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13. The Stricture Features

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Sections

The late 1980s and early 1990s saw the publication of a large number of articles treating features and feature geometry, following on the highly influential article by **Clements (1985)** that had argued for the organization of features into a hierarchically arranged tree. But if one takes a look at the features whose position and organization were so often debated, they fall into only a few groups: first, the vocalic features typically involved in vowel harmony – features of height, backness, rounding, or tongue root position; second, laryngeal features such as glottalization, voicing, and aspiration; and third, the place features labial, dorsal, and coronal and their dependents, especially those of coronal (see CHAPTER 27: THE ORGANIZATION OF FEATURES; CHAPTER 21: VOWEL HEIGHT; CHAPTER 19: VOWEL PLACE; CHAPTER 69: FINAL DEVOICING AND FINAL LARYNGEAL NEUTRALIZATION; CHAPTER 22: CONSONANTAL PLACE OF ARTICULATION; CHAPTER 12: CORONALS). Such a concentration can be traced back in part to the material covered in Clements's seminal article. But it also reflects those features that seem most often and most unequivocally involved in assimilation, or, to follow **McCarthy's (1988)** diagnostics, the trio of assimilation, dissimilation, and reduction or deletion. There was also notable interest in the position and behavior of [lateral] (CHAPTER 81: LOCAL ASSIMILATION; CHAPTER 60: DISSIMILATION; CHAPTER 79: REDUCTION; CHAPTER 31: LATERAL CONSONANTS). But most of the traditional manner and major class features – [continuant], [consonantal], [sonorant] – received short shrift.[1] These three, along with the less widely adopted feature [approximant], are sometimes called stricture features (**Kenstowicz 1994**: 480ff.), because they specify how the articulators are brought together but are not themselves inherently associated with any one articulator. They are "articulator-free," in the terminology of **Clements and Hume (1995)** and must be associated with some articulator to be fully interpreted. The major class features [consonantal] and [sonorant] do not participate often, if at all, in the archetypical phonological processes of spreading and delinking, and they do not form nice bundles of features that beg to be organized under a node of the feature geometry. The other major class features of **Chomsky and Halle (1968)**, [syllabic] and [vocalic] (the latter already tentatively withdrawn in a footnote in **Chomsky and Halle 1968**: 302), have over the decades been subsumed in representations, with [syllabic] coming to mean head or nucleus of the syllable and not being specified as a distinctive feature of any segment.[2] As early as 1974, Hankamer and Aissen suggested that the major class features might be superfluous, and in a more elaborated proposal, **Selkirk (1984)** proposed doing away with both [consonantal] and [sonorant] by replacing them with a multivalued sonorancy feature (see also CHAPTER 8: SONORANTS). Nonetheless, the consensus view seems to be that these features are still needed. Their necessity is taken for granted in many significant works on feature theory of the last decade or two, such as **Clements (2003)**, to mention one representative example. As an independent issue, the proper definition of [continuant] has always been problematic: it has not been obvious exactly what natural classes should be delineated by this feature, nor how it should be placed on the feature tree (see also CHAPTER 28: THE REPRESENTATION OF FRICATIVES).

In this chapter I will review some of the proposals to keep, redefine, or locate on the feature tree the problematic stricture

features [consonantal], [sonorant], and [continuant], or to do away with them altogether. In the spirit of the *Companion*, we will spend most of the time looking at the phonological and phonetic phenomena upon which these various proposals rested. The chapter is organized as follows. We begin with a discussion of the arguments for and against the existence of [consonantal]. In the second section, we turn a similar spotlight upon [sonorant]. The third section considers arguments that bear on the need for both features, hinging on the sonority sequencing principle, weight, and lenition. The final section treats the definition and feature geometry of [continuant].

1 The major class feature [consonantal]

Chomsky and Halle (1968: 301–302) distinguished a group of binary "major class features" that segregate segments into the large groups of consonants and vowels, sonorants and obstruents, glides and liquids, and syllabic and non-syllabic sounds. The binary feature [consonantal] makes the most obvious cut among segments, capturing the distinction between vowels and consonants.

> Consonantal sounds are produced with a radical obstruction in the midsagittal region of the vocal tract; nonconsonantal sounds are produced without such an obstruction. (**Chomsky and Halle 1968**: 302)

Anderson (1974: 298) elaborates:

> Consonantal sounds are made with a radical (i.e., at least as extreme as in fricative consonants) approximation of the speech organs at some point in the midsagittal plane of the oral tract. Vowels and glides (including *h* and ?) are nonconsonantal; all other sounds are consonantal.[3]

It might seem then that [consonantal] and the other major class features are so basic that one could not do without them. But is dividing sounds into classes enough to justify the existence of a feature? The largest question about [consonantal] is whether it acts as normal features do, participating actively in phonological processes like assimilation, dissimilation, and deletion. If not, if instead it is inert, is it needed at all? The same question can be asked of the other widely maintained major class feature, [sonorant]. Most of the published discussion on the possible inertness of major class features (**Kaisse 1992**; **Cho and Inkelas 1993**; **Hume and Odden 1996**) has dealt with [consonantal], though we shall see that many of the things that can be said for or against the retention of [consonantal] in the inventory of distinctive features can be applied to [sonorant] as well. Noting that [consonantal] has generally been thought to be inactive as far as the ability to participate independently in phonological processes goes, **McCarthy's (1988)** survey article locates it along with [sonorant] as an annotation on the root node, citing **Schein and Steriade (1986)**, who in turn credit Bruce Hayes with the observation that the major class features are phonologically inert. Nonetheless, the features are retained as part of the tree, because they bear that important sorting role and, additionally, because consonantality and sonorancy are copied in complete assimilations, along with all the other features.

Challenging the notion that [consonantal] is inactive, **Kaisse (1992)** presents five fairly detailed cases which seem to require it to actively participate in assimilation or dissimilation. There have been attempts by several authors to re-analyze each of these cases without the use of [consonantal], and the matter of whether the feature can be active remains controversial, as does the need for its existence at all. Kaisse treats the following phenomena:

(1)
a. *Cypriot Greek consonantalization*
The glide [j] becomes a voiceless palatal stop [c] after a consonant.
b. *Bergüner Romansh consonantalization*
The glides [j] and [w] are realized as the voiced stop [g] before a consonant.
c. *Uyghur vowel consonantalization*
Devoiced high vowels become syllabic fricatives before a consonant. /i/ is realized as [ʃ], /u/ as [φ^{w}] and /y/ as [$\varphi^{ɥ}$].
d. *Ahtna vocalization*
Certain consonants become vowels before a consonant. /b/ and /χ^{w}/ are realized as [u], while /ɣ/ and /c/ appear as [i].
e. *Halland Swedish vocalization*
The uvular fricative /ʁ/ is realized as the offglide [ɑ̯] before any consonant.

Kaisse (1996) adds the debuccalization of [s] to [h] in Argentinian Spanish, which only takes place when a coda /s/ is preceded by a vowel or glide. Thus the rule appears to be a rightward spreading of the feature [−consonantal].

Let us consider the first two examples, Modern Cypriot Greek and the Bergüner dialect of Romansh, in a little more detail.

