

Chapter 2: Process morphology

[Word count: 6,231]

The counterpart to morphologically conditioned phonology, discussed in Chapter 1, is morphology which is manifested as a phonological process (other than concatenation of morphemes). These processes can either themselves be the sole mark of a morphological category or may form the stems that are involved in the marking of that category. The terms ‘realizational morphology’ and ‘process morphology’ are used interchangeably for this phenomenon, the focus of the present chapter.

2.1. Three illustrative examples of process morphology

In Tohono O’odham, a well-known process of subtractive morphology derives perfective verbs from imperfectives by deleting a final segment. Before a final coronal consonant, a high vowel deletes as well. Examples come from Yu (2000:129-30), citing Zepeda 1984, and Anderson (1992), citing Zepeda 1983:

(1) Tohono O’odham perfective deletion

Imperfective	Perfective	gloss
síkon	síko	‘hoe object’
híwa	híw	‘rub against object’
hi:nk	hi:n	‘bark’

In Keley-i (Malayo-Polynesian), nonperfect aspect is marked by consonant gemination, providing a coda to what would otherwise be the leftmost light syllable (Samek-Lodovici 1992, citing original sources) (2a-c). In a word with all closed (heavy) syllables (2d), gemination is blocked.

(2) Keley-i nonperfect aspect gemination

	(a)	(b)	(c)	(d)
Base:	pili	duyag	?agtu	duntuk
Subject focus:	um-pilli	um-duyyag	Man-?agtu	um-duntuk
Object focus:	pilli	duyyag	?agtu	duntuk
Access. focus:	?i- pp ili	?i- dd uyag	?i-?agtu	?i- dd untuk

English provides a familiar third example: stress shift marks the conversion from verbs to nouns in English (e.g. Kiparsky 1982b):

- (3) *condúct* → *cónduct*
 abstráct → *ábstract*
 recórd → *récord*

Realizational morphology is important to study for several reasons. One is that its nature and prevalence can inform theories of morphology. Approaches to morphology have historically divided themselves into two kinds, those which are ‘item-based’ and those which are ‘realizational’ or ‘process-based’. Item-based approaches (e.g. Lieber 1980, Selkirk 1982, Kiparsky 1982) treat morphology much like syntax, linearly arranging phonologically stable form-meaning pairings in conformity with the hierarchical structure governing complex words. Distributed Morphology (Halle & Marantz 1993) is a recent example of such a theory. By contrast, realizational approaches treat morphology as rule-based; many of these approaches assume that morphological rules operate on words and eschew postulating word-internal structure. A-morphous Morphology (Anderson 1992) and Paradigm Function Morphology (Stump 2001) are well-known examples of this kind of approach (see also Bochner 1992). Still other approaches, like Construction Morphology (e.g. Riehemann 2001, Gurevich 2006, Booij 2010), are hybrids of the two, postulating general morphological construction schemas which can combine existing ‘items’ (words, stems, roots) as well as perform the phonological operations that encompass clear cases of process morphology, like those seen above. Insofar as process morphology poses a serious challenge for purely item-based theories of morphology, it is important to be aware of the extent to which realizational morphology exists in the world’s languages.

A second reason to study process morphology is that it sheds light on the nature of morphologically conditioned phonology. Process morphology and morphologically conditioned phonology overlap substantively to a very high degree. The more similar in form they appear, the more evidence there is for embracing a theory of morphology that can treat them, formally, in the same way. The overlap between them tends to favor constructional approaches to morphology, as argued in Orgun (1996), Inkelas (1998, 2008) and Inkelas & Zoll (2005).

In Chapter 1 we examined seven different types of phonological effects, each of which conditioned by morphological context in some language or another. In this chapter we will follow a similar itinerary tour, demonstrating (in Section 2.2) that the same types of phonological effects which can be morphologically conditioned are also capable of instantiating process morphology. Because process morphology has been a controversial topic in the past, many attempts have been made to analyze these effects as additive, more in line with item-and-arrangement morphology; attention will be drawn to these proposals, where relevant.

After this review, we will turn to several empirical questions, all grounds for future research: whether all kinds of phonological operations can realize morphological constructions

(Section 2.3), whether all kinds of morphological constructions can be realized via phonological processes (Section 2.4), how and/or whether to distinguish between morphologically conditioned phonology and realizational morphology (Section 2.5); and, finally, to the theoretical question of how morphologically conditioned phonology and process morphology should be modelled (Section 2.6).

2.2. Phonological substance of process morphology

These examples parallel, in substance, the morphologically conditioned phonological processes seen in Chapter 1.

2.2.1 Segment deletion

As seen in (1), in Tohono O’odham, final segment deletion marks the perfective category in verbs. Along similar lines, final vowel deletion marks nominative case in Lardil (4) (Blevins 1997:249, citing original sources):

(4) Lardil apocope in Nominative case

	gloss	UR	Nominative	cf. NonFuture Accusative (/n/)
a.	‘dugong’	/kentapal/	kentapal	kentapal-in
	‘storey’	/ngaluk/	ngalu	ngaluk-in
b.	‘rainbow’	/mayarra/	mayarr	mayarra-n
	‘sea’	/mela/	mela	mela-n

Initial vowel deletion marks imperative formation in Nanti (Kampan; Michael 2008:243, 245):

(5) Nanti imperatives

- a. /oog- eNpa =ro/ → genparo
 consume -IRREAL.A =3NMO
 ‘Eat it!’
- b. /ahirik -e =ro/ → hirikero
 hold -IRREAL.I =3NMO
 ‘Take it!’
- c. /ag -e =ro/ → gero
 take -IRREAL.I =3NMO
 ‘Take it!’

