Chapter 1: Morphologically conditioned phonology

Any study of the phonology-morphology interface must begin with the central topic of morphologically conditioned phonological patterns. A topic of intense theoretical interest since well before the inception of generative phonology, morphologically conditioned phonology is the phenomenon in which a particular phonological pattern is imposed on a proper subset of morphological constructions (affix, reduplication, compounding) and thus is not fully general in the word-internal phonological patterning of the language. Such phenomena have been the inspiration for a number of influential theories of the phonology-morphology interface, including Lexical Morphology and Phonology, Stratal Optimality Theory, and Cophonology Theory.

This chapter will survey various facets of the morphological conditioning of phonology, focusing on the types of morphological information that can condition phonological patterns and the types of phonological patterns that can be conditioned by morphology. Also covered will be several of the most influential theories of morphologically conditioned phonology, which aim to capture language-specific as well as cross-linguistic generalizations about the phenomenon. The chapter will focus specifically on phonological alternations or constraints that affect the surface form of morphemes. A number of closely related topics are taken up in other chapters: process morphology, in Chapter 2; prosodic templates, in Chapter 3; reduplication, in Chapter 4; phonology-morphology interleaving, in Chapter 6; phonology which applies only in morphologically derived environments, in Chapter 7; the interference of phonology with morphology, including suppletive allomorphy, in Chapter 8; the relationship between morphological structure and prosodic structure, in Chapter 9; and the effect of paradigmatic relationships on phonology, in Chapter 10.

1.1. Illustrative examples

We begin with three illustrative examples of morphologically conditioned phonological patterns. These examples are selected fairly arbitrarily out of an enormous set of possibilities; this is a truly vast phenomenon. The aim of these examples is to show that it is not the case, as the instructor of an introductory phonology class might temporarily mislead students into believing, that a language has a single fixed set of general phonological rules or constraints which apply in the same way to all word. Instead, much — perhaps the majority, it is hard to know — of

phonological alternations or constraints applying within words are subject to quite specific morphological conditioning.

Mam Maya exhibits the morphologically conditioned neutralization of stem vowel length. In Mam, a general constraint in the language prohibits a word from having more than one long vowel. Some roots have a long vowel; some suffixes have a long vowel. Suffixes partition into two classes in terms of the effect that suffixation has on vowel length in the stem (Willard 2004, based on England 1983). 'Dominant' affixes cause long root vowels to shorten (1a); 'Recessive' suffixes preserve root vowel length (1b). Dominant vs. recessive status is not predictable; it must be learned individually for each affix.

(1) a. Dominant suffix: shortens long root vowel

facilitative resultant	l**ii**ch'-	→	lich'-ich'iin	'break/breakable'
locative	j**uu**s-	→	jus-b'een	'burn/burned place'
directional	j**aa**w-	→	jaw-nax	'go up/up'
participial	n**oo**j-	→	noj-na	'fill/full'

b. Recessive suffix: preserves root vowel length

intransitive verbalizer	muq-	→	muq-oo	'bury (n.)/bury (v.)'
	b'**ii**tz-	→	b'**ii**tz-oo [b'liitza]	'song/sing'
instrumental	luk-	→	luk-b'il	'pull up/instrument for pulling up'
remainder	w**aa**-	→	w**aa**-b'an	'eat/remains of food'

In Malayalam (Southern Dravidian), consonant gemination applies at the internal juncture of subcompounds, which are noun-noun compounds with head-modifier semantics (2b). Gemination does not apply, however, at the internal juncture of cocompounds, which are noun-noun compounds with coordinate semantics (2c) (Mohanan 1995:49):

(2)

a.	meeša	'table'
	peṭṭi	'box'
	-kaḷ	(plural suffix)
b.	[meeşa-**pp**etti]$_S$ -kaḷ	'boxes made out of tables'
c.	[meeşa-**p**eṭṭi]$_C$ -kaḷ	'tables and boxes'

In English, suffixes fall into two classes (Allen 1978, Siegel 1974, Chomsky and Halle 1968, Kiparsky 1982a): those which shift stress (3a) and those which do not (3b):

(3)

Base	(a) Stress-shifting suffix	(b) Non-stress-shifting suffix
párent	parént-al	párent-ing
président	prèsidént-ial	présidenc-y
áctive	àctív-ity	áctiv-ist
démonstràte	demonstrative	démonstràtor

In all three of these examples, some morphological constructions in the language (affixation, compounding constructions) are associated with a pattern that other constructions (other affixation, other compounding constructions) are not.

1.2. Approaches to morphologically conditioned phonology

Approaches to morphologically conditioned phonology can be grouped into two main types: Single Grammar theories and Multiple Grammar Theories. In **SINGLE GRAMMAR THEORIES**, each language has a single phonological grammar, but that grammar includes, along with fully general phonological rules and constraints, other rules or constraints which are indexed to particular morphological environments and take effect only there. Under this umbrella are *The Sound Pattern of English* (Chomsky & Halle 1968) and the Indexed Constraint Theory variant of Optimality Theory (e.g. Benua, Alderete, Ito & Mester, Coetzee 2009), to name two of the most prominent.

In **MULTIPLE GRAMMAR THEORIES,** a language has multiple subgrammars, each indexed to one or more morphological constructions or lexical strata. Each subgrammar is composed of fully general rules and constraints. Under this umbrella are Cophonology Theory (Inkelas, Orgun & Zoll 1997; Orgun 1996; Inkelas 1998; Anttila 1997, 2002; Inkelas & Zoll 2005), Lexical Morphology and Phonology (Kiparsky 1982ab, 1984, 1985; Mohanan 1982, 1986; Mohanan & Mohanan 1984; Pulleyblank 1986), and Stratal Optimality Theory (Kiparsky 2000, 2003, 2008).

Any individual morphologically conditioned phonological pattern can easily be modeled in either of these two general ways. Consider, for example, Mam vowel length alternations. Let us assume, for sake of discussion, an Optimality Theory analysis in which stem vowel shortening is attributed to a constraint against long vowels (*VV); ranked above Faithfulness to input vowel length, *VV induces vowel shortening.[1]

In a Single Grammar Theory, the fact that only some suffixes are associated with stem vowel shortening in Mam could be handled by assuming that in general in Mam, Faithfulness

[1] For a basic introduction to Optimality Theory, see Archangeli & Langendoen 1997; Kager 1999; Prince & Smolensky 2004; McCarthy 2002, 2004, 2008.

outranks *VV, but that the Mam grammar also contains a constraint specific to stems formed by dominant suffixes:

(4) $\text{FAITH}_{\text{DominantSuffixStems}}$ » *VV » FAITH

By contrast, a Multiple Grammar Theory would posit two subgrammars (called 'cophonologies', 'levels' or 'strata'), each with opposite ranking of the *VV and Faith constraints. Each suffix construction would be associated with one of these subgrammars:

(5) Recessive subgrammar: *VV » FAITH
Dominant subgrammar: FAITH » *FF

Both approaches are equally capable of handling the distinction between dominant and recessive suffixes in Mam. In general, when looking at any single morphologically conditioned phonological alternation, there is no way to distinguish between the approaches, both of which are in wide use in the literature. The only way to distinguish between the Single and Multiple Grammar theories is to look at languages as a whole, taking all of their morphologically conditioned alternations into account, and asking questions such as these: how many different morphologically conditioned phonological effects can a single language have? How different from one another can the morphologically conditioned phonological patterns in the same language be? If the morphological constructions in a language can vary in their phonological patterning, what captures the overall phonological unity of a language?

Some of these questions will be addressed later in this chapter in section 1.7. Others, specifically having to do with the interaction of morphologically conditioned patterns when they are triggered in the same morphologically complex word, will be dealt with in Chapter 6. The evidence marshalled there suggests that Multiple Grammar theory has a slight edge over Single Grammar theory in terms of accounting for morphologically complex words.

In the next sections we will take a tour of the types of morphological conditioning that phonology can display cross-linguistically, moving from the general to the specific. Section 1.3 surveys sensitivity to lexical class; Section 1.4 looks at phonological asymmetries between roots and affixes, and Section 1.5 explores the degree to which individual morphological constructions can be associated with unique phonological patterns. Section 1.6 addresses the phonological substance of morphologically conditioned phonology.

1.3. Phonological sensitivity to lexical class.

Some patterns are sensitive to lexical class, applying differentially within defined classes of lexical items. Lexical classes can be defined in terms of part of speech (sections 1.3.1, 1.3.2), or

transparent etymological origin (1.3.3), or may seem completely arbitrary from a synchronic point of view (1.3.4).

1.3.1 Part of speech

It is not uncommon to find examples in which morphemes from different parts of speech, usually nouns and verbs, differ in their phonological patterning. Accent assignment in Tokyo Japanese is one well-known case of this. Japanese has a system of pitch-accent, phonetically realized as a drop from High to Low pitch (McCawley 1968, Haraguchi 1977, Poser 1984, Pierrehumbert & Beckman 1988, among others). A word can surface with at most one accent. However, not all words are accent. Some roots are lexically accented, while others are not; some affixes are accented and/or assign accent to stems. The distribution of accent is different in nouns and verbs. As pointed out by McCawley (1968), Poser (1984), Tsujimura (1996), Smith (1999) (for the Fukuoka dialect), and many others, the location of accent in lexically accented non-derived nouns is unpredictable, and must be learned individually for each such noun. Examples from Poser (1984:46) are given in (6a). By contrast, the location of accent in an accented verb follows strict rules, falling on the first mora of the syllable containing the penultimate mora of the verb. Examples from Poser (1984:52) are given in (6b). In (6), syllables are separated by dots, and the accented mora is underlined:

(6) Tone assignment in Japanese

		Accented		*Unaccented*	
a.	Nouns	fu.ku.ro	‘bag’	hasira	‘pillar’
		ta.ma.go	‘egg’	kusuri	‘medicine’
		su.to.rai.ki	‘strike’	udoN	‘noodle dish’
b.	Verbs	ka.ke.ru	‘hang’	kakeru	‘be broken’
		su.kuu	‘build a nest’	sukuu	‘rescue’
		ue.ru	‘starve’	ueru	‘plant’

Smith (2010) calls attention to another example of accentuation which is sensitive to part of speech, in Lenakel (Oceanic). Secondary stress assignment in Lenakel is sensitive to part of speech (Lynch 1978). Polysyllabic words usually exhibit primary stress on the penultimate syllable. In verbs and adjectives, secondary stress falls on the first syllable and every other syllable thereafter, up to but not including the antepenultimate syllable (avoiding the situation where the antepenultimate and penultimate syllable would both bear stress). In nouns, by contrast, secondary stress is assigned to alternating syllables to the left of the primary

penultimate stress. As Lynch (1978) observes, the result is that verbs and adjectives with four or more syllables always have initial (secondary) stress, but nouns of similar length do not:[2]

(7) Stress assignment in Lenakel (data from Lynch 1978:18-20)

a. Verbs (four or more syllables)

/r-ɨm-olkeikei/	[r̀ɨ.mɔl.gɛ́y.gɛy]	‘he liked it’
/n-ɨm-ar-olkeikei/	[nɨ̀.mɑ.ř ɔl.gɛ́y.gɛy]	‘you (pl.) liked it’
/n-ɨm-am-ar-olkeikei/	[nɨ̀.mɑ.mɑ̀.ř ɔl.gɛ́y.gɛy]	‘you (pl.) were liking it’
/t-n-ak-am-ar-olkeikei/	[tɨ̀.nɑ.gɑ̀.mɑ.ř ɔl.gɛ́y.gɛ́y] ~ [dɨ̀.nɑ.gɑ̀.mɑ.ř ɔl.gɛ́y.gɛ́y]	‘you (pl.) will be liking it’

b. Nouns (four or more syllables)

/nɨmwakɨlakɨl/	[nɨ.m^{w}ɒ̀.gə.lɑ́.gəl]	‘beach’
/tupwalukaluk/	[tu.b^{w}ɒ̀.lu.gɑ́.lʊk^{h}] ~ [du.b^{w}ɒ̀.lu.gɑ́.lʊk^{h}]	‘lungs’

In several languages, as Smith (2010) points out, nouns are singled out for augmentation, required to assume a particular minimal prosodic size which verbs are not required to reach. In Chuukese, for example, nouns must be minimally bimoraic, a condition which a monosyllabic noun can satisfy by possessing an initial (moraic) geminate (8a) or by undergoing vowel lengthening (8b). (Coda consonants are not moraic in Chuukese.) By contrast, verbs are allowed to surface in monomoraic CVC form (8c). Note that the data in (8a,b) show the effects of vowel apocope, an independent phenomenon (Smith 2010, citing Muller 1999:395 and Goodenough & Sugita 1980:xiv-xv):

(8)

a.	[kkej]	‘laugh’	(< /kkeji/)
	[ʧar]	‘starfish’	(</ʧʧara/)
b.	[faːs]	‘nest’	(</fasa/)
	[fæːn]	‘building’	(</fæne/)
c.	[fan]	‘go aground’	
	[mær]	‘move, be shifted’	

[2] Lynch notes that under certain circumstances, e.g. when a long vowel occurs in final position, verbs will take final stress. In that event, the antepenultimate syllable always takes secondary stress. Otherwise, the normal secondary stress rule then applies: secondary stress on the initial syllable, and every other syllable thereafter. This can only be seen in very long verbs, of eight syllables or more, e.g. /na-t-i-ep-ai-aukɨranɨmw-ín/ → [nɑ̀.dʸɛ.bɑ̀.yu.gə.ř ɑ̀.nɨ.m^{w}ín] ~ ‘we (excl. pl.) will be ready to drown it’ (p. 20).

