

LOCAL ASSIMILATIONⁱ

1. Overview

Local assimilation is a phonological alternation in which two sounds that are adjacent become more similar. Its opposite is DISSIMILATION, an alternation in which two sounds that are similar become more different. Local assimilation can also be contrasted with long-distance assimilation (HARMONY), in which sounds that are not immediately string-adjacent influence one another, and with COALESCENCE (see Casali 1996, Pater 1996) in which two adjacent sounds merge into a single segment that shares properties of both.

Local assimilation can be illustrated by different forms of the English negative prefix /m-/, as in (1). Examples in (1a) and (1b) illustrate common place assimilation: the basic form of the nasal consonant is /n/ (1a), but it assimilates to the place of articulation of a following stop (1b). When the prefix precedes a labiodental fricative (1c) assimilation of /n/ is optional, as it is with other prefixes or across a word boundary (1d). In words like "illegal" and "irregular" (1e), the /n/ is not pronounced at all: in Latin, the /n/ became identical to a following /l/ or /r/. These different aspects of the /m-/ alternation illustrate many of the questions and issues that arise in the cross-linguistic description of local assimilation.

1. An example of local assimilation in English.

- a. i[n]ability
i[nh]ospitable
i[ns]olvent
- b. i[mp]ossible
i[mb]alance
i[nt]erminable
i[nd]ecisive
i[ŋk]ongruent
- c. i[nf]requent or i[mf]requent
i[nv]ariant or i[mv]ariant
- d. u[nb]alanced or u[mb]alanced
i[n p]assing or i[m p]assing
- e. i[l]egal (Latin *il-legalis*)
i[r]egular (Latin *ir-regularis*)

If two adjacent sounds come to share just one feature, or a subset of their features, the assimilation is termed PARTIAL, illustrated by the word "impossible," where the consonants in prefix and root share place of articulation, but not nasality or voicing. If two adjacent sounds

become identical, as in "illegalis," the assimilation is TOTAL or COMPLETE. It is also useful to distinguish the direction of assimilation. In a sequence of sounds AB, if A changes to become more like B, the assimilation is termed ANTICIPATORY: A anticipates some feature of B. If B changes to become more like A, the assimilation is PERSEVERATIVE: some feature of A continues into B. (Anticipatory assimilation may also be called REGRESSIVE, since the assimilating feature is moving backwards, and perseverative assimilation may be termed PROGRESSIVE, since the assimilating feature is moving forward.) The assimilations in (1) are all anticipatory.

Local assimilation is the most common type of phonological alternation, and as such has played an important role in phonological theory. Phonological issues that arise with respect to local assimilation include the following:

- What features assimilate?
- What groups of features assimilate together?
- How can directional asymmetries be accounted for?
- What is the influence of morphological and prosodic context?
- What are the roles of production and perception in local assimilation?
- How is local assimilation different from coarticulation?
- How should local assimilation be formalized?

These questions concerning the nature and representation of local assimilation will be addressed in the remainder of this chapter, which is divided into two parts. Section 2 provides a cross-linguistic sampling of types of local assimilation, providing the data for more general theoretical discussion that follows in Section 3. Issues addressed in Section 3 are directionality and perception (3.1), production and coarticulation (3.2), and formalism (3.3). In addition to these larger questions that focus on the linguistic status of assimilation per se, other more specific issues often come up in the discussion of particular data sets or types of assimilation. Various processes of local assimilation have been important in providing evidence for and against phonological issues such as underspecification, privative vs. binary features, feature geometry, and lexical phonology. Such connections will not be treated in depth in this chapter, but will be noted, along with cross-references to other chapters where the issue is addressed more fully.

2. Examples of Local Assimilation

Local assimilation can affect nearly every phonological feature. In fact, participating in assimilation is considered prime evidence for featural status (McCarthy 1994, Hume & Odden 1996; see also DISTINCTIVE FEATURES). Some of the most common types of local assimilation are exemplified below.

2.1. Voicing and other laryngeal features

When obstruent consonants become adjacent, they often come to agree in voice, and sometimes in other laryngeal features as well. For example, in Russian (2), a string of obstruents always agrees in voicing with the rightmost obstruent in the sequence (Jakobson 1978, Padgett 2002).

2. Voicing assimilation in Russian.

[ot papɨ]	from papa
[od babuʃki]	from grandma
[od vzbútʃki]	from a scolding
[ot fspléska]	from a splash
[ot mamɨ]	from mama

A similar alternation is found in Yiddish (Katz 1987, cited in Lombardi 1999), illustrated in (3).

3. Voicing assimilation in Yiddish.

[vog]	weight	[vok-foi]	scale
[bak]	cheek	[bag-bejn]	cheekbone
but		[nud-nik]	boring person
		[mit-niten]	co-respondent

In both Russian and Yiddish, the assimilation is anticipatory: consonants anticipate the voicing of the rightmost obstruent in the cluster, whether voiced or voiceless. This is the unmarked direction for assimilation (Lombardi 1999). Perseverative voicing assimilation, in which the voicing value is determined by the leftmost consonant, may also be seen, usually in the case of assimilation of a suffix to a stem (Lombardi 1999, Borowsky 2000). Examples from English and Turkish are shown in (4) and (5).

4. Voicing assimilation in English, plural and past tense.

[ro-z]	rows
[ræg-z]	rags
[rak-s]	rocks
[ro-d]	rowed
[bæg-d]	begged
[kɪk-t]	kicked

5. Voicing assimilation in Turkish (Lewis 1967)

[git-tim]	go-PAST.1.SG
[kiz-dim]	got mad-PAST.1.SG
[komsu-muz-dan]	neighbor-POSS-ABL from our neighbor
[raf-tan]	shelf-ABL

Cases of voicing assimilation have been central to the debate over whether [voice] is a privative or binary feature. Cases like that of Yiddish, where either a voiced or voiceless cluster may be

formed, and where assimilation is independent of syllable-final devoicing, have been crucial. Is it possible to account for alternations such as [vog] ~ [vokfoi] without reference to a feature [-voice]? See Cho (1999), Lombardi (1999), Wetzels & Mascaro (2001), and LARYNGEAL FEATURES for further discussion.

Another important point to note about voicing assimilation in consonant clusters is that sonorant consonants are often neutral with respect to voicing assimilation. Thus there are sequences like [ot fspłéska] in Russian and [mitniten] in Yiddish, where the rightmost consonant in the cluster is a (voiced) sonorant, but the other consonants are voiceless. (Though note that the behavior of Russian /w/, which alternates with [v] and participates only partially in voicing assimilation, has been the subject of much discussion: see Padgett 2002 and references therein.)

