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19. Vowel Place

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Sections

What is vowel place and what role does it play in the sound patterns of language? The term "vowel place" means different things to different people. There are two main reasons for this. First, the relationship between the articulation and the acoustics of "place of articulation" is complex and multifaceted. Second, phonological features have a range of model-specific definitions. The purpose of this chapter is to give a general introduction to the phonetic and phonological issues necessary to understand vowel place.

1 The phonetics of "place"

At its most basic, "the behavior of the vocal tract in speech can be described as an alternation of closing and opening" (**Chomsky and Halle (*SPE*) 1968**: 301). These closings and openings result in a complex set of aerodynamic and acoustic effects. Depending on the amount of the contraction or expansion, combined with language-particular phonotactics, a resulting acoustic signal is interpreted as a consonant and/or a vowel. The type and degree of the vocal tract openings and closings on the articulatory side of things corresponds roughly (but, as we will see, not directly) to what are commonly and descriptively referred to as phonological major class features, consonant manner features, and vowel height features (CHAPTER 21: VOWEL HEIGHT)[1]. However, it is not enough to look at sound patterns only in terms of constriction. One must also attend to the precise location at which constrictions occur within the vocal tract.

We have known since the groundbreaking work of **Chiba and Kajiyama (1942)** that constrictions and expansions along the vocal tract have particular acoustic effects that can be explained in terms of tube acoustics. Depending on the proximity of a constriction or expansion to a node (i.e. point of minimal air displacement) or a loop (i.e. point of maximal air displacement) associated with a tube's resonance frequency, there will be different effects on that resonance frequency. A constriction at a loop causes a decrease in frequency, and a constriction at a node causes an increase. It is the location along the length of the vocal tract where articulatory gestures take place, combined with their acoustic correlates, that corresponds to a large extent (but not absolutely) to what is commonly known as phonological place of articulation.

From an articulatory perspective, place involves passive and active articulators (see **Figure 19.1**). The former are static landmarks along the upper surface of the vocal tract. The latter are mobile articulators along the lower surface of the vocal tract that move nearer to or further from the static landmarks during speech.

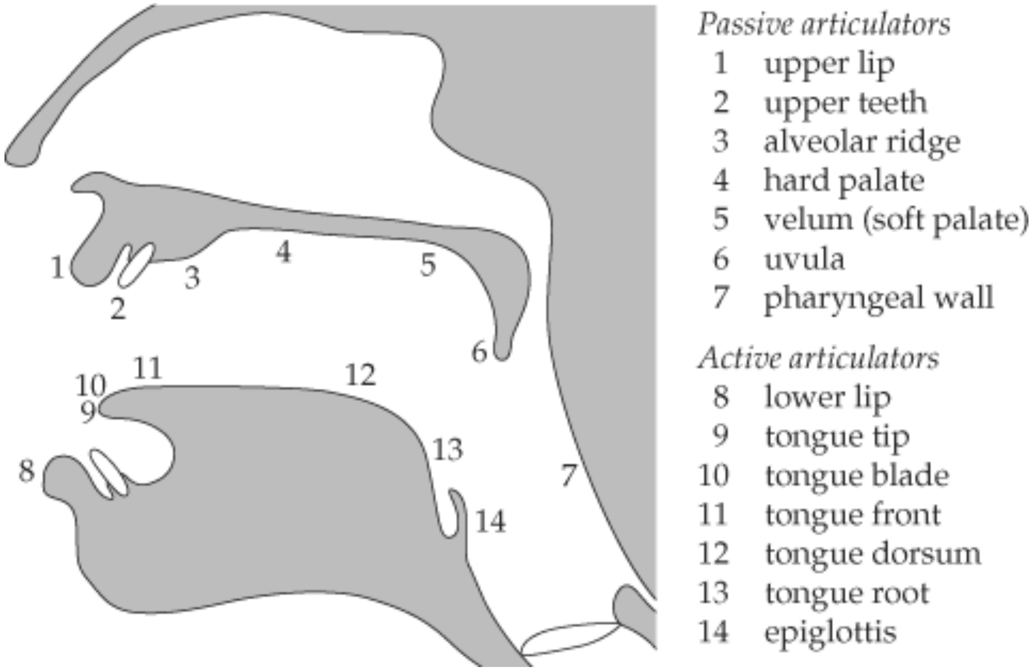


Figure 19.1 Vocal tract diagram

If one looks at the documented combinations of active and passive articulators found cross-linguistically, one sees evidence of all physically felicitous combinations. Further, neither active nor passive articulator seems to be privileged in having primary responsibility for defining place across contexts. For example, the passive uvula articulator can be used to single out the set of uvulars, and the active epiglottis articulator can be used to single out the set of epiglottals. However, the active tongue dorsum articulator is used for both dorsals and uvulars, whereas the passive pharyngeal wall articulator is used for both pharyngeals and epiglottals.

Combinations of active and passive articulators result in particular shapes of the vocal tract and cause the general acoustic effects described by Chiba and Kajiyama. To illustrate this in simplified terms, we can look at the schematized vocal tract in **Figure 19.2**. Here we see a tube closed at one end by the larynx and open at the other end by the lip orifice. The first three formants (F1, F2, and F3) are indicated by sine waves, and loops and nodes associated with these formants are indicated by solid and dashed vertical lines, respectively. The F1/F2/F3 loop labeled A corresponds to the labial region, the F3 node labeled B corresponds to the alveolar region, the F2 node C and F3 loop D correspond to the velar region, and E, F, and G correspond to the pharyngeal region.

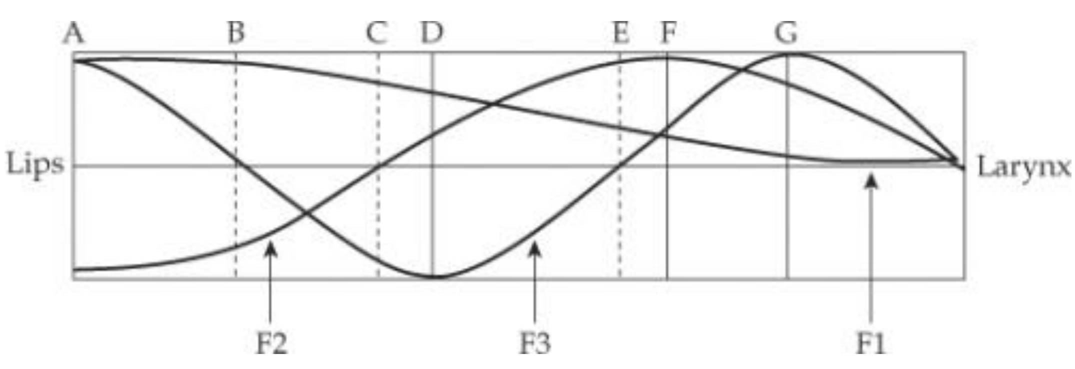


Figure 19.2 Illustration of vocal tract tube acoustics

The acoustic results of contractions at the various loops and nodes in the vocal tract are seen most clearly in F2 transition targets associated with stops. These correspond quite nicely to what are commonly described as the primary consonant places. This is illustrated in **Figure 19.3** for labial, alveolar, and velar stops in particular vowel contexts. We see that labial constrictions have a low F2 target (below 600 Hz). This is because the labial region is a loop for F2. Alveolar constrictions have a mid-range F2 target (approximately 1800 Hz), because this region is neither a loop nor a node for F2. Velars have a high F2 target (above 2500 Hz), because this is a node for F2[2].