In a recent cross-linguistic survey of noun vs. verb phonology, Smith (to appear) calls attention not just to the fact of noun-specific or verb-specific phonological patterns but to pervasive cross-linguistic asymmetries across languages in the types of patterns that are observed. Smith finds overall that that nouns tend to exhibit more contrasts, while verbs are more prone to neutralization. This finding is clearly consistent with the Japanese example in (6), though it is not as clearly applicable to the Lenakel or Chuukese examples. Smith's generalization will be discussed further in section 1.7.2.1.

1.3.2 Ideophones

Ideophones are a phonosemantic class of words whose meanings include color, smell, sound, intensity, or (often vivid) descriptions of unusual appearance or activity. Ideophones can belong to various parts of speech, most often adjectives, adverbs or verbs. They are of interest to the present discussion because in many languages they constitute a class of words with distinctive phonology, often departing from prosodic or segmental norms. For useful surveys of ideophones, see Hinton et al. 1994 and Voeltz & Kilian-Hatz 2001.

In Hausa, which has a fairly rich (ca. 500) set of ideophones (Newman 2000:242), ideophones employ the standard consonant and vowel inventory but depart from Hausa phonological norms in two ways Newman (1995, 2000, 2001). The first involves syllable structure. According to, ideophones are usually consonant-final, in contrast to the Hausa norm of vowel-final words. Furthermore, ideophones can end in obstruent consonants, including plosives, which is impossible in the other sectors of Hausa vocabulary.

(9) Hausa ideophones (Newman 1995:776, Newman 2000:244,250)

fát	fárí: fát	'white IDEO = very white'
ʃáɾ̃	kó:rè: ʃáɾ̃	'green IDEO = very green'
ƙút	àbó:kí: ƙút	'friend IDEO = very close friend'
ták	ɗájá ták	'one IDEO = exactly one'
ɾ̃úf	ja: ɾ̃úfè ƙó:fáɾ̃ ɾ̃úf	'3sg.masc close door IDEO = he closed the door tight'
fáɾ̃át	tá: tá:ʃì fáɾ̃át	'3sg.fem get_up IDEO = she got up very fast'
túɓús	yá: gàjí túɓús	'3sg.masc become_tired IDEO = he became very tired'
gàràrà	súnà: já:wò: gàràrà	'3pl walk IDEO = they roamed aimlessly'

A third characteristic of Hausa ideophones is that they are prononced with exaggerated intonation. Hausa has three lexical tones: H, L and Falling (a combination of H and L). Ideophones also exhibit these tones, but with a difference: H on ideophones is realized as extra-H, and L as extra-L. These differences are most noticeable when the ideophone is in

phrase-final position (Inkelas, Leben and Cobler 1987; Newman 1995, 2000). In summary, ideophones in Hausa push the envelope of what is permitted phonologically in the language. This situation is very common. However, as Childs (2001:182) points out, it is not universal. In some languages, ideophones may exhibit fewer phonological contrasts than are found in other parts of speech. A case of this kind in Guarani is discussed in Chapter 3; Guarani noise-word ideophones conform to a rigid template that exceptionally enforces vowel harmony and allows only about one third of the consonants in the Guarani inventory (Langdon 1994).

1.3.3 Etymological classes

Lexical class distinctions to which phonology is sensitive can be etymologically based. A common manifestation of this phenomenon is that certain phonological patterns are imposed or licensed in loanwords but not in native vocabulary items.

In a case study of lexical classes in Japanese, Itô & Mester (1999) point out (p. 62) that the lexical distinction between native vocabulary, Sino-Japanese vocabulary and loans from other (mainly European) languages is well-recognized by speakers of Japanese, due in part to its reflection in the writing system and in part to phonological differences between the sets of words, which Itô & Mester term vocabulary strata. Itô & Mester point to three phonological properties that distinguish the strata (10). The constraint No-DD bans voiced geminates; No-P bans singleton (onset) [p], and No-NT bans sequences consisting of a nasal consonant followed by a voiceless consonant.

(10) Etymologically-based stratification in the Japanese lexicon (Itô & Mester 1999)

	No-DD	No-P	No-NT
Yamato			
Sino-Japanese			violated
Assimilated foreign		violated	violated
Nonassimilated foreign	violated	violated	violated

The native, or Yamato, vocabulary in Japanese adheres to the strictest phonological conditions of the strata, enforcing all three constraints. DD, P and NT structures are not found in native roots, and when they arise through the concatenation of native morphemes, they are repaired, e.g. /yom-te/ 'read-GERUNDIVE' → [yonde], which converts an illegal NT sequence to a legal [nd] cluster. Sino-Japanese vocabulary items do not heed No-NT. Some contain NT sequences morpheme-internally, e.g. *keŋka* 'quarrel', and NT sequences created by the morphology in Sino-Japanese compounds are not repaired. The 'Foreign' strata are the most permissive, including surface voiced geminates (DD), singleton [p]s (P) as well as NT

sequences. In order for the differences among the strata to be captured, Ito & Mester (1999) propose that the phonological grammar of Japanese is sensitive to the stratal classification, either by means of postulating different subgrammars (cophonologies) for the different strata or by indexing specific constraints to specific strata. Observing that the strata differ in a scalar fashion in the subset of constraints (No-DD, No-P, No-NT) which they obey, Itô & Mester (1999) propose the following constraint ranking for Japanese. The only constraints which are indexed to strata are the Faithfulness constraints mandating identity between underlying and surface representations. The higher these are ranked, the more strongly lexical items will resist conforming to the phonological well-formedness constraints No-DD-, No-P, No-NT:

(11) Constraint ranking in Japanese (Itô & Mester 1999:73)

FAITH-UnassimilatedForeign
|
No-NT
|
FAITH-AssimilatedForeign
|
No-P
|
FAITH-SinoJapanese
|
No-DD
|
FAITH-Yamato

Ito & Mester (1999) observe (p. 70) that the classification of lexical items into strata is not always technically etymologically accurate. For example, the native item *anata* 'you' has contracted to *anta*, which violates *NT. Based on its phonological characteristics, *anta* should belong to one of the non-native strata, but it is etymologically native. Despite occasional counterexamples of this kind, however, the different classes of phonological behavior in Japanese hew quite closely to etymology.

1.3.4 Arbitrary lexical classes: patterned exceptions

Sometimes lexical class distinctions are purely arbitrary, with one set of morphemes simply resisting a phonological pattern that others conform to. For example, in Sacapultec (Mayan,

Guatemala), some nouns undergo final-syllable vowel lengthening in combination with possessive prefixes (12a), while others do not (12b) (DuBois 1985):[3]

(12)

	Plain		Possessive	
a.	ak	'chicken'	w-a:k	'my chicken'
	ts'eʔ	'dog'	ni-ts'i:ʔ	'my dog'
	ab'ax	'rock'	w-ub'a:x	'my rock'
	tiʔb'al	'stinger'	ri-tiʔb'a:l	'its stinger'
	mulol	'gourd'	ni-mulu:l	'my gourd'
b.	otʃ'	'possum'	w-otʃ'	'my possum'
	am	'spider'	w-am	'my spider'
	weʔ	'head hair'	ni-weʔ	'my head hair'

DuBois observes that the difference is lexically conditioned, and not reliably predictable from other factors. However, he also notes a weak semantic effect; many of the stems resisting possessive lengthening 'do not often occur in possessed constructions, e.g., wild animal names' (p. 396).

In the recent literature, much attention has been paid to finding statistical generalizations of this sort that might shed some light on seemingly arbitrary lexical class distinctions. Zuraw (2000) refers to the phenomena that this line of research seeks out as patterned exceptionality. For example, when the Tagalog prefix *paŋ-* combines with a following (consonant-initial) stem, the environment is created for the Tagalog rule of Nasal Substitution to apply. Nasal Substitution merges a nasal consonant and following stop into a single nasal consonant. As seen in (13), the rule does not apply systematically throughout the lexicon. Some roots undergo it when prefixed, and others do not:

[3] Transcriptions have been converted to IPA. The vowel alternations are due to an independent phrase-final lowering process. The 1st person prefix displays suppletive allomorphy, conditioned by whether the stem is vowel- or consonant-initial. On suppletive allomorphy, see Chapter 8.

(13) Lexical conditioning of Nasal Substitution in Tagalog, in environment of prefix *paŋ-*

Undergoer of Nasal Substitution		Non-undergoer of Nasal Substitution	
bugbóg	pa-**m**ugbóg	bigáj	pa**m-b**igáj
'wallo'	'wooden club for pounding clothes'	'gift'	'gifts to be distributed'
búlos	pa-**m**úlos	buʔóʔ	pa**m-b**uʔóʔ
'harpoon'	'harpoon'	'whole'	'something used to produce a whole'

In a thorough study of the Tagalog lexicon, Zuraw shows that while Nasal Substitution can never be completely predictable from phonological form, it is also not completely random. A number of factors influence the probability of application of Nasal Substitution. Voicing is one factor. Zuraw shows that statistically, stems beginning with voiced consonants undergo Nasal Substitution in a much higher proportion than do stems beginning with voiceless consonants (p. 29). Place of articulation is another factor. A greater-than-average proportion of labial-initial stems undergo Nasal Substitution; with velars, the situation is the opposite, and a lower-than-average proportion undergo the alternation. Dentals fall somewhere in between. In a psycholinguistic experiment in which native Tagalog speakers rated the acceptability of novel derived words in Tagalog, Zuraw was able to show that acceptability judgments paralleled the distribution of Nasal Substitution in the lexicon. Speakers were more likely to accept Nasal Substitution in the environment of a voiced consonant and, with some exceptions, mirrored in their ratings the place of articulation effects as well. Zuraw concludes from this study that speakers are highly sensitive to lexical patterns, even when imperfect, and proposes a model of grammar learning which incorporates and even gradually sharpens and enhances statistical lexical patterns.

On this model, it is to be expected that any dimension of similarity along which lexical items can be grouped is fodder for the conditioning of a phonologicaly pattern: semantic, syntactic, morphological, or, phonological.

Whether or not to follow this approach to its logical extreme in describing the grammar of a language is an open question. The argument in favor of recognizing statistical subpatterns in grammar is the mounting evidence from corpus studies and psycholinguistic experiments, like Zuraw's, that speakers are highly sensitive to the statistical profile of the lexicon. The argument against doing so is that the number of lexical subpatterns that could conceivably be identified is dauntingly large, making it impossible to summon psycholinguistic evidence for each one. As a thought experiment, Inkelas et al. 1997 raise the possibility of separate grammars for roots containing at least one closed syllable vs. those containing only open syllables, or separate grammars for roots beginning with consonants vs. those beginning with onsets; cross-cutting

these and other imaginable phonological dimensions will, if followed consistently, end up producing as many distinct subgrammars in a language as there are phonological distinct lexical items.[4]

Phonologists have generally limited themselves in practice to accounting for the phonological generalizations holding over subclasses of lexical items that form independently identifiably natural classes, such as those discussed in this section. However, it is important when working with morphologically justifiable subgrammars not to overlook the potential importance of subterranean statistical patterns in the lexicon.

