Contents

A The Language Sample

(96) *The language sample sorted alphabetically (genetic and geographic specifications according to WALS)*

	Iso-639-3	Macroarea	Genus	Family
Acoma (6)	[kjq]	N America	Keresan	Keresan
Afar (1)	[aar]	Africa	Lowland East Cushitic	Afro-Asiatic
Aghem (1)	[agq]	Africa	Wide Grassfields	Niger-Congo
Ainu (3)	[ain]	Eurasia	Ainu	Ainu
Aklan (2)	[akl]	Papuanesia	Greater Central Philippine	Austronesian
Anywa (2)	[anu]	Africa	Western Nilotic	Eastern Sudanic
Awa (2)	[awb]	Papuanesia	Gauwa	Trans-New Guinea
Bakweri (1)	[bri]	Africa	Bantu	Niger-Congo
Bangime (2)	[dba]	Africa	Bangime	Bangime
Barasana (1)	[bsn]	S America	Tucanoan	Tucanoan
Bari (3)	[bfa]	Africa	Eastern Nilotic	Eastern Sudanic
Chaha (1)	[sgw]	Africa	Semitic	Afro-Asiatic
Cherokee (2)	[chr]	N America	Southern Iroquoian	Iroquoian
Chichewa (4)	[nya]	Africa	Bantu	Niger-Congo
Chimila (1)	[cbg]	S America	Chimila	Chibchan
Chukchee (1)	[ckt]	Eurasia	Northern Chukotko-Kamchatkan	Chukotko-Kamchatkan
Ciyao (2)	[yao]	Africa	Bantu	Niger-Congo
Finnish (3)	[fin]	Eurasia	Finnic	Uralic
Fula (2)	[ful]	Africa	Peul-Serer	Niger-Congo
Gã (2)	[gaa]	Africa	Ga-Ndangme	Niger-Congo
Gaahmg (1)	[tbi]	Africa	Eastern Jebel	Eastern Sudanic
Gadsup (1)	[gaj]	Papuanesia	Gauwa	Trans-New Guinea
German (3)	[deu]	Eurasia	Germanic	Indo-European
Greek (2)	[ell]	Eurasia	Greek	Indo-European
Guébie (2)	[dic]	Africa	Kru	Niger-Congo
Hungarian (1)	[hun]	Eurasia	Ugric	Uralic
Igbo (4)	[ibo]	Africa	Igboid	Niger-Congo
Ik (2)	[ikx]	Africa	Kuliak	Eastern Sudanic
Italian (1)	[ita]	Eurasia	Romance	Indo-European
Kashaya (2)	[kju]	N America	Pomoan	Hokan
Ket (1)	[ket]	Eurasia	Yeniseian	Yeniseian
Kikuyu (1)	[kik]	Africa	Bantu	Niger-Congo
Kisi (1)	[kss]	Africa	Southern Mel	Niger-Congo
Kɔnnɪ (4)	[kma]	Africa	Oti-Volta	Niger-Congo
Korean (4)	[kor]	Eurasia	Korean	Korean
Koryak (4)	[kpy]	Eurasia	Northern Chukotko-Kamchatkan	Chukotko-Kamchatkan
Kpelle (2)	[xpe]	Africa	Western Mande	Mande
Kunama (2)	[kun]	Africa	Kunama	Kunama
Kuria (3)	[kuj]	Africa	Bantu	Niger-Congo
Lango (1)	[laj]	Africa	Western Nilotic	Eastern Sudanic
Makaa (2)	[mcp]	Africa	Bantu	Niger-Congo
Mao[1] (4)	[myf]	Africa	Blue-Nile Mao	Blue-Nile Mao
Margi (1)	[mrt]	Africa	Biu-Mandara	Afro-Asiatic
Mayo (2)	[mfy]	N America	Cahita	Uto-Aztecan
Mixtec (1)	[mig]	N America	Mixtec	Otomanguean
Miya (1)	[mkf]	Africa	West Chadic	Afro-Asiatic
Moro (2)	[mor]	Africa	Heiban	Kordofanian
Neve'ei (1)	[vnm]	Papuanesia	Oceanic	Austronesian
Nimboran (4)	[nir]	Papuanesia	Nimboran	Nimboran
Russian (2)	[rus]	Eurasia	Slavic	Indo-European
Samoan (1)	[smo]	Papuanesia	Oceanic	Austronesian
Seenku (2)	[sos]	Africa	Mande	Niger-Congo

[1] ≈ Bambassi

Shilluk (2)	[shk]	Africa	Western Nilotic	Eastern Sudanic
Shoshoni (3)	[shh]	N America	Northern Uto-Aztecan	Uto-Aztecan
Supyire (3)	[spp]	Africa	Senufo	Niger-Congo
Tagalog (2)	[tgl]	Papuanesia	Greater Central Philippine	Austronesian
Tamil (1)	[tam]	Eurasia	Dravidian	Dravidian
Tauya (1)	[tya]	Papuanesia	Rai Coast	Trans-New Guinea
Tenyidie (1)	[njm]	Eurasia	Angami-Pochuri	Sino-Tibetan
Tetsǫ́t'iné (1)	[chp]	N America	Athapaskan	Na-Dene
Tiriki (1)	[luy]	Africa	Bantu	Niger-Congo
Tlapanec (1)	[tcf]	N America	Subtiaba-Tlapanec	Otomanguean
Turkana (1)	[tuv]	Africa	Eastern Nilotic	Eastern Sudanic
Urarina (4)	[urn]	S America	Urarina	Urarina
Uspanteko (1)	[usp]	N America	Mayan	Mayan
Welsh (2)	[cym]	Eurasia	Celtic	Indo-European
Yoruba (1)	[yor]	Africa	Defoid	Niger-Congo