On the other hand, the laryngeal features of obstruents and sonorants do sometimes interact. Common cases include intervocalic (or intersonorant) voicing (6) and post-nasal voicing (7, 8).

6. Intersonorant voicing in Korean (Silva 1992)

[pap]	rice	[i-bab-i]	this rice-NOM
[kuk]	soup	[i-gug-i]	this soup-NOM
[tal]	moon	[pan-dal]	half moon
[palp]	walk	[palb-in]	that is walking
/motun kilim/	--> [modun gilim]	every picture	
/kulimul pota/	--> [kulimul boda]	to look at a picture	

7. Post-nasal voicing in Yao (Nurse & Phillipson 2003)

[ku-pélék-a]	to send	[kuu-m-bélek-a]	to send me
[ku-túm-á]	to order	[kuu-n-dúm-a]	to order me
[ku-kwéél-a]	to climb	[kuu-ŋ-gwéel-a]	to climb on me

8. Post-nasal voicing in Puyo Pungo Quechua (Orr 1962, Pater 1999, Rice 1993)

[sinik-pa]	porcupine's
[kam-ba]	yours
[wasi-ta]	the house
[wakin-da]	the others

It may also be the case that obstruents cause devoicing in sonorants, as in high vowel devoicing in Japanese (9), in which /i/ and /u/ devoice when surrounded by voiceless consonants, or sonorant devoicing in English (10), in which /l/ and /r/ devoice when preceded by a voiceless aspirated consonant.

9. High vowel devoicing in Japanese (Tsuchida 1996).

[kokɯsai]	international
[kʲitai]	expectation
[akʲiko]	woman's name
[ɸɯton]	bed

10. Sonorant devoicing in English

[p̥le]	play
[p̥re]	pray
[t̥ru]	true
[k̥le]	clay
[k̥ro]	crow

The interaction or non-interaction of sonorants and obstruents in voicing assimilation has played an important role in feature theory. On the one hand, the non-participation of sonorants has been cited as evidence that sonorants are underspecified for voice in underlying representation, with later fill-in by rule (Hayes 1984, Kiparsky 1985, Ito & Mester 1986). Alternatively, it has been argued that cases of sonorant/obstruent interactions involve features other than [voice] or [sonorant]. Rice (1993) argues that sonorants are specified with a different feature, [sonorant-voice], which may spread to neighboring consonants, accounting for cases of intersonorant or post-nasal voicing. In the case of devoicing, as in (7) and (8), the assimilating feature may be aspiration: [spread glottis] rather than [-voice]. For further discussion, see DISTINCTIVE FEATURES, UNDERSPECIFICATION, SONORANTS, LARYNGEAL FEATURES.

Another approach has been to argue that cases of apparent voicing assimilations between vowels and consonants are not featural assimilation at all, but phonetic coarticulation. Jun (1995), for example, argues that Korean intersonorant voicing comes about because the glottal opening gesture for lax voiceless consonants is weak, allowing vocal fold vibration to continue throughout a short closure duration. Browman & Goldstein (1989) point out that the large and late glottal opening gesture for English initial aspirated stops is sufficient to delay voice onset in a following liquid, without further addition of a rule assimilating either [-voice] or [spread glottis]. Section 3 below returns to the issue of disentangling coarticulation and assimilation.

When languages have multiple laryngeal contrasts, examples of the assimilation of multiple laryngeal features have been identified. Smyth (1920) gives examples of assimilation of both aspiration and voicing in Ancient Greek (11).

11. Ancient Greek assimilation of both voicing and aspiration (Smyth 1920)

[grap ^h -o]	I write
[gɛgrap-tai]	has been written
[grab-den]	writing/scraping
[trib-o]	I rub
[tetrip-tai]	has been rubbed
[etrip ^h -t ^h e:n]	it was rubbed

Sanskrit also exhibits assimilation of multiple laryngeal features. The pattern of assimilation of voicing and aspiration in Sanskrit is complex, and its description and analysis has a long history (Whitney 1889; Wackernagel 1896). The examples in (12) represent part of this interaction, and serve to illustrate local assimilation of voicing and aspiration from the coda of the verb root to the onset of the suffix.

12. Assimilation of voicing and aspiration in Sanskrit (Calabrese & Keyser 2006)

/b ^h aud ^h -ta/ -->	[budd ^h a]	awake-PST.PART.
/rud ^h -ta/ -->	[rudd ^h a]	obstruct-PST.PART
/sa:d ^h -ta/ -->	[sa:dd ^h a]	succeed-PST.PART.

Cases of simultaneous assimilation of more than one feature, such as those in (11) and (12), have been important in providing evidence for hierarchical organization of features. See section 3.3 below, and ORGANISATION OF FEATURES.

2.2. Nasality

Assimilation of nasality is very common. Vowels generally become nasalized when adjacent to a nasal consonant, as illustrated in (13) and (14). Such nasalization may be anticipatory, as in English (13), or perseverative, as in Sundanese (14). Sundanese nasalization can also be iterative and in some cases long-distant, applying across an intervening /h/: see Cohn (1993), and NASAL HARMONY.

13. Anticipatory nasalization in English

[k ^h æt]	cat	[k ^h æ̃n]	can
[ɹɪb]	rib	[ɹĩm]	rim
[θɪk]	thick	[θɪŋ]	thing

14. Perseverative nasalization in Sundanese (Cohn 1993)

[ŋãtur]	arrange
[mãrios]	examine
[ɲĩãr]	seek
[mãhãl]	expensive

Cohn (1993) argues that, in addition to differing in direction, English and Sundanese represent two distinct types of assimilation: the one categorical and phonological (Sundanese), the other gradient and phonetic (English). Section 3.2 below returns to this distinction.

Assimilation of nasality may also apply between adjacent consonants, as shown in (15) and (16).

15. Nasal assimilation from onset to coda in Korean (Kim-Renaud 1991).

[pap]	<i>rice</i>	[pam mekta]	<i>eat rice</i>
[ot]	<i>clothes</i>	[on man]	<i>only clothes</i>
[jak]	<i>medicine</i>	[jaŋ mekta]	<i>take medicine</i>

16. Nasal assimilation from prefix to root in Twi.

[bá]	comes	[m-má]	does not come
[gu]	pours	[ŋ-ŋu]	does not pour
compare			
[pɛ]	likes	[m-pɛ]	does not like
[tɔ]	does	[n-tɔ]	does not do

2.3. Continuant

Stops often become continuants when surrounded by, or in some cases just preceded by, continuants. The change from stop to fricative, termed SPIRANTIZATION, may be considered assimilation of the feature [continuant]. Examples from Spanish and Italian are shown in (17) and (18).

