in the word *bubbles*, which also contains an example of the close back unrounded vowel: [bɒbʉ].

The vowels [ʉ, ɤ, ʌ] occur normally in Vietnamese (Nguyễn, 1987). Examples are *từ* “forth” [tʉ], *tơ* “silk” [tɤ], and *âng* “favor” [ʌŋ]. One or more of these vowels may also be found in Lao (Enfield, 2007), Turkish, Thai, Korean, and Japanese (among others; International Phonetic Association, 1949, 1999).

The open back rounded vowel. The open back rounded vowel [ɒ] is found in several varieties of English, for example, in both British and some New England varieties. In British English, it is used in words such as *cod* and *cot*. This vowel can be counted as a disorder, however, when it occurs in varieties that do not have this vowel in their target systems. An example of such disordered usage was recorded by Pollock (2002) where, for example, a child in her study of Memphis vowels used [ɒ] for /æ/ in *car*. Chin (2003) also reported *doggie* realized as [dɒ:hi] by one of his study participants. (That this was not part of the target accent is seen in the same participant’s pronunciation of *dog*: [dag]).

Central vowels. Figure 1 shows three unrounded-rounded pairs of central vowels associated with close, close-mid, and open-mid points on the diagram ([i, ʉ, ə, ɐ, ɜ, ɛ]); and two lax vowel symbols, one in the mid position and the other in an opener position ([ə, ɐ]). Reynolds (2002) noted that one disordered realization of *shoes* by his Child M was [ʃu:z], and Bates et al. (2002) recorded [bʉts] as a realization of *boots*. This last, however, is most likely a reflection of the centralized quality of /u/ in the target accent (Scottish English), and thus not an example of disordered usage. This centralization is also found in Northern Irish English, and a similar tendency is developing in many

Figure 2. The IPA diacritic set.

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. $\underset{\circ}{j}$					
\circ Voiceless	$\underset{\circ}{n}$ $\underset{\circ}{d}$.. Breathy voiced	$\underset{..}{b}$ $\underset{..}{a}$	̠ Dental	$\underset{̠}{t}$ $\underset{̠}{d}$
̥ Voiced	$\underset{\text{̥}}{s}$ $\underset{\text{̥}}{t}$	̩ Creaky voiced	$\underset{\text{̩}}{b}$ $\underset{\text{̩}}{a}$	̡ Apical	$\underset{̡}{t}$ $\underset{̡}{d}$
̥^h Aspirated	$\underset{\text{̥}^h}{t}$ $\underset{\text{̥}^h}{d}$	̤ Linguolabial	$\underset{\text{̤}}{t}$ $\underset{\text{̤}}{d}$	̢ Laminal	$\underset{̢}{t}$ $\underset{̢}{d}$
̙ More rounded	$\underset{\text{̙}}{o}$	̜ Labialized	$\underset{\text{̜}}{t}^w$ $\underset{\text{̜}}{d}^w$	̣ Nasalized	$\underset{\text{̣}}{e}$
̚ Less rounded	$\underset{\text{̚}}{o}$	̝ Palatalized	$\underset{\text{̝}}{t}^j$ $\underset{\text{̝}}{d}^j$	̤^n Nasal release	$\underset{\text{̤}^n}{d}$
̟ Advanced	$\underset{\text{̟}}{u}$	̞ Velarized	$\underset{\text{̞}}{t}^v$ $\underset{\text{̞}}{d}^v$	̤^l Lateral release	$\underset{\text{̤}^l}{d}$
̠ Retracted	$\underset{\text{̠}}{e}$	̡ Pharyngealized	$\underset{\text{̡}}{t}^f$ $\underset{\text{̡}}{d}^f$	$\text{̤}^{\text{̠}}$ No audible release	$\underset{\text{̤}^{\text{̠}}}{d}$
$\text{̥}^{\text{̠}}$ Centralized	$\underset{\text{̥}^{\text{̠}}}{e}$	̡ Velarized or pharyngealized	$\underset{\text{̡}}{t}$		
$\text{̥}^{\text{̠}^{\text{̠}}}$ Mid-centralized	$\underset{\text{̥}^{\text{̠}^{\text{̠}}}}{e}$	̤ Raised	$\underset{\text{̤}}{e}$ ($\underset{\text{̤}}{j}$ = voiced alveolar fricative)		
̤ Syllabic	$\underset{\text{̤}}{n}$	̥ Lowered	$\underset{\text{̥}}{e}$ ($\underset{\text{̥}}{\beta}$ = voiced bilabial approximant)		
̥ Non-syllabic	$\underset{\text{̥}}{e}$	̤ Advanced Tongue Root	$\underset{\text{̤}}{e}$		
$\text{̥}^{\text{̠}}$ Rhoticity	$\underset{\text{̥}^{\text{̠}}}{ə}$ $\underset{\text{̥}^{\text{̠}}}{a}$	̥ Retracted Tongue Root	$\underset{\text{̥}}{e}$		