(97) *The language sample sorted by macro-area and family* (52 genera and 28 families)

	Iso-639-3	Macroarea	Genus	Family
Margi (1)	[mrt]	Africa	Biu-Mandara	Afro-Asiatic
Miya (1)	[mkf]	Africa	West Chadic	Afro-Asiatic
Afar (1)	[aar]	Africa	Lowland East Cushitic	Afro-Asiatic
Mao (3)	[myf]	Africa	Blue-Nile Ma	Afro-Asiatic
Chaha (1)	[sgw]	Africa	Semitic	Afro-Asiatic
Moro (2)	[mor]	Africa	Heiban	Kordofanian
Kpelle (2)	[xpe]	Africa	Western Mande	Mande
Seenku (2)	[sos]	Africa	Western Mande	Mande
Aghem (1)	[agq]	Africa	Wide Grassfields	Niger-Congo
Bakweri (1)	[bri]	Africa	Bantu	Niger-Congo
Chichewa (4)	[nya]	Africa	Bantu	Niger-Congo
Ciyao (2)	[yao]	Africa	Bantu	Niger-Congo
Kikuyu (1)	[kik]	Africa	Bantu	Niger-Congo
Kisi (1)	[kss]	Africa	Bantu	Niger-Congo
Kuria (3)	[kuj]	Africa	Bantu	Niger-Congo
Makaa (2)	[mcp]	Africa	Bantu	Niger-Congo
Tiriki (1)	[luy]	Africa	Bantu	Niger-Congo
Fula (2)	[ful]	Africa	Peul-Serer	Niger-Congo
Kɔnnɪ (4)	[kma]	Africa	Oti-Volta	Niger-Congo
Supyire (3)	[spp]	Africa	Senufo	Niger-Congo
Igbo (4)	[ibo]	Africa	Igboid	Niger-Congo
Guébie (2)	[dic]	Africa	Kru	Niger-Congo
Gã (2)	[gaa]	Africa	Ga-Ndangm	Niger-Congo
Yoruba (1)	[yor]	Africa	Yoruboid	Niger-Congo
Gaahmg (1)	[tbi]	Africa	Eastern Jebel	Eastern Sudanic
Ik (2)	[ikx]	Africa	Kuliak	Eastern Sudanic
Bari (3)	[bfa]	Africa	Eastern Nilotic	Eastern Sudanic
Turkana (1)	[tuv]	Africa	Eastern Nilotic	Eastern Sudanic
Anywa (2)	[anu]	Africa	Western Nilotic	Eastern Sudanic
Lango (1)	[laj]	Africa	Western Nilotic	Eastern Sudanic
Shilluk (2)	[shk]	Africa	Western Nilotic	Eastern Sudanic
Bangime (2)	[dba]	Africa	Bangime	Bangime
Kunama (2)	[kun]	Africa	Kunama	Kunama
Kashaya (2)	[kju]	N America	Pomoan	Hokan
Cherokee (2)	[chr]	N America	Southern Iroquoian	Iroquoian
Acoma (6)	[kjq]	N America	Keresan	Keresan
Uspanteko (1)	[usp]	N America	Mayan	Mayan
Tetsǫ́t'iné (1)	[chp]	N America	Athabaskan	Na-Dene
Mixtec (1)	[mig]	N America	Mixtec	Otomanguean
Tlapanec (1)	[tcf]	N America	Subtiaba-Tlapanec	Otomanguean
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Mayo (2)	[mfy]	N America	Cahita	Uto-Aztecan
Chimila (1)	[cbg]	S America	Chimila	Chibchan
Barasana (1)	[bsn]	S America	Tucanoan	Tucanoan
Urarina (4)	[urn]	S America	Urarina	Urarina
Chukchee (1)	[ckt]	Eurasia	Northern Chukotko-Kamchatkan	Chukotko-Kamchatkan
Koryak (4)	[kpy]	Eurasia	Northern Chukotko-Kamchatkan	Chukotko-Kamchatkan
Tamil (1)	[am]	Eurasia	Dravidian	Dravidian
Russian (2)	[rus]	Eurasia	Slavic	Indo-European
Welsh (2)	[cym]	Eurasia	Celtic	Indo-European
German (3)	[deu]	Eurasia	Germanic	Indo-European
Greek (2)	[ell]	Eurasia	Greek	Indo-European
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Tenyidie (1)	[njm]	Eurasia	Angami-Pochuri	Sino-Tibetan
Finnish (3)	[fin]	Eurasia	Finnic	Uralic

Hungarian (1)	[hun]	Eurasia	Ugric	Uralic
Ket (1)	[ket]	Eurasia	Yeniseian	Yeniseian
Ainu (3)	[ain]	Eurasia	Ainu	Ainu
Korean (4)	[kor]	Eurasia	Korean	Korean
Aklan (2)	[akl]	Papuanesia	Greater Central Philippine	Austronesian
Tagalog (2)	[tgl]	Papuanesia	Greater Central Philippine	Austronesian
Samoan (1)	[smo]	Papuanesia	Oceanic	Austronesian
Neve'ei (1)	[vnm]	Papuanesia	Oceanic	Austronesian
Nimboran (4)	[nir]	Papuanesia	Nimboran	Nimboran
Gadsup (1)	[gaj]	Papuanesia	Gauwa	Trans-New Guinea
Awa (2)	[awb]	Papuanesia	Gauwa	Trans-New Guinea
Tauya (1)	[tya]	Papuanesia	Rai Coast	Trans-New Guinea