- d. /am -ak -e paryanti/ → make paryanti
 bring -PERF -IRREAL.I plantain
 ‘bring plantains!’

The irrealis suffix is required in Nanti imperatives, but it is not a dedicated marker of the construction; irrealis marking is also found, for example, in negative declaratives, where imperative truncation is not applicable (p. 399, 145):

- (6) a. /teNkaŋki o= irag -e/ → teNkaŋki irag^he
 NEG.FOC 3NMS = cry -IRREAL.I
 ‘She didn’t cry at all’
 b. /te o= irag -e/ → te irage
 NEG.REAL 3NMS = cry -IRREAL.I
 ‘She didn’t cry’

In Hausa, a final long vowel is shortened in derived adverbs (Newman 2000:39-40):¹

- | | | | | |
|-----|------------|-----------|----------|------------------------|
| (7) | ‘ground’ | kásá: | kásá | ‘on the ground, below’ |
| | ‘forehead’ | gò:ǰí: | gò:ǰí | ‘on the forehead’ |
| | ‘wing’ | fíffíkè: | fíffíkè | ‘on the wing’ |
| | ‘hands’ | hánnà:ǰé: | hánnà:ǰé | ‘in/on the hands’ |
| | ‘fingers’ | ǰá:tsú: | ǰá:tsú | ‘on the fingers’ |

A whole syllable rime (VC) is the target of deletion in Alabama (Muskogean; Hardy and Montler 1986), which encodes pluralization of some argument, or repetitive action, in verbs. Alabama verbs fall into two classes with respect to the truncating stem alternations they undergo. One type class undergoes syllable rime truncation (8a) and the other undergoes coda truncation (and vowel lengthening) (8b). Stems are shown with the classifier suffixes *-ka* or *-li*:

¹ Derived adverbs also commonly drop a feminine suffix, except in the case of body parts like ‘hands’ or ‘fingers’; in some cases an all-H tone pattern is imposed. Some derived adverbs take a suffix *-à*.

(8) Alabama pluralization

	<u>gloss</u>	<u>singular</u>	<u>plural</u>	
a.	‘lie down’	bal-ka	balaa-ka	
	‘hit’	bat-li	batat-li	
	‘join together’	ibacas-li	ibacasaa-li	
	‘cut’	kol-li	kolof-li	(→ koloffi)
b.	‘slide’	salaa-li	salat-li	
	‘turn around’	haatanaa-li	haatanat-li	
	‘scrub’	kayoo-li	kayof-li	(→ kayoffi)

Parallel phenomena occur in other Muskogean languages; on Koasati, see especially Kimball 1991, Martin 1988; on Chickasaw, Choctaw, and Mikasuki, see Broadwell 1993 and the references cited therein.

Subtractive morphology has served as the strongest argument that morphological constructions are, at least in some cases, realizational, in the sense that they cannot be analyzed by means of the addition of a morpheme. This argument is laid out particularly clearly in Anderson 1992 (Chapter 3). There have been attempts to reanalyze subtractive morphology as additive; for example, Trommer & Zimmerman (2010) suggest that subtraction could be the phonological response to the addition of an abstract empty mora, citing Tohono O’odham as an example. But most theoretical treatments capture subtraction directly, either through deletion rules (e.g. Martin 1988, Anderson 1992), prosodic circumscription rules (e.g. Lombardi & McCarthy 1991) or anti-faithfulness constraints (e.g. Horwood 2001, Kurisu 2001).

2.2.2 Gemination

In Woleaian, denotatives are formed by geminating the stem-initial consonant (Kennedy 2003: 174). No overt affix accompanies gemination, which is the sole exponent of the denotative construction:

(9)	fili	→	ffili	‘choose it/to choose’
	βuga	→	bbuga	‘boil it/to boil’
	tabee-y	→	ttabe	‘follow it/to follow’

In Alabama, consonant gemination can be (along with high tonal accent) the sole mark of what Hardy & Montler (1988) characterize as an imperfective aspectual construction, as seen in (10) (pp. 402, 408). The pattern is for the onset of the penultimate syllable to geminate and for the antepenultimate syllable to receive a high tonal accent:

(10)	<u>stem</u>	<u>Imperfective</u>	<u>gloss</u>
	ilakallo	ilákkallo	'strong'/'(getting) stronger'
	hayooki	háyyooki	'deep'/'(getting) deeper'
	abaali	ámbaali	'high'/'(getting) higher' (< ábbaali)
	kasatka	kássatka	'cold'/'cool'
	litihka	littihka	'dirty'/'a little dirty'
	hopaaki	hóppaaki	'far'/'not as far'
	lamatki	lámmatki	'straight'/'pretty straight'
	acanaaka	acáannaaka	'lean against'/'be leaning'
	conotli	cónnotli	'bend over'/'be bent, stooped'
	wataali	wáttaali	'put around neck'/'wear around neck'
	acaapa	átcaapa	'object to, oppose' (< áccaapa)

Gemination, because it augments input structure in an additive way, has often been analyzed as the addition of a timing unit to the input. Thus, Hardy & Montler analyze imperfective aspect in Alabama as mora augmentation; the added mora is assigned to the antepenultimate syllable, and is fleshed out via the gemination of the following onset consonant:

$$(12) \quad \mu + \text{ilakallo} \quad \rightarrow \quad \text{ilákkallo}$$

In some cases, support for an additive analysis of consonant gemination is found in the fact that vowel lengthening is also an available strategy for realizing the affixed mora. This is the case in Alabama, as will be seen in the next section.