1.4. The root-affix distinction

The distinction between roots and affixes is relevant to many phonological generalizations. Specifically, roots are often subject to phonological size constraints that affixes can flout; conversely, affixes are often limited to smaller segmental inventories than roots exhibit.

In a discussion of root-affix asymmetries, McCarthy & Prince (1995:116) cite as examples the fact that Sanskrit roots may contain consonant clusters but affixes never do; the fact that Arabic roots may contain pharyngeal consonants, but affixes cannot; and that English suffixes favor coronal consonants, thought to be unmarked phonologically (e.g. Yip 1991). These are all statistical distributional generalizations, similar to those observed to hold between function and content words. In stress languages in which, as in English, content words are required to have a lexical stress, function words (e.g. prepositions, pronouns, conjunctions, auxiliaries) are typically exempt from this requirement.

There are certainly numerous exceptions to these generalizations. Many languages contain invidual roots which are smaller than individual affixes in the same language. The Turkish words *de-mek* 'say-INFINITIVE' and *gel-ecek* 'come-FUTURE' are just two of a huge number of examples that can be found across the world's languages. It is well known that most affixes derive historically from free-standing elements (like roots), and that the process of grammaticalization often involves reduction and erosion of the segmental material of the affix. This alone would account for the tendency for affixes to be smaller than roots.

The most interesting development in the literature on phonological root-affix assymetries is the claim that the root-affix asymmetry extends beyond statistical distributional asymmetries to the phonological behavior of roots and affixes when combined in words. In short, roots are claimed to be more resistant to undergoing alternations than affixes are. McCarthy & Prince raise root-controlled harmony processes as an example. In vowel harmony systems, one of the basic parameters is the directionality of harmony. In some languages it is

[4] See Golston (1997) for a related proposal, namely that instead of being listed with a phonological underlying form, morphemes are lexically represented as that set of phonological constraints which they violate.

purely directional (progressive or anticipatory); in other, so-called "dominant" harmony systems, a particular value of the harmonizing feature will spread bidirectionally throughout a word or stem containing it. In still other cases, harmony is triggered by particular morphemes, usually the root. In Ekuguusi (also known as Guusi, Bantoid; Cammenga 2002), for example, mid vowels in affixes harmonize in [ATR] with mid root vowels (*o, e, ɔ, ɛ*). This is true of prefixes as well as suffixes. Below, trigger root vowels are single-underlined and harmonizing affix vowels are double-underlined:

(14) Ekuguusi vowel harmony

o̲-mo̲-te̲	'tree'
ɔ̲-rɛɛ̲nt-ir-e	'he has brought'
e-ñuɔ̲m-ɔ̲	'marriage'
tɔ̲-ɣɛɛ̲nr-ɛ̲	'let us go'

To account for this type of root-affix asymmetry, McCarthy & Prince (1994, 1995) propose a universal constraint ranking which asserts that preserving root structure is more important than preserving affix structure:

(15) Root-Affix Faithfulness Metaconstraint (McCarthy & Prince 1994b):
Root-Faith >> Affix-Faith

This constraint predicts that lexical contrasts found in roots may be neutralized in affixes, with the result that affixes either surface with unmarked phonological structure or assimilate to roots (e.g. in vowel harmony). Urbancyk (2006) makes use of the RAFM to account for asymmetries in reduplication in Lushootseed (see also Downing 2006). Urbanczyk compares two co-existing reduplication constructions: the Diminutive, with a CV reduplication pattern, and the Distributive, with a CVC reduplication pattern. In the Diminutive, the reduplicant vowel defaults to unmarked [i] under most circumstances (16a). By contrast, in the Distributive, the reduplicant vowel is a stressed schwa, which a vowel normally found only in roots (and not affixes). Data are from Urbanczyk 2006, citing Bates et al. 1994:

(16) Lushootseed reduplication

a. Diminutives

'foot'	ǰásəd	→ ǰí-ǰəsəd	'little foot'
'animal hide'	s-k^{w}ábšəd	→ s- k^{w}í-k^{w}əbšəd	'small hide'

b. Distributives

'foot'	ǰásəd	→ ǰás-ǰəsəd	'feet'
'bear'	s-čátx^{w}əd	→ s-čát-čətx^{w}əd	'bears'

Urbancyzk (2006) analyzes the Distributive reduplicant within Generalized Template theory (see Chapter 4), treating CVC Distributive reduplicants as morphological roots, with all the phonological privileges — stressed schwa, syllable coda contrasts — accorded to roots but not affixes. Urbanczyk analyzes the Diminutive as an affix, characterized by the smaller size and vowel inventory of affixes generally.

Although McCarthy and Prince claim that there is no language in which the ranking in (15) is reversed, and despite supporting evidence of the type presented to this point for the RAFM, the generalization is not exceptionless. For example, many alternations occurring at the stem-affix boundary target stem segments and not affix segments, in violation of FaithRoot » FaithAffix. In a comprehensive study of root vs. affix strength, Pycha (2008:52) cites, among other cases, the example of velar deletion in Turkish. As seen in (17), stem-final velars (/k/ and /g/) delete when rendered intervocalic by suffixation (see also Lewis 1967, Zimmer & Abbott, Inkelas & Orgun, Inkelas 2009, to appear, among many others who have discussed this phenomenon). Examples are from Inkelas 2009:[5]

(17)

	nominative	3rd possessive	dative
'baby'	bebek	bebe-i	bebe-e
'street'	sokak	soka-ɯ	soka-a
'cow'	inek	ine-i	ine-e
'catalog'	katalog	katalo-u	katalo-a
'mathematics'	matematik	matemati-i	matemati-e
'go-REL'	git-tik	git-ti-i	git-ti-e
'understand-INF'	anla-mak	anla-ma-ɯ	anla-ma-a

However, suffix-initial velars do not delete, even though they occur in the same phonological environment as the deleting stem-final velars. Examples below are from Inkelas 2009 and Göksel & Kerslake 2005:62:

(18)

-gen	/altɯ-gen/	[al.tɯ.**g**en]
	'six-GON = hexagon'	
	/jedi-gen/	[je.di.**g**en]
	'seven-GON = septagon'	
-gil-ler	/bakla-gil-lAr/	[bak.la.**g**il.ler]

[5] The deleted velar is represented in the orthography as "ğ". In some dialects of Turkish and even for some speakers of standard Istanbul Turkish, "ğ" manifests as a weak labial glide between round vowels or as a weak palatal glide between front vowels (e.g. Lewis 1967:5, Göksel & Kerslake 2005:8).

	‘beans-group-plural = pulses’	
	/amca-sI-gil-lAr/	[am.ʤa.sɯ.**g**il.ler]
	‘uncle-3POSS-group-plural = his/her uncle & family’	
-ki	/sene-ki/	[se.ne.**k**i]
	‘year-REL = this year’s’	
	/ada-DA-ki/	[a.da.da.**k**i]
	‘island-LOC-REL = the one on the island’	

The question of why alternations at the stem-affix juncture so commonly target the stem rather than the affix is discussed at greater length in Chapter 7, which focuses on derived-environment effects. Here, however, the example simply illustrates the fact that the repair of an ill-formed configuration does not always preferentially target affixes over roots.

1.4.1 Case study: root-affix asymmetries in the resolution of VV hiatus through deletion

In a survey of 87 languages, 68 of them in the very large and diverse Niger-Congo family, Casali found two strong preferences in the case of vowel hiatus resolved via vowel deletion: one was for the first of two consecutive vowels to delete, and the other was for affix vowels to delete. These two interacting preferences add up to the prediction that stem-initial vowels should never delete in order to resolve a VV hiatus and the prefix-stem boundary. Casali found 21 cases in which a root vowel deletes if it occupies V1 position (19a), and 41 cases in which the affix vowel deletes, whether it is in first (19b) or second position (19c).

(19) a. Stem vowel deletes before suffix vowel: Turkish progressive suffix (Lewis 1967)

i.	‘understand’	/anla/	[anˈla]
	…+/-dI/ PAST	/anla-dI/	[anlaˈdɯ]
	-…+/-Ijor/ PROGRESSIVE	/anla + Ijor/	[anˈlɯjor]
ii.	cf. ‘take’	/al/	[ˈal]
	…+/-dI/ PAST	/al-dI/	[alˈdɯ]
	-…+/-Ijor/ PROGRESSIVE	/al + Ijor/	[aˈlɯjor]

b. Suffix vowel deletes after stem vowel: Chichewa (Mtenje 1992, Casali p. 521)

i. /mwana-uyɔ/ → [mwanayɔ]
‘child-that = that child’

ii. /bambɔ-awa/ → [bambɔwa]
‘man-this = this man’

iii. /ɲimbɔ-izi/ → [ɲimbɔzi]
‘songs-these = these songs’

iv. /khasu-ili/ → [khasuli]

‘hoe-this = this hoe’

c. Prefix vowel deletes before stem vowel: Ndebele (Sibanda 2004:132, 124)

i. li-elaph-a → lelapha ‘it (Cl. 5) treats…’

ii. bu-akh-a → bakha ‘it (Cl. 14) builds’

iii. si-elaph-a → selapha ‘it (Cl. 7) treats…’

iv. uku-os-a → ukosa ‘to roast’ (cf. uku-misa ‘to stop’)

v. a-a-elaph-a → elapha ‘3pl-REMOTE.PST-cure-FV=they treated/cured’

Casali found no case in his database of a stem-initial vowel deleting following a prefix-final vowel. This outcome would violate not only the phonetically-based preference to preserve the second of consecutive vowels but also the root faithfulness preference.

The statistical tendency to preserve root vowels is clear. However, exceptions do exist, showing that preferential root faithfulness can be overridden. For example, the Californian language Karuk (Karok) resolves VV hiatus across the boundary between a monosyllabic vowel-final prefix and a vowel-initial root by deleting the root vowel (Bright 1957, Kenstowicz & Kisseberth 1979). The verb and noun roots in (20b) are vowel-initial; CV prefixation produces a VV hiatus which is resolved by V2 deletion.[6] (Vowel-initial words undergo /ʔ/ epenthesis, but the contrast betweenand the consonant-intial roots in (20a), including *ʔaktuv* ‘pluck at,’ shows that the epenthetic /ʔ/ is not present at the stage at which VV hiatus is created and resolved.) Data are from Bright (1957:33, 44, 49).[7]

(20) Karuk

a. i.

gloss	UR	imperative	1singular	3singular
‘shoot’	/pasip/	pasip	ni-pasip	ʔu-pasip
‘stoop’	/kifnuk/	kifnuk	ni-kifnuk	ʔu-kifnuk
‘pluck at’	/ʔaktuv/	ʔaktuv	ni-ʔaktuv	ʔu-ʔaktuv

ii.

gloss	UR	noun	1sg.poss	3sg.poss
‘younger brother’	/čáːs/	čaːs		mú-čaːs
‘mother’	/taːt/	taːt	naní-ttaːt	mú-ttaːt

b. i.

gloss	UR	noun	1sg.poss	3sg.poss
‘leg’	/ápsiːh/	ʔápsiːh	naní-psiːh	mu-psiːh

ii.

gloss	UR	noun	1sg.poss	3sg.poss
‘fill’	/axjar/	ʔaxjar	ni-xjar	ʔu-xjar

[6] If, however, V1 is /a(ː)/, vowel contraction (to a lengthened vowel) occurs instead, e.g. /pa-akvaːt/ → *paːkvaːt* ‘DEF-raccoon = the raccoon’ (Bright 1957:34), /va-ápsuːn/ → *váːpsuːn* ‘IMPERSONAL.POSS-snake = its snake’ (p. 57), /pa-úkraːm/ → *póːkraːm* ‘DEF-lake = the lake’ (p. 34).

[7] Check to see whether all forms cited in K&K are present in Bright

‘jump’	/iʃkak/	ʔiʃkak	ni-ʃkak	ʔu-skak
‘point’	/uksup/	ʔuksup	ni-kʃup	ʔu-ksup

Another such case, from Nanti (Kampan; Michael 2008) is discussed in the next section.