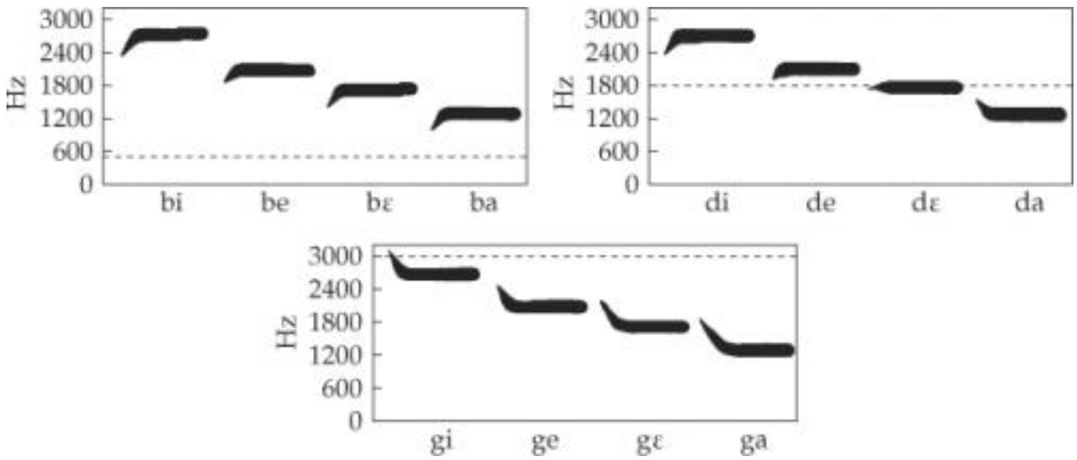


Figure 19.3 F2 schematics for several consonant-vowel combinations. Dashed lines indicate stop transition targets (modified from **Delattre *et al.* 1955**)

Although there are complications to this story when one looks carefully at particular contexts and at combinations of articulations in running speech, there is general consensus in the literature with respect to the relationship among some consonant articulations, acoustics, and phonological place features. This is in no small part due to the rather extreme constrictions that consonants require for their production. These allow for a robust and precise articulatory and acoustic characterization of consonants. Further, these extreme articulations and their natural proximity to resonance nodes and/or loops also produce "quantal effects" (**Stevens 1972, 1989)**, where relatively large movements along some regions of the vocal tract produce only small acoustic results, while small movements along other regions produce large acoustic results. Thus it is not surprising that certain consonant places are quite common across the world's languages. It is also not surprising that consonant place is well studied, and that the phonological features involved and their corresponding phonetic signatures are to some extent agreed upon.

2 The phonetics of vowel place

However, the situation with vowels is very different. Because vowel articulations involve more subtle degrees of constriction/expansion, which have less extreme effects on vocal tract cavity size and shape, they result in more subtle acoustic cues. The consequence is less obvious splitting of the vocal tract into distinct sub-cavities and thus a smoother acoustic continuum from one vowel quality to another. This has several interesting consequences.

First, there is often uncertainty regarding what place a given vowel has in isolation, and one must look more carefully at language-specific *relationships* among vowels than is usual in establishing consonant place. Second, there are often multiple articulations required to get a robust and consistent acoustic contrast among vowels. Some of these multiple articulations are called enhancement strategies, and it is not always clear which articulations are phonologically primary and which are phonologically secondary or purely phonetic. For example, back vowels tend to involve both tongue dorsum raising and lip rounding. Together these gestures lead to a more robust F2 difference between front and back vowels, thereby enhancing perceptual distinguishability. However, it is not always obvious if the labial or the dorsal gesture is phonologically relevant, or if one (or even both) is a phonetic enhancement. The decision requires phonological analysis of the entire vowel system and thus is made using theory-internal criteria and/or linguist-specific preference. Third, it is less straightforward to define vowel place features via vocal tract landmarks than consonant place, because of less extreme articulations at fixed locations. Therefore, place in vowels is often discussed in terms of fairly large ranges of F2 averages within the speech of individuals, rather than precise articulator combinations and F2 targets across populations. Fourth, differences between consonants and vowels with respect to articulations, acoustics, and straightforward assignability have led some researchers to conclude that different sets of features are appropriate for consonant place and vowel place. Fifth, although consonant and vowel place is usually discussed in terms of constrictions associated with the suprapharyngeal cavity, pharyngeal adjustments seem to play an important role in at least some of the consonant place literature (see **CHAPTER 25**: PHARYNGEALS). This is usually called pharyngeal, radical, or guttural consonant place. In contrast, pharyngeal adjustments made during the production of vowels are not typically seen as related to vowel place. We will come back to this below.

Finally, because of unavoidable articulatory differences between consonants and vowels involving vocal tract constrictions at the same location, there is often a mismatch between the acoustic cues that one expects for consonant and vowels made at that location. For example, consonants made with a constriction in the area of the velum are expected to have a high F2 target in some vowel environments (recall **Figure 19.3**), but vowels made with a constriction near the velum (i.e. back vowels) have a rather low F2.

However, the low F2 of back vowels is in part due to the fact that these vowels have a larger anterior oral cavity than front vowels (which can be made even larger via lip rounding, further lowering F2), and this has a significant effect on relative F2. The different F2 targets for certain consonants and articulatorily related vowels have led to an impression among some phonologists that consonant and vowel place features must be fundamentally different. However, a closer inspection of **Figure 19.4** clearly shows that this impression is incorrect. Not only do both velar consonants and back vowels have the same constriction location, but they also have similar F2 targets when anterior oral cavity size is controlled for. All velar constrictions result in a low F2 if there is a large anterior cavity (compare [ɔ o u] formant centers and the stop transition target in [gɔ go gu]). As indicated by the dashed lines in **Figure 19.4**, coronal consonant F2 is in the mid-range in non-back vowel environments, but it is in the high range in back vowel environments. The velar consonant F2 relationship is the opposite.

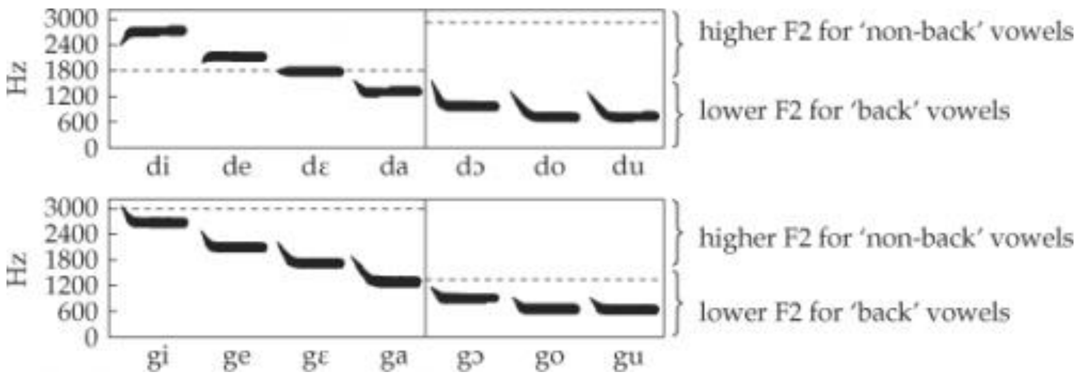


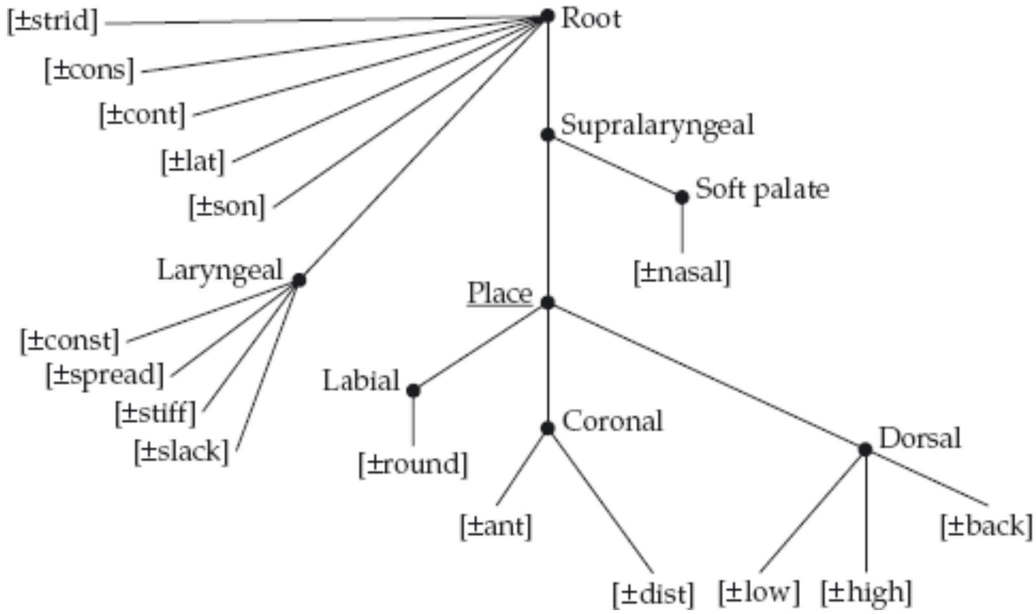
Figure 19.4 F2 schematics. Dashed lines indicate stop transition targets (modified from **Delattre *et al.* 1955**)

To summarize, the acoustics and articulation of vowel place are fairly similar to that of consonant place. The major difference is in the amount of constriction involved at particular locations and corresponding acoustic effects. Whereas, for anatomical/tube-acoustic reasons, consonant F2 transition targets are fairly precise, robust, and universal, vowel F2 ranges are less so, and vary by speaker and language due to the more continuous nature of vowel vocal tract adjustments and corresponding acoustics.