These two have mirror-image environments that make it unlikely that alternative analyses will succeed by identifying a specific position in the syllable, be it onset or coda, as the cause for consonantalization. On the other hand, Cypriot also shows the sorts of complications that offer a wedge to alternative analyses that do not use the spread of [consonantal].

Newton (1972a) describes a defining characteristic of all Cypriot dialects: what would appear as the glide [j] in other dialects is realized as a voiceless palatal stop after most consonants or as a voiceless velar stop after [r]. Numerous alternations in Cypriot support this consonantalization as a productive process. (The cognate form in non-consonantalizing dialects is the intermediate form shown to the right of the first arrow in the examples below.)

(2)

a.	aðerfi	'brother'
	/aðerfi+a/ → aðerfja → aðerfca	'brothers'
b.	vari	'heavy'
	/vari+ume/ → varjume → varkume	'I am bored'
c.	mati	'eye'
	/mati+a/ → matja → matca *or* maθca	'eyes'

This last example shows the continuancy adjustment that complicates the phenomenon, and which Kaisse regards as orthogonal to it. In virtually all dialects of Modern Greek (**Newton 1972b**), sequences of obstruents are adjusted so that the first is a fricative and the second a stop (see also **CHAPTER 28**: THE REPRESENTATION OF FRICATIVES). Though spread of [consonantal] seems the most obvious approach to the Cypriot alternation, **J. Harris (1996)** points out that the case is not straightforward, since we must devoice and obstruentize the glide, not merely turn it into a consonant.

Bergüner Romansh (**Kamprath 1986**) displays a process of "glide hardening" that is practically the mirror image of the Cypriot case: glides become velar stops before any consonant. Unlike Greek, Romansh has a [w] as well as a [j]. Both glides become [g], which may then devoice before voiceless consonants.

(3)

a.	kreja	/krej+a/		'believes'
	krekr̥	/krej+r/		'to believe'
b.	/skrejver/	→	skregvr̥	'to write'
c.	/lavowra/	→	ləvogrə	'works'

Note that both for Cypriot and Romansh, there is no place, continuancy or sonorancy assimilation. Thus the most likely first analysis is that this is a simple spread of the feature [consonantal], which is indeed how Kamprath formalizes the rule.

Since onsets tend to favor strengthening of consonants (**CHAPTER 55**: ONSETS), the Romansh case is useful in showing that position in onset is not a necessary condition for consonantalization of glides. The Greek case shows it is not sufficient, either, since a word-initial or post-vocalic glide does not strengthen, lacking as it does a preceding consonant.

(4)

jerakos	'falcon'
lojazo	'pay attention to'

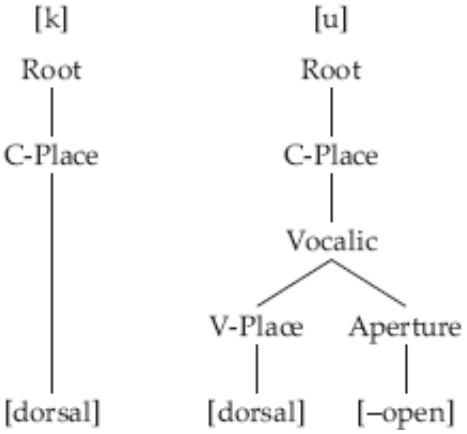
Cho and Inkelas (1993) attempt to re-analyze Cypriot and Romansh without [consonantal] spreading, and object that all the examples cited by Kaisse must refer to structural information in addition to features. This seems a peculiar objection, as many voicing and place assimilations, for example, affect only segments in coda position. Moreover, it is not true of all Kaisse's examples: Ahtna and Uyghur involve only features, not position in the syllable. And we have just seen that the Cypriot Greek case involves segments in the onset, while its mirror image in Romansh involves those in the coda. Nonetheless, with so few examples in the literature, there is indeed a danger that they can all be accounted for either by referring to syllabic position without [consonantal] or by replacing [consonantal] with some other active feature, and allowing consonantality to come along as a side-effect. Cho and Inkelas suggest that in Cypriot, consonantalization is a side-effect of the imposition of the [+cont][−cont] template that Kaisse argues must be imposed on all Modern Greek consonant clusters.

Hume and Odden (1996) take a more ambitious and thoroughgoing approach in attempting to dispose of Kaisse's examples. Their ultimate goal is to remove [consonantal] from the inventory of features altogether, by demonstrating that it is superfluous. They give three types of arguments.[4] First, no segments are distinguished only by the one being [+consonantal] and the other [−consonantal]. Thus, the difference between [w] and [β] is not only one of consonantality but also one of sonority, the difference between [j] and [ʎ] lies in laterality as well as consonantality, and so forth. Second, [consonantal] is never employed crucially to describe a natural class. (The class would be vowels, glides, and possibly laryngeal consonants for the negative value; all other segments would bear the positive value.) Where it looks like we might need [−consonantal], they argue that the feature organization of **Clements (1991)** and **Clements and Hume (1995)**, which distinguishes between Vowel-Place and Consonant-Place, is independently needed and easily characterizes rules that seemed in the past to need [−consonantal]. To illustrate the superfluity of [consonantal], they recast **Hayes's (1986)** description of vowel backing in Lithuanian, where [u] and [w] trigger a backing rule while velar consonants do not, which was originally formulated as follows:

(5) [−cons, −high] → [+back] /__ [−cons, +back, +high]

However, Hume and Odden contend it is better seen as assimilation of dorsal under V-Place, but not of the dorsal that is dominated by C-Place (after **Hume and Odden 1996**: 351).

(6)



To complete their disposal of [consonantal], Hume and Odden must re-analyze the cases advanced by **Kaisse (1992)**. Ahtna, they argue, is not a dissimilation of [consonantal] but rather vocalization aimed at maximizing CV syllables. Following **Chomsky and Halle (1968)**, they adopt the still controversial notion that the laryngeal consonants [ʔ] and [h] are [−consonantal] in all languages. Since these laryngeals also trigger vocalization, the argument goes, [consonantal] cannot be the dissimilating feature. Similarly, Halland Swedish vocalization also occurs before [h], so if the Chomsky and Halle definition is correct, the feature [consonantal] cannot be the relevant one. Kaisse's examples are indeed weakened by the failure to discuss the behavior of the laryngeal consonants, which, lacking a midsagittal constriction, may indeed class as [−consonantal] glides at least in some languages. I believe the issue for Ahtna and Halland cannot be fully resolved on this point until the general behavior of the laryngeals in the two languages is investigated. As mentioned earlier, it may well be that in some languages, the laryngeals act as a natural class with the consonants since their acoustic cues for consonantality and sonorancy are ambiguous. (See the discussion of emergent features in acoustically ambiguous segments in the final section of this chapter.) Hume and Odden offer an analysis of Halland Swedish where /ʁ/ is vocalized in codas. The complication for them then is that this vocalization only occurs if a consonant follows the /ʁ/. They must stipulate that glides cannot appear prepausally.