However, it is important to point out that even on an additive, affixation-style analysis of consonant gemination in which the morphology adds an empty mora and the phonology supplies segmental content to it, not all added moras are fleshed out in the same automatic way. The Alabama imperfective construction comes with strict phonological instructions on the realization of the added mora (antepenultimate syllable, filled with consonant). Mora affixation itself is a very incomplete description of the construction.

2.2.3 Vowel lengthening

Imperfective aspect in Alabama is realized as vowel lengthening when the syllable whose onset would be the target of consonant gemination is initial (because the stem is disyllabic; (13a)) or when the antepenultimate syllable is closed (CVC), preventing the following onset consonant from geminating (13b). Alabama does not permit initial CC clusters or intervocalic CCC clusters. In such cases, the onset of the following syllable cannot geminate; instead, the

penultimate syllable undergoes vowel lengthening and receives tonal accent (Hardy & Montler 1988:403, 404, 408):

(13)	<u>stem</u>	<u>Imperfective</u>	<u>gloss</u>
a.	hofna	hóofna	‘smell’
	isko	íisko	‘drink’
	noci	nóoci	‘fall asleep’
b.	campoli	campóoli	‘taste good’/‘be sweet’
	ibakpila	ibakpíila	‘turn upside down’

In a discussion of mora augmentation in several languages, Álvarez (2005) cites the case of Huallaga Quechua, from Weber (1989). Additional data can be found in Weber & Landeman (1985). As seen in (14), vowel lengthening realizes first person possessive in nouns ending in a short vowel (14a); otherwise, the suffix *-ni:* is used instead (14b) (Weber 1998:54):

(14)	<u>gloss</u>	<u>noun</u>	<u>1sg.possessive</u>	<u>cf. 2sg.possessive</u>
a.	‘head’	uma	uma:	uma-yki
	‘house’	wasi	wasi: [wasi: ~ wase:]	wasi-ki
b.	‘older (sibling)’	mayur	mayur-ni:	mayur-nin

Vowel lengthening also realizes first person marking in verbs (Weber 1998:10, 81, 340; Weber & Landeman 1985:98):

(15)	a.	aywa	‘go’
		aywa-pa:ku-n	‘go-PL-3’
		aywa-sha	‘go-PRTC’
		aywa-nan	‘go-3 > 3SUB’
	b.	aywa-:	‘go-1sg’
		aywa-:-chu	‘go-1sg-NEG’

It is common for vowel length alternations to mark different verb grades in Indo-European languages. Estonian is known for a complex set of grade alternations that affect both vowel and consonant length (e.g. Prince 1980:538).

(16)		Strong grade	Weak grade
a.	‘other’	tei:se (ill.sg.)	teise (gen.sg.)
	‘eat’	söö:ma (inf.)	söönut (p.p.)
	‘weight’	kaa:lu (part.sg.)	kaalu (gen.sg.)
b.	‘sin’	pat:tu (part.sg.)	pattu (gen.sg.)
	‘town’	lin:na (part.sg.)	linna (gen.sg.)

In sum, vowel lengthening can be the sole marker of a morphological category. It is generally possible to analyze vowel lengthening as the addition of a mora, making it formally resemble affixation rather than a non-additive phonological process. Mora affixation is clearly motivated in cases where vowel lengthening alternates contextually with consonant gemination, affixation or in some cases reduplication; see e.g. Yu (2005) on Washo. From a larger perspective, however, the point of these examples is to show that the cases of vowel lengthening accompanying affixation, which are standardly attributed to morphologically conditioned phonology (Chapter 1) are parallel, in the effects on vowel length, to the cases described in this section.

2.2.4 Truncation to a prosodic constituent

Truncation, seen in Chapter 1 as a concomitant of affixation in several cases, can also serve as the sole exponent of a morphological category. The difference between subtractive morphology (Section 2.2.1) and truncation is whether the phonological constant in the process applies to the unit deleted (subtractive morphology) or the unit resulting from truncation. As mentioned in Chapter 1, a large literature on truncation has produced a consensus that truncation is guided by a small list of prosodic constituent types: the syllable, the foot, the phonological word. Useful surveys of truncation are provided by Weeda 1992 and Kurisu 2001.

Truncation as the sole marker of a morphological category is particularly common in the case of nickname formation and vocatives. (This is also true of truncation which accompanies affixation, as discussed in Chapter 1.) In the Spanish nickname formation process illustrated in (17), proper names are truncated to their first two syllables, the second of which must be open (Pineros 2000:71).

(17)	Spanish nickname truncation	
	Ricardo	→ Rica
	Armando	→ Arma
	Jesus	→ Jesu
	Concepción	→ Conce

In the often-cited case of Yapese vocatives (18) (Jensen 1977), names are truncated down to a heavy syllable at the beginning of the word. (This case is discussed in McCarthy & Prince 1986 and much subsequent work.)

(18)	Yapese		
	<u>name</u>	<u>vocative</u>	
	luʔag	luʔ	
	bajaad	baj	
	maŋefel	maŋ	

As is typical of truncation in general, and illustrated in the Spanish and Yapese examples just seen, the prosodic constituent which results from truncation is not necessarily identical to a foot or syllable in the longer name; rather, it is a foot or syllable that can be constituted from the segments at the beginning (in these cases) or end (in other cases) of the original word. Sometimes the truncatum is the largest prosodic constituent of the relevant type that can be constructed; this characterization applies to Yapese (18). Sometimes it is the most optimal or unmarked prosodic constituent; this characterization applies to the Spanish nicknames in (17).