3 Uses of the label "vowel place"

In addition to being used to describe the physical attributes of vowels, the label "vowel place" is also used in two distinct, but related, ways in the phonological literature. First, it is a descriptive term given to a set of phonological features that correspond in some way to the phonetic characteristics just mentioned (**CHAPTER 17**: DISTINCTIVE FEATURES). The most obvious of these is [±back] (**Chomsky and Halle 1968**), which expresses a binary distinction among vowels along the front–back dimension of oral cavity constriction that has particular F2 and sound pattern consequences. Second, "vowel place" can also refer to an abstract organizing node within some autosegmental models (**CHAPTER 14**: AUTOSEGMENTS; **CHAPTER 27**: THE ORGANIZATION OF FEATURES). This node is used to bind together and organize individual place features. For example, **Clements (1985)** introduced a place node in his feature geometry on which individual place features (e.g. [labial], [coronal], [dorsal]) are dependent. This idea has been modified a number of times over the years, for example in (1).

(1) *Feature geometry of Sagey (1990)*



It is important to note that this type of geometry groups traditional place features and non-place features under "place" organizing structures. For example, Sagey uses place, labial, coronal, and dorsal organizing "place" nodes that have dependent [s±round], [±anterior], and [±back] "place" features and dependent [±distributed], [±low], and [±high] "non-place" features.

Although there are language-particular phonetic and phonological facts that have led to this proposal, there are a number of unanswered questions that must be asked. For example, what is the formal difference between a place node and a place feature? Why can some structures, such as [coronal], be both a feature and an organizing node for dependent features, while other structures, such as C-place, V-place, and aperture, can only be an organizing node? Is there a formal reason for this? What is "place" in a model where both place features and non-place features are dependent on the same "place" nodes? It is beyond the scope of this chapter to answer these questions, but it is important to think about what "place" really means and how it might be modeled.

To summarize, we have to contend with at least three meanings of the term "vowel place" in the literature. It can be a descriptive term for related articulatory and/or acoustic characteristics. It can be a descriptive term for related phonological features. It can be a formal term for segment-internal organizing structure.

4 The phonology of vowel place

If we assume there is phonological vowel place from a featural and/or an organizational perspective, we have to ask ourselves what it is used for. There are seven major types of phenomena that are relevant here:

(2)

a. Vowel contrasts

b. Consonant contrasts

c. Vowel interactions

d. Consonant-vowel interactions

e. Consonant–vowel alternations

f. Vowel neutralizations

g. Consonant interactions

The first five will be discussed below.

The most obvious use of vowel place features is to establish contrasts among vowels (see CHAPTER 2: CONTRAST). However, given the interactions among vowel articulations and acoustics discussed above, it is difficult to establish absolute and precise articulatory or acoustic characteristics for vowel place and translate these directly to phonological structures. It is thus common to describe vowel inventories via a combination of articulatory configuration and relative position along F1 and F2 continua in charts such as that in Figure 19.5. The vertical axis represents F1 and relative openness of the oral cavity (see CHAPTER 21: VOWEL HEIGHT). The horizontal axis represents F2 and relative location along the front–back dimension of the oral cavity, where there is a constriction or expansion.

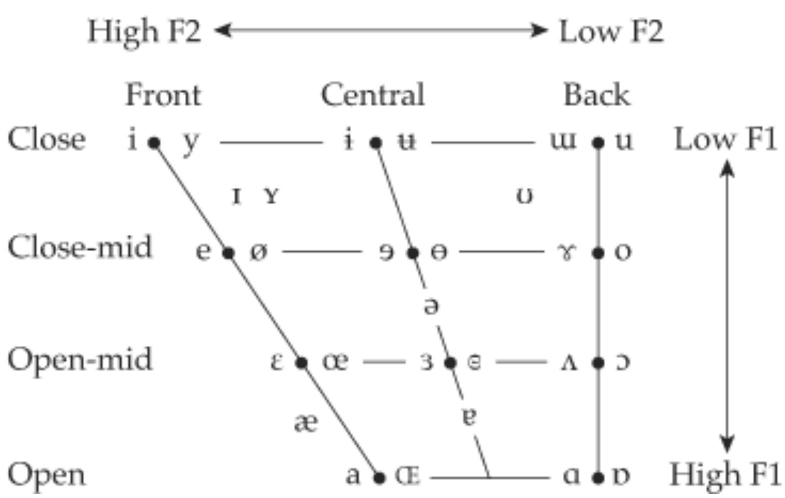


Figure 19.5 Standard vowel chart (IPA)

What is important for our purposes is the number of differences along the horizontal axis if relative F1/openness/tongue height is controlled for. It is also important to relate those differences to articulator configurations and phonological patterns. As we see in Figure 19.5, there seem to be six major categories along the F2 acoustic dimension for most vowel heights[3] – [i y ɨ ʉ ɯ u], [e ø ɘ ɵ ɤ o], and [ɛ œ ɜ ɞ ʌ ɔ], and these divide articulatorily into three main areas based on tongue position (i.e. front, central, and back), with a further split based on lip configuration (i.e. rounded and unrounded).

There are four interpretations for the fact that lip rounding can combine with tongue configuration to produce contrasts along the F2 continuum. First, vowel features are defined acoustically, rather than articulatorily. After all, one cannot claim that Figure 19.5 represents articulatorily defined vowel features having to do with tongue position (i.e. "front–back") and height, and then include labial characteristics. The second is to claim that [round] is not a vowel place feature, but some other type of feature. This leaves vowel place as defined solely via tongue position – this is the position taken by Chomsky and Halle (1968). The third is to suggest that vowel features are not defined purely on acoustic or articulatory characteristics, but different features are acoustically or articulatorily defined. This seems to be the position taken by most generative phonologists, even if they do not state so explicitly. Finally, one could claim that vowel place features are articulatorily defined via the location along the vocal tract where constrictions or expansions occur. This is essentially the position of Articulatory Phonology (Browman and Goldstein 1986, 1992; see also CHAPTER 5: THE ATOMS OF PHONOLOGICAL REPRESENTATIONS).

While it is fairly uncontroversial that the vowel space is divided roughly into six phonetic regions along the F2 dimension when one looks at cross-linguistic inventories, there is considerable debate about how these phonetic regions should be classified from a phonological perspective. Clements (1991) suggests that three distinct, unary, place features/nodes are needed to capture six contrastive vowel places – two features/nodes for tongue position along the front–back dimension (i.e. [coronal] and [dorsal])[4] and one feature/node for lip rounding (i.e. [labial]). This is a minor modification of *SPE*-based feature theory. There are, of course, a number of ways to implement this system, depending on one's assumptions about underspecification/full specification, feature co-occurrence markedness, etc. (CHAPTER 4: MARKEDNESS; CHAPTER 7: FEATURE SPECIFICATION AND UNDERSPECIFICATION). (3a) and (3b) show two possible implementations for high vowels[5].

(3) a.

	[labial]	[coronal]	[dorsal]
[ɨ]			
[ʉ]	✓		
[i]		✓	
[ɯ]			✓
[y]	✓	✓	
[u]	✓		✓
—		✓	✓
—	✓	✓	✓

b.