B Basic Statistics of Language Sample

The following tables contain basic numerical statistics on our language sample which comprises 138 distinct anticyclic mutation patterns in 70 languages.[2] Note that we have included all patterns here which classify as anticyclic under the lexicalist approach presupposed in the main part of the paper (see section 1). Thus some phrase-level patterns of mutation listed here would not count as anticyclic under the alternative approaches to cyclicity discussed in section 5.1. The single patterns are identified by circled numbers in the language data summaries in appendix C. The linguistic macroareas in table (98) are the ones used in WALS (Dryer & Haspelmath 2013, see Miestamo et al. 2016 for possible alternatives). Modality (table (99)) and type (table (100)) of mutation follow the classifications used throughout the paper.

The sample is opportunistic in that it provides a collection of the maximal number of distinct anticyclic mutation patterns across the languages, accessible to us in published literature (with a number of limitations discussed below). Thus the numbers in the following tables are not intended as evidence for the typological distribution of (specific) anticyclic mutation (patterns), but as an indication of the sample's coverage of typological and grammatical diversity.

Two evident (and related) biases in the data are the predominance of tone and of African languages which both constitute roughly half of the sample. These reflect the fact that tonal morphophonology is considerably more variegated than other single phonological modalities (cf. Hyman's dictum that "tone can do everything that segmental and metrical phonology can do, but . . . the reverse is not true" Hyman 2011:198), the density of tonal languages in Africa, and the much better documentation of tone in African languages compared to other parts of the world, especially the Americas and Papuanesia. The lack of morphological tone is also probably one of the reasons for the absence of data from Australian languages in the sample.[3]

(98) *Anticyclic mutation data from different linguistic macroareas*

	Africa	Eurasia	Papuanesia	North America	South America	Total
Number	70	29	14	19	6	138
Percentage	50.7%	21.0%	10.1%	13.8%	4.3%	

(99) *Phonological modality*

	Tone	Vocalic Features	Consonantal Features	Length	Stress	Total
Number	70	24	20	13	11	138
Percentage	50.7%	17.4%	14.5%	9.4%	8.0%	

On a global scale, our sample is also likely to underrepresent Root-to-Word mutation and tautomorphemic mutation. Since the structural interpretation of phrasal morphophonology is much more contentious than mor-

[2] We have identified mutation patterns as distinct if they differ either in the features they manipulate (e.g., High tone vs. Low tone), their directionality (inducing mutation to the left or right of the mutation trigger, or on the trigger itself). Thus alternating mutations are counted as different patterns here.

[3] Note that the typological distribution of *cyclic* mutation patterns discussed in the current literature is similar. Thus the two most comprehensive recent surveys, Akinlabi (2011) and Wolf (2007) both draw roughly 70% of their data from Africa and Eurasia, lack data from Australia, and have roughly 10% of data from South America and Papuanesia.

phophonology within the lexical phonology (see, e.g., the discussions in sections 2.5 and 5.1.2), our coverage of the documented cases is less comprehensive than for word-internal cases (for example, we have not included the Dogon data addressed shortly in section 5.1.2). Since they instantiate a kind of 'mild' form of anticyclicity, we also have not searched systematically for tautomorphemic mutation phenomena. The tautomorphemic patterns included here are thus mostly restricted to variants of (otherwise strictly anticyclic) alternating patterns.

(100) *Structural types of anticyclic mutation*

	Root to Affix	Affix to Affix	Affix to Word	Root to Word	Tauto-morphemic Root	Tauto-morphemic Affix	Total
Number	52	24	13	35	11	3	138
Percentage	37.7%	17.4%	9.4%	25.4%	8.0%	2.2%	

C Language Data

This appendix lists all languages of our language sample for anticyclic mutation and provides data for the patterns not explicitly discussed in the main text. Each language entry specifies the language family according to WALS (`https://wals.info/`) and provides the Isocode (ISO-639-3) for the language and a web link to its Glottolog page (`https://glottolog.org/`), which contains more detailed information on its genetic affiliation and geographic location.[4]

The single mutation patterns in this appendix are listed under schematic tables as in (101), where the first part of each entry (before the double bars "‖") specifies the general morphosyntactic type and directionality at different levels of concreteness, and the second part (after "‖") its phonological content, generically in the first column, and in the second one with the specific phonological features involved.

(101) ①

Root-to-Affix	Root-to-Suffix	→ ‖	Vocalic Features	+ATR

Alternating mutation is coded as in (102) (for Aklan below) where the tilde ("∼") separates the different alternating patterns.

(102)

①	Root-to-Affix	Root-to-Suffix	→	Stress
	∼	∼	∼	
②	Tautomorphemic Root	Tautomorphemic Root	↻	

Circled numbers indicate the anticyclic mutation patterns we have identified as distinct either because they differ in the involved phonological feature, directionality (affecting left-adjacent or right-adjacent targets, marked by arrows), structural type (e.g., Root-to-Affix vs. Root-to-Word), or in having a segmental component or not. Alternations between different anticyclic mutation types as in (102) are thus counted as separate basic patterns.