Accent is another domain in which roots have been found to exert special influence. Alderete (2000) has drawn recent attention to cases in which root accent prevails over affix accent, and attributes this pattern to root-faithfulness. The following data from Cupeño show that when an accented root and accented affix co-occur in the same word, root accent prevails:

(21) Accented root + accented affix(es): accent surfaces on root [Cupeño]

a. /pə́ + √míʔaw + lu/ pə-míʔaw-lu
   3SG + COME + MOTION ‘He came’
b. /√ʔáyu + qá/ ʔáyu-qa
   WANT + PRES.SING ‘He wants’

Unaccented root + accented affix(es): accent surfaces on affix, not root

c. /pə́ + √yax/ pə́-yax
   3SG + SAY ‘He says’
d. /nəʔən + √yax + qá/ nəʔən ya-qáʔ
   1SG + SAY + PRES.SING ‘I say’

However, other languages show the opposite phenomenon. In the the Yakima dialect of Sahaptin (Penutian), for example, Hargus & Beavert (2006) argue that accent is affix-controlled. The following examples show that the root (underlined) retains its lexical accent only when it combines with unaccented affixes (22a,b). Otherwise, an accented affix draws accent away from the root (22c), (22d) (Hargus & Beavert 2006:181):[8]

(22) Accented root + unaccented affix(es): accent surfaces on root [Yakima Shahaptin]

a. /ʔi + ʔatɬ’áwi + ʃa/ ʔiʔatɬ’áwiʃa
   2SG.NOM + beg + IMPRF ‘he’s begging him’
b. /wánp + ani + m/ wánpanim
   sing medicine song + BENEFACTIVE + CISLOCATIVE ‘sing for me’

[8] The accentual system is more complicated than what is presented here; Hargus & Beavert (2006) also distinguish a class of ‘strong’ roots, which retain their inherent accent under more condition than regualr accented roots do. Hargus & Beavert posit the overall faithfulness ranking FAITH-SUFFIX » FAITH-ROOT$_{STRONG}$ » FAITH-PREFIX » FAITH-ROOT.

Accented root + accented prefix(es): accent surfaces on prefix

c. /pá + ʔatɬ'áwi + ʃa/ páʔatɬ'awiʃa
INVERSE + beg + IMPRF 'he's begging him'

Accented root + accented suffix(es): accent surfaces on suffix

d. /wánp + áwaas/ [wanpáwaas]
sing medicine song + INSTRUMENTAL 'sing medicine song'

The complex morphological sensitivity of accentuation processes will be discussed in more detail in section 1.5.7.

In sum, there seem to be clear cases in which roots are immune to alternations that affixes undergo; perhaps, though this has not yet been demonstrated, the majority of asymmetries are in this direction. However, there are certainly clear examples that go on the other direction.

One issue that arises in the study of root vs. affix faithfulness, even in cases where FAITH-root » FAITH-affix is descriptively appropriate, is whether the correct dichotomy is root morphemes vs. affix morpheme, or whether it is bases of affixation vs. the affixes that attach to those bases. The difference between these dichotomies is whether complex stems pattern with roots. If they do, then what passes for a FAITH-Root » FAITH-Affix ranking may instead be reducible to base-identity effects of the kinds discussed in Chapter 6 (Interleaving) or Chapter 10 (Paradigmatic effects).

It is also important to observe that the examples cited in the literature in support of FAITH-root » FAITH-affix tend to involve general phonological processes, not ones which are tied to specific affixes. These will be explored in section 1.5 of this chapter. We will see that they tend to single out roots, or bases of affixation. Process morphology, the topic of chapter 2, is similar in this respect. Despite the robustness they sometimes display in comparision to affixes, roots are also often the special target of phonological alternations that leave affixes alone.

1.5. Beyond roots: Morphological construction-specific phonology

The discussion up to this point has focused on static patterns and on root-affix asymmetries, for the most part permitting the reader to maintain the tacit assumption that the phonological patterns applying within a language are quite general, sensitive only to such large-scale dimensions as root class or morpheme type (root vs. affix).

However, any more in-depth investigation has to confront the fact that the bulk of morphologically conditioned phonology resides in the association of phonological patterns with

the individual morphological constructions which derive and inflect new words. In this section we embark on a broader survey of morphologically conditioned phonology which illustrates that virtually every type of phonological alternation or constraint that can be imposed upon words occurs with this type of morphological conditioning, in one language or another.

1.5.1 Segment deletion

Segment deletion commonly occurs as a morphologically conditioned phonological process. In Turkish, vowel hiatus arising at stem-suffix boundaries is repaired in most cases by glide epenthesis, but in one case – that of the progressive suffix /-Ijor/ –by vowel deletion:[9]

(23)

	C-final root		V-final root	
	'do'	'come'	'understand'	'say'
	jap	gel	anla	søjle
Facilitative /-Iver/:	jap-ɯver	gel-iver	anl**a-j**ɯver	søyl**e-j**iver
Progressive /-Ijor/:	jap-ɪjor	gel-ijor	anl-ɯjor	søyl-yjor

In Nanti (Kampan), morphological conditioning determines how VV hiatus is resolved across the prefix-stem boundary. In the case of most prefixes, VV hiatus is resolved by deletion of the prefix vowel (24a) (Michael 2008:149, 241, 243, 268). This is consistent with Casali's observation that VV hiatus, cross-linguistically, is resolved either be deletion of V1 or by deletion of the affix vowel; in the case of prefix-stem VV hiatus, these descriptions amount to the same thing:

(24) a. /no = am-e/ → name
1S = bring-IRREAL.I 'I'm going to bring'

cf. /no = keNkitsa-ak-i/ → nokeNkitsatake
1S = tell.story = PERF-REALIS.i 'I told a story'

b. /pi = ogi-aratiNk-e = ro/ → pogaratiNkero
2S = CAUS-stand.up-IRREAL.I=3NMO [pogaratiŋksero] (*piogiaratiNkero)
'You will stand it up (e.g. a housepost) (polite imperative)'

cf. /pi = n-kem-e/ → pinkeme
2S = IRREAL-hear-IRREAL.i 'you didn't hear it

[9] Uppercase letters in underlying representation indicate vowels whose surface quality is determined by progressive vowel harmony; this is the standard convention in analyses of Turkish.

c. /pi = oog-eNpa = ro/ → poogeNparo
2S = consume-IRREAL.A=3NMO 'Please eat it'

d. /pi = arateh-an-ak-i/ → paratehanake
2S = wade-ABL-PERF-REAL 'You waded away'

However, in case the prefix is 1PL.INC.S, VV hiatus is resolved via deletion of the stem vowel (Michael 2008:270, 242). This applies straightforwardly in (25a); in (25b), a regular process of intervocalic N-deletion creates VV hiatus and feeds the V2 deletion that targets the root vowel.

(25) a. /a = obiik -eNpa/ → abiikeNpa
1PL.INC.S drink -IRREAL.A (*obiikeNpa)
'let's drink!'

b. /a = N- obiik -eNpa oburoki/ → abiikeNpa oburoki
1PL.INC.S IRREAL- drink -IRREAL.A manioc.beer (*obiikeNpa oburoki)
'Let's drink manioc beer!'

As Michael notes, it might be possible to attribute root vowel deletion to the need to preserve the monovocalic prefix. The 3rd person masculine /i-/ and 3rd person non-masculine /o-/ agreement prefixes in Nanti are also monovocalic. A general V → Ø / _V rule would delete all three before vowel-initial roots, resulting in homophony that could contribute to confusion (Michael 2008:268-69). 3rd person non-masculine does delete, as (26a), but /a-/ triggers root vowel deletion (as seen above) and 3rd masculine /i-/ glides (26b):[10]

(26) a. /o = arateh -an -ak -i/ → aratehanake
3nmS = wade -ABL -PERF -REAL.I (*oratehanake)
'She waded away'

b. /i = arateh -an -ak -i/ → yaratehanake
3mS = wade -ABL -PERF -REAL.I (*iratehanake, aratehanake)
'He waded away'

Anti-homophony considerations of this kind are discussed in more detail in Chapter 8. Regardless, the fact that the three vocalic prefixes behave differently is in itself evidence of morphological conditioning of vowel deletion.

[10] Michael notes (p. 269) that 3mS /i-/ does delete before the only two /i/-initial verb roots in the language, namely *irag* 'cry' and *irak* 'be ripe'. Thus the verb *irigaka* is ambiguous between 'he cried' (/i-irag-ak-a/) and 'she cried' (/o-irag-ak-a/).

1.5.2 Gemination

In Hausa, prefixing pluractional verb (27a) and intensive adjective (27b) reduplication includes a process of stem-initial gemination that other prefixing constructions do not exhibit (Newman 2000:234-235, 425, 16, 47, 365). Historically it arose from CVC reduplication with assimilation across the prefix-stem boundary. Hausa does not tolerate obstruent codas. However, nasal and liquid codas are well-formed (as in (27c)). The gemination in (27a,b) is morphologically conditioned phonology:

(27)	a.	'beat'	búgà:	→	búbbúgà:
		'press down, oppress'	dánnè:	→	dáddànné:
		'be well repaired'	gʲà:rú	→	gʲàggʲà:rú
		'follow'	bí	→	bíbbí
		'drink'	ʃá:	→	ʃáʃʃá:
	b.	'brittle'	gáutsí:	→	gàggáutsá:
		'strong'	ƙárfí:	→	ƙàƙƙárfá:
		'salty, brackish'	záɾ̃tsí:	→	zàzzáɾ̃tsá:
	c.	'DIM-work'	ɗan-táɓà		
		'hair-LINKER-mouth = mustache'	gà:ʃì-n-bà:kí		
		'PROHIBITIVE-2m.sg = don't you!'	káɾ̃-kà		

As seen earlier in (2), gemination serves as a phonological accompaniment to subordinate compounding, but not to coordinate compounding in Malayalam.

1.5.3 Vowel lengthening

It is very common for individual affixes to trigger lengthening on an adjacent syllable. In Turkish, for example, the place name-forming suffix *-iye* triggers lengthening of the vowel /a/ in a stem-final open syllable. Although vowel length is phonemic in Turkish and some /a/ vowels in stem-final syllables are underlyingly long (28b), that is not the case for the words in (28a):[11]

(28)		Orthography	UR	Nominative	Accusative (/-I/)	as place name in /-Ije/
	a.	*Murad* (name)	/murad/	[murat]	[muradɯ]	[mura:dije]
		refah 'comfort'	/refah/	[refah]	[refahɯ]	[refa:hije]

[11] Data are from the Turkish Electronic Living Lexicon (TELL): http://linguistics.berkeley.edu/TELL. Note: of the two speakers represented in TELL, one had an underlyingly short /a/ vowel in *sultan*, and the other has an underlyingly long vowel, as represented in (28b).

	Ümran (name)	/ymran/	[ymran]	[ymranɯ]	[ymraːnije]
b.	*sultan* 'sultan'	/sultaːn/	[sultan]	[sultaːnɯ]	[sultaːnije]
	zaman 'time'	/zamaːn/	[zaman]	[zamaːnɯ]	

1.5.4 Truncation to a prosodic constituent

Truncation commonly accompanies affixation, e.g. in Swedish nicknames (29) (Weeda 1992:121, citing original sources):

(29)	a.	alkoholist	→	alk-is	'alcoholic'
		laboratori:um	→	labb-is	'lab'
	b.	mats	→	matt-e	(proper name)
		fabian	→	fabb-e	(proper name)

Truncation is almost always found in hypocoristic or vocative constructions (see e.g. Weeda 1992, Kurisu 2001 for surveys). Germanic nicknames, represented by Swedish in (29), are well-known, as is the Japanese nickname-forming pattern in which a longer name is (optionally) truncated to a bimoraic base to which the suffix /-ʧan/ is attached (Poser 1984, 1990; Itô 1990). In Japanese, short vowels count as one mora, and long vowels count as two; coda consonants also count as a single mora. The options are illustrated in (30a-c). Individual bases can vary in how they truncate to two moras, as seen in (30d) (Poser 1990:82-83, 84, 87):

(30) Truncation and suffixation Japanese girls nickname formation:

a.	(C)VCV		
	akira	→	aki-tyan
	megumi	→	megu-tyan
	wa-sabu-roo	→	wasa-tyan
b.	(C)VV		
	syuusuke	→	syuu-tyan
	taizoo	→	tai-tyan
c.	(C)VC		
	kinsuke	→	kin-tyan
d.	Variation in instantiation of 2-mora "template"		
	midori	→	mii-tyan, mit-tyan, mido-tyan
	kiyoko	→	kii-tyan, kit-tyan, kiyo-tyan
e.	ti	→	tii-tyan

Example (30e) illustrates that truncation is a side effect of requiring the base to conform to a bimoraic template. The occasional base that is less than two moras long, as in (30e), has to lengthen, rather than truncate, in order to conform to the size condition.