	[labial]	[coronal]	[dorsal]
—			
—	✓		
[i]		✓	
[ɯ]			✓
[y]	✓	✓	
[u]	✓		✓
[ɨ]		✓	✓
[ʉ]	✓	✓	✓

As we see in (3a), the central unrounded vowel [ɨ] is placeless, three vowels ([ʉ i ɯ]) have one place feature specified, and two vowels ([u y]) have two places. Interestingly, factorial combination predicts two additional vowels that seem to be absent from descriptions of cross-linguistic inventories. In (3b), we see another possible use of three place features to describe the same six-place cross-linguistic inventory.

There are two questions that result from comparing (3a) and (3b). First, is it an advantage or disadvantage to have indeterminacy in the feature specification of central vowels, as predicted by this three-feature system? Second, why is there no documented language that makes contrastive use of the full eight-vowel place distinction allowed by this system? I will not answer these questions here, but simply point out the issue.

Related to these two questions, but in a slightly different context, is an empirical difficulty encountered by a three-feature system pointed out by **Rice (2002)**. A survey of the languages in **Maddieson (1984)** reveals a maximum of only four front–back distinctions in any one language – not the six or eight predicted by Clements. Some four-high vowel inventory patterns from Maddieson are given in **Table 19.1**[6].

	front unrounded	*front rounded*	*central unrounded*	*central rounded*	*back unrounded*	*back rounded*
Tavgy, Tuva	[i]	[y]	[ɨ]			[u]
Swedish, Norwegian	[i]	[y]		[ʉ]		[u]
Osmanli, Chuvash, Turkish, Yakut, Korean	[i]	[y]			[ɯ]	[u]

Table 19.1 Sample of high vowel inventories taken from **Rice (2002)**, based on **Maddieson (1984)**

In examining Maddieson's typology, we see that contrasts between front unrounded and rounded vowels are quite common, but there seems to be no documented language that distinguishes among central or back vowels with respect only to rounding. While Osmanli, Chuvash, Turkish, Yakut, and Korean seem to do exactly this (see e.g. CHAPTER 118: TURKISH VOWEL HARMONY), Rice claims that the unrounded back vowel in these languages is best analyzed as phonologically central. The conclusion that she draws is that only two phonological place features are needed to phonologically contrast vowels cross-linguistically – [coronal] and [peripheral][7]. The latter is closely related to the features [−grave] and [+flat] of **Jakobson *et al.* (1952)**.

Within Rice's system, the vowels in **Table 19.1** are given the feature specifications in (4).

(4)

	[coronal]	[peripheral]
[ɨ] or [ʉ] or [ɯ]		
[i]	✓	
[ɯ] or [u]		✓
[y]	✓	✓

We see here that the cross-linguistic differences among central and back vowels with respect to rounding are claimed by Rice to be due to language-specific phonetic implementation of phonologically identical feature specifications. This leads to cross-linguistic ambiguity in some cases, as we see with [ɯ], which can be placeless or [peripheral] depending on the contrastive system of the language. There are several interesting results of assigning feature specifications based on language-specific contrasts and allowing for weak phonetic-phonological feature correlations. The one that most impacts the present discussion is that in the absence of central vowels at a given height, one cannot a priori determine the place specification of a vowel based only on contrast. This is demonstrated in (5) via three possible feature specifications for a simple two-way front-back contrast (i.e. [i] *vs.* [u]). To determine which feature-specification option is used in a given language, additional evidence from the language's sound patterns (e.g. assimilation and neutralization) is needed.

(5)

	Option 1		*Option 2*		*Option 3*	
	[coronal]	[peripheral]	[coronal]	[peripheral]	[coronal]	[peripheral]
[i]			✓		✓	
[u]		✓				✓

It is beyond the scope of this chapter to explore the Clements and Rice proposals in full, but it should be clear that both make predictions that must be examined carefully, and there are several issues that they highlight that are relevant for a full understanding of phonological vowel place.

To summarize, regardless of what theory of phonological features one subscribes to, one is obliged to account for the mapping of vowel features to both the articulatory and acoustic dimensions of place and to account for language-particular contrastive vowel inventories and their restrictions. As we have seen, there seem to be generalizations regarding relative numbers of surface vowel differences allowed at a given vowel height, and perhaps generalizations about what their phonetic realizations might be.

4.1.1 Other contrastive vowel place features?

As discussed in §1, place from a phonetic perspective entails active articulators that constrict the vocal tract at a particular location along its length and certain corresponding acoustic characteristics. Following **Chomsky and Halle (1968)**, the place literature usually concentrates on oral cavity constrictions made in the vicinity of passive articulators (i.e. [±back]), as we did in the previous section. However, the literature also explicitly relies on active articulators and pharyngeal cavity adjustments to define some feature specifications. We already saw vowel place defined in terms of the active articulator in Clements's use of [dorsal], even if this could easily be reformulated in terms of the passive articulator, by using [velar]. However, there is at least one feature that necessarily uses an active articulator – retroflex. Although usually considered a phonological manner characteristic, retroflex clearly involves phonetic place, and therefore must be discussed here. Regarding pharyngeal adjustments, the feature [pharyngeal] (or some related feature depending on the model) has been used extensively for consonant inventories – most notably for the Semitic, Caucasian, and Salishan language families. Are retroflex and pharyngeal also used contrastively among vowels, and if so, should they be considered vowel place? (See also **CHAPTER 25**: PHARYNGEALS.)

4.1.2 "Retroflex"

Retroflex segments have a wide range of articulations, depending on the language and context. They involve a combination of the tongue blade or tip and the post-alveolar region. Retroflex segments using the tongue blade are called laminal and those using the tongue tip fall into two classes – apical and sub-apical.

While retroflexion is best studied in consonants, it is clear from the literature that some languages have a contrast between plain vowels and retroflex vowels. These include a number of languages spoken in India. For example, Kalasha has a full set of plain, nasal, retroflex, and retroflex nasal vowels (**Heegård and Mørch 2004**), as shown in (6).

(6) *Contrastive vowels in Kalasha*

[i ĩ i˞ ĩ˞] [u ũ u˞ ũ˞]
[e ẽ e˞ ẽ˞] [o õ o˞ õ˞]
[a ã a˞ ã˞]

Importantly, the non-front retroflex vowels involve constrictions in at least two locations along the vocal tract (i.e. double articulations). If we believe that phonological place has some (semi-)transparent relationship to active and passive articulator combinations, then contrastive retroflex vowels involve a phonological place contrast.

It is important to mention here that the acoustic effects of retroflexion are not necessarily seen most directly in F2, contrary to what one might expect, given the discussion of place thus far. Rather, they involve a lowering of F3. The consequence is that what looks like place along the articulatory dimension does not look like place along the acoustic dimension, if the latter involves exclusively a F2 difference. Thus, considering retroflexion a phonological vowel place property depends on one's theory of the mapping of phonetics to phonological features.

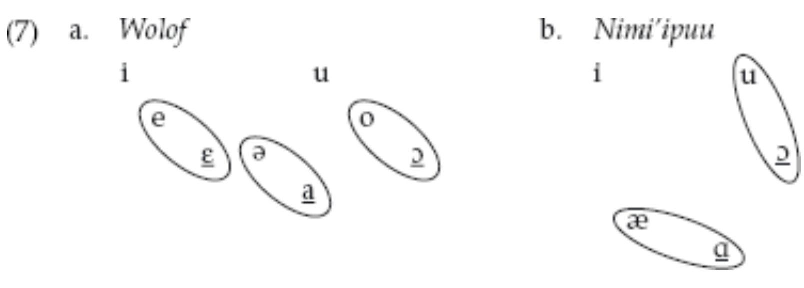
4.1.3 "Pharyngeal"

Perhaps better known, but possibly more controversial, is the role that pharyngeal adjustments play in vowel contrasts. As already stated, there is little doubt that consonants can have pharyngeal place. Less clear is the phonological nature of similar vowel articulations. Because we have only recently developed the technology to easily observe the workings within the pharyngeal cavity, we have had to guess at what is happening there based on transcriptions relying on secondary observations such as acoustic effects. Given that vowel pharyngeal articulations are quite complex, involve simultaneous adjustments of several cavities, and have consequences for more than F2, there has been little motivation for viewing them as place-related. Also, it is not always clear which of many phonetic events involved in pharyngeal articulations correspond to phonological features either cross-linguistically or within a language.