17. Post-continuant spirantization of voiced stops in Spanish

/la gata/ --> [la ɣata]	the (fem.) cat
/la data/ --> [la ðata]	the date
/la bola/ --> [la βola]	the ball
/las gata/ --> [las ɣatas]	the (fem.) cats
/las bolas/ --> [las βolas]	the balls

18. Intervocalic spirantization of voiceless stops in Florentine Italian (Villafana 2006)

/la kaza/ --> [la xaza]	the house
/la torta/ --> [la θorta]	the cake
/la pal:a/ --> /la φal:a]	the ball

Similarly, continuants often "harden" to stops or affricates in post-nasal position, an alternation that may be considered assimilation of [-continuant] from the preceding nasal (Padgett 1994).

19. Post-nasal hardening in Setswana (Tlale 2006)

[supa]	point at	[n-t ^h upa]	point at me
[ʃapa]	hit	[n-tʃ ^h apa]	hit me
[xapa]	capture	[ŋ-kx ^h apa]	capture me
[rut'a]	teach	[n-t ^h ut'a]	teach me

20. Post-nasal hardening in Kikuyu (Armstrong 1967, Clements 1985)

imperative *1sg imperfect*

[bur-a]	[m-bur-eetɛ]	lop off
[reh-a]	[n-deh-eetɛ]	pay
[yor-a]	[ŋ-gor-eetɛ]	buy

Spirantization and hardening are not necessarily considered to be cases of assimilation, however, but cases of a separate phonological process of LENITION or FORTITION, in which features other than [continuant] may be involved. Spanish stops may weaken to more open approximant articulations (/la bola/ --> [la voła]) and intervocalic /k/ in Florentine often weakens to [h] (/la kaza/ --> [la haza]). Conversely, post-nasal fortition in Setswana involves changes in laryngeal features as well as in continuant. See Lavoie (2001), Kirchner (1998), Gurevich (2003) and LENITION for numerous further examples and discussion.

2.4. Consonantal place of articulation

2.4.1. Nasal place assimilation

Assimilation of place of articulation is probably the most ubiquitous phonological alternation. Especially common is nasal place assimilation: nasals assimilate in place of articulation to a following consonant. Examples could be found in almost any language. Nasal place assimilation in English and in the African languages Yao, Twi, Setswana, and Kikuyu was seen in examples (1), (7), (16), (19) and (20) above. Additional examples are shown in (21—25): Catalan (21), Zoque (22), Malayalam (23), Sri Lankan Creole (24), and Zulu (25). Zulu is included to illustrate the point that in place assimilation to complex segment such as clicks and labiovelars, assimilation to the dorsal place of articulation is most common (Maddieson & Ladefoged 1989).

21. Nasal place assimilation in Catalan (Mascaró 1976, Kiparsky 1985)

so[n]	amics	they are friends
so[m]	pocs	they are few
so[m]	felicós	they are happy
so[n̩]	[d̩]os	they are two
so[n̩]	rics	they are rich
so[n̩]	[l̩]iures	they are free
so[n̩]	grans	they are big

22. Nasal place assimilation in Zoque (Wonderly 1946, cited in Padgett 1994)

[pama]	clothing	[m-bama]	my clothing
[tatah]	father	[n-datah]	my father
[tʃima]	calabash	[n-dʒima]	my calabash
[kaju]	horse	[ŋ-gaju]	my horse
[gaju]	rooster	[ŋ-gaju]	my rooster

compare nasal deletion preceding fricatives:

[faha]	belt	[faha]	my belt
[ʃapun]	soap	[ʃapun]	my soap
[rantʃo]	ranch	[rantʃo]	my ranch

23. Nasal place assimilation in Malayalam (Mohanam 1993)

[awan]	he
[awam-paran̩nu]	he said
[awan-t̩at̩iccu]	he became fat
[awan-ca:t̩i]	he jumped
[awan-karan̩nu]	he cried
[kamalam]	proper name
[kamalam-paran̩nu]	Kamalam said
[kamalan̩-t̩at̩iccu]	Kamalam became fat
[kamalan̩-ca:t̩i]	Kamalam jumped
[kamalan̩-karan̩nu]	Kamalam cried

24. Assimilation of non-coronal nasals in Sri Lankan Portuguese Creole (Hume & Tserdanelis 2002, Hume 2003).

<i>Nom.sg.</i>	<i>Gen.sg.</i>	<i>Dat.sg.</i>	<i>Verbal Noun</i>	<i>gloss</i>
ma:m	ma:n-su	ma:m-pə	ma:ŋ-ki-	hand
mi:tiŋ	mi:tin-su	mitim-pə	mi:tiŋ-ki-	meeting
si:n	si:n-su	si:n-pə	si:n-ki	bell

25. Assimilation to the dorsal place of clicks in Zulu (Doke 1926, cited in Padgett 2002)

/iziN-/	class 10 plural prefix
[izim-pap ^h ε]	feathers
[izin-ti]	sticks
[iziŋ-kεzɔ]	spoons
[iziŋ- ezu]	slices
[iziŋ- uŋ ulu]	species of bird (pl.)
[iziŋ- aŋ a]	green frogs

A number of cross-linguistic differences and similarities in nasal place assimilation are worth noting.

As in the Zoque and Zulu examples, it is often the case that a nasal (or nasal-final) affix undergoes obligatory place assimilation in every lexical item in which it occurs. In such cases, it may be impossible to determine empirically the basic or underlying form, and it is often argued that such nasals are unspecified for place (e.g., Kiparsky 1985). A segment specified only as [nasal], but with no underlying place features, may be symbolized /N/. Depending on how a particular alternation is formalized, however, underspecification may or may not be assumed. (See UNDERSPECIFICATION.)

Relevant to the debate over underspecification is the observation that the coronal nasal assimilates more often than either labial or velar nasals. In many languages, such as Catalan and Spanish (Navarro Tomás 1970, Honorof 2000), only the coronal nasal assimilates, although for some languages such as Malayalam, assimilation of non-coronal nasals is also attested. In Sri Lankan Creole, all nasals *except* [n] assimilate. Asymmetries in place assimilation are discussed further in sections 3.1 and 3.2 below.