If an alternation may affect different directions simultaneously, this is marked by "∼ =" instead (see, e.g., Anywa in C.6 below). The entry for Acoma immediately below in C.1 illustrates a further aspect of the notation: Affixes or clitics which do not contain a segmental component are given in shaded rounded boxes (reminiscent of the classical autosegmental notation for floating features). If an anticyclic mutation pattern has a cyclic counterpart this is additionally specified in parentheses (see Acoma for an example). Recall also from section 2.2 how we indicate mutation triggers and targets in language data: target morphemes (or words) are marked by boxes and triggers by underlining (hence the pure underscore "_" in cases where the trigger doesn't have segmental content). More information on the distribution of the sample is provided in appendix B.

[4]For the languages in the sample for which WALS doesn't provide an entry (Afar, Gã, Mao, Seenku, Urarina and Uspanteko), we have substituted the family (and genus in tables (96) and (97)) of closely related languages where possible, or otherwise the affiliation given by Glottolog. Since Glottolog doesn't specify genera, we have used the most low-level genetic grouping provided by Glottolog instead.

C.1 Acoma – N America – Keresan [kjq] (6 patterns)

Affix-to-Affix	Prefix-to-Prefix	←	Consonantal Features	① aspiration ② glottalization ③ palatalization

(| Affix-to-Root | Suffix-to-Root | ← | Consonantal Features | aspiration, glottalization, palatalization |)

The Keresan language Acoma, spoken in Western New Mexico, exhibits Affix-to-Affix mutation and Root-to-Affix mutation for several consonantal features, as shown by Gleim (2015) based on the grammar of Miller (1965). Featural affixation expresses valency-changing categories such as Benefactive and Passive and TAM categories like Habitual and Continuous. Phonologically it involves aspiration glottalization and palatalization (partially in combination). (103) illustrates these with suffixes which – cyclically – modify root consonants. Note that the term 'palatalization' is an oversimplification. The process changes retroflex obstruents into palatals (e.g., /ʈ/ → [c], into postalveolars (e.g., underlyings → [ʃ]), or into dentals (e.g., /ʦ̡/ → [t]), depending on their manner of articulation. It mutates velar stops into dental affricates (e.g., /k/ → [ʦ]), and palatal stops into dental stops (e.g., /c/ → [t]). Gleim analyses this by a floating complex of a Coronal feature dominating [+laminal]. In the following, we will abbreviate this simply as [+laminal]:

(103) *Acoma cyclic Affix-to-Root mutation (Miller 1965, Gleim 2015)*

a. *Aspiration* ([+s(pread) g(lottis)])
   s'-úum'inaat-$^{[+sg]}$íʔit → s'-íum'inaat^{h}-i 'I spoke to him for her' p.34 ((/t/ → [t^{h}]))
   1-speak-BEN

b. *Glottalization* ([+c(onstricted) g(lottis)])
   k-áítsee̯e̯a-$^{[+lam][+cg]}$áát'an → k-áítsee̯ʃ'-áát'a 'he is dreaming' p.74 ((/ʦ̡/ → [ʃ']))
   3-dream-HAB

c. *Palatalization* ([+lam(inal)])
   i. k-áítsee̯e̯a-$^{[+lam][+cg]}$áát'an → k-áítsee̯ʃ'-áát'a 'he is dreaming' p.74 (/ʦ̡/ → [ʃ'])
   3-dream-HAB

   ii. s-$^{[+lam][+cg]}$uts'a̯a̯can-$^{[+lam]}$a̯a̯jan → s'-its'a̯a̯t-a̯a̯ja 'I am pinning it' p.74 (/c/ → [t])
   1-pin-CONT

Prefixes trigger anticyclic mutation for the same features changing more outwards prefixes (pronominal prefixes show a complex allomorphy depending on tense, aspect, mood and root class, which we don't represent in the glosses):

(104) *Acoma anticyclic Affix-to-Affix mutation (Miller 1965, Gleim 2015)*

a. *Aspiration* ([+s(pread) g(lottis)])
   k-$^{[+sg]}$-áʦ̡ik^{h}an → k^{h}-__-áʦ̡ik^{h}a 'he smoked tobacco' p.74 (/k/ → [k^{h}])
   3-ANTIP-smoke.tobacco

b. *Glottalization* ([+c(onstricted) g(lottis)])
   i. s-$^{[+cg]}$-u̯u̯k^{h}atʃ^{h}an-$^{[+cg]}$aat → s'-__-iu̯k^{h}atʃ^{h}an'-a 'We saw him' p.27 (/s/ → [s'])
   1-TR-see-PL

   ii. ʦ̡a- $^{[+cg]}$-úst'-$^{[+sg]}$íʔit → ʦ̡'á-__-st'-í 'I gave you water' p.71 (/ʦ̡/ → [ʦ̡'])
   1>2-BEN-give.water-BEN

c. *Palatalization* [+lam(inal)])
   i. k-$^{[+lam][+cg]}$-ázo̯kaN-iʦ̡ → ʦ'-__-á'ʈəkán'i 'it has been smoked' p.121 (/k/ → [ʦ']))
   3-PASS-smoke-COMPL

   ii. ʦ̡-$^{[+lam]}$-úst'-íʔit → ʃ-__-íst'-íʔi 'you gave him water' p.71 (/ʦ̡/ → [ʃ])
   2-BEN-give-BEN

There are several locality effects indicating that the non-segmental diathesis affixes in (104) are in fact inside (to

the right) of the segmental affixes they modify. As shown by (105-c,d,e), the palatal ([+laminal]) feature cannot modify a consonant across an underlying vowel even if this is deleted as in (105-d). Whereas glottalization can skip an intervening vowel (e.g., (105-a)), it systematically modifies the last not the first (or both) consonants of a prefix (105-d). Note that Gleim assumes that in (105-e) association of [+cg] is blocked by an intervening zero affix marking dual (/sku-/ is a generic 3>1 person prefix).[5]