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approximants because these sound types, unlike plosives, fricatives, and affricates, lack special symbols for their voiceless counterpart. There are also diacritics (such as advanced, retracted, raised, and lowered) that are normally used to show slight differences from the usual sound associated with the bare symbol. (See Ball, 2001, for a taxonomy of diacritics.) In this section of the tutorial, we will concentrate on a subset of these diacritics: those that are likely to be most useful for the clinician and that have been used in investigations of disordered language, and that might be encountered in the transcription of other languages commonly encountered in the speech therapy clinic. The nasalized diacritic was described and illustrated in the first part of this tutorial (Ball, Müller, Rutter, & Klopfenstein, 2009) and will not be returned to here.

Voicing diacritics. These diacritics are added to symbols to show either that the sound denoted is partially devoiced/partially voiced or that it is wholly voiceless or voiced. In the latter usage, they are needed when there is no symbol for the voiceless or voiced equivalent of a sound. As noted in Ball, Müller, Rutter, and Klopfenstein (2009), Burmese has voiceless nasals, but there are no IPA symbols designed for these sounds; therefore, the symbol for the voiced nasal is employed with the addition of the voicelessness diacritic.¹⁰ Icelandic has a range of voiceless sonorants, including $[\text{m}^{\text{̥}}]$, $[\text{n}^{\text{̥}}]$, $[\text{l}^{\text{̥}}]$, $[\text{r}^{\text{̥}}]$, these being allophonic variants of their relevant phonemes (Sveinn Haraldsson, personal communication, May 5, 2009).

In English, the voiceless diacritic is used to show partial devoicing of approximants following voiceless consonants.

Examples are shown here:

play	$[\text{p}^{\text{̥}}\text{leɪ}]$	clay	$[\text{k}^{\text{̥}}\text{leɪ}]$
twin	$[\text{t}^{\text{̥}}\text{wɪn}]$	quick	$[\text{k}^{\text{̥}}\text{wɪk}]$
preen	$[\text{p}^{\text{̥}}\text{ɪn}]$	cream	$[\text{k}^{\text{̥}}\text{ɪm}]$
smile	$[\text{s}^{\text{̥}}\text{maɪl}]$	slay	$[\text{s}^{\text{̥}}\text{leɪ}]$

In disordered speech, the voiceless diacritic has been used to show the use of voiceless nasals, for example, in cleft palate speech (see Ball, Müller, Rutter, & Klopfenstein, 2009). Reports of other voiceless sonorants in disordered speech are not common. However, this may be the fault of inexact transcriptions, and Masilon and Ross (1996) reported that mistiming of voicing by infants may lead to acoustically voiceless vowels and sonorants, and that clinical transcribers may ignore these in transcription.

Powell (2001, p. 60) noted the use of the voiced diacritic in disordered speech to show an unexpected partial voicing of a target voiceless consonant: *Sue* $[\text{s}^{\text{̥}}\text{u}]$.

Consonant release diacritics. Voiceless consonants may be released with aspiration: that is, a small period of voicelessness before the voicing starts for a following voiced sound. Normal English fortis stops are aspirated, except when following $/s/$: *tie* $[\text{t}^{\text{̥}}\text{aɪ}]$ versus *sty* $[\text{st}^{\text{̥}}\text{aɪ}]$. In other languages, aspiration may be found with, for example, fricatives and affricates. The International Phonetic

¹⁰There are very few IPA symbols representing voiceless sounds that lack a voiced counterpart symbol. One example is the symbol for the voiceless postalveolar-velar fricative $[\text{ɟ}^{\text{̥}}]$.

Association (1999) noted that Cantonese has the aspirated and unaspirated affricates [ts^h] and [ts], whereas Korean has an aspirated fricative described as alveolar (International Phonetic Association, 1949) or alveolopalatal (International Phonetic Association, 1999).