If we assume that place for both consonants and vowels is directly related to the position along the length of the vocal tract where constrictions/expansions take place, then constriction within the pharynx indicates a pharyngeal place for both types of segments. However, while vowel pharyngeal constriction (i.e. retracted tongue root (RTR)) is quite well known and well studied, it is almost always assumed to be separate from place.

Why is RTR not considered a vowel place, while similar gestures are considered to correspond to consonant place? As discussed above, this has to do with assumptions about how one defines phonological features – either universally or language-specifically. Consonants with primary pharyngeal place have unmistakable and quite extreme constrictions within the pharynx that mirror in every way consonant constrictions within the oral cavity. Thus, they have robust articulatory and acoustic cues and phonological patterns that make it difficult to argue that they do not involve a phonological pharyngeal place. RTR vowels, on the other hand, involve more subtle articulations and a range of F2 and F1 effects depending on the context. For those phonologists who define vowel place exclusively via relative position of the tongue within the oral cavity (e.g. [±back]), then RTR cannot involve a place feature. For those phonologists who define vowel place exclusively via relative F2 within a given vowel height (i.e. F1) range, simultaneous F1 and F2 movements associated with RTR cannot involve a place feature.

However, if place is phonetically defined as the relative location along the vocal tract where constrictions and/or expansions take place, and if we acknowledge the non-isomorphism in consonant and vowel place features and acoustics across contexts discussed above, then it is hard to argue in a principled way for the exclusion of at least some pharyngeal articulations as involving some sort of vowel place feature[8]. To illustrate this point, look at the surface realization of contrastive vowels in Wolof (**Backley 1997**) and Nimi'ipuu (also known as Nez Perce – **Aoki 1966**; **Morén 2006b**) in (7). RTR vowels are underlined and plain-RTR vowel pairs involved in phonological alternations are circled. It is obvious from phonological patterns that the circled pairs are phonologically related, and it is obvious from phonetic facts that this is best characterized articulatorily as involving primarily a pharyngeal cavity adjustment. This adjustment is typically interpreted as the phonological feature [−ATR] (advanced tongue root) or [+RTR].



It is also clear in looking at (7) that related vowel pairs differ in both F1 and F2 (cf. **Figure 19.5**). What is unclear is why the F2 difference is not considered to be related to phonological place for these vowel pairs, as it is for other vowel pairs (e.g. [i] and [u]) in these same languages. This question becomes even more interesting when one realizes that it is cross-linguistically quite rare for related front-back vowel pairs to differ only in F2. Rather, they often also involve differences in F1 that are abstracted away from for phonological descriptive expediency.

Thus the fact that Wolof and Nimi'ipuu non-RTR/RTR vowel pairs differ in both F1 and F2 does not automatically justify dismissing a pharyngeal place hypothesis. More evidence is needed. One might fruitfully compare the subtle F2 differences here with those between the labial and non-labial vowel pairs discussed in §4.1 (e.g. [i] and [y]). What makes labiality an obvious candidate for a phonological place distinction for vowels, but not pharyngeality?

Finally, there is evidence from some Arabic varieties that vowels can have contrastive pharyngeal place. For example, Cairene Arabic is usually described as having just three contrastive vowels, /i u a/; however, recent studies show that there are four contrastive vowels in this language – /i u a ɑ/ (**Youssef 2006, 2007**). The vowel [ɑ] is a contrastive "emphatic" vowel that triggers what is called emphasis spread and is also the result of spreading emphasis to /a/. If the descriptive term "emphasis" is interpreted as involving a phonological pharyngeal feature (as is commonly done), then this language has a contrastive pharyngeal and non-pharyngeal low vowel. As one might expect from looking at Wolof and Nimi'ipuu, the difference between pharyngeal and non-pharyngeal vowels in Cairene Arabic is realized acoustically by both F2 and F1 differences, where the pharyngeal vowel has a higher F1 and a lower F2.

To summarize, there are at least five vowel places from an articulatory perspective: labial, coronal, velar, pharyngeal, and retroflex. The first four primarily involve passive articulators, while the fifth primarily involves a particular active-passive articulator combination. Further, the acoustic correlates of the first three involve almost exclusively variation in F2, while the fourth involves both F1 and F2, and the fifth F3. There is currently disagreement in the literature on vowel place contrasts with respect to how many vowel place features are needed to establish cross-linguistically possible and language-particular phonological contrasts. This is in no small part due to the fact that different theories use different aspects of phonetics (and their relationship to phonology) to define phonological place features.

4.2 Consonant place contrasts

In addition to being used to account for place contrasts among vowels, vowel features have also been used to account for place contrasts among consonants (see also **CHAPTER 75**: CONSONANT-VOWEL PLACE FEATURE INTERACTIONS). This is traditionally done in two ways. Either some set of vowel features is used to determine what is called "secondary place of articulation," or they are used to determine primary place of articulation. We will begin with the former.

4.2.1 Consonant secondary place

It has long been observed that some languages make use of what is called secondary place (**CHAPTER 29**: SECONDARY AND DOUBLE ARTICULATION; **CHAPTER 71**: PALATALIZATION). This may be described as a less extreme constriction of the vocal tract occurring roughly simultaneously with a more extreme constriction at a different point along the vocal tract. This less extreme closure is approximately that of a glide and is often attributed to the specification of a consonant with an extra vowel feature (e.g. **Chomsky and Halle 1968**; **Clements 1985**; **Odden 1991**). Examples of secondary articulation are labialization (e.g. [tʷ]), palatalization (e.g. [tʲ]), velarization (e.g. [tˠ]), and pharyngealization (e.g. [tˤ]). Some languages claimed to have single secondary place contrasts are listed in **Table 19.2**.

	labialization	*palatalization*	*velarization*	*pharyngealization*
Chipewyan	✓			
Russian, Irish		✓		
Arabic varieties, Ponapean			✓	
Arabic varieties				✓

Table 19.2 Sample of languages described as having secondary place distinctions

It has also been observed that each secondary place can contrast with other secondary places within a single language (**Table 19.3**).

	labialization	palatalization	velarization	pharyngealization
Nambakaengo	✓	✓		
Nupe		✓	✓	
Marshallese	✓	✓	✓	
Salishan, Caucasian and Semitic varieties	✓			✓
Caucasian and Semitic varieties		✓		✓

Table 19.3 Sample of languages described as having multiple secondary place distinctions

4.2.2 Consonant primary place

There is also a long tradition of using vowel features to define consonant primary place. For example, **Chomsky and Halle (1968)** defined all postalveolar consonant places via a combination of vowel place and height features. What is interesting regarding the *SPE* features [±high], [±low], and [±back] is that while the former two are used by Chomsky and Halle to express vowel height and the latter to express vowel place, the three join forces to express a variety of primary consonant places when combined with [−coronal, −anterior], as shown in (8) (**Chomsky and Halle 1968**: 305). This mix of different types of vowel features to define "consonant place" makes one wonder if it makes sense to discuss place as a phonologically relevant concept at all, or whether "place" is simply a convenient descriptive label that is ultimately epiphenomenal. Further, if place is a phonologically relevant concept, then what is its phonetic grounding, given that phonetically disparate characteristics are used to define place in different contexts?

(8)

	palatals	velars	uvulars	pharyngeals
[high]	+	+	−	−
[low]	−	−	−	+
[back]	−	+	+	+

We will not explore these *SPE* phonological features and the implications that an *SPE*-like system has for both cross-linguistic inventories and phonological alternations, but what is relevant here is that vowel features (e.g. [±back]) are often used to establish primary place contrasts for both vowels and consonants. Many researchers have taken up this strategy, using slightly different feature sets and different representations – particularly within the autosegmental framework (**Clements 1985**; **Steriade 1987**; **Sagey 1990**; **Odden 1991**; **Hume 1994**; **Clements and Hume 1995**; etc.).