Another point of interest in nasal place assimilation is whether or not nasals assimilate to [+continuant] segments. In Catalan and Sri Lankan, nasals assimilate to both stops and continuants, but in Malayalam and Zoque, nasals assimilate only to stops. In Malayalam, unassimilated nasal-fricative clusters are tolerated, but in Zoque the nasal deletes when a

fricative follows. In other languages, other processes may apply to repair disfavored nasal-fricative clusters. In Setswana and Kikuyu (19, 20 above), fricatives harden to stops or affricates in post-nasal position. In English, as was noted in (1), assimilation of /n/ to /f/ is optional: the nasal-fricative cluster in the word "infrequent" may be pronounced [nf] in careful speech or [mf] in less careful speech, but "impolite" is invariably [mp]. The propensity for place assimilation and continuant assimilation to occur together leads Padgett (1994) among others, to posit a dependency relation between features for place and the feature [continuant], though this requires a different explanation for cases like Spanish "so[m̩ f]elicos" and English "i[m̩f]requent" (see the discussion in section 3.2 below, and ORGANISATION OF FEATURES).

Data on nasal place assimilation, probably more because it is so common than because of any inherent phonological property, has often been invoked in debates on domains of application. Catalan nasal place assimilation played an important role in arguments for cyclic rule application, and the distinction between lexical and post-lexical phonology (Kiparsky 1985). The observation that place assimilation applies to English /ɪn-/ "impossible", /kən-/ "congruent", and /sɪn-/ "sympathy", but not /ʌn-/ "unprepared," provided important data for level ordering of affixes in English. The ability of nasal place assimilation to create sounds that are not part of the underlying inventory of the language, such as [m̩] in English and Catalan, has informed debate on Structure Preservation, and on the lexical/post-lexical distinction (Kiparsky 1985; LEXICAL PHONOLOGY).

Finally, data on nasal place assimilation has also been crucial in the theory of Feature Geometry (discussed in section 3.3 below), and in development of the theory of Articulatory Phonology (discussed in section 3.2).

2.4.2. Other consonantal place assimilations

Place assimilation most often involves nasals, but other consonants undergo place assimilation as well. In Korean, for example, optional place assimilation applies to certain obstruent clusters, as illustrated in (26): final [t] may assimilate to a following labial or dorsal stop, and [p] to a following dorsal.

26. Place assimilation in Korean obstruents (Kim-Renaud 1991, Kochetov & Pouplier 2008)

/pat ^h -pota/ -->	[pat p'oda] or [pap p'oda]	rather than the field
/pat ^h -kwa/ -->	[pat k'wa] or [pak k'wa]	field and
/pap-kilis/ -->	[pap k'irit̚] or [pak k'irit̚]	rice bowl
/t ^h op-k ^h al/-->	[t ^h op k ^h al] or [t ^h ok k ^h al]	handsaw

compare

/pap-to/ -->	[papt'o]	*[patt'o]	rice also
/pak-to/ -->	[pakt'o]	*[patt'o]	outside also

/kuk-po/ --> [kukp'o] *[kupp'o] national treasury

In other cases, subsidiary place features assimilate between adjacent consonants. Most often the features [anterior] and [distributed] assimilate in sequences of coronal consonants. It was seen above that Catalan nasals (21) assimilate to a following consonant at all places of articulation. Catalan laterals also assimilate (27), but only to a following coronal. (See LATERALS for further discussion.)

27. Assimilation of laterals in Catalan (Mascaró 1976)

e[l p]a	the bread
e[l ɰ]ia	the day
e[l r]ic	the rich
e[ʎ ʒ]erma	the brother

In English, coronal stops and nasals assimilate the [-anterior] feature of a following [ɹ], or the dental articulation of a following dental fricative.

28. Assimilation of retroflex and dental in English

train	[tɹeɪn]
drain	[dɹeɪn]
tenth	[t ^h ɛnθ]
eighth	[wɪtθ]
width	[wɪdθ]

In Sanskrit, Murinbata and other languages of India and Australia (Steriade 2001), place assimilation among coronal clusters is often perseverative: that is, the onset assimilates to the coda, as shown in (29) and (30). This reversal in expected direction is discussed further in Section 3.1 below.

29. Perseverative retroflex assimilation in Sanskrit (Whitney 1889 cited in Steriade 2001)

/iṣ -ta/ -->	[iṣ-ta]	sacrificed
/ṣaṇ-nam/ -->	[ṣaṇ-ṇam]	of six
/giṛ-su/ -->	[giṛ-ṣu]	in songs

30. Perseverative retroflex assimilation in Murinbata (Street & Mollinjin 1981 cited in Steriade 2001)

/pan-tal/ -->	[pan-tal]	cut it – 3 sg
/ɲudu-ʎɛ-nu/ -->	[ɲudu-ʎɛ-ɲu]	roll– fut

As was noted with respect to nasal place assimilation, evidence from consonantal place assimilation in general has been crucial in the development of phonological theory. One point of particular interest is how place assimilation, which may involve a whole set or subset of different features, may be formalized as a unitary process (see section 3.3. below). Another point is the problem of directionality (section 3.1): why is it that codas usually assimilate to onsets rather than vice-versa? Place assimilation has also played an important role in the debate over assimilation vs. coarticulation, and in the development of the theory of Articulatory Phonology (section 3.2).

2.4.3. Vowel and consonant place interactions

While place assimilation usually applies to consonant clusters, vowels and consonants may also assimilate to each other. Consonants often assimilate the properties of adjacent vocalic articulations. For example, in the Wakashan language Oowekyala (Howe 2000), velar and uvular consonants contrast in rounding in initial position and following most vowels (31). Immediately following /u/, however, all velars and uvulars assimilate to the vowel's [round] feature (32).

31. Contrastive rounding in Oowekyala (Howe 2000)

q ^w ut'a	full
quɭa	bent

32. Rounding assimilation in Oowekyala (Howe 2000)

pusq'a-xʔit	to become very hungry
ʎ'u'xwalasu-x ^w ʔit	to become sick
məja-gila	make (draw or carve) a fish
ʔamastu-g ^w ila	make kindling

In the neighboring language Nuxalk, Howe reports that rounding assimilation is anticipatory rather than perseverative: velars and uvulars become round *preceding* /u/.

Another assimilation from vowel to consonant is palatalization of a consonant adjacent to front vowels and glides. Palatalization may take the form of an alveolar or dental (or sometimes velar) becoming alveopalatal, or it may take the form of secondary articulation, adding an additional high front tongue position without changing the consonant's primary place of articulation.

Languages differ in the input sequences that trigger palatalization, and in the resulting outputs. Three examples are shown in (33)—(35); see PALATALIZATION for further examples and discussion. In English (33), alveolars become alveopalatals before /j/. In Japanese (34), alveolars become alveopalatals before /i/, while velar and labial consonants become secondarily palatalized. In one pattern of palatalization in Polish (35), labials receive secondary palatalization before [i] and [e], while velars and alveolars change their primary place. (Palatalization in Slavic languages is both common and complex: see SLAVIC PALATALIZATION and SLAVIC YER.)