An example of truncation in a suffixed vocative (used to address others or attract attention) comes from Tswana (Bantu), cited by Weeda (p. 84-95). In this construction, the base is reduced to a monosyllable and suffixed with *-í*:

(31)	'blessings'	màtlhɔ́xɔ̀nɔ́lɔ̀	→	tlhɔ̀x-í
	'trash (female)'	màtlàkàlà	→	tlàk-í
	'payer (male)'	mòlèfɛ́	→	lèf-í

Affix-triggered truncation does occur in constructions other than hypocoristics, e.g. but is not common, plausibly for the functional reason that truncation eliminates a lot of the segmental structure that distinguishes lexemes from one another. Ambiguity is less important in nicknames than in many other morphological constructions.

Caballero (2008:123-126) discusses an interesting case of non-hypocoristic truncation in Rarámuri (Uto-Aztecan) which is associated with the denominal suffix *-tá* and with a noun incorporation construction. As seen, the verbalizing suffix *-tá~ti* 'make' combines straightforwardly with disyllabic nouns to form verbs (32a,b). If the noun is trisyllabic, however, truncation applies to reduce it to a disyllabic base (32c) (Caballero 2008:126, 310):

(32) a. nori-rá-ma ré (cf. *nori* 'cloud')
cloud-VBLZ-FUT:SG DUB
'It will get cloudy'

b. nihé aka-rá-sa sapato (cf. *aka* 'sandal')
1sgN sandal-VBLZ-COND shoes
'I will wear shoes'

c. sipu-tá-a čukú (cf. *sipúča* 'skirt')
skirt-VBLZ-PROG bend
'(She is) putting on a skirt'

d. komá-ti-ma (cf. *komáre* 'comadre')
comadre-VBLZ-FUT:SG'

Not all suffixes trigger truncation, as the following examples show (Caballero 2008:59, 139, 141). Truncation is morphologically conditioned.

(33) a. tiyópi-či < /tiyopa-či/
church-LOC

b. banisú-ki-ni-ma
pull-APPL-DESID-FUT:SG
'will want to pull for'

c. wikará-n-čane
sing-DESID-EV
'it sounds like they want to sing'

Base truncation also occurs with the morphological construction of body part noun incorporation, illustrated in (32). Disyllabic nouns incorporate without incident, but trisyllabic nouns shorten to two syllables by losing their final syllable:

(34) Body part incorporation in Rarámuri

a.	/busí + kási/	→	busí-kasí	
	'eye + break'			
b.	/čaméka + repú/	→	čame-répu	* čameká-repu
	'tongue + cut'			
c.	/čerewá + bi'wá/	→	čere-bíwa	
	'sweat + clean'			

As Caballero observes (p. 193), this pattern could be analyzed as directly imposed by the incorporation construction, or it could be the indirect result of a three-syllable initial stress window (coupled with the requirement that the second member of the construction must be stressed). In any case, this type of truncation is specific to this construction, exemplifying morphologically conditioned phonology.

Another instance of suffixation + truncation which is not hypocoristic in nature occurs in Japanese denominal verb formation; see (60).

Truncation has played an especially important role in the literature on the phonology-morphology interface because of the light it sheds on phonological representations. The output of truncation usually matches one of the following shapes, identified in the theory of Prosodic Morphology developed by McCarthy & Prince (1986):

(35) prosodic word
foot
syllable (heavy or unrestricted)
mora

The Swedish and Tswana truncation + suffixation constructions shown in () and () truncate input stems to a (heavy) syllable; the Japanese and Rarámuri constructions in () and () truncate input stems to a foot. Somewhat more unusual is truncation to one mora, the pattern seen in Zuni, triggered by the 'familiar' *-mme* (36a), and in the first member of compounds (36b).

(36) Monomoraic template: truncation in Zuni (Newman 1965, cited in McCarthy & Prince 1986)

a.	kʷ'alasi	kʷ'-a-mme	'Crow'
	suski	su-mme	'coyote'
	kuku	ku-mme	'father's sister'
b.	tukni	tu-mokʷkʷ'anne	'toe-shoe = stocking'
	melika	me-ʔoše	'Non-Indian-be:hungry = hobo'
	paču	pa-lokk'a-akʷe	'Navajo-be:gray = Ramah Navajo'

A contribution of the theory of Prosodic Morphology is the observation that the shapes that truncated stems assume are the same as those featuring in truncation without accompanying affixation (Chapter 2), in prosodic templates (Chapter 3), and in reduplication (Chapter 4).

1.5.5 Ablaut and mutation

Vowel ablaut or consonant mutation can accompany overt affixation. These terms are reserved for alternations in vowels (ablaut) or consonants (mutation) that are too complex or opaquely conditioned to be treated as simple assimilation or dissimilation alternations. Very familiar examples of vowel ablaut include German plurals, such as *Buch* 'book' ~ *Büch-er* 'books', *Koch* 'cook' ~ *Köch-e* 'cooks', which are understood to result historically from assimilation to a front suffix vowel which has since lost the property that originally transparently triggered the alternation.

A less-well known case of vowel ablaut is found in the Papuan language Hua (Haiman 1998), in which the subjunctive auxiliary *-su*, the invariable jussive *-no*, and the invariable future medial *-na* trigger the fronting of stem-final /o/ and /u/ to /e/ and /i/, respectively:

(37) Hua ablaut

Basic stem	Subjunctive stem		gloss
eat	do-	de-su-e	'let me eat'
		de-si-e	'let him/her eat'
	cf.	do-ga-ne	'you will eat'
	cf.	do-gu-e	'I will eat'
be	bai-	bai-su-e	'let me be'
		bai-si-e	'let him/her be'
do	hu-	hi-su-e	'let me do'
		hi-si-e	'let him/her do'

The term ‘consonant mutation’ often evokes the phrasally regulated consonant alternations in Celtic (REFS) or Mande (REFS) languages, but consonant mutations are also found tied to specific word-internal morphological constructions. One example to which we will return in a different context in Chapter 6 is the consonant mutation triggered by the short causative suffix in several Bantu languages. In Chibemba, for example, the causative /-i/ mutates the preceding consonant, itself surfacing as an offglide depending on the place and manner of the preceding consonant (Hyman 1991). Before the causative, /p b/ spirantise to *-fy-*, /d t k g/, /s/, and /l/ spirantise to *-sh-*, and /n, m/ palatalize to *-ny-* and *-my-* respectively:

(38) Chibemba

a.	*lub-a*	lost	*lufy-a*	cause to be lost
b.	*tump-a*	stupid	*tumfy-a*	cause to become stupid
c.	*end-a*	walk	*ensh-a*	cause to walk/move
d.	*pit-a*	pass	*pish-a*	cause to pass
e.	*kul-a*	grow	*kush-a*	cause to grow
f.	*pook-a*	burst	*poosh-a*	cause to burst
g.	*lung-a*	hunt	*lunsh-a*	cause to hunt
h.	*kos-a*	hard	*kosh-a*	cause to become hard
i.	*pon-a*	fall	*pony-a*	cause to fall
j.	*kom-a*	be deaf	*komy-a*	cause to be deaf

The ‘long’ causative, which also begins with a high front vocoid, does not trigger mutation, proving the morphological conditioning of the alternations in (38):

(39) transitives *-ish*

a.	*imb-a*	sing	*imb-ish-a*	cause to sing
b.	*sek-a*	laugh	*sek-esh-a*	cause to laugh
c.	*pet-a*	fold	*pet-esh-a*	cause to fold
d.	*beleng-a*	read	*beleng-esh-a*	cause to read
e.	*tem-a*	chop	*tem-esh-a*	cause to chop

Among all morphologically conditioned phonological alternations, ablaut and mutation are the most likely to be given an autosegmental analysis in which the alternations result from the affixation of a nonsegmental morpheme, rather than being (directly) the result of a morphologically conditioned phonological rule. In Hua, for example, the subjunctive suffix could be said to contribute a floating [-back] feature which links to the stem-final vowel and fronts it; the Chibemba short causative could be analyzed as a subsegment which coalesces with a preceding consonant in a way that fully segmental vowels do not (see e.g. Zoll 1996).

However, even representational solutions such as these often require morphologically conditioned phonology in order to know how precisely to associate the ostensible autosegmental affix with the base of affixation.

1.5.6 Dissimilation and 'exchange' rules

Morphologically conditioned phonological processes include effects where one segment surfaces with a value opposite either to its own input value ('Exchange rules', 'toggles') or to the the output value of another segment in the same word ('dissimilation'). For a survey, see Kurisu 2001.

In Kɔnni, Class 1 nouns form their plurals by means of a suffix *-a ~ -e* whose tone dissimilates with respect to the preceding stem tone (Cahill 1998). In (a), singular nouns end in a H tone and the plural suffix has Low; in (b), singulars end in L and the plural suffix is H. The fact that the singular suffix ends in H-toned *ŋ* is not relevant to the outcome of plural suffixation to the stem:

(40)		gloss	singular	plural
	a.	'fish'	síŋ	sí-à
		'house'	tígíŋ	tíg-è
	b.	'breast'	bììsíŋ	bììs-á
		'stone'	tǎŋ	tàn-á

According to Cahill (pp. 20-21), plural suffixes for all other noun classes are H toned; the polarity exhibited by the Class 1 plurals is morphologically conditioned.

Phenomena similar to this have been documented in a number of other languages; see e.g. Newman (2000) on Hausa and Pulleyblank (1986) on (Margi?).

Affix-specific dissimilation can also target stems, as in the example below from Dholuo, representing the West Nilotic family. In Dholuo, plural suffixation (with *-e*) is associated with voicing dissimilation in the stem: voiced consonants devoice (41a) and voiceless consonants voice (41b):

(41)		gloss	singular	plural
	a.	'bone'	chogo	chok-e
		'stone'	kidi	kit-e
		'rubber'	raba	rep-e
	b.	'breastbone'	agoko	agog-e
		'coat'	koti	kod-e
		'shirt'	sati	sad-e

Dissimilation alternations are a challenge for item-based theories of morphology because of the difficulty in positing a single representation for the affix in question that would unambiguously result in dissimilation. Even if one posited both H and L tone in Kɔnni suffixes, or both [+voice] and [-voice] autosegments as part of the Dhulou plural suffix, it would still be necessary to posit a morphologically specific phonological statement to ensure that the dissimilatory option is chosen.

1.5.7 Stress/pitch-accent (re)assignment

Stress and accent shift are very frequent morphologically conditioned concomitants of affixation and other overt morphological processes, as in the example of English stress-shifting suffixes in (3).