4.3 Vowel place interactions

Arguably one of the most visible types of evidence for vowel place features comes from phonological interactions among vowels. These seem to fall into three categories:

(9) a. Adjacent vowel assimilation

b. Adjacent vowel dissimilation

c. Non-adjacent vowel assimilation (also known as vowel harmony)

For reasons of space, only vowel harmony is discussed below.

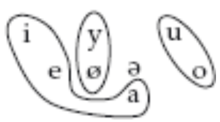
4.3.1 Vowel place harmony

Many languages display long-distance vowel assimilations – commonly called vowel harmony (**CHAPTER 91**: VOWEL HARMONY: OPAQUE AND TRANSPARENT VOWELS; **CHAPTER 118**: TURKISH VOWEL HARMONY; **CHAPTER 123**: HUNGARIAN VOWEL HARMONY). As discussed in van der **Hulst and van de Weijer (1995)**, there is evidence of harmony involving all possible vowel features. The cases that they demonstrate are [front], [labial], [ATR], [RTR], [high], [low], [retroflex], and [nasal].

Vowel place harmony is quite common cross-linguistically, and is often descriptively characterized as involving primarily F2 assimilation. Some of the Finno-Ugric, Caucasian, and Turkic languages are well known for having it. Because vowel place harmony is well studied and there is a vast literature, I will illustrate it with just one case. This comes from the Finno-Ugric language Mari (formerly known as Eastern Cheremis).

As shown in (10), Mari has eight surface vowels (**Sebeok and Ingemann 1961**).

(10) *Mari*



In this language, certain suffixes containing non-schwa mid vowels show a three-way alternation depending on the nature of preceding vowels. [o] appears following [u o], [ø] appears following [y ø], and [e] appears following [i e a]. The natural classes of "triggers" are circled in (10).

The nature of the harmonizing vowel in post-schwa position is interesting because it shows a behavior that is quite common among place harmony systems – vowel transparency. Transparent vowels neither trigger nor block a harmony-related alternation. In the case of Mari, the harmonizing vowel surfaces as [e] when it follows only schwas. Otherwise, it harmonizes to the rightmost non-schwa vowel that precedes it. Because the harmonizing vowel surfaces as [e] in words containing only schwa, one might hypothesize that this is the underlying or default vowel. This implies that the triggers of harmony form two natural classes – [y ø] and [u o].

The actual analysis of front-back harmony systems is greatly debated, and there are many disagreements regarding the representations involved and whether an individual language is best characterized as having front/coronal or back/ dorsal harmony. Since back vowels in many languages are also round, it is also not always easy to tell if harmony involves back/dorsal or round/labial. We will not engage in this debate with regard to Mari. However, this language clearly has vowel place harmony, and the patterns suggest /e/ rounds following phonologically round vowels and backs following phonologically back vowels.

In addition to oral cavity place harmony, there are also languages that have pharyngeal cavity vowel harmony. These are usually called [ATR] or [RTR] harmony systems. As van der Hulst and van de Weijer point out (and this should not be surprising, given the above discussion about pharyngeal place), the correct characterization of pharyngeal place harmony is not always straightforward. Particular languages are often analyzed as having ATR or RTR harmony depending on the researcher and their assumptions about feature theory. Further, although height harmony is usually discussed as involving aperture features and F1 differences, it often involves significant pharyngeal differences as well. Thus, it is not always clear that a case of height harmony is not really place harmony. This is the conclusion that van der Hulst and van de Weijer come to when claiming that round, front, high, low, ATR, and RTR harmony are all types of place harmony.

To summarize, vowel harmony is the long-distance assimilation of some feature among vowels. All vowel features are seen to harmonize in one language or another. In looking at the phonetics and phonology involved in vowel harmony phenomena, it becomes difficult to provide a unifying phonetic characteristic for place other than an articulatory one – i.e. all cases of "place" harmony involve making reference to fixed locations along the length of the vocal tract. There may be more or less stable acoustic cues for a given "place" in a given context, but across contexts, the single unifying factor seems to be **Chiba and Kajiyama's (1942)** original observation regarding tube acoustics and the location of vocal tract constrictions and expansions. If we take this to be true, then a range of features not normally considered place-related in the literature (e.g. retroflexion and RTR) seem to involve vowel place features after all.

4.4 Consonant-vowel interactions

There are four types of consonant-vowel interactions that might be construed as involving vowel place:

(11) a. Consonant place effects on adjacent vowel place

b. Vowel place effects on adjacent consonant place

c. Consonant participation/interference in vowel harmony

d. Vowel participation/interference in "consonant harmony"

4.4.1 Consonant effects on vowels

In some languages, consonant place has a direct effect on vowel place. In those cases where the relevant consonant and vowel place are phonetically similar, this may be interpreted as assimilation and a sharing of the same feature by two major classes of segments (CHAPTER 81: LOCAL ASSIMILATION).

The first case we will look at is "vowel fronting" in Serbian. This involves the fronting of back mid vowels in some suffixes when following postalveolar coronal consonants.

(12) [ɔ] → [ɛ] / [ṭ͡ʃ ḍ͡ʒ ṭ͡ʃʷ ḍ͡ʒʷ ʃ̣ ʒ ɲ ʎ j] + __

(13)

a.	*Neuter noun nominative accusative singular* [-ɔ] ~ [-ɛ]					
	sel-o	[ṣɛlɔ]	'village'	~ *polj-e*	[pɔʎɛ]	'field'
b.	*Masculine instrumental singular* [-ɔm] ~ [-ɛm]					
	grâd-om	[gra:ḍɔm]	'city'	~ *mûž-em*	[mu:ʒɛm]	'husband'
c.	*Genitive singular* [-ɔg] ~ [-ɛg]					
	dobr-og	[ḍɔbrɔg]	'good'	~ *loš-eg*	[lɔʃ̣ɛg]	'bad'
d.	*Masculine plural* [-ɔv-i] ~ [-ɛv-i]					
	grad-ov-i	[graḍɔvi]	'city'	~ *múž-ev-i*	[mu:ʒɛvi]	'husband'

As pointed out by Morén (2006a), Serbian's quite rich set of coronal consonants combined with this assimilation process suggest that the triggers and targets of velar fronting share a vowel "coronal" place feature. The importance to the present discussion is that these data complement other facts of Serbian to show that palatal consonants in this language are specified with a "vowel" place feature and no "consonant" place feature.

Another case comes from well-known restrictions on vowel quality allowed between two labial consonants in Cantonese (Cheng 1991; Hume 1991). As Cheng shows, non-low vowels must be front (i.e. [i e y ø]) within a syllable containing a coronal onset and coda. One account for this is that the two consonants must share their consonantal coronal place within the syllable domain and intervening vowels must become coronal as a result of feature spread through them. Unlike Serbian, these facts suggest that the front vowels make use of a consonant place feature, not a vowel place feature.

(14)

[kʰut]	'bracket'	[kʰyt]	'decide'
[ho]	'river'	[hø]	'boots'
[tʰuk]	'bald head'	[kʰut]	'bracket'
[tʰok]	'to support'	[kot]	'to cut'
[tʰyt]	'to take off'	*[tʰut]	
[tʰøn]	'a shield'	*[tʰon]	

Khoisan languages have a similar relationship between consonants and vowels in that only back vowels can surface following velar and uvular consonants (including clicks) (Traill 1985).

To summarize, the Serbian, Cantonese, and Khoisan patterns suggest that "vowel place" and "consonant place" are occasionally convenient as descriptive labels, but vowels seem to be able to have “consonant place” and consonants seem to be able to have “vowel place.”

4.4.2 Vowel effects on consonants

In addition to consonant quality affecting vowels, vowel quality can also affect consonants (**Clements 1991**; **Hume 1991**). The most obvious case is that of vowels causing secondary place to appear on adjacent consonants. There are numerous examples of this in the literature, and they have the general pattern illustrated in (15)[9].