In disordered speech, target aspirated sounds may be realized as unaspirated, and target unaspirated sounds may be realized as aspirated. An example of the former is given in Ball et al. (2004), where over a period of time, the client's fortis plosives went from [p^h, t^h, k^h] to [p, t, k].¹¹ On the other hand, Binnie, Daniloff, and Buckingham (1982) described a child who became deaf at age 5;0 and developed a range of atypical pronunciation patterns that included adding aspiration to final obstruent consonants. Scott, Clegg, Rudge, and Burgess (2006) described a case of foreign accent syndrome following a cerebral vascular accident. Among the consonant errors was heavily aspirated /p/ even when following /s/ (that can be transcribed [ph] and [sph], with the full [h] symbol demonstrating heavy aspiration).

In English, word-final plosives may have no audible release. (Ball & Müller, 2005, describes the ways that this may be accomplished.) Therefore, *hat* may be pronounced as either [hæt^h] or [hæt̚]. Unreleased stops are always found word-finally in Cantonese, for example, and the production of fully released stops may be difficult for bilingual Cantonese English speakers. Clearly, if unreleased stops are used in target English utterances other than as optional word-final realizations, they will be deemed disordered. Louko and Edwards (2001) and Shriberg (1993) urge that unreleased stops should be transcribed by the clinician, and Powell (1989) provides illustrations of their use.

The diacritics for nasal release and lateral release are not often needed if one uses the syllabic diacritic; this is discussed further later.

Consonant place diacritics. The following diacritics can be classed as marking consonant place: advanced, retracted, dental, apical, and laminal. In English, allophonic variants of velar consonants can be marked with the advanced and retracted diacritics to show precise tongue-palate contact (e.g., *key* [k̟i] vs. *car* [k̠ɑ]). We can also use the dental diacritic to show dental allophones of /t, d, n/: *tenth* [t̪ɛnθ], and compare these with retracted (i.e., postalveolar) variants: *unrest* [ʌn̠ˈɹɛst].¹² The apical and laminal diacritics are not usually needed in English transcription, but are required for languages that contrast tongue tip and tongue blade articulations in otherwise identical consonants (e.g., [ɖ] versus [ɗ] in Ewe, a language of West Africa; International Phonetic Association, 1999).

In disordered speech, these diacritics will be useful in marking misarticulated fricatives. The dental diacritic, for example, is useful to mark grooved, dental realizations of

fricatives (see Grunwell, 1987, for several examples of the use of these grooved, dental fricatives). Similarly, an alveolar slit fricative can be transcribed as [θ̟] or [ʃ̟] dependent on the precise channel shape. The apical diacritic is ideal for transcribing an apical-r (rather than a bunched-r): e.g., [ɹ̟]. Unfortunately, there is no agreed way of marking a bunched-r, and the laminal diacritic would really not be appropriate here.¹³

Consonant manner diacritics. The three diacritics for raised, lowered, and syllabic can be used to mark differences in consonant manner from that of the bare symbol. The lowered diacritic has been used to transcribe an approximant version of a fricative where no dedicated symbol exists. For example, one realization of English /r/ is a bilabial approximant with no back or front tongue raising (i.e., neither [w] nor [ɥ]). This realization has no IPA symbol, so we can use the symbol for the voiced bilabial fricative and add a lowering diacritic to show the wider air channel: [β̞]. This sound is found in disordered speech and as a normal pronunciation in younger British English speakers. Ball, Müller, Rutter, and Klopfenstein (2009) provide references to both normal and disordered use of this sound.

The raised diacritic can also be used with realizations of English /r/. In many varieties, /r/ is a fricative following /t/ and /d/, so *dry* can be narrowly transcribed as [d̟ɹ̟]. Naturally, this transcription may also be employed if target English /r/ is realized as a fricative in contexts other than these.

The syllabic diacritic is used in English to mark syllabic laterals and syllabic nasals that are commonly used in many varieties in words, such as *bidden*, *middle*, *bitten*, and *metal* ([bɪd̩n̩, mɪd̩l̩, bɪt̩n̩, met̩]). Other consonants may take on syllabic status, however, and be found in disordered speech. Pharr, Bernstein Ratner, and Rescorla (2000) noted the excessive use of syllabic consonants (e.g., [ʃ̩]) in children with specific language impairment as compared to children with normal language, and Reynolds (2002, p. 121) also noted an example of [ʃ̩] in his Child R: *circus* realized as [fethʃ̩].