Hume and Odden discuss two classes of phenomena where the class [−consonantal] does seem at first glance to be required. These are nasalization and the calculation of sonority. The first is exemplified by Arabela and several other languages, where nasality spreads to vowels, glides, and laryngeals (CHAPTER 78: NASAL HARMONY). However, Hume and Odden point out that the general hierarchy of segments able to be nasalized parallels the sonority hierarchy (see CHAPTER 49: SONORITY), so that in some languages, liquids are added to the class of nasalizable segments, in others voiced stops, and so forth. We will see in the next section that later research has suggested that the sonority hierarchy may in fact be a derivative notion. Hume and Odden anticipate this line of attack, arguing that the sonority hierarchy need not refer to [consonantal]; it can be unified with the nasalizability scale using the notion of impedance, "the resistance offered by a sound to the flow of air through the vocal tract above the glottis." Since laryngeals have no impedance, they are vowel-like and nasalizable, but they are inadequate syllable peaks, because some impedance is required for a syllable peak.

The remaining cases of consonantal spread offered in **Kaisse (1992)** are reanalyzed by Hume and Odden as fortitions involving other features: continuancy in the case of Cypriot Greek, voicing in the case of Uyghur, and perhaps some combination of structural position and continuancy dissimilation for Romansh.

J. Harris (1996) also proposes to eliminate the major class features and takes on a re-analysis of the Cypriot case as his major example. His argument is that the Cypriot process specifically targets a glide in the onset position of a coda-onset cluster. I do not think this particular solution will work, since the rule applies word-initially:

(7)

a.	/θios/ → θjos → θcos	'uncle'
b.	pi	'drink'
	/na pi+o/ → na pjo → na pco *or* na fco	'that I drink'

Greek is particularly coda-averse and accepting of complex onsets, as judged by the intuitive syllabifications of native speakers and the wide variety of complex onsets *vs.* the very strict restrictions on coda consonants. Consequently, native speakers do not judge that a word-initial consonant like the [f] in [na.fco] is syllabified into the coda of a preceding vowel-final word (**Joseph and Philippaki-Warburton 1987**: 241ff.).

In conclusion, the cases of consonantal spread advanced by **Kaisse (1992)** constitute a reasonable body of data that

suggest that [consonantal] may be an active feature that is useful in describing cases of consonantalization of glides and vowels and vocalization of consonants. But there are not enough cases that are immune from re-analysis to allow phonologists to rest comfortably in the knowledge that the feature is required in our theory. The rest of this section considers other evidence for the superfluity or redundancy of [consonantal].

Clements and Hume (1995) and **Levi (2004)** contain excellent demonstrations that [consonantal] in itself is inadequate to account for phenomena involving the transparency of consonants to vowel harmony and the distinction between underlying vowels and true underlying glides; what we need is a feature-geometric distinction between vowels, which have a vocalic place node, and consonants, which do not (unless they happen to have a secondary vowel-like feature such as palatalization). **Levi (2004**; **CHAPTER 15**: GLIDES) shows that if basic (underlying) glides have no vocalic node, while glides derived from vowels do, a whole suite of contrasting behaviors follows. Basic glides cannot serve as the nucleus of a syllable – they instead prompt epenthesis when they are not syllabifiable; they are inert in vowel harmony, as evidenced clearly in Turkish, and show several other diagnostic behaviors. Levi also demonstrates that simply calling underlying glides [+consonantal], as had been proposed by **Hyman (1985)**, **Deligiorgis (1988)**, and **Hayes (1989)**, does not capture their phonological behavior and makes no phonetic sense.

The largely redundant nature of [consonantal] is brought out in another manner by **Stevens and Keyser (1989)**. They propose that three distinctive features for consonants are the most perceptually salient, and should thus be expected to be utilized and possibly enhanced in most consonant inventories; the three are the major class feature [sonorant], as well as the manner feature [continuant] and the place feature [coronal]. Notice that [consonantal] does not figure in this list – it instead serves as an enhancing or entirely predictable secondary feature in this system. **Stevens and Keyser (1989**: 89–90) point out that of the eight segment types one gets by combining these features, [consonantal] is predictable for six. If a segment is [+continuant] and [+sonorant], it will not have the narrow vocal tract configuration that defines a consonant and will be [−consonantal]. Anything [+coronal] in their system is [+consonantal], as they consider [coronal] only to characterize the place of articulation of consonants.[5] And anything [−coronal] but also [−continuant] and [+sonorant] would be [+consonantal].

2 The major class feature [sonorant]

The feature [sonorant] has perhaps come under less direct attack than [consonantal], but suffers from similar weaknesses in its motivation. Let us begin with a definition of the feature, taken from **Anderson (1974**: 298), who in turn bases his definition on that of **Chomsky and Halle (1968)**. For related discussion of many of the topics in this section, see **CHAPTER 8**: SONORANTS and **CHAPTER 49**: SONORITY.

(8) Sonorant sounds are articulated without sufficient constriction in the supraglottal tract to cause a significant rise in supraglottal pressure. Such an increase in supraglottal pressure, by reducing the pressure drop across the glottis, could have the effect of inhibiting spontaneous vocal-cord vibration. Vowels, glides, nasals, and liquids are [+sonorant]; obstruent consonants are [−sonorant].

Definitions that stem from the Chomsky and Halle tradition, like this one and that of **Clements (1990)**, amongst many others, treat [sonorant] as a binary feature. However, an alternative view is that [sonorant] is a scalar feature, with numerical values (**Vennemann 1972**; **Selkirk 1984**). Selkirk in particular gives a spirited defense of the notion that the sonority sequencing and the sonority hierarchy are best described using a multivalued [sonorant] feature, dispensing with the other major class features altogether.

Parker (2002) takes on the frequent complaint that [sonorant] has vague or conflicting phonetic definitions; he shows that the traditional feature (for which he ultimately supports a scalar rather than a binary-valued feature) and the traditional sonority hierarchy have regular phonetic correlates, namely intensity and, to a lesser extent, intra-oral pressure.

Sonority certainly does seem to be an important concept in speech perception, as one would expect if it is based in loudness. Recall that **Stevens and Keyser (1989)** pick it out as one of three perceptually salient features that can be expected to be used and enhanced in many segment inventories. This perceptual argument is reinforced from another angle in more recent work by **Bates *et al.* (2007)**, who show that the feature [±sonorant] plays an important role in modeling pronunciation for speech recognition. Whether these perceptually based observations constitute arguments that impinge on the actual universal inventory of phonological features, however, is not entirely obvious. As we have noted already, the gold standard for motivating a phonological feature is its activity in one or more processes of assimilation, dissimilation, or deletion. Even less than [consonantal], [sonorant] does not seem to behave actively in such phonological processes. For this reason, **McCarthy's**

(1988) survey article likewise locates it as an annotation on the root node. Furthermore, [sonorant] is subject to the same critique as [consonantal] when it comes to its use in defining the position of a segment in the sonority hierarchy and in sonority sequencing. We shall see in the next section that many phoneticians have argued that universals of segment ordering are derivative from perceptual factors. If that argument is accepted, the feature [sonorant] may be superfluous.