33. English palatalization before /j/

[d ~ dʒ]	grade	gradual
[t ~ tʃ]	habit	habitual
[s ~ ʃ]	press	pressure
[z ~ ʒ]	use	usual

34. Palatalization in Japanese (Vance 1987, Chen 1996)

[kas-anai]	lend-NEG	[kaʃ-ita]	lend-PAST
[kat-anai]	win-NEG	[kaʃ-ita]	win-VOLITIONAL
[wak-anai]	boil-NEG	[waʃ-ita]	boil-VOLITIONAL
[job-anai]	call-NEG	[joʃ-ita]	call-VOLITIONAL

35. Palatalization in Polish (Szpyra 1989, Chen 1996)

[tupɨ]	booty	[tupʲ-ic]	to rob
[zabava]	game	[zabavʲ-ic]	to entertain
[złoto]	gold	[złoc-ic]	to gild
[kwas]	acid	[kwaɕ-ic]	to make sour
[rana]	wound	[rap-ic]	to wound
[sok]	juice	[sotɕ-ek]	juice-DIM
[mex]	moss	[mex-ek]	moss-DIM

Vowels may also assimilate to adjacent consonants. In Russian (36), palatalization on consonants is contrastive, and the vowels [ɨ] and [i] are in complementary distribution: /i/ is found in initial position and following palatalized consonants, [ɨ] follows non-palatalized consonants. (See SLAVIC PALATALIZATION for additional discussion.) In the Dravidian language Tulu (37), the accusative suffix /-i/ becomes round when it follows a labial consonant (or another round vowel).

36. Vowel backing in Russian (Halle 1971, Padgett 2002)

[ivan]	Proper name
[k-ivanu]	to Ivan
[ital'ia]	Italy
[v-ital'iju]	to Italy

37. Rounding assimilation in Tulu (Bright 1972 cited in Kenstowicz 1994)

katt-i	bond-acc
kapp-u	blackness-acc
ucc-u	snake-acc

Another type of assimilation from consonant to vowel is vowel lowering. Vowel lowering after uvular, pharyngeal, and laryngeal consonants (the class of GUTTURAL consonants) is found in many Semitic, Caucasian, and North American languages (Herzallah 1990, McCarthy 1994, Rose 1996, Bessell 1992, 1998). In Syrian Arabic (38), for example, the feminine suffix is realized as [a] after laryngeals, pharyngeals, and uvulars, and as [e] after all other consonants. In Oowekyala (39), /i/ and /u/ are lowered to [e] and [o].

38. Vowel lowering in Syrian Arabic (Cowell 1964, Rose 1996)

daraz -e	step
ʃerk-e	society
madras-e	school
wa:ʒh-a	display
mni:h-a	good
dagga:R-a	tanning

39. Vowel lowering in Oowekyala (Howe 2000)

/ʌiq-ila/ -->	[dliq ^ʔ ela]	to give a name to someone
/qusa/ -->	[qosa]	bent, crooked
/hula/ -->	[hola]	heap up
/Gwixila/ -->	[Gwixela]	to bake bread

Vowel lowering has figured prominently in the debates over what features constitute the class of guttural consonants. In various cases the feature has been argued to be [low], [-high], or [pharyngeal]. See PHARYNGEALS for further examples and discussion.

In general, the question of when and how vowels and consonants interact with each other has been important in the area of feature theory. Consonants are often transparent to long-distance vowel-to-vowel assimilation, yet they also interact with vowels in local assimilations, as has been illustrated. Transparency to vocalic alternations suggests that vowels and consonants have different features, or that consonants bear vocalic features only as secondary articulations: e.g., front vowels and palatalized consonants are [-back], while alveolar and dental consonants are [coronal]. Such an approach accounts for cases assimilation of palatalization and rounding as secondary articulations. But it fails to account for cases where the vowel causes a change in the consonant's primary place of articulation, or where the consonant causes a change in the backness of a vowel. Such alternations have led to proposals (e.g., Hume 1994, Clements 1993, Clements & Hume 1995) that vowels and consonants share the same features: e.g., alveolar consonants, alveopalatal consonants, and front vowels are all [coronal]. See VOWEL PLACE, CONSONANT PLACE FEATURES, and INTERACTION OF CONSONANTS AND VOWELS.

2.5. Complete assimilations

Complete assimilation occurs when two adjacent sounds become identical. Complete assimilation is particularly common in clusters involving /r/ and /l/ (see RHOTICS and LATERALS). Complete assimilation of the Latin prefix /in-/ to both /l/ and /r/ as in “illegalis” and “irregularis”, was seen in (1) above. Similar cases are found in Ponapean (40) and Korean (41).

40. Assimilation of /n/ to /l/ and /r/ in Ponapean (Rehg & Sol 1991, Rice 1993)

/nanras/ -->	[narras]	ground level of a feasthouse
/nanleŋ/ -->	[nalleŋ]	heaven
/pahn liŋan/ -->	[pahl liŋan]	will be beautiful
/pahn roŋ/ -->	[pahr roŋ]	will listen

41. Assimilation of /n/ to /l/ in Korean (Davis & Shin 1999)

/non-li/ -->	[nolli]	logic
/tan-lan/ -->	[tallan]	happiness
/c ^h ən-li/ -->	[c ^h əlli]	natural law

In some cases, a sonorant may assimilate completely to a following obstruent. In Arabic (42), /l/ assimilates to a following coronal, but not to consonants at other places of articulation. In Havana Spanish (43), the /l/ assimilates completely to most following consonants. The exception is that if the following consonant is a voiceless stop, the /l/ assimilates in all features except [voice].

42. Assimilation of /l/ in Arabic (Kenstowicz 1994)

ʔaf-ʃams	the sun
ʔad-daar	the house
ʔan-nahr	the river
ʔaz-zajt	the oil
compare	
ʔal-qamr	the moon
ʔal-kitaab	the book
ʔal-faras	the mare

43. Assimilation of /l/ in Havana Spanish (Harris 1985)

albañil	a[bb]añil	mason
tal droga	ta[dd]droga	such a drug
pulga	pu[gg]a	flea
tal mata	ta[mm]ata	such a shrub
el fino	e[ff]ino	the refined one
el pobre	e[bp]obre	the poor man
el tres	e[dt]res	the three

A similar case of near-complete assimilation occurs in Kannada (44). The final consonant of the morpheme meaning "big" copies all features from the following consonant, except that the resulting cluster must be voiced, regardless of input.