An example from Hausa, a lexical tone language with H and L tone, is given below. In Hausa, a number of morphological constructions trigger the replacement of base stem tone with a tonal melody, composed of H and L tones, which associates to the syllables of the base in a predictable manner (Newman 1986, 2000):

(42) Hausa tone replacement

a. Suffixation with tone replacement (various plural classes)

má:làm	→	mà:làm-ái	'teacher-pl'	-LH
rì:gá:	→	rí:g-únà:	'gown-pl'	-HL
tàmbáyà:	→	támbáy-ó:yí:	'question-pl'	-H

b. Suffixation without tone replacement (various)

dáfà:	→	dáfà:-wá	'cook-ppl'	-LH
gàjé:ré:	→	gàjé:r-ìyá:	'short-fem'	-LH
hù:lá:	→	hù:lâ-ř	'hat-def'	-L

In Japanese, morphological constructions, which include prefixation, suffixation, zero-derivation and compounding, come in two essential varieties: those which preserve lexical stem accent and those which erase it. Poser (1984) terms the two types 'recessive' and 'dominant', respectively, building on terminology introduced in Kiparsky 1973 (see also Kiparsky and Halle 1977, Halle & Mohanan 1985). Japanese pitch-accent is subject to strict distributional regularities: each word has at most one accent, and in cases of conflict between two lexically accented morphemes in the same word, the general principle is that the leftmost accent wins (Poser 1984). Recessive suffixes, as shown in (43), behave according to the leftmost wins principle. An unaccented suffix, e.g. past tense *-ta*, leaves stem accent unaffected (43a), while an accented recessive suffix, e.g. conditional *-tára*, surfaces with its accent only if the stem is

not already lexically accented (43b). Otherwise, Leftmost Wins results in the elimination of suffix accent (43c). Page numbers are from Poser 1984:

(43) Recessive affixes

a. Unaccented

yóm-	→	yóN-da	'read'	[49]
yob-	→	yoN-da	'called'	[49]

b. Accented

yóm-	→	yóN-dara	'if he reads'	[48]
yob-	→	yoN-dára	'if he calls'	[48]

c. Preaccenting

áNdoo	→	áNdoo-si	'Mr. Ando'	[54]
nisímura	→	nisímura-si	'Mr. Nishimura'	[54]
matumoto	→	matumotó-si	'Mr. Matsumoto'	[54]

In contrast to recessive affixes, dominant affixes trigger deletion of stem-accent. Some suffixes are purely accent-deleting, as in (44a), so that the words they produce are unaccented, regardless of base accent. Other dominant affixes are associated with accentual patterns that wipe out any accent the stem brings along. Accented dominant suffixes, as in (44b), surface with accent, instead of succumbing to Leftmost Wins (cf. the behavior of recessive accented suffixes in 43b, above). Still other dominant suffixes place accent on the final or penultimate stem syllable, as illustrated by the family naming *-ke* suffix (44c), or the girls' name-forming *-ko* (44d). The 'true' prefix *ma(C)-* (44c) is dominant post-accenting, putting accent on the stem-initial syllable (44e):

(44) Dominant affixes

a. Unaccented suffix

kóobe	→	koobe-kko	'an indigené of Kobe'	[72]
nágoya	→	nagoya-kko	'an indigené of Nagoya'	[72]
nyuuyóoku	→	nyuuyooku-kko	'an indigené of New York'	[72]

b. Accented suffix

abura	→	abura-ppó-i	'oil, fat/oily'	[49]
yásu	→	yasu-ppó-i	'cheap/cheap, tawdry'	[49]
adá	→	ada-ppó-i	'charming/coquettish'	[49]

c. Pre-accenting suffix

nisímura	→	nisimurá-ke	'the Nishimura family'	[55]
ono	→	onó-ke	'the Ono family'	[55]
hára	→	hará-ke	'the Hara family'	[55]

d. Penult-accenting suffix

haná	→	hána-ko	‘flower/name’	[58]
kaede	→	kaéde-ko	‘maple/name’	[59]
mídori	→	midóri-ko ~ midorí-ko	‘green/name’	[59]

e. Post-accenting prefix

futatu	→	map-pútatu	‘two/exactly half’	[57]
sáityuu	→	mas-sáityuu	‘amidst/in the very midst of’	[57]
syoozíki	→	mas-syóoziki	‘honesty/downright honest’	[57]

Affixes that McCawley and Tsujimura call ‘preaccenting’ and which Poser calls ‘dependent’ have an accent that ‘is realized only if the baseform to which they are attached is accented’ (Poser 1984:50). These affixes cause stem accent to ‘shift’ to a designated syllable, but have no effect on unaccented stems.

(45) Dependent affixes

a. Accent shifts to suffix

a’u	→	ai-te’	‘meet/companion’	[50]
ka’ku	→	kaki-te’	‘write/writer’	[50]
kataru	→	katari-te	‘recount/narrator’	[50]

b. Accent shifts to stem-final

kona’	→	kona’-ya	‘flour/flour seller’	[55]
ku’zu	→	kuzu’-ya	‘junk/junk man’	[55]
kabu	→	kabu-ya	‘stock/stockbroker’	[55]

The figure below, compiled from Tsujimura 1996:90-92, illustrates how the accentuation of the same noun stem can vary according to what kind of suffix it combines with.[12] Boldface is intended to draw attention to stems and suffixes that surface with accent other than what is in their underlying representation:

[12] Tsujimura uses the term “preaccenting” for the column labeled here “dependent”, following Poser 1984.

(46)

	a.	b.	c.	d.
Noun stem	-ga (Nominative)	-ma'de 'even'	-gurai 'about'	-sika 'only'
	Recessive, unaccented	Recessive, accented	dominant, accented	Dependent
i'noti 'life'	i'noti-ga	i'noti-**made**	**inoti**-gu'rai	i'noti-sika
koko'ro 'heart'	koko'ro-ga	koko'ro-**made**	**kokoro**-gu'rai	koko'ro-sika
atama' 'head'	atama'-ga	atama'-**made**	**atama**-gu'rai	atama'-sika
miyako 'capital'	miyako-ga	miyako-ma'de	miyako-gu'rai	**miyako'-**sika

Thus for each affix, or more generally for each morphological construction, since compounding and zero-derivation (see Chapter 2) are subject to similar accentual parameters, it is necessary to know which of several possible accent placement patterns the affix triggers (none, stem-initial, stem-final, stem-penultimate) and whether those patterns preserve or delete lexical stem accent (dominant vs. recessive).

1.6. Substance of morphologically conditioned phonology

As far as is known, any kind of phonological pattern, other than the most low-level allophonic alternations, may be associated with a morphological construction; most unnatural phonological alternations (such as *ki* → *tʃi*, or post-nasal devoicing) are morphologically conditioned in this way (see e.g. Spencer 1998).

Looking for finer-grained generaliations, Smith (2001, 2010) has offered the interesting generalization that the majority of phonological phenomena which are specific to part of speech (specifically to nouns or to verbs) are prosodic in nature. A similar observation has been made for prosodically optimizing suppletive allomorphy (Paster 2008) and common infixation sites (Yu 2007). Yu suggests, for infixation, that this generalization has to do with breadth of generalization; prosodic parameters are ones for which all words have a value (since all words have syllables and, in certain languages, stress or pitch-accent), permitting generalizations for which all words are probative.

1.7. Generalizing over the morphological conditioning of phonology within a language

An interesting question that has been addressed for decades in the literature is the degree to which morphologically conditioned phonological patterns can differ from one another within the same language.

Both qualitative and quantitative answers have been suggested. On the quantititave side, it has been proposed that the number of distinct morphologically conditioned patterns in a given languge may be strictly limited to 2 or 3. On the qualitative side, it has been suggested that distinct morphologically conditioned patterns in the same language differ from one another in a principled way, namely the relative degree of faithfulness to lexical entries. We will examine these and other hypotheses in the next sections.

1.7.1 How many types of morphologically conditioned phonological patterns can there be in a language?

The question of how many distinct morphologically conditioned patterns a given language may have is the topic of much discussion in the literature. It is the main parameter differentiating Cophonology Theory from Lexical Morphology and Phonology (LMP) and its sucesssor, Stratal Optimality Theory. In Cophonology Theory, each individual morphological construction is associated with its own phonological subgrammar, or 'cophonology'. In LMP and Stratal OT, the morphological conditioning of phonology is accomplished by assigning each morphological construction to one of 2, 3 or 4 distinct levels, each associated with its own phonological subgrammar.

For example, Mohanan 1982 proposes the following level ordering schema for Malayalam:

(47)

Stratum 1:	Derivation (negative, unproductive causative, among others)
Stratum 2:	Subcompounding, productive causative suffixation
Stratum 3:	Cocompounding
Stratum 4:	Inflection (case and tense)

The division of the morphology into four levels is motivated, on the phonological side, by different characteristic phonological patterns that each level exhibits.

In Level Ordering theory it is necessary to know only the level to which a morphological construction belongs to predict which phonological patterns it will conform to. In this family of theories, the subphonologies, called 'levels' or 'strata', are assumed to be ordered, such that all the morphological constructions associated with Level 1 phonology apply first, all those associated with Level 2 phonology occur next, and so on. Stratal OT is the latest theory to incorporate claims of this kind.

However, level ordering theory has typically attended only to the most general phonological patterns, leaving the more narrowly conditioned ones aside; thus it is not a very good fit with the data from many languages with complex morphology and considerable morphophonemic alternations.

In part this deficiency is due to the claim that levels are strictly ordered. For example, Czaykowska-Higgins (1993) observes that level ordering theory would require at least ten levels to account for morphologically conditioned stress patterns in Moses-Columbian Salish (Nxa'amxcin). Suffixes in Nxa'amxcin are either dominant (stress-shifting) or recessive (stress-preserving), in terms of their effect on base stress. Yet, as Czaykowska-Higgins observes, there is no way to predict this phonological difference from the morphological properties of suffixes. Dominant and recessive suffixes are freely interspersed among each other in Nxa'amxcin words.

In part the deficiency of Level Ordering Theory is due to the fact that in many languages, the sheer number of distinct phonological patterns exceeds the number of levels posited as universally available in existing stratal models. Such systems are better suited to the more descriptively flexible Cophonology Theory.

For example, although nobody has proposed a level ordering system for Hausa, data like that in (42) show that Hausa requires a number of cophonologies simply to account for the numerous different tonal effects that constructions can have on the stems they apply to. Hausa would require more phonologically distinct levels than LMP has ever proposed, if all of its lexical phonology is to be accounted for.

Even in Malayalam, an original poster child for the restrictive model of Lexical Morphology and Phonology, Mohanan & Mohanan 1984:588 observe that the rule of Palatalization is not accommodated by the model: “[T]he effects of Palatalization being blocked in plurals and across the "compound boundary" cannot be derived by restricting its domain of application in any fashion: it is clear that the rule must apply at least at stratum 2 and stratum 4. At stratum 2, however, it applies to causative and verbalizing suffixes and not to compounds, and at stratum 4 it applies to the dative and not the plural. Perhaps the right solution is to say that Palatalization is blocked when the segment has some ad hoc diacritical feature [- P]. The velars in (25a), but not those in (25b), have the feature [- P]. Similarly, the plural has [-P], but not the causative and verbalizing suffixes. This leaves the problem of accounting for the absence of Palatalization in compounds. It is important to note that the stem-initial velar of a compound does not undergo Palatalization, even if a medial consonant in the same morpheme does. Thus, the second velar in kanak'am 'gold' palatalizes, but the initial one does not, in the compound paccakkanak'am 'green gold'. Therefore, the exceptionality is a feature of the segment, not the morpheme. What we need, in these cases, is a lexical redundancy rule that marks all stem-initial segments as [-P], thereby preventing palatalization across the stems of a compound (or across words). “

1.7.2 How different can morphologically conditioned patterns in the same language be from one another?

The question of quantitative differences among phonological subpatterns, or cophonologies, in the same language is no more vexing than the question of qualitative differences. The essential challenge faced by any model of morphologically conditioned phonology is in characterizing the 'genius' of a language, i.e. of capturing the phonological generalizations that the language hews to despite other internal variation, and of constraining language-internal diversity so that it is in some principled way more limited than the kind of diversity that distinguishes languages from one another.

This challenge has been met in several different ways.

(48) Proposed means of constraining language-internal phonological variation

- Strong Domain hypothesis (Lexical Morphology & Phonology; Kiparsky 1985)
- Stratum Domain hypothesis (Lexical Morphology & Phonology; Mohanan 1986)
- Grammar Dependence (Alderete 1999, 2001)
- Grammar Lattice (Anttila 1997, 2002)

Within Lexical Morphology & Phonology, Kiparsky (1985) and Mohanan (1986) advanced the Strong Domain Hypothesis and the Stratum Domain Hypothesis, respectively. Both are defined in terms of ordered levels and are formulated within rule-ordering theory. The Stratum Domain Hypothesis holds that if a phonological rule applies within two different levels (e.g. 1 and 3), it must also apply at all intervening levels (e.g., 2). It prevents rules from turning 'on' and 'off' willy-nilly in a level ordering system. The Strong Domain Hypothesis takes this restriction one step further, requiring all rules in a level-ordered system to apply at level 1, so that rules may 'turn off' at different levels, but must all apply from the beginning.