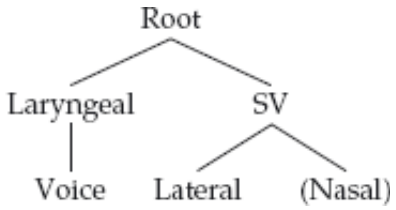
I am aware of only two direct defenses of [sonorant] as an active feature that participates in an assimilation process. **Milliken (1988)** suggests that flapping in North American English (see CHAPTER 113: FLAPPING IN AMERICAN ENGLISH) can be seen as the spread of [+sonorant]. In this process, a coronal stop becomes a voiced flap, roughly in inter-sonorant position. **Olson and Schulz (2002)** bring forward a much less familiar case, which thus bears presenting in some detail: the alternation of the 3rd person singular suffix /-ɲa/ in the Nilo-Saharan language Bilaala. This suffix appears as [ɲa] after nasals, liquids, glides, and vowels. That is, it is a nasal sonorant when adjacent to a sonorant. However, it appears as an obstruent following an obstruent, but maintains its place of articulation, ruling out spread of the entire root node. As the data below show, the process is not simply spread of [−sonorant]; the suffix also takes on the voicing and continuancy of the preceding obstruent, suggesting possible if unwieldy lines of re-analysis for someone attempting to dispose of this case.

(9)	a.	mon-ɲa	'his child'
		ɓɛr-ɲa	'his slave'
		kuhul-ɲa	'his hip'
		kaw-ɲa	'its length'
		ʧe-ɲa	'his mother'
	b.	got-ʧa	'his place'
		bob-ʤa	'his father'
		gurus-ʃa	'his money'

Olson and Schulz have certainly found a very relevant case for the question of whether [sonorant] is an active feature. Still, this process is a morphologically circumscribed one in Bilaala. It applies only to this pronoun; the nasal-initial 1st person singular, /-ma/, is invariant. One would like more robust cases on which to base a decision. As Olson and Schulz themselves say, until more cases are found, the question of the cross-linguistic phonological activity of [sonorant] remains unresolved. They offer and argue against a less elegant solution, where [−nasal] rather than [−sonorant] spreads. Such a solution is hardly ideal, requiring that nasal be a binary, not a privative feature, but it would allow a way out of the current case.

Rice (1993) attacks the traditional definition of [sonorant] from another direction. Summarizing and expanding work by **Piggott (1990)** and by **Rice and Avery (1989)**, she proposes eliminating [sonorant] as an annotation on the root note and replacing it with a feature [spontaneous (or sonorant) voice], with dependents [lateral] and (predictable) [nasal].

(10)



Rice's proposal is based on the fact that even voiced obstruents in some systems, such as that of Southern Barasano (**Piggott 1992**) and Rotokas, can act like sonorants, take their voicing from sonorants or alternate with sonorants. These obstruents possess a spontaneous voicing node. In such languages, the basic division between consonants seems to fall not between the class of obstruents and the class of sonorants but rather between voiceless obstruents and everything else. Rice's proposal also encompasses the well-known fact that in many languages the voicing of obstruents acts very differently phonologically from that of sonorants. For instance, in Japanese, voiced obstruents block the voicing process known as Rendaku, but voiced sonorants do not block voicing. Rice shows that the familiar way of explaining such facts – namely that sonorant voicing only becomes available post-lexically – is not empirically adequate, motivating her alternative proposal.

3 The features [sonorant] and [consonantal] in sonority sequencing, weight, and lenition

Another strong motivation for retaining the features [consonantal] and [sonorant] may be that they are critical in describing sonority sequencing, the general tendency of syllables to have the most obstructed, consonant-like segments at the margins (the onset and the coda) and to progress to more vowel-like segments at the peak or nucleus. **Clements (1990**: 292) adds up the major class features [consonantal], [sonorant], and the less generally recognized [approximant] to give a sonority value for non-syllabic segments, resulting in the widely known scale.

(11)

O	<	N	<	L	<	G	
−		−		−		−	"syllabic"
−		−		−		+	vocoid
−		−		+		+	approximant
−		+		+		+	sonorant
0		1		2		3	rank (relative sonority)

The positive values in each column are added to yield the relative sonority rank. The major class features employed here need some elaboration: [vocoid] is simply the opposite of [consonantal]; [approximant], a category first proposed by **Ladefoged (1964, 1982)**, contains the liquids, glides, and vowels and excludes the nasals and obstruents. **Clements (1990**: 293) modifies Ladefoged's definition to the following:

(12) An approximant [is] any sound produced with an oral tract stricture open enough that airflow through it is turbulent only if it is voiceless.

The acceptance of the additive and binary calculation of sonority, and, even more crucially, of some sonority-based scale which explains the order of segments within syllables, is extremely widespread amongst phonologists. **Zec's (2007)** overview article on the syllable takes sonority sequencing as a primitive, and fails to mention alternative explanations for segment ordering. **Blevins (1995)**, a similarly influential major handbook chapter, had endorsed such a view a decade earlier. Zec argues that regarding sonority as derived from the major class features is probably superior to looking at it as a multivalued feature, since the major class features are needed independently in any case. But one theme of the current chapter is that arguments for the major class features do not always rest on stable ground.

Because the sonority hierarchy and the sonority sequencing principle are so well covered in the survey articles of Zec and Blevins and in this *Companion* (see CHAPTER 49: SONORITY), the present chapter will not engage in a detailed discussion of the empirical ground covered by these concepts. However, it is worth pointing out that a strong challenge has been offered to the explanation of segment sequencing that relies on sonority and on distinctive feature theory, a challenge that may be less familiar to phonologists. **Wright (2004)** synthesizes several compelling arguments for rejecting sonority as the primary organizing principle behind the sequencing of segments.[6] Instead, he sees perceptibility – that is, the ordering of segments so that the cues to their identities are readily perceived, even in noise – as the principle behind such phonotactic phenomena, and he rejects the endeavor to pin down an ever-elusive definition of sonority. If Wright's arguments are accepted, one of the strongest bases for the phonological relevance of the feature [sonorant] is undercut.

Numerous exceptions to the sonority sequencing principle are widely acknowledged and well summarized by **Clements (1990)**, but attempts to deal with them without reference to cues, Wright argues, have been largely stipulative and piecemeal. The cue-based framework works on the premise that the optimal ordering of segments maximizes the robustness of each segment's cues. The phonotactics of human language are arranged to maximize redundancy of cues, strong auditory impact of each cue and resistance of cues to masking by surrounding noise. Since some segments contain internal cues that do not depend on their flanking segments, they are expected to figure in apparent exceptions to segment sequencing generalizations. Noisy (strident) fricatives, for instance, can be recognized without a following vowel or sonorant consonant because the noise of frication allows them to be uniquely identified. Thus /s/ figures repeatedly in clusters where sonority plateaus or is reversed (CHAPTER 38: THE REPRESENTATION OF SC CLUSTERS). Similarly, nasal consonants contain nasal poles and zeros that allow their manner of articulation, though not their place, to be reconstructed without a flanking vowel. Thus, sonority-reversing onset clusters like [nd] are frequently found in the world's languages, and not all can be explained away as prenasalized stops.