(15)	a.	/t+i/ → [tʲi]	b.	/p+i/ → [pʲi]
		/t+o/ → [tʷo]		/p+o/ → [pʷo]
		/t+ɑ/ → [tˤɑ]		/p+ɑ/ → [pˤɑ]

Another type of vowel-to-consonant place interaction is when vowel place affects primary consonant place. Serbian “velar palatalization” is an example of this. As discussed in **Morén (2006a)**, velar palatalization is a process by which velar obstruents become apical postalveolar when followed by some suffixes beginning with a front vowel.

(16) [k x g] → [t͡ʃ̺ʷ ʃ̺ ʒ̺] /__ + [i ɛ]

(17)	a.	*Masculine vocative singular* [-ɛ]					
		vojnīk	[vɔjni:k]	‘soldier’	~	*vojnīč-e*	[vɔjni:t͡ʃ̺ʷɛ]
		bôg	[bɔ:g]	‘god’	~	*bož-e*	[bɔʒɛ]
		siromāh	[s̺irɔma:x]	‘poor’	~	*siromāš-e*	[s̺irɔma:ʃ̺ɛ]
	b.	*Diminutive* [-it̺͡ʃ̺(-a)]					
		krûg	[kru:g]	‘circle’	~	*kruž-ić*	[kruʒit̺͡ʃ̺]
		rúka	[ru:ka]	‘hand’	~	*ruč-ić-a*	[rut͡ʃ̺ʷit̺͡ʃ̺a]
	c.	*Denominal* [-it̺-i]					
		muka	[muka]	‘pain’	~	*muč-it-i*	[mut͡ʃ̺ʷit̺i]
		sûh	[s̺u:x]	‘dry’	~	*súš-it-i*	[s̺u:ʃ̺it̺i]

Unlike some other Slavic languages, Serbian consonants cannot have secondary coronal place, so the effect of “palatalization” of velars is one of primary place change, not secondary place addition. As was the case with Serbian mid vowel fronting discussed in §4.4.1, velar palatalization suggests that the trigger and the target share a phonological place feature. However, the difference is that mid vowel fronting involves a consonant feature affecting a vowel, while velar palatalization involves a vowel feature affecting a consonant.

A final example comes from consonant epenthesis. In some varieties of English, there is consonant resyllabification or epenthesis in certain environments (**Kahn 1976**). This is sometimes called glide formation (**CHAPTER 15**: GLIDES), epenthesis, or consonant “intrusion,” depending on the context and quality of the consonant – [j w], [ˀ], or [ɹ], respectively. The details regarding the conditioning environments and subtle dialect differences are beyond the scope of this chapter, but what is important here is that this type of phenomenon is widely distributed across the English-speaking world (**Kahn 1976**; **McCarthy 1993**; **Uffmann 2007**; **Krämer 2008**) and that the place of epenthetic consonants can depend on the quality of the preceding vowel. An example is given in (18), which shows a partial “intrusive r” paradigm in one New York City dialect[10].

(18)	a.			*is*	[ˈʔɪs]	*a*	[ˈʔə]
	b.	*Ca*[11]	[ˈkʰæ:]	*Ca is*	[ˈkʰæ:ʔɪs]	*Ca a*	[ˈkʰæ:ʔə]
	c.	*beef*	[ˈpif]	*beef is*	[ˈpifɪs]	*beef a*	[ˈbifə]
	d.	*bee*	[ˈpi:]	*bee is*	[ˈpijɪs]	*bee a*	[ˈbijə]
	e.	*zoo*	[ˈzuw]	*zoo is*	[ˈzuwɪs]	*zoo a*	[ˈzuwə]
	f.	*law*	[ˈlɔ:]	*law is*	[ˈlɔɹɪs]	*law a*	[ˈlɔɹə]
	g.	*bra*	[ˈpɹa:]	*bra is*	[ˈpɹa:ɹɪs]	*bra a*	[ˈpɹa:ɹə]
	h.	*banana*	[pəˈnæ:nə]	*banana is*	[pəˈnæ:nəɹɪs]	*banana a*	[pəˈnæ:nəɹə]

As we see in (18a) and (18b), *is* and *a* are preceded by a glottal stop in initial position and when following a low front vowel. Otherwise they are preceded by a non-glottal consonant – i.e. a resyllabified coda, a glide, or [ɹ], depending on the context. Crucially for our purposes, a rhotic appears when the preceding underlying segment is a non-front low vowel or schwa[12]. In the context of a discussion of phonological place, we have to ask what the place of the surface rhotic is and what relationship that has to the preceding vowel place (**CHAPTER 30**: THE REPRESENTATION OF RHOTICS). It is clear that the American English rhotic is usually described in the literature as having a coronal feature (perhaps even retroflex) and that low back vowels and schwa are not. While I will not provide an analysis here, this type of phenomenon involves consonant and vowel place interactions and requires an adequate theory of vowel place to get the facts right.

4.4.3 Consonant participation/interference in vowel harmony

The next type of phenomenon suggesting that vowels and consonants can share the same place features comes from the participation of consonants in the vowel harmony in some languages. For example, Turkish palatal laterals block frontback vowel harmony, as discussed by **Mahanta (2008)**, among others.

(19)	/petroʎ/	'gasoline'		
	[petroʎ]	(NOM SG)		
	[petroʎy]	(ACC SG)	*[petroʎu]	(expected under harmony)
	[petroʎde]	(LOC SG)	*[petroʎda]	(expected under harmony)

4.4.4 Vowel participation/interference in consonant harmony

True consonant harmony is exceedingly rare (see also **CHAPTER 72**: CONSONANT HARMONY IN CHILD LANGUAGE; **CHAPTER 77**: LONG-DISTANCE ASSIMILATION OF CONSONANTS). Many cases that are described as consonant harmony involve secondary place of articulation, retroflexion, or neutralization. Thus, it is difficult to find unambiguous cases to illustrate vowel interference in consonant-triggered long-distance assimilation. The case we will consider comes from emphasis spread in Palestinian Arabic. While the details differ from language to language, emphasis spread seems to involve the long-distance spread of a velar/dorsal or pharyngeal "secondary" place feature from a consonant to all segments in some morphophonological domain. In some varieties of Arabic, the feature spreads unimpeded in both directions from a trigger consonant to the edges of the appropriate domain. In other varieties, however, there are segments that block spread in one and/or the other direction. There are three important things to note about this phenomenon. First, the majority of the literature claims that only consonants can be contrastively specified for the emphasizing feature (see **Youssef 2006, 2007** for a counter-proposal for Cairene Arabic). One might thus suppose that the feature is primarily a consonant feature, not a vowel feature in these languages. Second, the segments that block emphasis are usually palatal. Third, while the set of palatal blockers differs from variety to variety, they always include high front vowels and sometimes a subset of postalveolar coronal consonants. The Palestinian Arabic examples of emphasis spread and blocking given in (20) come from **Davis (1995)**.

(20)	a.	bˤaˤlˤlˤaˤaˤsˤ	'thief'
		ʔˤaˤbˤsˤaˤtˤ	'simpler'
		mˤaˤnˤaˤaˤfˤiˤðˤ	'ashtrays'
		xˤaˤjˤjˤaˤaˤtˤ	'tailor'
		nˤaˤʃˤaˤaˤtˤ	'energy'
	b.	ʔˤaˤtˤfˤaˤaˤlˤ	'children'
		tˤuˤbˤbˤaˤkˤ	'your blocks'
		sˤoˤoˤtˤaˤkˤ	'your voice'
	c.	tˤiinak	'your mud'
		sˤaˤjjaad	'hunter'
		ˤaˤtˤʃaan	'thirsty'
		ðˤaˤʤʤat	'type of noise (PL)'

In (20a), we see unimpeded leftward emphasis spread from the trigger consonant (underlined). In (20b), we see unimpeded rightward spread. In (20c), we see blocking by a set of "coronal" segments – [i j ʃ ʥ]. Again, the point is that the blockers seem to share a phonological place feature that disrupts long-distance place assimilation triggered by a consonant. Further, it seems that a vowel place feature blocks this type of consonant place "harmony."