These proposals, while restrictive and interesting, have fallen out of favor. As has been mentioned in this chapter and is discussed in more detail in Chapter 6, level ordering has been challenged by counterevidence; without level ordering, the qualitative Strong and Stratum Domain Hypotheses are not coherent. Furthermore, the approaches do not translate straightforwardly into Optimality Theory, another reason that they are no longer front and center in the theoretical literature.

Within Stratal Optimality Theory, Kiparsky (2003) has suggested that the phonologies of strata in the same language differ in restricted ways, proposing that the constraint ranking of one level, e.g. Word, may differ from the constraint ranking of a lower level, e.g. Stem, only by "promotion of one or more constraints to undominated status." For example, Kiparsky (2008) argues that alternating secondary stress in Finnish is optional at the Stem level but obligatory at the Word level, due to the promotion of *Lapse above *Stress at the Word level. Without a

more elaborated theory of how many constraints can be undominated and whether constraints can leapfrog over one another into undominated position in successively higher strata, however, this proposal is not sufficiently explicit to generate substantive predictions about stratal variation within a language.

The most explicitly worked out proposals for restricting language-internal variation are Grammar Dependence, formulated within the mono-stratal Indexed Constraint Theory, and grammar lattices, formulated within Cophonology Theory.

Grammar Dependence is the hypothesis, developed in work by Fukazawa (1998), Ito & Mester 1999, Alderete (1999, 2001), and Kawahara (2001), that morphologically conditioned phonological patterns in the same language may differ from one another only in the degree to which they preserve underlying structure from the effects of the language's general phonological requirements. The term 'Grammar-Dependence' reflects the claim that the 'genius' of a languages lies in its fixed ranking of markedness constraints. Only the ranking of faithfulness constraints can vary across morphological environments, predicting greater and lesser degrees of compliance with the basic phonology of the language.

This approach works very effectively for cases like the Japanese stratal differences discussed by Itô & Mester and illustrated earlier in (10). The ranking below, repeated from (11), illustrates the differential ranking of morphologically specific faithfulness constraints among the fixed markedness hierarchy Itô & Mester 1999:73:

(49) $\text{Faith}_{\text{UnassimForeign}}$ » No-NT » $\text{Faith}_{\text{AssimForeign}}$ » No-P » $\text{Faith}_{\text{SinoJapanese}}$ » No-DD » $\text{Faith}_{\text{Yamato}}$

Adhering to Grammar Dependence reduces the overall number of distinct phonological patterns that a language can enforce. Grammar Dependence is also intended to rule out markedness reversals, in which the reranking of markedness constraints could allow cophonologies to differ in the unmarked structures that they impose when faithfulness permits. The Grammar Dependence view is that all languages should be like Japanese, with a series of successively stricter patterns imposed in different morphological environments.

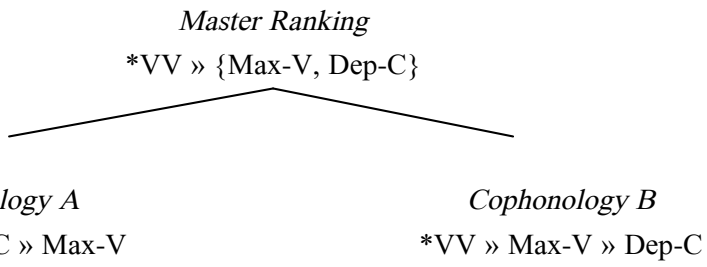
However, as Itô & Mester (1993, 1995ab, 1999) have observed, even Japanese does not conform to this expectation. The mimetic vocabulary stratum in Japanese allows /p/ but bans voiceless postnasal obstruents; the No-NT » FaithMimetic » No-P ranking is inconsistent with the No-P » No-NT ranking required for the Sino-Japanese stratum (49), which obeys No-P but allows voiceless postnasal obstruents. Further discussion of the predictions of Grammar Dependence can be found in Rice 1997; Fukazawa, Kitahara & Ota 1998, and Inkelas & Zoll 2008, among others.

An approach to understanding language-internal variation which is not as rigid as the forgoing proposals is the Grammar Lattice approach, formulated within Cophonology Theory by Anttila (1997, 2002; see also Anttila & Cho 1998). On this view, generalizations over

cophonologies in the same language are captured by organizing cophonologies in an inheritance hierarchy according to the similarity of the patterns they impose. Anttila models his Grammar Lattice theory in the Optimality framework, so that cophonology similarity is defined by the partial constraint ranking that two cophonologies share. Cophonologies inherit shared constraint rankings from a subordinate metaconstruction defined by the shared properties. All cophonologies inherit from the top node in the lattice; the partial constraint ranking there, or what Inkelas & Zoll term the 'Master Ranking', is what corresponds to the 'genius' of the language.

To illustrate with a very simple example, consider the case of Turkish VV hiatus resolution, illustrated earlier in (23). As analyzed by Inkelas & Zoll (2008), all suffix constructions in Turkish share the imperative that hiatus be resolved, i.e. the ranking *VV » {Dep-C, Max-V}, which both cophonologies conform to. This partial ranking of constraints is fixed in the Master Ranking which all individual constructions inherit (must conform to). It is left to the individual cophonologies to further specify the relative ranking of Dep-C (which bans glide insertion) and Max-V (which bans vowel deletion):

(50)



In this very simple grammar lattice, only one node (the top) has a partial constraint ranking. It is, however, also possible for subordinate nodes to themselves be associated with partial constraint rankings, as Anttila has demonstrated, based on larger fragments of Finnish grammar (see in particular Anttila 1997, 2002, 2009).

To wrap up this discussion, theories of morphologically conditioned phonology share the goal of capturing generalizations about what the internal patterns of a language have in common, while still allowing for observed variation. Frameworks vary greatly in detail, perhaps because the empirical generalizations about degree of language-internal variation are still not clear. Future research is needed to illuminate this corner of the phonology-morphology interface.

1.7.2.1 Noun privilege

Approaching the issue of qualitative variation from a different angle, Smith (2001) has proposed that languages tend to be restricted in the ways in which part of speech-sensitive phonology can

differ. In a survey of languages in which phonological patterns are specific to nouns or to verbs, Smith found that the majority pattern is 'noun privilege', in which nouns exhibit more contrasts and are less subject to phonological neutralization than verbs. Smith also observes that most of the patterns of this kind that turned up in the survey involved prosodic properties: size, stress, tone.

An example from Rarámuri illustrates the tendency Smith has documented. According to Caballero (2008:76), vowel hiatus (VV) in Rarámuri is treated differently in nouns and verbs. VV occurs, and is tolerated, in nominal roots (51a), but is not found inside verb roots.

(51) a. čo.ké.a.ri 'mountain dove'
ko.čí.a.-ra 'eyebrow-POSS'
wí.a 'rope'
a.wa.kó.a.ni 'scorpion'

According to Smith, this type of asymmetry follows from a potentially universal ranking of faithfulness constraints:

(52) Faith-Noun » Faith-Verb

When a markedness constraint, e.g. *VV in Rarámuri, is ranked between the two category-specific faithfulness constraints, contrast asymmetries between the two parts of speech are the result.

The ranking in (5252) is not universal; for example, in Turkish, the productive alternation whereby intervocalic stem-final /g/ and /k/ delete between vowels applies only to nouns (53a,b), and not to verbs (53c,d):

(53)

a.	[be.bek]	[be.be.i]	b.	[ba.dem.ʤik]	[ba.dem.ʤi.i]
	/bebek/	/bebek-I/		/badem-CIk/	/badem-CIk-I/
	'baby'	'baby-acc'		'almond-DIM'	'almond-DIM-ACC'
c.	[bi.rik]	[bi.ri.ken]	d.	[ge.rek]	[ge.re.ki.jor]
	/birik/	/birik-En/		/gerek/	/gerek-Ijor/
	'gather'	'gather-REL		'be necessary'	'be necessary-PROG'

Many of the most often-cited cases in which phonology is sensitive to lexical class, including most those cited by Smith, resemble the Rarámuri example in that the asymmetry is observed to hold among monomorphemic roots. It is much harder to find a language in which one phonological generalization holds of all nouns, whether monomorphemic or derived, and different phonological generalization holds of all verbs, whether monomorphemic or derived.

This is true of Turkish, in which verb suffixes ending in /k/ undergo deletion (e.g. /gel-ECEK-E/ 'come-FUT-DAT' → [ge.le.ɟe.e], but verb roots do not.

It is also true of Rarámuri, in which noun roots, but not verb roots, allow VV hiatus. This asymmetry is limited to roots. As (54) shows, VV hiatus occurs and is tolerated in a variety of morphological contexts in morphologically complex verbs (Caballero 2008):

(54) VV hiatus in suffixed verbs in Rarámuri

semé-i	'play.violin-IMPF'	(57)
sipu-tá-a	'skirt-VBLZ-PROG'	(57)
bené-ri-ame	'learn-CAUS-PTCP'	(58)
wi.pi.só.-a	'hit-PROG'	(76)
bo.ti.wí.-o	'sink-EP'	(76)
ni.ké.-o	'bark.APPL.-EP'	(76)
koči-nál-si-a=ni	'sleep-DESID-MOT-PROG=1SG.N'	(301)
porá-p-ti-si-o	'cover-REV-REFL-MOT-EP'	(301)
šiné-ami	'every-PTCP'	(428)

The difficult in finding a pervasive noun phonology in a language, which contrasts with a pervasive verb phonology in the same language, is undoubtedly related to the fact that it is common to find a great deal of phonological variety among the individual morphological constructions into which noun and verb roots can enter, as seen in section 1.5. To illustrate the complication this poses for testing the hypothesis of noun privilege, we turn to a case study of Japanese.

1.7.2.2 Case study: Japanese

Even Japanese, perhaps the most-cited example in the literature of a noun-verb asymmetry because of its accentuation patterns, does not generalize the asymmetry to complex nouns and verbs. In example (6) we saw that the location of monomorphemic noun accent is contrastive, but while the location of monomorphemic verb accent is predictable and not contrastive. This is a clear example of a case in which noun faithfulness outranks markedness constraints enforcing the location of accent, while verb faithfulness is outranked by markedness. However, the morphological constructions deriving new nouns and verbs, or inflecting existing nouns and verbs, exhibit wide variety and do not conform overall to a simple generalization of noun faithfulness outranking verb faithfulness.

As seen earlier, Japanese affixes differ along several basic accentual parameters. Dominant affixes trigger the erasure of base accent; recessive affixes do not. Some affixes are inherently accented; others are not. Some affixes are associated with accentuation patterns placing accent on the stem-final syllable; others are not.

In assessing the noun privilege hypothesis, we may consider dominant suffixes to neutralize the contrast between accented and unaccented inputs, while recessive suffixes and dependent suffixes preserve that contrast. The question for the noun privelege hypothesis, or more generally for the question about broadly part-of-speech-sensitive phonology is through a lexicon, is is whether it applies to derived parts of speech, or pertains only to nonderived stems.

In the case of Japanese, the noun privilege hypothesis would predict that nominal morphology would be recessive (preserving contrast), whereas contrast-neutralizing dominant or preaccenting (dependent) accentual patterns would be associated with verbal morphology.

To test this hypothesis, we look first at part-of-speech preserving constructions. These include derivational constructions (deriving nouns from nouns, or verbs from verbs) as well as inflectional ones. Here we see considerable accentual variety.

(55) Accentual variation amoug N→N affixes

a. Recessive (see 43c, 46a,b), e.g. unaccented nominative *-ga*

i'noti	→	i'noti-ga	'life-NOM'
koko'ro	→	koko'ro-ga	'heart-NOM'
miyako	→	miyako-ga	'capital-NOM'

b. Dominant (see 44a,c,d), e.g. unaccented *-kko*

nágoya	→	nagoya-kko	'an indigené of Nagoya'
nyuuyóoku	→	nyuuyooku-kko	'an indigené of New York'

c. Dependent (see 45b), e.g. pre-accenting *-ya*:

ku'zu	→	kuzu'-ya	'junk/junk man'
kabu	→	kabu-ya	'stock/stockbroker'

A comparable range of accentual variation is observed with verbal morphology. Recessive verbal morphology includes the unaccented past tense *-tai*, seen in (43), as well as accented suffixes such as the conditional (43b) and the provisional *-re'ba*, as seen in (56a). Dominant verbal morphology is illustrated in (56b) by a politeness suffix, accented *-ma's*, which deletes base accent. Several dependent verbal suffixes are illustrated in (56c-d). Both the causative *-(s)ase* and passive *-(r)are* trigger the regular verbal accentuation rule, but only if the input stem is itself accented, in which case accent shifts to the syllable containing the penultimate mora. The verbal negative suffix *-na'i* is dependent preaccenting. It shifts stem accent, if any, to the stem-final vowel; otherwise, i.e. if the input stem is unaccented, the inherent accent of *-na'i* surfaces.