Stops, on the other hand, do not contain internal cues – their formant transitions and noise bursts are best perceived if a vowel or sonorant follows. Therefore, strings of stops not flanked by vowels or liquids are hard to recover (CHAPTER 46: POSITIONAL EFFECTS IN CONSONANT CLUSTERS). The ideal encoding for all segments results from the alternation of vowels and consonants. This is not only for the sake of the consonants. Though cues to vowels are the formants of the vowel itself, in natural speech, where a steady state is frequently not achieved, the formant transitions from a preceding consonant can add valuable information. CV is an optimal syllable not only because the V maximizes the cues to the C's identity but also because the C maximizes the cues for the V.

Clements (1990) encodes the naturalness of CVCV sequences with his construct of the "demisyllable": a sequence of adjacent tautosyllabic consonants + vowel or of adjacent tautosyllabic vowel + consonants (CHAPTER 33: SYLLABLE-INTERNAL STRUCTURE). When conjoined with his Dispersion Principle, which favors maximal changes in sonority between adjacent

segments in a syllable, the alternation of consonants and vowels becomes optimal. But without perceptual underpinning (CHAPTER 98: SPEECH PERCEPTION AND PHONOLOGY), we are still short of an explanation of why demisyllables with large sonority jumps are preferable.

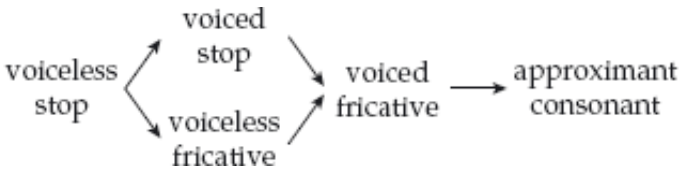
A cue-based theory can also offer an explanation for the preference which languages demonstrate for onsets over codas, for obstruent onsets over sonorant onsets, and for sonorant codas over obstruent codas, tendencies that do not fall out from the sonority sequencing principle without additional stipulations. **Clements (1990)** stipulates that steep dispersion in the CV demisyllable and shallow dispersion in the VC demisyllable are favored. And indeed this observation was a significant step forward. But it need not be a stipulation. **Wright (2004)** explains that the response pattern of the auditory nerves favors CV sequences over VC because of the perceptual boost that occurs at the beginning of a stimulus. An onset consonant, especially an obstruent, receives a boost but a coda consonant tends to be masked because the nerve fibers are already saturated by the sound of the vowel. (The nerve fibers recover quickly, in a matter of a few milliseconds, so that even the brief silence that occurs during a stop closure allows for the whole boost phenomenon to re-set; see **Moore (1989)**. Therefore, even the burst and transitions of a medial C in a CVCV sequence get a boost, due to the silence created by the closure of that consonant.) Nasals are not particularly boosted in onset position, because the nerve fibers are saturated before the nasal ends, so nasals are less favored in onsets than obstruents are, yielding an apparent favoring of steep sonority dispersion in CV onsets and a shallow one in VC codas. Codas should be sonorous, because only sonorant consonants and fricatives, but not stops, can encode their own cues without needing release into a vowel. Cue-based sequencing explanations thus also cover the "Syllable Contact Law" (**Murray and Vennemann 1983**), which prefers a large fall in sonority between the coda of one syllable and the onset of an adjacent syllable. Even the tendency of nasals to lose their place of articulation in codas is encompassed in the cue-based view, since nasals have good voicing and manner cues internal to their realization, but not good place cues. The apparent preference for gradual sonority slopes from nucleus to coda is thus a by-product of the poorness of the internal cues of stops.

To summarize our discussion of the relation between the major class features and phonotactic constraints, the current view of many phonologists is that [consonantal] and [sonorant] are needed to describe sonority sequencing. The sonority feature may be binary (**Clements 1990**; **Zec 2007**) or multivalued (**Selkirk 1984**; **Parker 2002**). But there are also strong arguments that sonority sequencing is epiphenomenal, and that cue robustness covers the empirical ground better (**Wright 2004**). The last view, if accepted, undercuts one of the major arguments that we need [sonorant] or [consonantal] as a distinctive feature.

One might also think that the feature [sonorant] would be required to define syllable weight in languages where this concept is needed to describe the distribution of stress or contour tone or to define the minimal word. **Zec (1995)**, for instance, makes major strides in demonstrating how something like sonority can operate in defining what constitutes a heavy syllable in a given language. However, **Gordon (2002, 2004)** argues that weight is a non-uniform, phonetically driven concept, not best captured with a feature. The definition of a heavy syllable can differ within even a single language, with the stress system, for instance, treating one kind of syllable as heavy while the tone system employs a different definition. Gordon finds that the energy within the syllable rhyme correlates with the tendency of a stress system to treat it as heavy, while the portion of the rhyme characterized by sonorant energy best determines whether it can bear contour tone. (For more on this discussion see CHAPTER 39: STRESS: PHONOTACTIC AND PHONETIC EVIDENCE and CHAPTER 57: QUANTITY-SENSITIVITY.) So once again, the issue of whether [sonorant] is required remains without complete consensus.

Finally, the features [sonorant] and [consonantal], along with [continuant] and [voice], have been repeatedly argued to participate in weakening or lenition processes, especially those occurring intervocalically (CHAPTER 66: LENITION). The typical lenition pattern is summarized by **Lass and Anderson (1975)** as follows:

(13)



For instance, the pre-Old English phoneme /g/ weakens to /ɣ/ in Old English and to /w/ in Middle English before being lost altogether in late Middle English. While such developments are both common and intuitively natural, they are difficult to describe in a unified or coherent fashion using the binary distinctive features. Voicing and continuancy are kinds of manner features, while sonorancy and consonantality are major class features. Dependency phonologists (see for instance **van der Hulst and Ewen 1991**) have proposed that what is going on is the gradual addition of a |V| component, a sonorancy feature that is more present in voiced sounds than voiceless ones, more in fricatives than stops, more in sonorants than obstruents, and more in vowels and approximant consonants than in non-approximants. A similar solution has been proposed within Government Phonology by **J. Harris (1990)**, which sees lenition as a loss of the elements representing occlusion and noise.[7]

4 The manner feature [continuant]

Three major issues dog the discussions of [continuant] in the literature (see also CHAPTER 16: AFFRICATES; CHAPTER 28: THE

REPRESENTATION OF FRICATIVES). First, there is debate on the proper definition of the feature and thus about its values for laterals. Second, there is the question of what kinds of processes [continuant] participates in and what these tell us about where is it located on the feature tree. In particular, is it a direct and independent daughter of the root node, or is it somehow implicated in a daughter relation with Place? Or is it, perhaps, the organizing node of the tree, as proposed by **Steriade (1993)**? The last issue deals with the structure of affricates: are they a sequence of [−continuant] and [+continuant] features characterizing a single root (**Sagey 1986**), an unsequenced complex containing both values (**Hualde 1987**; **Lombardi 1990**), or basically stops whose release is fricated rather than strictly open (**Steriade 1993**)?