(19)		Yapese: maximal syllable	Spanish: optimal foot
	Syllabification of full name:	[lu][ʔag]	[ri][kar][do]
	Truncatum:	[luʔ]	[ri][ka]
		*[lu]	*[ri][kar]

For surveys of truncation in forming hypocoristics, see e.g. Lappe 2003.

In addition to its use in hypocoristic formation, truncation is also commonly invoked on its own to produce casual or colloquial variants of longer words. Examples of trisyllabic truncation from Peninsular Spanish (Piñeros 2002:438,440; (20a)) and Japanese (Itô & Mester 1992 (20b)) are given below:

(20)	a.	Spanish truncations		
		‘ecologist’	ekoloχísta	> ekólo
		‘proletariat’	proletáριο	> proléta
		‘amphetamine’	aŋfetamína	> aŋféta
		‘anarchist’	anarkísta	> anárko
		‘masochist’	masokísta	> masóka
	b.	Japanese clippings		
		‘trichloro-ethylene’	torikurooetireN	> torikuro
		‘rehabilitation’	rihabiriteesyōN	> rihabiri
		‘asparagus’	asuparagasu	> asupara
		‘Hysterie (Ger.)’	hisuterii	> hisu
		‘hunger strike’	haNgaasutoraiki	> haNsuto
		‘Akasaka Prince (hotel)’	akasaka puriNsu	> akapuri

In general, truncation as the sole marker of morphological constructions is identical to truncation that accompanies affixation (Chapter 1). The main phonological difference between the two is that a truncated base to which suffixes attach does not itself have to be syllabified exhaustively, while bare truncata must be syllabifiable. Thus, for example, the Australian English colloquial or slang clippings that are suffixed with *-o* in (21) are disyllabic in the output, but the truncatum is itself not necessarily a well-formed syllable. (For discussion of similar examples, see Lappe 2007.)

- (21) business > bizz-o
 conversation > conv-o (Facebook, 8/21/11)
 aggravation, > aggr-o (*aggr)
 aggression

The *aggr-o* example, in particular, contains a consonant cluster, the second consonant of which syllabifies as the onset of the syllable headed by suffixal *-o*, but which would not be able to syllabify otherwise. This is the opposite of the German truncation pattern analyzed by Itô & Mester (1997), in which the truncatum is the largest possible syllable that can be formed from the beginning of the base; this truncatum is then suffixed with *-i*, as seen below. (Note that consonant doubling is orthographic only.)

- (22) Gabriele > Gab-i (*Gabr-i)
 Dagmar > Dagg-i (*Dagm-i)
 Gorbatschow > Gorb-i
 Klinsmann > Klins-i

The German pattern matches its counterpart *-y* construction in English, where the truncatum can either surface on its own as a nickname or can combine with *-y*:

- (23) Daniel > Dan ~ Danny
 Jonathan > Jon ~ Jonny
 Elizabeth > Liz ~ Lizzie
 Bertram > Bert ~ Bertie

2.2.5 Ablaut and mutation

Morphological operations can consist of a change in the features of a segment in the base. As mentioned in Chapter 1, the term ‘mutation’ covers a wide variety of complex or opaque effects

on consonants; language families which are famous for this process include Celtic and Atlantic languages. An illustrative example is provided by Seereer (Atlantic; McLaughlin 338):

(24)	<u>gloss</u>	<u>infinitive</u>	<u>singular</u>	<u>plural</u>
a.	‘want, like’	bug	bugu	mbugu
	‘be ill’	jir	jir	ɲjir
	‘stutter’	duʔ	duʔa	nduʔa
b.	‘look for’	waad	waada	mbaada
c.	‘do’	fiʔ	fiʔa	piʔa
d.	‘pour out waste water’	ɓaf	ɓafa	ɓɔafa
	‘cut’	dɛg	dɛga	fɛga

Plural forms of the Seereer verb are prenasalized if they begin with a voiced (non-implosive) consonant (24)a,b), stopped if they begin with a continuant (24)b,c), and devoiced if they begin with an implosive consonant (24)d). Mutation effects are generally assumed to be the historical residue of an earlier affixation process which triggered junctural alternations at the prefix-stem boundary (e.g. Greenberg 1977). From a synchronic perspective, mutation must either be handled by a set of rules or constraints enforcing change, in which case it is clearly realizational morphology, or by floating features representing a nonsegmental affix, in which case it could be classed with ordinary prefixation, differing only in that its segments are phonologically defective (Zoll 1997).

Note, however, that it is often a challenge to posit a straightforward phonological representation for a single mutation prefix that would predict, through the application of the general phonology of the language, all the attested effects upon combining with the base of affixation. In Seereer, the mutations in plural forms of verbs involve prenasalization in some cases, stopping in others, and devoicing in still others. These effects can be made to follow from the prefixation of a fixed representation (McLaughlin suggests [+nasal]) only if a number of highly specific phonological rules or constraints are appealed to to account for the fully complexity of the alternations. Whether or not mutations qualify as process morphology depend on the degree to which researchers are prepared to go in positing abstract representations and associating them with the morphologically conditioned phonological mapping necessary to produce the correct surface forms.

2.2.6 Dissimilation and ‘exchange’ rules

Both realizational morphology and morphologically conditioned phonology 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 surveys, see Weigel 1993, Kurisu 2001, and Baerman 2007.