(105) *Acoma anticyclic Affix-to-Affix mutation (Miller 1965, Gleim 2015)*

a.	ʂa-$^{[+cg]}$-úst'-$^{[+sg]}$íʔit 1>2-BEN-give.water-BEN	→	ʂ'á-__-st'-í	'I gave you water'	p.71 (/ʂ/ → [ʂ'])
b.	s-$^{[+cg]}$-u̲u̲k^{h}atʃ^{h}an-$^{[+cg]}$aat 1-TR-see-PL	→	s'-__-i̲u̲k^{h}atʃ^{h}an'-a	'We saw him'	p.27 (/s/ → [s'])
c.	cu-$^{[+lam][+cg]}$-íit'aa 2>1-TR-step	→	c'ú-it'a *t'ú-it'a	'You stepped on me'	p.74 (/c/ → [c'])
d.	ʂku-$^{[+lam][+cg]}$aʔa-a̲a̲ʃaatsím 3>1-PASS-cut	→	ʂk'-aʔa̲a̲ʃaatsí *ʃc'-aʔa̲a̲ʃaatsí *ʂ'k-aʔa̲a̲ʃaatsí *ʂ'k'-aʔa̲a̲ʃaatsí	'I was cut'	p.57
e.	ʂku-Ø-$^{[+lam][+cg]}$aʔa-a̲a̲ʃaatsím 3>1-DU-PASS-cut	→	ʂk-aʔa̲a̲ʃaatsí *ʂk'a-ʔa̲a̲ʃaatsí	'We two were cut'	p.57

Finally, palatalizing affixes also have an effect on the following root: they front back vowels (106), again indicating that they are structurally the innermost affixes.

(106) *Acoma anticyclic Affix-to-Affix mutation (Miller 1965, Gleim 2015)*

a.	k-$^{[+lam]}$-u̲u̲katʃ^{h}an 2-OBV-see	→	ts-__-i̲u̲katʃ^{h}a	'he saw him'	p.75 (/k/ → [ts])
b.	ʂ-$^{[+lam]}$-úst'-íʔit 2-BEN-give-BEN	→	ʃ-__-íst'-íʔi	'you gave him water'	p.71 (/ʂ/ → [ʃ])

Root-to-Affix	Root-to-Prefix	←	Consonantal Features	④ aspiration ⑤ glottalization ⑥ palatalization

In addition to Affix-to-Affix mutation, Acoma also has roots which trigger aspiration, palatalization and/or glottalization on prefixes, hence Root-to-Affix mutation. Note especially the minimal triple in (107-a-i,ii,b-i), where the 3sg prefix /k-/ appears in three different mutated shapes (cf. the minimally different /k-aipet'a/ 3-anus → [k-aipet'a] 'his anus' (p.144), where the prefix emerges in its underlying form).

[5]Miller notates the sibilant in 2>1 ʂku ((105)-d,e) as <s>. But since /s/ predictably becomes [ʂ] in clusters where it precedes /k/, the morpheme is always realized as ʂku-, which we assume here as the underlying form

(107) *Acoma Root-to-Affix mutation (Miller 1965, Gleim 2015)*

a. *Aspiration* ([+s(pread) g(lottis)])

i. k-[+sg]aːmaː → [kʰ]-aːmaː ‘his thigh’ p.144 (/k/ → [kʰ])
3-thigh

ii. k-[+sg][+lam]aːmˀuːcˀa → [tsʰ]-aːmˀuːcˀa ‘his toe’ p.144 (/k/ → [tsʰ])
3-toe

b. *Glottalization* ([+c(onstricted) g(lottis)])

i. k-[+cg]-uːpi → [kˀ]-uːpi ‘his forehead’ p.145 (/k/ → [kˀ])
3-forehead

ii. s-[+lam][+cg]-utsˀa̰a̰can-[+lam]a̰a̰jan → [sˀ]-itsˀa̰a̰t-a̰a̰ja ‘I am pinning it’ p.74 (/s/ → [sˀ])
1-pin-CONT

c. *Palatalization (anticyclic,* [+laminal])

i. s̻-[+lam]aʔátsˀin → [ʃ]-aʔátsˀi ‘you arrived’ p.74 (/s̻/ → [ʃ])
2-arrive

ii. ʦ̻ʰ-[+lam]aʔátsˀin → [ʧʰ]-aʔátsˀi ‘did you arrive?’ p.74 (/ʦ̻/ → [ʧʰ])
2-arrive

C.2 Afar – Africa – Afroasiatic (Cushitic) [aar] (1 pattern)

①	Affix-to-Word	Suffix-to-Word	→	Length	consonant gemination

The Cushitic language Afar has a Genitive suffix for feminine nouns which is realized as gemination on the following noun if the latter starts with a consonant (108-a) but as the segment [h] if it is vowel-initial (108-b).