4.5 Consonant-vowel alternations

The final type of phenomenon suggesting that vowels and consonants can share the same place features comes from alternations between consonants and vowels. Although **Schein and Steriade (1986)** and **McCarthy (1988)** claim that vowels and consonants do not alternate, they do in some languages. This is important for a discussion of vowel place features because one must consider what the relationship is between consonant and vowel place when segments change from one major class to the other.

The most obvious vowel-consonant alternations involve glides (**CHAPTER 15**: GLIDES). That is, what look like underlying vowels surface as homorganic glides when syllabified into a non-nuclear position, and/or underlying glides surface as homorganic vowels when syllabified into a nuclear position (**Rosenthall 1994**). For example, Matumbi initial underlying vowels surface as vowels when followed by a consonant, but they surface as glides when followed by a vowel (**Odden 1996**).

(21)	/u+teliike/	[uteliike]	'you cooked'
	/i+taabua/	[itaabwa]	'books'
	/i+a+tuumbuka/	[jaatuumbuka]	'they will fall'
	/i+otu+i+k+e/	[jootwiike]	'they have holes'
	/u+a+teleke/	[waateleke]	'you should cook'
	/i+ula/	[juula]	'frogs'

In feature theories where vowels and glides are the same segment in different syllabic positions, nothing need be said about place feature specification. However, in feature theories where vowels and glides are featurally distinct, then something must be said about their surface place similarities – especially if those theories postulate different place features for consonants and vowels.

Less obvious vowel-consonant alternations involve liquids. It is common among the Slavic languages to have alternations between a lateral and a vowel. For example, Serbian syllable-final laterals surface as mid back round vowels (**Morén 2006a**), while in Slovenian, they surface as a high back round vowel/glide (**Morén and Jurgec 2007**). The former is shown in (22).

(22) *Serbian*

pev-ao	/pɛval/	→	['pɛ.vaɔ]	'sang'
orao	/ɔral/	→	['ɔ.raɔ]	'eagle'
posao	/pɔs̪al/	→	['pɔ.s̪aɔ]	'work'
misao	/miːs̪al/	→	['miː.s̪aɔ]	'thought'
čitao-ca	/t̪͡ʃʷitalt̪͡s̪a/	→	['t̪͡ʃʷi.taɔ.t̪͡s̪a]	'reader'

Ignoring the issue of how to establish the correct vowel height during vocalization, the unrounded anterior coronal lateral is clearly related to a surface vowel that is both back and round. This place relationship is not straightforwardly accounted for in some theories.

While one might argue that the Slavic data show alternations of underlying consonants with surface vowels, Yoruba seems to show the opposite. According to **Akinlabi (2007)**, Yoruba [i] surfaces as [ŋ] following a vowel.

(23) /àwɔ́ ì wɔ́ tɑ̃́/ → [àwɔ́ ŋ̀ wɔ tɑ̃́]
flowing NEG flow finish
'that which flows (of gown) without end'

He interprets this as fortition, in which the high front vowel becomes a syllabic nasal so as not to require (perhaps not license) an onset. What is relevant to us is that a front vowel alternates with a velar nasal. Given that most feature theories assume that coronal is the default/unmarked place, it is not a trivial matter to explain why a coronal vowel alternates with a velar consonant.

Finally, vowels can also alternate with consonant secondary articulations[13]. As noted by **Clements (1991)**, Etsako high vowels appear as secondary place on preceding consonants to avoid hiatus. Again, we see "vowel place" surfacing on consonants.

(24)	/ki+buga/	[kibuga]	'town'
	/ki+gele/	[kigele]	'foot'
	/mu+kazi/	[mukazi]	'woman'
	/mu+limi/	[mulimi]	'tiller'
	/li+ato/	[lʲaato]	'boat'
	/ki+uma/	[kʲuuma]	'metal object'
	/mu+iko/	[mʷiiko]	'trowel'
	/mu+ojo/	[mʷoojo]	'soul'

To summarize, there are a number of phenomena found cross-linguistically that involve interactions/alternations between vowels and consonants. Many of the interactions involve what looks like a commonplace feature shared between these two major classes. In addition, many of the alternations either do not involve place changes or involve unexpected place changes. Both of these suggest that consonant and vowel place are more tightly connected than is typically discussed or formalized in many feature theories.

5 Conclusions

“Place,” from a physical perspective, involves a combination of active and passive articulators that constrict/expand the vocal tract at fixed locations, and results in certain acoustic effects. The term “vowel place” is used in three distinct ways in the literature: (i) to describe certain physical characteristics of vowels, (ii) to describe a set of related phonological features, and (iii) as a label for a particular feature geometric structure in some autosegmental models.

There are a maximum of between four and ten cross-linguistically relevant vowel place contrasts described in the literature, depending on the model and linguists’ assumptions about phonological representations and their relationship to phonetics, intra-dialect contrast, and inter-dialect distinguishability. The most common phonological models assume two or three “vowel place” features, as shown in (25).

(25) a. *Two-feature models*

[coronal]	[peripheral]
[–back]	[+back]
[I]	[U]

b. *Three-feature models*

[coronal]	[dorsal]	[labial]
[–back]	[+back]	[+round]

Although vowel place features are usually discussed in terms of passive articulators in the oral cavity and relative position of formant centers along the F2 continuum, active articulators (e.g. apical, laminal) and pharyngeal adjustments play an important role in the characterization and patterning of vowels in some languages. However, these are not traditionally considered vowel place-related, because they involve significant non-F2 effects. Closer inspection of physical and phonological parallels between vowels and consonants suggests that the traditional view needs to be reconsidered.

From a phonological perspective, vowel place features are relevant to seven major types of phenomena. I have discussed five of these, and each both supports and challenges some of the more common approaches to vowel place found in the literature. Combined, they suggest that we have a fairly good understanding of relevant phenomena and formalisms, even if we sometimes disagree about the details of data interpretation or which feature theory is best.

Finally, this chapter began by posing the question: “What is vowel place and what role does it play in the sound patterns of language?” To begin answering this question, we explored the phonetics and phonology of “place” more generally, as well as examined why some scholars make different choices regarding the relationship between phonetics and phonology and between vowels and consonants. We saw that vowel place is both simpler and more complicated than one might expect, and that more work is needed to resolve some long-standing and fundamental issues.

Notes

1 I will not discuss openings and closings of the glottis.

2 Although not shown in **Figure 19.3**, the close proximity of an F2 node and F3 loop in the velar region results in the well-known “velar pinch” typical of velar consonant formant transitions in some contexts – i.e. F2 is high and F3 is low (**Stevens 1989**).

3 I do not discuss here the important work of **Lass (1984)**, which claims that there is evidence for ten place distinctions. This claim is not based on contrasts within the speech of individual speakers, but on what he calls “dialect distinguishability.” Because there is no evidence that so many contrasts are needed within a given phonological grammar, I take this to indicate fine-grained phonetic distinguishability that does not translate into phonological feature specifications. This is also the conclusion of **Rice (2002)**.

4 These labels make use of two aspects of the phonetics. Descriptively, “coronal” refers to the passive articulator (i.e. the crown of the oral cavity) and “dorsal” refers to the active articulator (i.e. tongue dorsum). It is unclear what the advantage is of having this mixed set of labels.

5 This is an illustration, and it is not meant as an endorsement of this over other approaches.

6 As Rice points out, this abstracts away from several factors such as length, tenseness, nasalization, etc.

7 This claim has much in common with Dependency Phonology (**Anderson and Ewen 1987**), Element Theory (**Kaye *et al.* 1985**; **Harris and Lindsey 1994, 1995**), and Particle Theory (**Schane 1984**).

8 An issue not addressed here is the lack of a principled means within the feature theory literature to include pharyngeal place features for consonants and exclude pharyngeal place features for vowels.

9 While palatalization and labialization are quite common cross-linguistically, pharyngealization in the context of a low back vowel is not. However, this is found in some Arabic varieties as a reflex of emphasis spread.

10 These data were collected by the author and transcribed fairly narrowly with the help of instrumental acoustic analysis.

11 This is the truncated form of the name Caroline.

12 [ɔː] is phonologically a low vowel in this dialect (**Morén 1999**).

13 Similar alternations occur in Luganda (**Clements 1991**) and Matumbi (**Odden 1996**).

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