Among the more surprising effects of this kind are the ‘toggle’ effects seen in Nilotic languages, where a binary phonological parameter — voicing, in some languages; vowel length, in others — takes on its opposite value to form a new word. Discussions of exchange rules from a theoretical perspective can be found in Anderson 1992, Alderete 1999, Kurisu 2001, and Anttila & Bodomo, among others. An example from Dinka (Nilotic; Sudan) is given below. In Dinka, singular and plural nouns usually have opposite vowel lengths: if one is short, the other is long. Data below are from Malou (1988:66-71):

(25)	<u>Gloss</u>	<u>Singular</u>	<u>Plural</u>
a.	‘dorsal fin of fish’	ñiim	ñim
	‘mahogany’	tiit	tit
	‘razor blade’	rëët	rët
b.	‘bell’	löṭ	lööṭ
	‘kind of bread’	tak	taak

These kinds of effects have been cited for other West Nilotic languages as well, including Dinka’s close relative Nuer (Frank 1999). In Dinka and Nuer, vowel length ‘toggles’ are not the only pattern relating singulars and plurals, but form a recognizable subpattern within the nominal morphology.

An interesting toggle effect occurs with first person singular possession in Itunyoso Trique: a stem-final /h/ is deleted (26a), and /h/ is suffixed to all other stems (i.e. those ending in a vowel or /ʔ/, which is replaced) (26b). The result is an /h/~∅/ toggle (Christian DiCano p.c.).² (Alienably possessed nouns also have prefixes.)

(26)	gloss	base noun	1 st person possessive
a.	‘foot’	ta ³ koh ⁴	ta ³ ko ⁴³
	‘petate’	ββeh ⁵	tu ³ -ββe ⁴³
	‘money’	sã ³ ʔãh ²	si ³ -sã ² ʔã ²
	‘corn’	ʔnih ⁵	si ³ -ʔni ⁴³

² The /h~∅/ toggle is also discussed by Baerman 2007. Note that alienably possessed nouns also take possessive prefixes; inalienably possessed nouns do no. Superscripts in (26) encode tone. /h/-deletion and /-h/ suffixation are accompanied by systematic tonal alternations; see below for discussion.

b. ‘face’	ri ³ ã ³²	riãh ³
‘head’	tʃa ³¹	tʃah ³
‘tongue’	ya ³²	yah ³
‘breath, air’	na ³ ne ¹	si ³ -na ¹ neh ¹
‘candle’	kkaɾ ³	si ³ -kkah ³

Effects like those in Dinka and Trique can be analyzed in terms of phonological dissimilation, qualifying straightforwardly as realizational morphology. However, doing so might not be the right analysis, given the existence of what Weigel calls ‘toggle morphology’, Baerman (2007) calls ‘morphological reversals’, and Anttila & Bodomo call ‘polarity morphology’. These cases involve affixes which have a constant form but which appear to toggle the value of a morphological feature of the base.

In Dagaare (Gur), for example, the overt suffix *-ri* switches the value of number encoded by the stem between singular and plural number (Anttila & Bodomo 2009:1). For the stems in (27a) and (27b), plurals are marked with *-ri*; a bimoraic minimality condition forces vowel epenthesis on monomoraic singular stems (27b). Other stems, however, form their plural with the [-round] vowel suffix (27c); these stems form singulars by taking the suffix *-rɪ*³ (Anttila & Bodomo 2009: 56, 57, 61):

(27) Toggle morphology in Dagaare

	<u>gloss</u>	<u>stem</u>	<u>singular</u>	<u>plural</u>
a.	‘forest’	tùù-	túú	túú-rí
	‘police’	pòlísì-	pòlísì	pòlísì-rí
	‘moon’	kyúú-	kyúù	kyúú-rì
b.	‘log’	wég-	wégè	wég-rì
	‘child’	bì-	bíé	bíí-rí
	‘farm’	wè-	wíé	wè-rí
c.	‘rock’	pì	pì-rí	pì-é
	‘book’	gán-	gán-í	gám-à
	‘seed’	bí	bí-rì	bí-è
	‘rope’	mí	mí-rì	mí-è

In a survey of morphological toggle effects, Baerman (2007:42) cites the example of Tübatülabal (Voegelin 1935), which encodes the distinction between telic and atelic verbs by means of a reduplicative vocalic prefix. For some verbs, the telic stem is basic and the atelic

³ Anttila & Bodomo argue, based on its different phonological characteristics, that the final vowel in the plurals in (27c) has a morphological source, and is not the same epenthetic vowel that appears in the singulars in (27b).

verb is derived by reduplication. For other verbs, the atelic stem is basic and the telic stems is derived by the same reduplicative process:

(28) Toggle morphology in Tübatülabal

	<u>gloss</u>	<u>telic</u>	<u>atelic</u>
a.	‘jump’	e-ʔela	ela-
	‘eat’	i-tik	tik-
	‘get down’	a-ndana	tana-
	‘be tired’	a:-ba:abi	pa:abi
b.	‘pound’	nʊŋ	ʊ-nʊŋ-
	‘shell nuts’	patsa:h	a-patsa:h-
	‘kick’	taŋ	a-ndaŋ-
	‘yell’	tsa:ya:u	a:-dza:ya:w-

No known semantic basis distinguishes the two verb classes; they simply differ arbitrarily, according to Voegelin 1935 and Baerman 2007, in whether the basic verb stem is telic or atelic, and derive the other via a morphological construction that toggles the value for [telic] to its opposite.