The definition of [continuant] is intimately bound up with an empirical question: do lateral consonants form a natural class with stops, which are [−continuant], or with fricatives and other [+continuant] sonorants such as rhotics? (See also CHAPTER **30**: THE REPRESENTATION OF RHOTICS; CHAPTER **31**: LATERAL CONSONANTS.) **Chomsky and Halle (1968**: 317) adopt the following definition:

(14) In the production of continuant sounds, the primary constriction in the vowel [sic] tract is not narrowed to the point where the air flow past the constriction is blocked; in stops the air flow through the mouth is effectively blocked.

Since laterals have airflow along one or both sides of the tongue, they are [+continuant] by this definition, and we will want to adopt it if it can be demonstrated that the great majority of phenomena bearing on the question categorize laterals with fricatives rather than with stops.

Halle and Clements (1983: 7), on the other hand, consider laterals to be non-continuants, and therefore modify the definition.

(15) Continuants are formed with a vocal tract configuration allowing the airstream to flow through the midsagittal region of the oral tract; stops are produced with a sustained occlusion in this region. (Vowels, glides, *r*-sounds, fricatives *vs.* nasal and oral stops, laterals.)

The mention of a sustained occlusion alludes to and endorses **Chomsky and Halle's (1968**: 318) assertion that taps and trills are essentially continuant, since vibration against the palate is due to the Bernoulli Principle, and does not genuinely interrupt the airflow. The addition of the requirement for midsagittal airflow – that is, airflow down the center of the oral tract – is what excludes laterals.

For some time, the evidence bearing on how laterals pattern was sparse and scattered, and thus the proper definition of [continuant] was elusive. However, **Kaisse (1998, 2000)** and **Mielke (2004, 2005)** gathered much data that bears on the question.[8] Based on a dozen closely analyzed cases, my conclusion in 2000 was that lateral sonorants are [−continuant]. In my view, confusion had arisen from systems like those of the Athabaskan languages, where obstruent lateral affricates are opposed to obstruent lateral fricatives. (In such a system, the lateral fricative is categorized as [+continuant].) I argued that once we separate out the Athabaskan-type cases, the evidence strongly favors the value [−continuant] for /l/, although a few murky cases remain, for which I offered alternative analyses. It was clear when I did that research that phonologists had not come to a consensus on the continuancy of laterals or the definition of [continuant], and this remains the case to this day. I have surveyed 13 phonology texts, from **Chomsky and Halle (1968)** through **Odden (2005)**. Of these, seven list /l/ as [+continuant], four as [−continuant], and two say that the value can vary from language to language.[9] While the earlier texts all follow **Chomsky and Halle (1968)** in choosing [+continuant], decisions thereafter fluctuate. This source of this vacillation is to be found at least as early as **Chomsky and Halle's (1968**: 318) discussion of the issue, where the environment of a Scots English lengthening rule is noted as favoring [−continuant] as the correct value for *l*, but data from a very strident lateral in the Athabaskan language Dëne Sųłiné (also known as Chipewyan) tips the scale towards the ultimate decision that all laterals are [+continuant].

Mielke (2004, 2005) surveyed over 6,000 languages bearing on several questions of feature membership, and came to

quite a different conclusion than Kaisse. He found 66 cases that bore on the question of the continuancy of laterals. These cases led him to conclude that laterals are unpredictably categorized for continuancy from language to language. Of 66 languages where laterals clearly patterned with a natural class of segments, Mielke found 36 cases where they joined the class of continuants and 30 where they acted with the non-continuants. In the face of such evidence of ambiguity, it is very difficult to maintain the stronger position advocated in **Kaisse (2000)**, namely that sonorant laterals are invariably non-continuant, and that apparent counterexamples can be re-analyzed. Mielke concludes that while *some* segments, such as stops and fricatives, are virtually unambiguous for continuancy, both phonetically and phonologically, others, like laterals, give ambiguous phonetic cues about their continuancy and can join either class. For Mielke, the enterprise of determining the continuancy value of laterals once and for all is a futile one. Features are not innate but are constructed by learners on the basis of phonological patterning and acoustic cues, and thus we should expect to find variation between languages and even within them when it comes to whether laterals and nasals pattern with stops or with fricatives.

Mielke gives a case from Finnish as a representative example of [l] acting with the continuants, citing **Sulkala and Karjalainen (1992)**. Of the possible stem-final consonants /t s n r l/ in Finnish, the continuants /s/ and /r/ and, *ex hypothesi*, /l/, cause a following /n/ to undergo complete assimilation, while /t/ instead undergoes complete assimilation itself.

To this kind of example (though this Finnish one was not in my corpus), my paper of 2000 responded that when a phenomenon is clearly related to continuancy, laterals always pattern with the non-continuants.

It is worth considering one such example in detail. In Argentinian and Castilian varieties of Spanish (**Navarro Tomás 1965**; **Lozano 1979**; **Harris and Kaisse 1999**), a palatal fricative (orthographic <ll> in the examples in (16)) is realized as an affricate following stops, nasals, and the lateral, but not after vowels, fricatives, or rhotics. Affricates in Spanish, as in most languages, are the realization of basic [−continuant] stops and should themselves be classified as [−continuant]. In Argentinian the alternation involves the palato-alveolar fricative /ʒ/, which is realized as the affricate [d͡ʒ] (CHAPTER 16: AFFRICATES) after [−continuant] sounds. **Lozano (1979)** noted that /n/ and /l/ are triggers, while /r/ and vowels are not. **Harris and Kaisse (1999)** investigated this phenomenon amongst Argentinian speakers, adding the rarer category of syllable-final stops to the data. These additional data show that stops, nasals, and the lateral form the natural class of affrication triggers, opposed to fricatives, vowels, and the rhotic. The two columns in (16) indicate a bifurcation in the results. For two of my consultants (left column) only coronal stops and nasals could spread their continuancy to the following coronal /ʒ/. For the third consultant (right column) stops and nasals at any place of articulation were triggers. The majority requirement that the trigger and target of the rule be homorganic is not of immediate consequence, but is worth remembering in our upcoming discussion of whether or not continuancy typically spreads independent of place.

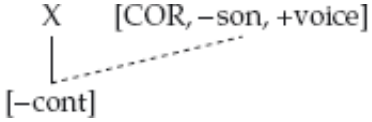
(16)

				Dialect A: homorganicity required	*Dialect B: homorganicity not required*
Rafael llega	'Rafael arrives'	/l+ʒ/	→	lʤ	lʤ
Ru[t] *llega*	'Ruth arrives'	/t+ʒ/	→	tʧ	tʧ
la red llega	'the net arrives'	/d+ʒ/	→	dʤ	dʤ
el Jeep llega	'the Jeep arrives'	/p+ʒ/	→	pʒ	pʤ
el coñac llega	'the cognac arrives'	/k+ʒ/	→	kʒ	kʤ
Juan llega	'John arrives'	/n+ʒ/	→	nʤ	nʤ
Menem llega	'Menem arrives'	/m+ʒ/	→	mʒ	mʤ
Hector llega	'Hector arrives'	/r+ʒ/	→	rʒ	rʒ
Roberto llega	'Robert arrives'	/o+ʒ/	→	oʒ	oʒ
Khruschef llega	'Khruschev arrives'	/f+ʒ/	→	fʒ	fʒ

I include so much detail because this case illustrates the interesting complexities that can surround the ostensible spread of continuancy. The details are also worthwhile simply to show that a large typological study like Mielke's has weaknesses as well as obvious strengths. In a survey of some 6,000 languages, it is not practical to investigate each case in anything approaching the detail I was able to lavish on twelve cases. But sometimes the devil is in the details.