44. Complete assimilation with voicing in Kannada (Roca & Johnson 1999)

[tere]	screen	[hed-dere]	big screen
[kumba[a]	pumpkin	[heg-gumba[a]	big pumpkin
[dzenu]	bee	[hedz-dzenu]	big bee
[mara]	tree	[hem-mara]	big tree

Finally, complete local assimilation of one vowel to another can also be found. Many languages will not tolerate successive non-identical vowels (VOWEL HIATUS). While vowel hiatus is often repaired by deleting one vowel or the other (see Casali 1996, 1997; and HIATUS), another strategy is assimilation, as shown in (45).

45. Vowel assimilation in Yoruba (Welmers 1973)

[owo]	money
[owe-epo]	oil money
[owa-ade]	Ade's money

2.6. Instances where local assimilation doesn't apply

The preceding list of types of local assimilation has been long. Nonetheless, there are situations where local assimilation is not typically found. These include, on the one hand, environments where the trigger and target of assimilation tend not to be immediately string adjacent, as in tone and vowel harmony. On the other hand, there are features for which languages prefer an alternating pattern, such as CVC within a syllable or stress-unstress within a foot.

Features such as [round], [back], and [advanced tongue root] often assimilate from vowel to vowel within a word, but such assimilation is usually not local at the level of the segment, since vowels are most often separated by consonants; (see VOWEL HARMONY). Similarly, tone assimilations are quite common, and have played an important role in the development of theories of phonological representation. Tone assimilation, however, is also generally a long-distance phenomenon, applying at least from vowel to vowel across intervening consonants, and often across stretches of multiple syllables (See BANTU TONE, REPRESENTATION OF TONE, CHINESE TONE SANDHI). Because this chapter focuses on local processes, vowel harmony and tone assimilation are not treated further here.

It has been argued that the features [consonantal] and [sonorant] do not assimilate (McCarthy 1988). Consonants do not become vowels when adjacent to vowels, and vice versa (but see Kaisse 1992 for a possible counterexample). Although consonant clusters may come to agree in sonorancy as a result of nasal assimilation or complete assimilation, the feature [sonorant] does not assimilate independently. But see Rice (1993) for discussion of a feature [sonorant-voice], which is proposed to distinguish sonorants from obstruents, and to be active in cases of sonorant/obstruent voicing interactions. See also MANNER FEATURES.

Length does not assimilate: if anything, lengthening of one segment will induce shortening of neighboring segments, or vice versa (see VOWEL LENGTH, COMPENSATORY LENGTHENING). Stress does not assimilate. If two stressed syllables become adjacent, languages will often resolve the "clash" by moving or deleting a stress to restore the alternating pattern. (See STRESS).

3. General Phonological Issues in Local Assimilation

Section 2 has provided examples of the most common kinds of local assimilations, and has pointed out theoretical issues raised by specific cases, such as privativity of the feature [voice] and the featural description of the class of guttural consonants. Section 3 now turns to broader questions, which are applicable to many or all kinds of local assimilation. These include directionality and perception (Section 3.1), the relation between assimilation and coarticulation (Section 3.2), and finally, the formal treatment of local assimilation (Section 3.3).

3.1. Directionality and Perception

In nearly every case discussed above, there has been a preference in the directionality of assimilation. The following principles can be deduced:

- 1) Assimilation in consonant clusters tends to be anticipatory: the specification of the rightmost consonant dominates;
- 2) Codas assimilate to onsets, rather than vice-versa;
- 3) Affixes assimilate to stems and roots, rather than vice versa;

Many phonologists have analyzed these asymmetries in structural terms. Itô (1998) for example, proposes that onsets "license" place features, and that in many languages codas can only acquire place features by sharing them with an onset consonant, thus forcing assimilation. Lombardi (1999) proposes a similar argument for laryngeal features. Beckman (1998) extends the positional analysis in proposing a theory of "positional faithfulness": certain structural positions, including onset of a syllable or word, are privileged, and changes to these privileged positions are dispreferred. Stems and roots are privileged over affixes, thus affixes tend to assimilate to stems rather than vice versa. Hyman (2008) proposes a structural account of directional asymmetries in a number of Bantu languages.

Other linguists, however, argue that asymmetries in direction of assimilation can be explained by asymmetries in perceptibility, without reference to structural positions. Steriade (2001), for example, emphasizes that consonantal place of articulation is most clearly cued by the formant transitions and burst noise that occur when a closure is released into a vowel. Steriade argues that codas most often assimilate to onsets because the phonological features of a post-vocalic stop are less clearly perceived than the features of a pre-vocalic stop, and thus a change to the coda consonant is less obvious. In cases where a particular distinction is better cued in coda position the direction of assimilation is reversed: there is perseverative assimilation of retroflexion in Sanskrit and Murinbata consonant clusters ((29) and (30) above), because retroflexion is best cued by formant transitions on the *preceding* vowel.

Similar arguments from perception can be applied to explain why nasals and coronals so often undergo assimilation. Nasals may be especially prone to assimilate because nasal resonances interfere with the formant information that conveys place of articulation. Coronals may more frequently assimilate because cues to coronal place of articulation are weakest, and may be overwhelmed by the stronger cues from a following stop at a different place (Kawasaki 1982, Byrd 1992). Cho & McQueen (2008) and Sohn (2008) offer perceptual accounts of Korean place assimilation. See also Paradis & Prunet (1991) and Hume (2003) for arguments respectively for and against general coronal unmarkedness; and CORONALS.

Integral to the discussion of perception in local assimilation is the role of *misperception*. A speaker may produce a word or phrase in a way that is faithful to the lexical representation, but if perceptual cues to a particular contrast in a particular position are weak or non-existent, a listener may perceive something different. That is, a speaker may say [np], but the listener may hear [mp]. If the listener assumes /mp/ was the intended utterance, the listener may postulate a

phonological alternation. For further discussion see Ohala (1981), Hume & Johnson (2001); and PHONOLOGIZATION and PERCEPTUAL EFFECTS.

3.2. Assimilation and Coarticulation

Processes of local assimilation are "natural", in the sense the word is used in the theory of Natural Phonology (Donegan & Stampe 1979); that is, the phonetic motivation for such processes is clear, and the motivation works in the direction of making speaking easier. While phrases like "ease of articulation" and "articulatory effort" are difficult to quantify (see Lindblom 1983, Kirchner 1998, 2000), local assimilation has an obvious phonetic basis in coarticulation.

The term COARTICULATION describes the influence segments have on one another simply by being adjacent, apart from any featural change. Because articulators cannot change position instantly, there is necessarily either some anticipatory or perseverative effect, if not both, on neighboring segments, as articulators move from one target to the next. Two examples illustrate the point. If the velum is to be fully open by the time a consonant closure is achieved, then opening must begin during the preceding vowel, resulting in some inevitable nasal resonance during the vocalic portion. If the tongue body is to reach its target vowel position by the time the onset consonant in a CV syllable is released, articulation of vowel and consonant must begin simultaneously. Thus a [k] is made further forward in the mouth when it precedes a front vowel.