Vowel diacritics. Diacritics that can be used to refine vowel symbols are raised, lowered, advanced, retracted, advanced tongue root, retracted tongue root, centralized, mid-centralized, more and less rounded, rhotic, and nonsyllabic. The first eight of these give extra information on tongue position, and the next two on lip shape. Data from contributions to Ball and Gibbon (2002) illustrate a number of these diacritics. Pollock (2002) used the following diacritics to denote some vowels used by her Child K25: [ɪ̟, ɛ̟-ɪ̟, ɛ̟]. Reynolds's Child P used [ɑ̟, ɛ̟, ɔ̟]; his child A used [ɑ̟]; and his Child O used [ɑ̟], [ɔ̟], [ɛ̟] and [ɪ̟]. Scott et al. (2006) noted that their client used a value for target British English /ɒ/ that had the tongue moved toward the /ɔ/ position (this could be transcribed [ɔ̟]). The more and less rounded diacritics should not be used to mark the total opposite rounding of a symbol (as of course there are alternative vowel symbols to show this). These diacritics are useful to denote, for example, the loss of expected

¹¹The International Phonetic Association has no diacritic for non-aspirated release. Such a diacritic is included in the Extensions to the IPA, which are discussed in the third and final part of this series (Rutter, Klopfenstein, Ball, & Müller, 2010).

¹²The IPA has no diacritic to mark alveolar, but as with lack of aspiration, such a diacritic is included in the Extensions to the IPA, which are discussed in the final part of this series (Rutter et al., 2010).

¹³Laver (1994) suggested the use of [ɹ̠]. Using IPA diacritics to show a retracted tongue body, we would suggest [ɹ̠̟].

coarticulatory effects, as in the Ryalls et al. (1993) study of speakers with hearing impairment where the speakers with profound hearing impairment used less than expected rounding on [u]. The increasing fronting and unrounding of /u/ in young person's contemporary English could be shown as [ʊ+].

The rhotic diacritic is of course used in rhotic accents but can be added to any vowel to show nontarget rhotic quality. Finally, we can note that the nonsyllabic diacritic can be added to one of the symbols of a diphthong (as an alternative to using the tie-bar notation). This also allows us to distinguish falling diphthongs (where the first part of the diphthong carries most emphasis), as in English *eye* [aɪ̯], from rising diphthongs (where the final part carries the emphasis), as in Welsh *lliw* [liu̯], “color”; clearly this diacritic might be needed in disordered speech if diphthongs differ from the target language in terms of falling or rising.

Secondary articulation diacritics. The main secondary articulations are labialized, palatalized, velarized, and pharyngealized; the diacritics used here are small, raised versions of relevant symbols. Grunwell (1987) provided examples of the use of palatalized alveolar fricatives in disordered speech (/s, z/ → [sʲ, zʲ]), and Ball, Lowry, and McInnis (2006) noted the use of velarization (e.g., *parent* [pʲɛəʊənt]). Powell (2001) has references to other examples of secondary articulations in disordered speech, and in Ball, Müller, Rutter, and Klopfenstein (2009), we referred to the use of pharyngealization in Arabic; here we can note the possibility of interference in English with clients whose first language is Arabic.

English clear- and dark-l are usually described as palatalized and velarized, respectively: [lʲ] and [lʷ].¹⁴ Some dialects, however, have only clear-l (e.g., Irish English), and others have only dark-l (e.g., Canadian English). These diacritics will be needed when clear- and dark-l variants are used incorrectly in disordered speech. For example, Scott et al. (2006) noted that their foreign accent syndrome client used clear-l in all positions. Finally, the labialization diacritic is used in the narrow transcription of English sounds preceding rounded vowels, for example, *toe*, *sew*, *go* [tʰoʊ̯, sʰoʊ̯, ɡʰoʊ̯], and is used when labialization is used incorrectly in disordered speech.

CONCLUSION

We noted in Ball et al. (2009) that it is not possible to learn to recognize these non-English sounds from the pages of a tutorial. Recall that recordings do exist of a wide range of non-English consonants and vowels. For example, Ball and Müller (2005) have recordings of most of the sounds covered in this tutorial article on accompanying CDs. Web sites with recordings of the sounds can also be accessed; for example, the York University version is at <http://www.yorku.ca/earmstro/ipa/>; the UCLA version is at

<http://www.phonetics.ucla.edu/course/chapter1/chapter1.html>; and the UCL site gives details of how to order an audio cassette or CD of the sounds produced there (<http://www.phon.ucl.ac.uk/home/wells/cassette.htm>).

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¹⁴The transcription [ɫ] is often found for dark-l, using the IPA diacritic meaning either velarized or pharyngealized, as “dark” qualities of consonants may be produced with either or both of these characteristics.

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