(108) *Afar Genitive (Bliese 1981:165-167)*

a.	ruga:gé calf	+	galbó hide	→	ruga:gé__	g:albó	‘calf’s hide’
	baːrá woman	+	bilá necklace	→	baːrá-__	bːilá	‘woman’s necklace’
	boːdá meadow	+	cajsó grass	→	boːdá__	cːajsó	‘meadow’s grass’
b.	sagá cow	+	íba foot	→	sagá__	híba	‘a cow’s foot’
	diːdaːlé bee	+	amó head	→	diːdaːlé-__	hámo	‘a bee’s head’
	baːdó country	+	ulːulːú slope	→	baːdó-__	hulːulːú	‘country’s slope’

That this is not just full assimilation of a final /h/ can be seen by the contrast to other homophonous formatives such as the case/postposition suffix /-h/ ‘for’ and the modal suffix /-h/ (‘ought’) which faithfully surface before consonants. This is shown for both markers in the sentence in (109).

(109) *Afar h-Infinitive (Bliese 1981:44)*

dajˈlo-h	lakˈco	gaːboj-ˈse-h	meˈce-m	dalejna
children-for	money	gather-INF-MOD	good-NOM	parents

‘It is parents who ought to gather money for children’

C.3 Aghem – Africa – Niger-Congo (Narrow Grassfields) [agq] (1 pattern)

①	Root-to-Word	→	Tone	↓	↜ Hyman (1979, 2001)

In the Grassfields Bantu language Aghem, specific high-toned nouns such as /wó/ 'hand' trigger downstep on following (high-toned) demonstratives (110-b'), under Hyman's analysis triggered by a floating Low tone which is part of the root. That this downstep is an idiosyncratic effect of the noun is evident from the comparison with other high-toned nouns such as /fú/ 'rat' which don't trigger downstep (110-b). Independent evidence for the floating Low comes from the fact that the same nouns also fail to trigger an otherwise general process of H-spreading ((110-c') vs. (110-c), note also that noun class prefixes such as /kí-/ are obligatorily dropped if a noun is modified by a demonstrative as in (110-b)).

(110) *Root-to-Word downstepping in Aghem (Hyman 2001:3 Hyman 1979)*

a.	kí-fú		'rat'	a'.	kí-wó		'hand'
	CLS-rat				CLS-hand		
b.	fú	kín	'this rat'	b'.	wó	↓kín	'this hand'
	rat	DEM			hand	DEM	
c.	kí-fú	kí-mɔ̀	'one rat'	c'.	kí-wó	kì-mɔ̀	'one hand'
	CLS-rat	CLS-one			CLS-hand	CLS-one	

C.4 Ainu – Eurasia – Ainu [ain] (3 patterns)

Root-to-Affix	Root-to-Suffix	→	Vocalic Features	① [+high] ② [+back] ③ [-back]	↜ Ito (1984)

In Ainu, vocalic Root-to-Affix mutation involves multiple phonological features for different roots, [+high] and [±back] has been identified by Ito (1984). The Ainu transitivizing suffix is a single vowel, which is identical to the root vowel for many roots (111-a). For specific non-low roots, however, it is a high vowel which systematically differs from the root vowel in backness (111-b).

(111) *Ainu Transitivizing affixation: High mutation (Ito 1984:506)*

a.	*Copying*		b.	*'Polarity'*	
(i)	tus-u	'to shake'	(i)	mus-i	'to choke'
(ii)	pop-o	'to boil'	(ii)	hop-i	'to leave'
(iii)	ker-e	'to touch'			
(iv)	mak-a	'to open'			

Under Ito's classical analysis of these data, this pattern is the result of a suffix which lacks vocalic features. These are in the default case (i.e., (111-a)) supplied by spreading from the root vowel. The roots in (111-b), on the other hand, have a floating [+high] feature feeding vowel dissimilation for [+/-back] (restricted to non-spreading contexts since dissimilation targets identical adjacent features not multiply associated single features). A second idiosyncratic group of roots with low vowels seems instead to specify [-back] (112-a,b) or [+back] (112-c,d) under height dissimilation as in (112).

(112) *Ainu Transitivizing affixation: back mutation (Dettmer 1989:479f.)*

a.	an-i	'to have'	b.	car-i	'to rotate'
c.	ram-u	'to think'	d.	jak-u	'to destroy'

C.5 Aklan – Papuanesia – Austronesian [akl] (2 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Stress
	~	~	~	
②	Tautomorphemic Root	Tautomorphemic Root	↻	

The Aklan system of postaccentuation is similar to the one in Tagalog (appendix C.59), but has an interesting twist. As in Tagalog, roots determine whether stress is on the final or prefinal syllable extending this pattern to affixation (113). An example where penultimate stress falls on the affix is [hag-ambag-án-un], 'maxim', Hayes 1980:183).

Following Hagberg's 2006 analysis for Tagalog, we will assume that penultimate stress is the phonological default pattern while final stress is the result of anticyclic mutation.

(113) *Root-to-Affix stress in Aklan (Hayes 1980:181, Chai 1971)*

	Penultimate stress roots			*Final stress roots*	
a.	híkut	'cook'	e.	butáŋ	'place'
b.	hikút-an	'cook-REF.FOC.FUT'	f.	butaŋ-án	'place-REF.FUT'
c.	sípaʔ	'kick'	g.	bisá	'kiss'
d.	sipáʔ-a	'kick-GOAL.FOC.IMP'	h.	bisa-hí	'kiss-REF.IMP'

However, this generalization is overwritten by the requirement that penultimate closed syllables have primary stress. Thus the positional stress contrast is suppressed for un-affixed forms as in (114-e+g) but emerges under suffixation, additionally highlighting the abstract nature of the (pen-)ultimate contrast.