Some articulatory overlap is inevitable, but degree and direction of coarticulation will differ from language to language (see COARTICULATION). Given that language-specific patterns of coarticulation must be learned as part of the grammar, some linguists have argued that there is no need to state independent phonological rules of nasalization, rounding, palatalization, or place assimilation. In particular, the theory of Articulatory Phonology (Browman & Goldstein 1992) argues that all productive phonological changes can be accounted for in terms of differences in articulatory organization, particularly gestural overlap and reduction, without invoking any phonological feature change. Browman & Goldstein (1990), using x-ray microbeam data, show that a coronal closing gesture is still present in English phrases which sound as though a coronal nasal had become labial: for example in the phrase "seven plus" heard as assimilated "se[vmp]lus". They argue that the [n] is not deleted or changed from [coronal] to [labial], but is overlapped by the following [p], according to the general pattern of consonant coordination at word boundaries in English. The [n] and [p] articulated together sound like [m] (see also Byrd 1992). Browman & Goldstein further argue that place assimilation in "tenth" (28 above) is also the result of overlap and blending: the tongue tip cannot be both dental and alveolar at the same time, so a compromise blended position is reached. Zsiga (1995) argues for an overlap account of palatalization at word boundaries in English. The phrase "this year" may sound like "thish year", but data from electropalatography shows that the word-final fricative is not identical to an underlying [ʃ]. Rather, it is the acoustic result of an [s] and [j] articulated at the same time, with tongue tip and blade gestures blended together. Some proponents of Articulatory Phonology incorporate gestural dynamics into constraint-based theory (Gafos 2002, Bradley 2007).

It is not clear, however, whether all local assimilations are best described in terms of gestural overlap. One distinction that is often made is that categorical phonological alternations should be represented as the result of a change in featural specification, while partial and gradient

changes are attributed to gestural overlap (see GRADIENCE AND CATEGORICALITY). Thus Cohn (1993), for example, identifies two different kinds of nasalization in English and Sundanese. Using nasal and oral airflow data, Cohn demonstrates that nasalization of a vowel in English is partial and gradient, due to coarticulation with the opening velum, and very much dependent on timing and context. In contrast, nasalization in Sundanese is categorical: a nasalized vowel must be specified with its own featural target. In a similar vein, Zsiga (1995) argues that palatalization at word boundaries in English is the gradient result of overlap, while palatalization at morpheme boundaries (33 above) is the categorical result of a featural change. Ladd & Scobbie (2003:16) provide data that vowel assimilation at word boundaries in Sardinian is categorical and conclude (p. 16) "that gestural overlap is on the whole *not* a suitable model of most of the assimilatory external sandhi phenomena in Sardinian, and more generally that accounts of gestural overlap in some cases of English external sandhi cannot be carried over into all aspects of post-lexical phonology."

Other researchers, however, follow Browman (1995) in arguing that that categorical-seeming deletions and assimilations are just the endpoints of a gradient distribution: deletion being the limiting case of reduction and categorical assimilation the limiting case of overlap. Thus Kochetov & Pouplier (2008), for example, describe the categorical change of /pk/ --> [kk] in Korean (26 above), in which they show the assimilated sequence to be identical to an underlying /kk/ cluster, as full reduction of the lip closing gesture and temporal extension of the velar closing gesture. One crucial question is whether there is a theory of gestural timing and organization that is both powerful enough to account for gradient changes, and constrained enough to account for changes that result in category neutralization (see the discussion in Ladd & Scobbie 2003, Scobbie 2007, Zsiga 1997). Another challenge lies in integrating articulatory and perceptual approaches. Further discussion of coarticulation and gestural overlap can be found in GRADIENCE AND CATEGORICALITY, COARTICULATION, ARTICULATORY EFFECTS, AND PHONETIC GROUNDING.)

3.3. Formalizing local assimilation

Local assimilation has played an important role the development of phonological formalism. McCarthy (1988:84) states "The goal of phonology is the construction of a theory in which cross-linguistically common and well-established processes emerge from very simple combinations of the descriptive parameters of the model." He further argues that the ubiquitous presence of assimilation, both local and long-distance, warrants assigning it a "privileged status" in phonological formalism (1988:86). Despite its clear phonetic bases, the process of assimilation has not necessarily been simple to capture in phonological representation.

In the formal theory of Chomsky & Halle (1968) processes of assimilation were expressed with the use of alpha notation. In this formalism, Greek letters stand for variables over "+" and "-", and every instance of the variable in a rule must be filled in with the same value. Thus, a rule of obstruent voicing agreement, as would be needed for example in Yiddish (3), would be written as in (46).

46. Obstruents agree in voicing: alpha notation

$[-\text{sonorant}] \rightarrow [\alpha\text{voice}] / \text{ ____ } [-\text{sonorant}, \alpha\text{voice}]$

While the use of a special notation does convey the privileged status of the notion of "agreement", non-occurring rules can also be easily represented, with no increase in formal complexity.

47. Obstruent voicing must match the value for [+/- back].

$[-\text{sonorant}] \rightarrow [\alpha\text{voice}] / \text{ ____ } [-\text{sonorant}, \alpha\text{back}]$

Thus, as pointed out, for example, by Bach (1968) and Anderson (1985), this rule formalism is too powerful, in that it predicts that rules (46) and (47), being equal in complexity, should be equally likely to occur. On the other hand, the common and straightforward process of nasal place assimilation (section 2.4.1 above) is represented via a complicated formula (48):

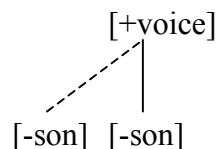
48. Catalan nasal assimilation using alpha notation

$[+\text{nasal}] \rightarrow$	$[\alpha \text{ coronal}] / \text{ ____ }$	$[\alpha \text{ coronal}]$
	$[\beta \text{ anterior}]$	$[\beta \text{ anterior}]$
	$[\gamma \text{ labial}]$	$[\gamma \text{ labial}]$
	$[\delta \text{ back}]$	$[\delta \text{ back}]$
	$[\epsilon \text{ high}]$	$[\epsilon \text{ high}]$
	$[\phi \text{ distributed}]$	$[\phi \text{ distributed}]$

The formalism of Chomsky & Halle (1968) is further discussed in THE LEGACY OF SPE.