2.2.7 Stress/tone/pitch-accent (re)assignment

Stress and accent shift commonly expone morphological categories on their own, as seen earlier in the English verb-to-noun conversions. In Somali, gender is marked on nouns by means of tonal morphemes. Masculines exhibit H tone on the penultimate vowel, while feminines exhibit H tone on the final vowel (Hyman 1981, 2008; Saeed 1999).

(29) Somali noun gender: marked by tone placement

<u>masculine</u>		<u>feminine</u>	
ínan	‘boy’	inán	‘girl’
náʔas	‘stupid man’	naʔás	‘stupid woman’
góray	‘male ostrich’	goráy	‘female ostrich’
darmáan	‘colt’	darmaán	‘filly’

Hausa uses full-scale tone melody replacement in the formation of imperative verbs. Each verb in Hausa exhibits the characteristic tone melody of its lexical grade. Tone melody distinctions are neutralized in the imperative, which imposes a LH tone pattern. As illustrated in (30), H is realized on the final syllable and L on all preceding syllables (Newman 2001):

(30) Hausa imperatives: marked by LH tone pattern

Declarative	Imperative	gloss
ká:mà:	kà:má:	‘catch’
rúfê:	rùfê:	‘close’
bíncìkè:	bìncìkè:	‘investigate’
ká:wó:	kà:wó:	‘bring’
nánnè:mó:	nànnè:mó:	‘seek repeatedly’ (cf. <i>né:mó:</i> ‘seek’)
sò:yú	sò:yú	‘be fried’

Rarámuri also marks imperatives accentually, by shifting stress to the stem-final syllable (Caballero 2008:119):

- (31) a. ra’amá-bo ‘give.advice-FUT:PL’ ra’amá ‘give advice!’
 ra’ámi-ri ‘give.advice-PST’
 b. ra’iǰá-ma ‘speak-FUT:SG’ ra’iǰá ‘speak!’
 ra’iǰi-ki ‘speak-PST:1’

In Upriver Halkomelem, as documented by Galloway and discussed by Urbanczyk and Kurisu 2001, stress shift is one of several complementary processes for realizing the continuative aspect on verbs. As seen in (32), CV reduplication (32a), hə-prefixation (32b) and vowel lengthening (32c) are the realizations of continuative aspect for initially stressed stems; which method is selected depends on phonological properties of the base. For bases that are *not* initially stressed, however, continuative aspect is realized simply: stress shifts to the first syllable (32d).

(32) Upriver Halkomelem continuative stress shift

	Noncontinuative	Continuative
a. ‘sing’	ˈtʰiləm	ˈtʰilələm
b. ‘swallow’	ˈməqət	ˈhə-mq’ət
c. ‘walk’	ˈʔiməx	ˈʔiiməx
d. ‘soak’	ʔəl.ˈqi	ˈʔəlqi
‘bark’	ʔəˈwəls	ˈʔəwəls
‘bleed’	caaləxˈwəm	ˈcaaləxˈwəm

Stress shift alone is sufficient to encode continuative aspect in Upriver Halkomelem.

2.3. Phonological substance of process morphology

As suggested by the examples above, process morphology overlaps substantially with morphologically conditioned phonology. We saw in Chapter 1 that morphologically conditioned phonology also overlaps to a large degree with ‘regular’ word-internal phonology, i.e. phonology which is not morphologically conditioned. However, morphologically conditioned phonology strongly tends to include less phonetically natural, historically older processes. The same is true of process morphology.

The phonological operations used to realize morphological constructions are essentially the same operations that can accompany overt affixation, reduplication and compounding. A more comprehensive survey might well find that certain types of phonological effects are much more rarely found as the sole markers of morphological categories than others are, and that certain types of phonological effects are more likely to be morphologically restricted (in any way) than others are. The reasons for this would be interesting to explore.

2.4. Morphological substance of process morphology

No extensive cross-linguistic survey of process morphology has yet been undertaken, but even a casual review suggests that process morphology is widely distributed in grammar, occurring in derivation and inflection alike. Most of the examples discussed to this point in this chapter have been inflectional (encoding aspect, number, case), but several (English, Woleian, Turkish) have been derivational.

2.5. Distinguishing between morphologically conditioned phonology and realizational morphology

The survey in section 2.2 suggests that the phonological operations used to realize morphological constructions are essentially the same operations that can accompany overt affixation, reduplication and compounding. In terms of substance alone, there is no clear basis for distinguishing the two (cf. Anderson 1975). This overlap creates a potential problem of discriminability. Theories which offer separate treatments of realizational morphology and morphologically conditioned phonology require some criteria for telling the two part, even when they resemble one another in form.

The practical criterion seems to be that a phonological alternation is classified as ‘realizational morphology’ if it is the sole exponent of a morphological construction, whereas it is classified as ‘morphologically conditioned phonology’ if it accompanies something else which is judged to be the primary exponent of a morphological construction (affixation, reduplication, compounding). All of the examples discussed in section 2.2 were selected according to this criterion.

- (33) Realizational Morphology Diagnostic Criterion (RMDC): the phonological alternation in question is the sole marker of the morphological construction

Classifying cases according to the RMDC, realizational morphology appears to be far less common than morphologically conditioned phonology. For example, it is extremely easy to find examples of stress shift conditioned by affixation; it is much more difficult to find examples in which stress shift is the sole marker of a morphological construction. This is also true of gemination, vowel length alternations, and the other effects discussed in Section 2.2. The explanation for this asymmetry could be diachronic; for example, insofar as realizational morphology is the result of the phonological erosion of the affix that originally triggered a morphologically conditioned phonological effect, realizational morphology would be a proper subtype of morphologically conditioned phonology, and about as common as entire affix erosion.