In **Harris and Kaisse (1999**: 142) we analyzed this process as spread of the feature [−continuant]:

(17)



Navarro Tomás (1965) describes virtually the same process for Castilian Spanish. Since this example manifestly involves a change from [+continuant] to [−continuant], **Kaisse (2000)** considered it to be the best kind of evidence for the continuancy of /l/. Mielke's Finnish case is not so obviously related to continuancy. It could, for instance, have to do with the

unmarked status of /t/. Nonetheless, it seems unlikely that such a stance could successfully dispose of all 30 of Mielke's examples. But since Finnish is the only [+continuant] case he reports in any detail, the matter cannot yet be fully resolved.

Mielke also discusses a different and intriguing kind of ambiguous behavior on the part of laterals. As has been much discussed, in Catalan, Spanish, and Basque, the lateral acts as [+continuant] before consonants at some places of articulation and [−continuant] before other places. In a related but distinct kind of case, some speakers of Hungarian add /l/ to the class of palatalizable non-continuants while others do not (**Abondolo 1988**: 64, cited in **Mielke 2005**). Again, let us consider the Spanish version of this phenomenon, as it is both well-known and frustratingly complicated. The process in question distributes the voiced obstruents, which come in stop and fricative variants. (**J. W. Harris 1985**; **Kenstowicz 1994**). But the case is really too vexed to draw any firm conclusion from. The judgments for these alternations are unstable – the same speaker can produce the stop and the fricative variant in the same environment – there are variations amongst idiolects and dialects that are not understood, and the theoretical bases for some of the analyses that have been proposed are shaky. Almost every analysis of the phenomenon one could think of has been vigorously defended by an excellent phonologist, and no consensus has emerged. The process works as follows. Spanish has no underlying contrast between voiced stops and voiced fricatives. Descriptions generally simplify the distribution as follows: after vowels, fricatives, and *r*, the voiced fricative allophones [β ð ɣ] appear. The voiced stops appear initially, after a pause, and after stops and nasals.

(18)	tu βeso	'your kiss'	besos	'kisses'
	los βesos	'the kisses'	um beso	'a kiss'
	por βesos	'through kisses'	futbol	'football'

The behavior of *l* as a trigger is more complex: following the lateral, we find the stop [d] but the fricatives [βɣ].

(19)	el βeso	'the kiss'
	el dinero	'the money'
	el ɣato	'the cat'

Exactly what one is to make of even these simplified facts has been the subject of some debate, well summarized in **Kenstowicz (1994**: 487–489) Apparently, the process involves the spread of [continuant]. If this is so, is the lateral showing its true colors in contact with the homorganic obstruent [d] or with the non-homorganic [β ɣ]? We saw in the affrication process described earlier that some speakers may require homorganicity in order for a consonant to spread its continuancy to a palatal fricative. This suggests that it is in clusters with coronals that /l/ shows its continuancy – it is [−continuant] – and that fricatives are the underlying members of the voiced obstruent phoneme, emerging unscathed after *l* when not homorganic with it. On the other hand, the mixed environments in which the stop variants occur (after pause as well as after nasals and stops) suggests that the stops are underlying and the voiced fricatives are derived by spread of [+continuant]. Following that line of reasoning would suggest that /l/ is [+continuant].

But the facts are actually even more complicated. The rule is highly variable, and even utterance-initial fricatives are occasionally produced. I have had the same speaker produce a fricative and a stop in the same context, one after the other, in elicitation. Technically, the proposal of spread of [+continuant] is hard to execute in theories where non-contrastive features are not present in the lexical phonology, because vowels would have to be represented as [+continuant] at the point in the derivation where spreading occurs, while voiced obstruents were still [0 continuant] at that point (so as to be able to take on the continuancy of the preceding segment). The upshot is that we would do better to base our decision on the continuancy of laterals on less daunting cases. Mielke in fact uses this case to argue that even within a single process of a single language, the continuancy of a lateral may differ. But one stands on shaky ground at this point in drawing conclusions from this phenomenon. Similar comments can be made about two other Iberian languages, Catalan (**Mascaró 1984, 1991**) and Basque (**Hualde 1991**), whose continuancy alternations are remarkably similar to those of Spanish, probably due to areal influences. (See also **CHAPTER 28**: THE REPRESENTATION OF FRICATIVES.)

An appealing recent proposal is that features are emergent, rather than innate (**Pulleyblank 2003**; **Mielke 2004, 2005, 2008**). Speakers are not born with a definition for continuant and a categorization of segments according to that feature (see also **CHAPTER 17**: DISTINCTIVE FEATURES). Rather, they may group sounds together as a phonological category because those sounds have acoustic and articulatory similarities or because in the language they are learning, they act as a natural class. As Mielke puts it, stops and fricatives are archetypically and unmistakably [−continuant] *vs.* [+continuant]. So we almost always find them patterning as such in phonological processes, whatever language they occur in. But laterals and nasals have ambiguous cues and may be categorized as [+continuant] in one language and as [−continuant] in another. Even more iconoclastically, perhaps, Mielke's survey of 571 languages found 6,077 phonologically active classes of sounds, only 71 percent of which were describable by any set of distinctive features at all.

We turn now to the question of where the feature [continuant] should be located in the feature geometry. **Kenstowicz (1994)** contains an excellent summary of the issues. As mentioned at the beginning of this chapter, there are comparatively few phonological processes which make use of the feature [continuant], so while the need to employ it to differentiate contrasting segments has not been challenged, locating it in the feature geometry is not easy. As Kenstowicz explains, a series of proposals have dealt with its hierarchical position. In the model proposed by **Sagey (1986)** and **Halle (1992)**,

continuant is a direct dependent of the root node and must be integrated with the primary place articulator in phonetic implementation, since, for example, a palatalized labial stop realizes [−continuant] at the labial place, not the coronal one involved in the secondary articulation. **Clements (1987)**, accounting for intrusive stops in English such as those in [wɔɹmᵖθ] *warmth* and [pɹɪnᵗs] *prince*, proposes a modification whereby both Place and [continuant] are daughters of an organizing oral cavity node. In this way, the fact that the intrusive stop has the [−continuant] value and the place value of the preceding nasal can be captured by spreading the whole oral cavity node. **Padgett (1991)** argues that manner and place are firmly linked, with [continuant] as a dependent of Place. However, as we saw above, the phenomenon from Spanish involving the allophony of voiced stops with voiced continuants, which forms one of the better-known examples of such linked spreading, is at best very complicated. Both **Kenstowicz (1994)** and **Hall (2007)** point out that Padgett's proposal is flexible enough to allow [continuant] to spread independently of place. This flexibility is needed, since Spanish voiced obstruents tend to take on the continuancy of the preceding segment even when they are not homorganic with it, as illustrated by the pair [besβol] 'baseball' *vs.* [futbol] 'football'. Yet another proposal, that of **van de Weijer (1993)**, locates Place as a dependent of [continuant]; Hall notes that this approach will have trouble with such Spanish examples, since it predicts that any spreading of place must result in homorganicity of the assimilating segments.