(114) *Root-to-Affix stress in Aklan* (Hayes 1980:181, Chai 1971)

	Penultimate stress roots			*Final stress roots*	
a.	bítbit	'carry'	e.	gásta	'spend'
b.	bitbít-a	'carry-GOAL.FOC.IMP'	f.	gasta-hún	'spend-GOAL.FUT'
c.	hámbag	'speak'	g.	ʔasírtar	'lucky'
d.	h-ag-ambág-un	'that which should be said'	h.	ʔasirta-hí	'lucky-REF.IMP'

C.6 Anywa – Africa – Eastern Sudanic (Western Nilotic) [anu] (2 patterns)

① ②	Root-to-Affix ~= Tautomorphemic Root	Root-to-Suffix ~ = Tautomorphemic Root	→ ~ = ↻	Tone	High

(Affix-to-Root | Prefix-to-Root | → | Tone | High)

Anywa is a case where mutation affects a different formative and the mutation trigger itself *simultaneously*: Many low-toned morphemes impose H on a following low-toned morpheme. This is shown for prefixes triggering raising of roots in (115). The example (115-b) also illustrates a further tonal regularity of the language: If a root or a suffix carry a H, this spreads to the other morpheme (H-spreading is plausibly restricted to this domain under the assumption that roots and suffixes as in many languages form a PWord to the exclusion of prefixes).[6]

(115) *Anywa Affix-to-Root mutation (Reh 1993:68)*

a. à^{H}- ɖjàŋ → à-ɖjáŋ
NMLZ- durra:bird 'durra bird'

b. à^{H}- càŋ -ɟì → à-cáŋ-ɟí
PST- eat -it 'you ate it'

Accordingly, if roots trigger H-mutation on following suffixes, the H not only surfaces on the affix, but also tautomorphemically on the root itself (116). Note that these nouns occur with L tones in other contexts, thus the root in (115-b) is [gàtˌ] in isolation (in the singular).

[6] We have slightly adjusted Reh's notation of examples: We have added predictable voicing where Reh gives underspecified archiphonemes. The syllables we write here as Low tones with floating H's are notated as Mid tones by Reh, while she explicitly states that these are pronounced with low pitch (Reh 1993:45).

(116) *Anywa Root-to-Affix mutation (Reh 1993:69)*

a. gàt̪^{H} -è → gát̪-é
'trade' PL 'types of trade'

b. àcù:l^{H} -è → àcú:l-é
island PL 'islands'

C.7 Awa – Papuanesia – Nuclear Trans New Guinea [imo] (2 patterns)

① ②	Root-to-Affix ~ Root-to-Word	Root-to-Suffix ~ Root-to-Word	→	Tone	Low	↜ McPherson (2016)

The Papuan language Awa exhibits a similar alternation as described for Kpelle in section 3.1. McPherson (2016, 42-47) based on data from Loving (1966) shows that roots with a final floating L impose this either on a following suffix (e.g., /tàhnúⓁ/ 'flea' + /táté/ 'DU' → [tàhnú-tàtě] 'fleas (DU)', p. 47) or – in absence of a suffix – on a following syntactic word. In this case, however, the morphophonological effect is slightly different: In the language, tones of non-initial words are independently raised to H after many syntactic categories (e.g., /kàpàntéh/ 'sick' + /kàpàtà/ 'bird' → [kàpàntéh kápátá] 'sick bird') For lexemes with a floating Low, this is realized on top of this neutralization process, e.g., /ànòqtâhⓁ/ 'big' + /kàpàtà/ 'bird' → [ànòqtâh kàpátá] 'big bird' and /kàwèqⓁ/ 'good' + /nàh/ 'house' → [kàwèq nǎh] 'good house'. Compare this to a low-toned suffix after a floating-L base which simply remains low: /tàhnúⓁ/ 'flea' + /-è/ 'aug' → [tàhnú-è] 'big flea'.

C.8 Bakweri – Africa – Niger-Congo (Bantu) [bri] (1 pattern)

①	Affix-to-Affix	Prefix-to-Prefix	←	Tone	↓ High

An interesting variant of the prefix-to-prefix tone mutation in Chichewa (pattern ③ in appendix C.14) is found in another Bantu language, Bakweri, where the Past 2 prefix /-ma/ imposes a H followed by a downstep on preceding subject prefixes, no matter whether these have underlyingly a H or a L (117). The downstep must be an inherent part of the mutation process since it doesn't depend on a L on the prefix and adjacent H's in the language do not generally trigger downstep (cf. /ó-/ 'Subj' + /vá-/ 'them + /fáf/ 'hit' + /-é/ (final vowel) → ['ó-vá-fáf-é] 'hit them (Subj)', p. 23).

(117) *Bakweri (Marlo & Odden 2007:20+21)*

	Future		*Past* 2	
a.	nà-zòz-à S1SG-wash-FV	'I will wash'	ná$^{↓}$-má-zòz-zà S1SG-PST2-wash-FV	'I have washed'
b.	và-zòz-à S3PL-wash-FV	'they will wash'	vá$^{↓}$-má-zòz-zà S3PL-PST2-wash-FV	'they have washed'

C.9 Bangime – Africa – Isolate [dba] (2 Patterns)

① ②	Root-to-Affix ~ Tautomorphemic Root	Root-to-Suffix ~ Tautomorphemic Root	→ ~ ↻	Tone	High	↜ Hantgan (2009)

(see section 3.3 for data and discussion)

C.10 Barasana – S America – Tucanoan [bsn] (1 Pattern)

①	Root-to-Affix	Root-to-Suffix	→	Tone	High	↜ Gomez-Imbert & Kenstowicz (2000)

Barasana is a restricted tone language, where under the analysis of Gomez-Imbert & Kenstowicz (2000) morphemes may either carry a High tone or a High-Low melody. With bimoraic roots, the High of both underlying tone types might either show up on the first mora (e.g., High [gáwá] 'white people' vs. [-wádì] 'fish', p.423)

or on the second mora, as shown in (118), where it leads to a mutation-like effect. In isolation (118-a), roots of both types have a Low-High profile on the surface (with an epenthetic initial Low under Gombert & Kenstowicz' analysis). However, with tonally underspecified suffixes (118-b), final High spreads, and the Low of High-Low roots docks to the affix (see Gomez-Imbert & Kenstowicz for details on affixes which have underlying tone).