(56) Accentual variation among V→V affixes

a. Recessive (see 43a,b, as well as *-re'ba* (provisional form of verb) (Poser 1984:71))

kake'ru	'be broken'	→	kake'-reba
kakeru	'hang'	→	kake-re'ba

b. Dominant: *-ma's* 'politeness to addressee' (Poser 1984:49)

yo'm-	'read'	→	yomi-ma'si-ta	(*-ta* = recessive, unaccented;
yob-	'call'	→	yobi-ma'si-ta	see 43a)

d. Dependent preaccenting: *-(s)ase* (causative), *-(r)are* (passive) (Poser 1984:52), *-na'i* (negative)

yo'm-	'read'	→	yom-a're-ta	(causative-past)
		→	yom-a'se-ta	(passive-past)
kake'ru	'hang'	→	kake'-nai	(negative)
yob-	'call'	→	yob-are-ta	(causative-past)
		→	yom-ase-ta	(passive-past)
kakeru	'be broken'	→	kake-na'i	(negative)
sukuu	'rescue'	→	sukuwa-na'i	(negative)

In sum, the accentuation asymmetry between nouns and verbs almost disappears under affixation. The main residue of the stem asymmetry occurs under recessive affixation, in which the asymmetric accentual properties of noun and verb roots are preserved. As Poser points out, the gerund, participle and past tense forms of the verb fall into this category. The details of morphologically conditioned accentuation in Japanese are intricate and interesting, and full justice cannot be done to them here. The crucial observation is, simply, that it does not seem to be the case, as a naïve noun privilege hypothesis might predict, that contrast preservation is limited to nouns, or that contrast neutraliation is limited to verbs. Both types of accentution are found in both parts of speech.

A second point of comparison between derived nouns and verbs is compounding. Here, the parts of speech differ noticeably in their accentuation patterns. V-V compounds are always accented, regardless of the accentual status of the input members. In (57a), both members are accented; in (57b), neither member is. (57c) and (57d) illustrate compounds in which one member is accented. Accent in VV compounds is assigned according to the default rule for verbs, i.e. to the syllable containing the penultimate mora (Poser 1984:53):

(57) Verb-verb compounds in Japanese

a.	bu't	ko'm	buti-ko'mu
	'hit'	'be full'	'throw into'
b.	hik	mekur	hiki-meku'ru
	'pull'	'strip off'	'peel'

c.	yo'm	oe	yomi-oe'ru
	'read'	'finish'	'finish reading'
d.	kari	tao'su	kari-tao'su
	'borrow'	cheat	'bilk'

By contrast, noun-noun compounds follow a more complex pattern. In 'long' nominal compounds, namely those in which the second member of the compound is more than 2 moras long, the compound is always accented, with the location of accent depending on the location of accent (if any) in the second member. According to Poser (1984), if the second member of the compound "is unaccented or accented on the final syllable, the compound is accented on the first syllable of the second member. If the second member is accented elsewhere, its accent becomes the accent of the whole compound."[13] Data are from Tsujimura 1996:

(58) 'Long' N-N compounds in Japanese

a. Unaccented second member (p. 81)

ni'	kuruma	ni-gu'ruma
'load'	'car'	'cart'

b. Final-accented second member (p. 80)

hanari'	musume'	hanauri-mu'sume
'flower selling'	'girl'	girl who sells flowers'

c. Second member with non-final accent (p. 80)

yama'	hototo'gisu	yama-hototo'gisu
'mountain'	'quail'	'mountain quail'

This comparison supports the noun privilege hypothesis in that at least some noun-noun compounds preserve the contrast between presence and absence of input accent, while verb-verb compounds do not. However, the location of accent in noun-noun compounds is not contrastive, any more than it is in verb-verb compounds. The details of compound accentuation are, like the details of N→N and V→V suffix accentuation, intricate and interesting; much more detail can be found in McCawley (1968), Poser (1984), Tsujimura (1996), and others.

A third point of comparison between the accentuation of nouns and verbs in Japanese is the fate of deverbal nouns or denominal verbs. This is a particularly interesting comparison: will category-changing morphology trigger the accentuation pattern of the base or that of the derived category? In Japanese, verbs are converted to nouns by zero-derivation, if the verb is

[13] Tsujimura (1996) modifies the generalization about final-accented second members such that either final- or penultimate-mora accent qualifies; see pp. 85-86.

vowel-final, or by the addition of a suffix -i, if the verb is consonant final. (Poser 1984 analyzes this suffix as epenthetic.) When verb-verb compounds are converted to nouns in this manner, accent is always deleted (59a). Thus neither verb-verb compounds (which are always accented) nor their noun counterparts (always unaccented) exhibit any accentual contrast. For non-compound verbs which are converted to nouns, accentuation is input-dependent. If the input verb is unaccented (59b), so is the resulting deverbal noun, but if the input verb is accented (59c), the deverbal noun has final accent, with a few exceptions (Poser 1984: 62).

(59) Accentuation of deverbal nouns in Japanese

a. Nouns formed from compound verbs: accent deleted (p. 96)

hiki-age'ru	'pull up'	→	hikiage	'pulling up'
ii-a'u	'quarrel'	→	iiai	'quarrel'
mi-oto'su	'overlook'	→	miotosi	'oversight'

b. Nouns formed from unaccented non-compound verbs: noun is unaccented (p. 60)

kariru	'borrow'	→	kari	'borrowing'
kasu	'lend'	→	kasi	'lending'
utagau	'doubt'	→	utagai	'doubt'

c. Nouns formed from accented non-compound verbs: noun has final accent (p. 61)

haji'ru	'be ashamed'	→	haji'	'shame'
neba'ru	'be sticky'	→	nebari'	'stickiness'
sonae'ru	'furnish, prepare'	→	sonae'	'provision, preparation'

In summary, the existence and location of output accent in Japanese deverbal nouns is not uniformly faithfully preserved from input.

Denominal verbs in Japanese are created by a variety of strategies, varying in detail according to whether the input is an obvious loanword, Sino-Japanese, a mimetic vocabulary item, or a proper name. All share the property that the original noun is clipped, suffixed with -ru, and accented on the penultimate syllable, regardless of the location of input accent, if any (Tsujimura & Davis, n.d.)

(60) a. (non-Chinese) loanword based: kopiru (< copy), kaferu (< café), teroru (< terrorism)

b. Sino-Japanese-based: kokuru (< kokuhaku "confession"), jikoru (< jiko "accident")

c. mimetic-based: nikoru (< nikoniko: for smiling), chibiru (< chibichibi: for little by little)

d. proper name-based: makuru (< McDonald's), sutabaru (< Starbucks)

According to Tsujimura & Davis (n.d.), "regardless of the location of the accent in an original noun, the accent of the verbal root invariantly falls on the root-final mora… This is shown in the gerund forms of denominal verbs since the gerundive suffix *–te* does not influence the location of the accent in verbal roots."

(61)

gloss	Source noun	Gerundive form of denominal verb
'copy'	ko'pii	kopi'-tte
'accident'	ji'ko	jiko'-tte
(mimetic for smiling)	ni'koniko	niko'-tte
'Starbucks'	sutaaba'kkusu	sutaba'-tte
'linguistics'	gengo'gaku	gengogaku'-tte
'café au lait'	kaɸeore	kaɸeore'-tte

A naïve interpretation of noun privilege might predict that deverbal nouns would invoke noun faithfulness and preserve input accent, while denominal verbs would be default to unmarked accentuation and undergo default verbal accent assignment. In the data we have just seen, this prediction is borne out in that denominal verbs obliterate input accent contrasts. However, the prediction is only weakly borne out, in that most deverbal nouns also neutralize input accent contrast, with the exception of nouns formed from accented verbs (59c).

In summary, this case study of some of the better-known facts of Japanese accentuation suggest that the accentual asymmetry often observed between noun and verb roots is only a small piece of the puzzle, and is not reflective in general of a stark asymmetry between the behavior of nouns and verbs in the language as a whole.

If this is generally true in other languages as well — and the research has not yet been done, so we can only speculate — then it becomes even more acutely important to ask why the faithfulness asymmetry seems so well-established in roots across languages.

In some cases, the tighter restrictions on verbs can be epiphenomenal, due to morphological restrictions. This is what Hargus and Tuttle (1997) say about the well-known size asymmetry between nouns and verbs in most Athapaskan languages. While nouns can be monosyllabic or polysyllabic, verbs must be polysyllabic. Previous accounts attributed this difference to a minimality condition holding on verbs but not nouns; however, Hargus and Tuttle attribute it to the morphological requirement that verbs be tensed, and to the fact that all tense marking is accomplished by affixes that bring even monosyllabic verb stems up to the observed disyllabic minimum (p. 192). For example, cognates of the Witsuwit'en prefixes in (62b) have been analyzed as phonologically epenthetic, in other Athapaskan languages, in service of disyllabic minimality, but Hargus & Tuttle argue convincingly that the prefixes are present even in longer verbs and are morphological in nature, not phonological.

(62) a. Witsuwit'en monosyllabic nouns (Hargus & Tuttle 1997:182)

ʔa	'fog'
ʔaç	'snowshoe'
ts'o	'spruce'
tl'oɬ	'rope'
ye	'louse'
bet	'mittens'

b. Witsuwit'en monosyllabic verb stems (Hargus & Tuttle 1997:181)

hə-tsəɣ	's/he is crying'
hə-tl'et	's/he is farting'
hə-bəl	's/he is swinging'

One likely factor behind the observed noun-verb root asymmetries is language contact as a source of marked structures in languages. It is a truism of language contact that languages are more likely to borrow nouns than verbs, and this alone could account for a larger segment and syllable type inventory, as well as a greater variety in size, among nouns than verbs. This cannot be not the whole story, by any means, and in particular it cannot account for the noun augmentation patterns that Smith observes. (These patterns do not conform to the Faith-Noun » Faith-Verb ranking either; as Smith notes, they instead support a more over-arching generalization of noun salience, or noun robustness.) However, in light of borrowing as a potentially significant contributing factor to the noun root - verb root asymmetry, it becomes especially important to look beyond roots to test the robustness of the generalization.

Further research is needed to explore more fully whether noun privilege and the noun-verb asymmetries noted in the literature extend beyond nonderived roots. If not, then the likely explanation for them lies in the pathways by which languages acquire nouns and verbs. It is well known that languages are much more likely to borrow nouns intact from a contact language than they are to borrow verbs. Furthermore (and not entirely independent), languages tend to have more nouns than verbs. These asymmetries are plausible sources for the existence of larger segment inventories and contrasting structures in nouns, vs. verbs. However, once a noun or verb root is subjected to the morphology of the language, such stark differences do not emerge.

1.7.3 Interaction between morphologically conditioned patterns, in complex words

An important question to address is the interaction between phonological patterns associated with different morphological constructions co-occurring in the same morphologically complex word. This is the topic of Chapter 6. As discussed there, both Cophonology Theory and level ordering theory predict cyclic interaction, since phonology is applying in tandem with

morphology as a word is generated from the root out. Constraint indexation can be implemented either cyclically or noncyclically, but, insofar as it is intended as an alternative to cophonologies and level ordering, is more typically implemented noncyclically. Chapter 6 will address the important question of the interleaving of phonological patterns and the morphological constructions that trigger them within the same word.

1.8. Summary

The primary focus of this chapter has been on allomorphy governed by phonological alternations which are not general in the language but are specific to particular morphological constructions, such as compounding, truncation, affixation, or reduplication (see e.g. Dressler 1985, Spencer 1998). Insofar as a morphological construction is productive, any phonological pattern associated with it is a crucial component of a speaker's knowledge of his or her language. In Chapter 2, we turn to the closely related phenomenon of process morphology, in which a phonological process (other than overt affixation or compounding) is sufficient to realize a morphological category.