The feature [continuant] is critical in **Steriade's (1993)** aperture theory. Only the non-continuant segments, namely the stops and affricates, carry two A (aperture) positions – closure (A_0; zero aperture) and release (A_{max} or A_f) – and thus only they, as opposed to fricatives, approximants, and vowels, can support contours. Continuant segments have only one Aperture feature (A_{max} for approximants and vowels, and A_f for fricatives). Since the aperture positions act like root nodes in having place, laryngeal, and nasality as daughters, this is a very continuant-centric version of feature geometry, with continuancy essentially organizing all other features beneath it. The empirical payoff for Steriade is that she is able to explain a wide range of restrictions on contour nasal segments. Only stops and affricates can be pre- or post-nasalized, and this is because the privative feature [nasal] can hang from either of their aperture nodes.

We turn now to one more theoretical issue in which [continuant] has figured in the discussion for two decades: the proper representation of affricates (CHAPTER 16: AFFRICATES). Affricates bear some hallmarks of single segments – for instance they can appear syllable-initially in languages which otherwise do not tolerate consonant clusters in the onset. However, they also resemble a sequence of a stop plus a homorganic fricative. **Sagey (1986)** made the appealing suggestion that affricates are contour segments which are [−continuant] on the left edge and [+continuant] on the right. As such, a rule like the English one distributing plural and 3rd person allomorphs would treat affricates as a natural class with fricatives, since it is looking at the right edge of the affricate:

(20) *eat-s*
miss-es
lurch-es

On the other hand, a rule like Zoque post-nasal voicing, which is looking at the left edge of the affricate, would treat it as a [−continuant] and class it with the stops, which voice after nasals, rather than with the fricatives, which do not:

(21)	min-pa	→	minba	'he comes'
	pʌn-ʧʌki	→	pʌn-ʤʌki	'figure of a man'
	winsaʔu	→	winsaʔu	'he received'

Unfortunately, it turns out that there are also phonological processes that class affricates and stops together even if they are looking at the wrong edge of the affricate, such as a deletion rule in Basque (**Hualde 1987**) that deletes a stop before another stop but turns an affricate to a fricative in the same environment, as it were deleting the [−continuant] portion of the affricate:

(22)	bat paratu	→	ba paratu	'put one'
	hots bat	→	hos bat	'a cold'

Kenstowicz (1994: 499–503) contains an excellent summary of the various moves theoreticians made after Hualde's demonstration that affricates were not simply contour segments with the [−continuant] segment ordered first. The most comprehensive solution yet proposed is that of **Steriade (1993)**. As mentioned above, Steriade treats affricates as a species of stop whose release feature has the same degree of stricture as a fricative's. Thus affricates are generally expected to pattern with stops, as in the Basque and Zoque cases. However, the adjacent fricative releases that would result in English if the [s] or [z] allomorph was employed after an affricate prevent affricates from acting with the stops in this case.

To summarize this section, a number of proposals for the proper position of [continuant] in the feature geometry have been proposed, many with positive empirical consequences. However, no consensus has been reached which would allow us to say that one of them has been the most widely adopted by the phonological community. On a similar note, the proper extension of the feature to laterals remains troubled and may be a reflection of the emergent nature of features, which have no universal or innate definition. Finally, the behavior of affricates is not well explained by regarding them as segments with

ordered minus and plus [continuant] values (see CHAPTER 16: AFFRICATES).

Notes

1 **Chomsky and Halle (1968**: 299–300) distinguish five kinds of features: major class, cavity, manner of articulation, source, and prosodic The major class features are [sonorant] and [consonantal] (and the quickly eliminated [vocalic]). The manner features are [continuant], [delayed release], [tense], and several features related to suction and ejection. Major class features, they explain, mainly have to do with closing and opening and with pressure buildup and release. While [continuant] was not categorized as a major class feature by Chomsky and Halle, it is the one manner feature that strongly relates to how closely the articulators are approximated. **Padgett (1991)** and **Kenstowicz (1994)**, amongst others, thus group [consonantal], [sonorant], and [continuant] together as stricture features.

2 **Padgett (2008)** argues that [vocalic] should be reinstated to describe the difference between vowels, which have no frication, and the type of glide that shows some frication. For Padgett, both [consonantal] and [vocalic] should be employed so as to capture a fine hierarchy of degree of stricture.

3 The consonantality and sonority of the laryngeals have not been resolved, and will not be treated in this chapter. It seems likely that some processes in some languages treat them as obstruent consonants while others treat them as laryngeal glides. **Clements (1990)** captures their ambiguity by referring to his feature-geometric tree, where sonority-determining features such as [consonantal] are annotations on the supralaryngeal node. Since laryngeals of course have no such node, their sonority is underdetermined and largely attributable in each language to diachronic factors. **Parker (2002**: 223–225) argues instead that it is the ambivalent acoustic and articulatory qualities of [h] and [ʔ] that complicate their assignment to a sonority ranking. He concludes that [h] has the intensity of a rather loud obstruent or a rather quiet sonorant, while its intra-oral pressure is ambiguous between that of a sonorant and an obstruent. [ʔ] is very quiet and hence obstruent-like, but in all other cues to sonority acts like a sonorant. Such acoustic ambiguity tends to lead to variance among languages in what natural classes the laryngeals act with, as argued by **Mielke (2004, 2008**; see CHAPTER 17: DISTINCTIVE FEATURES).

4 Hume and Odden's line of attack follows from the same sort of reasoning as that given in **Harris (1996)**. He argues that we can motivate the need for a particular distinctive feature in four ways: features code lexical contrasts, define natural classes of segments, determine syllabification, and guarantee phonetic interpretability.

5 This would not be true in systems that characterize front vowels and glides as [coronal], but let us put that aside. In such a system, [coronal] would be a dependent of vocalic place and thus [−consonantal] would be predictable via another angle.

6 Wright makes clear that his new perspective on sonority sequencing is a synthesis of work by several researchers, including **Kawasaki (1982)**, **Lindblom (1983)**, **Bladon (1986)**, **Ohala (1990)**, **Flemming (1995)**, **Steriade (1995)**, **Byrd (1996)**, and **Silverman (1997)**.

7 Within Optimality Theory, **Kirchner (2004)** proposes that lenition is not a phonological process of spreading that refers to distinctive features at all. Rather it is achieved through the high ranking of a constraint LAZY, which penalizes biomechanical effort and works on a highly detailed phonetic scale of such effort.

8 **Mielke (2004)** also discusses the ambiguity of nasal consonants. In his survey, he found nasals acting in a natural class with non-continuants 21 times and with continuants 17 times. However, he provides only the names of the languages, not the data that resulted in these categorizations, so we will leave the question of the continuancy of nasals aside.

9 I have included Chomsky and Halle on the [+continuant] side, but their discussion (**1968**: 317–318) is actually more nuanced than their charts might imply, as discussed shortly in the text.

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