It was the study of long-distance assimilation – tone and vowel harmony – that introduced autosegmental phonology (Goldsmith 1976, Clements & Sezer 1982), but this formalism was quickly adopted for local assimilations as well. In autosegmental representation, assimilation is represented by "feature spreading" through the addition of an "association line": a feature that begins as a property of one segment comes to be associated with more than one, as in the anticipatory voicing assimilation in (49):

49. Obstruents agree in voicing: autosegmental notation



Feature spreading gives assimilation a privileged status as an elementary operation, while more complicated feature switches have a correspondingly more complicated representation.

The addition of class nodes in a more elaborated FEATURE GEOMETRY allows for a simple representation of rules that target a group of features. As noted by Clements (1985:226), "If we find that certain sets of features consistently behave as a unit with respect to certain types of rules of assimilation or resequencing, we have good reason to suppose that they constitute a unit in phonological representation." Local place assimilation is the prime example of a set of features that behave as a unit. McCarthy (1988:86—87) states: "The basic motivation for feature geometry [is] the naturalness of place assimilation."

Consensus has not been reached, however, on exactly which geometry is correct. The need is clear for a class node grouping consonantal place features to account for assimilations such as that in Catalan (21), one grouping laryngeal features to account for assimilation of voicing and aspiration together as in Greek and Sanskrit (11, 12), and a ROOT node grouping all features for complete assimilation as in Ponapean or Arabic (40, 42). Less clear is the need for a SUPRALARYNGEAL node that groups all features except the laryngeal features. Cases like those in Cuban Spanish (43) and Kannada (44), where all features except voice assimilate, would argue for such a node (see Clements 1985); however, McCarthy (1988:92) counters that spreading of the supralaryngeal node "is known from only one or two examples that are subject to reanalysis." Other points of contention include where to attach manner features (Padgett 1994), how to represent the class of guttural consonants (McCarthy 1994) and, probably most difficult, how to handle vowel and consonant interactions and lack of interaction. Clements and Hume (1995, Clements 1993, Hume 1994) suggest separate Place nodes for C-place and V-place: different patterns of interaction and transparency will depend on which nodes are targeted for assimilation. For extended further discussion, see MANNER FEATURES, AUTOSEGMENTS, VOWEL PLACE, INTERACTION OF CONSONANTS AND VOWELS, CONSONANT PLACE, PHARYNGEALS, ORGANIZATION OF FEATURES.

Constraint-based theories (Prince & Smolensky 1993/2004) offer a different way of formalizing assimilations. Although autosegmental representation is generally assumed, the details of feature-geometrical representations become less crucial. One way of representing local assimilation is through the mechanism of AGREE constraints: markedness constraints that state that two adjacent segments must agree with respect to the specified feature. These markedness constraints interact with constraints requiring faithfulness to underlying features, with language-specific rankings producing different patterns of assimilation (see CONSTRAINT RANKING). Thus Lombardi (1999) proposes the constraints in (50) to account for voicing assimilation in Yiddish (3 above). The positional faithfulness constraint (50c) is needed to account for the fact that the coda assimilates to the onset and not vice versa.

50. Constraints on obstruent voicing agreement (Lombardi 1999)

- a. AGREE: Obstruent clusters should agree in voicing.
- b. IDENT(LARYNGEAL): Consonants should be faithful to underlying laryngeal specification
- c. IDENT-ONSET(LARYNGEAL): Consonants in [pre-sonorant position] should be faithful to underlying laryngeal specification.

If these are ranked such that the agreement constraint and the positional faithfulness constraint outrank general faithfulness, as in (51), the result is that the coda will assimilate in voicing to the onset.

51. Tableau for voicing assimilation in Yiddish (Lombardi 1999)

bak bejn	AGREE	IDENT-ONSET(LAR)	IDENT-(LAR)
bak.bejn	*!		
☞ bag.bejn			*
bak.pejn		*!	*

Steriade (2001) treats place assimilation with parallel formalism, but substitutes positional faithfulness constraints that reference differences in perceptibility rather than syllable structure (see Section 3.1 above).

52. Tableau for place assimilation (Steriade 2001)

at pa	AGREE	IDENT-PLACE/C V	IDENT-PLACE/V C
atpa	*!		
☞ appa			*
atta		*!	*

Place assimilation is also often handled with reference to positional markedness as well as positional faithfulness (Kager 1999). In this approach, assimilation is not driven by a constraint requiring agreement. Rather, the markedness constraint that forces the alternation is based on Ito's (1998) insight that codas may not license place features alone. Direct reference to a "coda condition" captures the insight that assimilation to the place of an adjacent onset consonant is just one way to repair the coda violation; epenthesis and deletion, which change the syllable structure rather than featural context, are others. The use of different constraints for place assimilation and voice assimilation captures the generalization that, cross-linguistically, epenthesis and deletion often occur to repair clusters that do not match in place, but they do not occur to repair clusters that do not match in voicing (see Bakovic 2000 and Lombardi 2001). The representation of nasal place assimilation in (53) and (54) is adapted from Shepherd's (2003) analysis of Spanish.

53. Coda constraint:

CODA CONDITION: A coda cannot license place features

54. Tableau for nasal place assimilation in Spanish

taN.po.ko "neither"	CODA-COND	ID-ONSET(PLACE)	ID-(PLACE)
tan.po.ko	*!		
☞ tam.po.ko			*
tan.to.ko		*!	*

Note that in the tableaux above, there is no specific reference to feature geometry or a Place node. In keeping with a general move away from solutions based in representations and rules, the sets of features targeted for assimilation are defined within the content of the constraints, not in terms of a universal hierarchical structure that must be made to work for all cases. Padgett (2004) specifically argues against a Place node in feature geometry, proposing instead that constraints that target defined sets of features better account for partial place assimilations.

In conclusion, it may be said that questions of representation encapsulate the debates that continue over the linguistic nature of local assimilation. Phonologists are working toward finding the representation that will capture crucial cross-linguistic generalizations about assimilation in the simplest and most straightforward form, while accounting for the details of individual data sets. Debates continue over defining the features and feature classes that are active in assimilation, and whether the definition of classes should be representational or set-theoretic. It remains a question whether structural or perceptual approaches to directional asymmetries best account for the range of cross-linguistic data. Another important question is whether assimilation is featural at all: should local assimilation be defined in terms of manipulation of phonological features, in terms of articulatory organization, or in some other way? Accounting for both gradience and variability on the one hand and systematic category change on the other continues to be a challenge. Finally, theories of the phonology-morphology interface, the phonetics-phonology interface, and most generally, theories of the overall structure and architecture of the phonological grammar continue to reference processes of local assimilation. Certainly local assimilation, the most common phonological alternation, will continue to play a central role in phonological theorizing.

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ⁱ The outline of the argument in this chapter follows that of the briefer treatment of the same subject in Zsiga (2006).