A problem for the RMDC is that many morphological constructions exhibit multiple phonological alternations, making it difficult or impossible to determine which phonological effect is the primary marker of the morphological construction (i.e. (realizational) morphology), and which is the secondary phonological correlate (i.e. morphologically conditioned phonology).

In Hausa (Newman 2000), for example, the dimensions of whether a morphological construction is tone-replacing and/or has overt affixation are independent:

(34)

	base tone replaced	base tone preserved
zero derivation	✓	✓
overt affixation	✓	✓

The same tone-replacement phenomenon in some cases is classified as realizational morphology (35a) and in others as morphologically conditioned phonology (35c).

- (35) a. No affixation; tone replacement (imperative formation)
- ká:mà: → kà:má: ‘catch (!)’
- bíncìké: → bìnçìké: ‘investigate (!)’
- nánné:mó: → nànnè:mó: ‘seek repeatedly (!)’ (< né:mó: ‘seek’)
- b. No affixation, no tone replacement (Grade 2 verbal noun formation)
- fànsá: → fànsá: ‘redeem/redeeming’
- tàmbáyà: → tàmbáyà: ‘ask/asking’
- c. Overt affixation, 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

- d. Overt suffixation, no tone replacement (various)
- | | | | | |
|----------|---|-------------|-------------|-----|
| dáfà: | → | dáfà:-wá | ‘cook-ppl’ | -LH |
| gàjé:ré: | → | gàjé:r-ìyá: | ‘short-fem’ | -LH |
| hù:lá: | → | hù:lá-ř | ‘hat-def’ | -L |

The same analytical conundrum is posed the familiar case of truncation in nickname formation, e.g. the English pattern discussed back in (23):

(36)	<u>Full name</u>	<u>(a) Truncation</u>	<u>(b) Truncation + affixation</u>
	Daniel	Dan	Danny
	Elizabeth	Liz	Lizzy
	Michael	Mike	Mikey
	Rebecca	Beck	Becky
	Robert	Rob	Robby

Truncation must be analyzed as realizational morphology in the (36a) nicknames, but accompanies suffixation in (36b). Must truncation be reclassified as morphologically conditioned phonology in the (36b) examples?

Two reductionist solutions to this problem present themselves. One is to analyze all apparent cases of realizational morphology as morphologically conditioned phonology which happens to accompany zero derivation. In this way, English *Dan* and *Danny* would both have truncation as a morphologically conditioned phonological side effect; the primary morphological process would be zero derivation (for *Dan*) and affixation of *-y* (for *Danny*). The alternative reductionist approach would be to analyze all apparent cases of morphologically conditioned phonology as realizational morphology, treating forms like *Lizzy* as containing two different nickname-forming constructions, or exhibiting multiple exponence. This approach is taken by Kurisu (2001) for cases in which overt morphology (affixation) is accompanied by morphologically conditioned phonology; for more discussion, see Chapter 8.

- (37) PHONOLOGICAL REDUCTIONISM: all constructions consist of one primary morphological operation (affixation, compounding, reduplication, zero-derivation) and an associated phonological pattern, possibly complex
- MORPHOLOGICAL REDUCTIONISM: morphologically conditioned phonology is actually realizational morphology; multiple exponence is more common than thought

Multiple or ‘extended’ exponence is a well-known phenomenon (see e.g. Matthews 1972; Stump 1991), existing completely independent of the question of morphologically conditioned phonology or realizational morphology. In Fox, for example, subject person is marked twice on

verbs, once by an inner suffix encoding both person and number of the subject, and one by an outer prefix which encodes subject person (Dahlstrom 1997; see also Crysmann 1998):

(38) Fox subject agreement (■ = root)

	sg	pl		
1	ne-■	ne-■-pena	a.	ne- nowi: 1 go.out 'I go out'
2	ke-■	ke-■-pwa	b.	ke- nowi: 2 go.out 'you(sg) go out'
			c.	ne- nowi: -pena 1 go.out -1PL 'we go out'
			d.	ke- nowi: -pwa 2- go.out -2PL 'you(pl) go out'

In Hausa, the formation of class 13 noun plurals shows triple exponence; suffixation, reduplication, *and* tone replacement take place (Newman 2000:458):

(39) Hausa class 13 noun plurals

tsírò:	→ tsìr-é + tsìr-é	'shoot, sprout(s)'
kwánà:	→ kwàn-é + ksàn-é	'corner, curve(s)'
há báicì:	→ hàbàic-é + hàbàic-é	'innuendo(s)'

Barasana presents a case similar to the Hausa example, in that one of the exponents is an overt affix and another is a tonal effect that would, according to the RMDC, be classified as morphologically conditioned phonology, rather than realizational morphology. But there is an interesting twist the Barasana example that supports an analysis of multiple exponence, i.e. that (contra the RMDC) shows that both the affixation and the tonal effect are realizational morphology. Barasana is a tonal accent language in which a number of suffixes exert effects on stem tone (Pycha 2005, based on Kenstowicz & Gomez-Imbert 2000). For example, the Non3rdSubj suffix *-bi* causes H tone to align all the way to the right in words containing it (40a), while the Interrogative suffix *-ri* causes H to align all the way to the left (40b):

(40) a.	baa-bi HH H	'swim-NON3RDSUBJ = I/you/we swim'
b.	baa-ri H	'swim-INTERR = did he/she/they swim?'

These suffixes cannot co-occur; one might say they belong to the same position class, so that the presence of one excludes the other, even though the morphosyntactic functions they encode are perfectly compatible. While position class blocking is not uncommon in languages (see e.g. the discussion of Turkish suffix incompatibility in Chapter 8), the Barasana suffixes in

(41) are unusual in exhibiting what Pycha (2005) calls ‘mutual partial blocking.’ In words where both meanings are desired, we find the segments of the Interrogative *-ri* and the tones of the Non3rdSubj (41b):

- (41) a. *baa-ri-bi, *baa-bi-ri ‘did I/you/we swim?’
 b. baa-ri ‘did I/you/we swim?’
 HH H

Pycha’s interpretation of the facts in (41) is that both the Non3rdSubj and the Interrogative categories achieve exponence, by using the segments of one and the cophonology of the other. This poses a paradox for theories that (as per the RMDC) distinguish realizational morphology from morphologically conditioned phonology. The tone pattern of the Non3rdSubject must, by the RMDC, be analyzed as morphologically conditioned phonology based on the fact that it co-occurs with a ‘primary’ exponent, namely the suffix *-bi*; yet its ability to expone the Non3rdSubject even when *-bi* is absent identifies it as realizational morphology.

At a minimum, the impossibility of classifying the segmental and tonal components of Barasana suffixes absolutely as morphologically conditioned phonology, or as realizational morphology, supports proposals that realizational morphology and morphologically conditioned phonology should be analyzed in the same way (Ford & Singh 1983, 1985; Poser 1984; Dressler 1985; Singh 1987, 1996; Anderson 1992; Bochner 1992; Orgun 1996; Inkelas 1998, 2008).

2.6. Theoretical approaches to process morphology

Any documented instances of realizational morphology that cannot readily be reanalyzed as affixation of abstract phonological structure lend strong support to theories of morphology other than pure item-and-arrangement. However, as we have seen, the Phonological Reductionism approach makes it possible for any theory to handle such cases, since all apparent realizational morphology can be classified as the phonological accompaniment to zero derivation if desired (ignoring the suggestive Barasana example). Therefore the existence of realizational morphology is not technically probative when it comes to choosing a morphological framework. However, it is highly relevant to the choice of a framework for capturing the phonology-morphology interface, even more so if one recognizes realizational morphology as a real phenomenon and is committed to capturing the substantive overlap between it and morphologically conditioned phonology.

In Chapter 1, we reviewed several different theoretical approaches to the morphology-phonology interface with respect to their ability to capture morphologically

conditioned phonology: Cophonology theory, Indexed Constraint theory, and Level Ordering theory.

In Cophonology Theory (e.g. Anttila 2002, Inkelas & Zoll 2007) and Indexed Constraint Theory (e.g. Alderete 2001), there is essentially no formal distinction between morphologically conditioned phonology and realizational morphology; both are captured easily, and in the same formal way. Even if researchers working in these frameworks have classified particular effects one way or the other, this is not required by the architecture of the theory, and is only an informal attribution. In Cophonology Theory, both morphologically conditioned phonology and realizational morphology result from the association of a phonological mapping (cophonology) with a semantic/syntactic between input and output.

- (42) Cophonology for imperative, Class 13 plural constructions: Tone = LH » IDENT-Tone
 Cophonology for tone-preserving constructions: IDENT-Tone » Tone = LH

In Indexed Constraint Theory, both morphologically conditioned phonology and realizational morphology are handled by indexing a constraint or constraints to the morphological construction in question. For example, the above pair of Hausa constructions (Imperative, Class 13 Noun Plurals) could both be indexed to a high-ranking Markedness constraint requiring the surface tone pattern to be LH.

- (43) Tone = LH_{imperative, C13Plurals} » IDENT-Tone » Tone = LH

In both approaches, the method of imposing the LH tone melody is in principle entirely independent of whether or not an overt affix is present. Morphologically conditioned phonology and realizational morphology are handled by the same types of constraints. The only significance difference between the two is felt in theories of exponence which count the number of exponents of a morphological category; in such theories, constructions like Hausa class 13 noun plurals would be classified as instance of multiple exponence, requiring a special statement. However, as noted above, such statements are needed anyway in cases of multiple overt affixation.

In contrast with Cophonology Theory and Indexed Constraint Theory, Level Ordering theories (e.g. Kiparsky 1982, 2006) is forced by their architecture to distinguish between the morphologically conditioned phonology and realizational morphology. Because the number of levels in such theories is so small, ranging from 2 (in Stratal OT; Kiparsky 2006) to 4 or 5 (e.g. Kiparsky 1984, Mohanan 1986, Hargus 1988), it is impossible to ascribe realizational morphology to levels. Levels are intended to account for morphologically conditioned phonology, which is assumed to generalize across morphological constructions instead of being limited to specific morphological categories. Of course, as we saw in Chapter 1, this basic

assumption is questionable. Level ordering theory as standardly construed is too restrictive to account for all of morphologically conditioned phonology. Level ordering theory is more a theory about higher-level generalizations in the phonology-morphology interface of a given language, or perhaps across languages, than it is a model of the entire phonology-morphology interface in any individual language. Level ordering theory has called very interesting generalizations to the attention of researchers into the phonology-morphology interface, highlighting in particular the phonological salience of stem-level constituents within words. But it is too blunt a knife to dissect the kinds of detail that make the phonology-morphology interface so compelling in individual languages, especially those with complex morphology.