(118) *Barasana (Gomez-Imbert & Kenstowicz 2000:427)*

	Underlying High		*Underlying High-Low*	
a.	gohé	'hole'	wekó	'parrot'
b.	gohé-ré	'to the hole'	wekór-è	'to the parrot'

C.11 Bari – Africa – Eastern Sudanic (Eastern Nilotic) [bfa] (3 Patterns)

①	Root-to-Affix	Root-to-Suffix	→	Vocalic Features	high, round

Several verb roots in the Eastern Nilotic language Bari trigger [+high +round] mutation on suffixes (Yokwe 1986). For example, the roots /ʄʊ̀t/ 'to plant' and /gìr/ 'to tattoo' raise low back vowels of following suffixes to their high round counterpart [ʊ], as for the Benefactive suffix /-akin/: /gìr-ákìn/ → [gìr-ʊ́kìn] 'to tattoo for (BEN)', (p.28) /ʄʊ́t-ákìn/ → [ʄʊ̀t-ʊ́kìn] 'to plant for (BEN)' (p.52), the Antipassive suffix /-(j)a/: /gìr-á// → [gìr-jʊ̂] 'to tattoo (ANTIP)' (p.33), /ʄʊ̀t-a// → [ʄʊ̀dː-ʊ̂] 'to plant (ANTIP)' (p.32), and the Ablative suffix /-árà/: /ʄʊ̀t-árà// → [ʄʊ̀t-ʊ́rʊ́] 'to plant away(ABL)' (p.52). Interestingly, in the latter case, the effect extends to both low vowels of the affix (*[ʄʊ̀t-ʊ́rà]). Note also that while all verbal roots which trigger this mutation are [+high], the majority of verbs of this shape doesn't trigger raising, cf. the Benefactives [dìp-ákín]/*[dìp-ʊ́kín] 'to support for (BEN)' (p.27), [tʊ́n-ákìn]/*[tʊ́n-ʊ́kìn] 'to gather for (BEN)' (p.27).

② ③	Root-to-Affix ~ Tautomorphemic Root	Root-to-Suffix ~ Tautomorphemic Root	→ ~ ↻	Tone	(Low-)High(-Low)

Monosyllabic verb roots in Bari also evidence Root-to-Affix tone mutation alternating with tautomorphemic mutation. Several verbal affixes in the language are apparently tonally underspecified with their tone supplied by spreading from the verb root. Thus the Benefactive suffix which is realized as /-akin/ after consonants and as /-kin/ after vowels is typically H throughout after verb roots ending in a H and L after verb roots ending in a L tone (e.g., /dújám/ 'cause to collapse' + /-akin/ → [dújám-ákín] 'cause to collapse for' vs. /dìlílì/ 'winnow grain' + /-akìn/ → [dìlílì-kìn] 'winnow grain for', p.24+25). Although the language in principle allows falling contours (e.g., in the noun [têŋ] 'herd', p. 226), all monosyllabic verb roots have a single H in isolation, which for many verbs spreads to tone-less suffixes like the Benefactive (e.g., /dér/ 'cook' + /-akin/ → [dér-ákín] 'cook for'). However, there is a second class of verbs which exhibit the melody LHL in these forms (e.g., /sút/ 'bet' + /-akin/ → [sùt-ákìn] 'bet for', p.25). Following Yokwe (1986) in the assumption that these roots underlyingly carry a floating Low-High-Low melody, the High component of this melody alternatingly shows up on suffixes and on the root itself.

C.12 Chaha – Africa – Afro-Asiatic (Semitic) [sgw] (1 pattern)

①	Affix-to-Affix	Suffix-to-Suffix	→	Consonantal Features	voicing and continuancy

(119) shows a minimal pair where the object marker /-β/ shows up in its underlying form after the verb root with a 3sg subject (and no subject agreement marker) in (119-a) but in its hardened and devoiced form after the mutation-triggering 3pl subject agreement suffix /-o/ (119-b).

(119) *Object marking in Chaha (Rose 2007, 40)*

a. jɨ-rəxɨ-β-a
S3-'find'-MAL-O.3.SG.F-TNS.S
'he finds (sth) to her detriment'

b. jɨ-rəxɨ-o-p-a
S3-'find'-MAL-S3.PL-O3SG.F-TNS
'they find (sth) to her detriment'

(see section 2.3 for more data and discussion)

C.13 Cherokee (Oklahoma) – North America – Iroquoian [chr] (2 patterns)

①	Root-to-Affix	Root-to-Prefix	←	Tone	High

In Cherokee, specific verb roots such as /dlo:/ ‘strap’ trigger appearance of a High tone on a preceding prefix (120-a). (120-b) shows a verb not triggering H-tone as a minimal contrast:

(120) *Cherokee root-triggered High tone (Uchihara 2013:198 citing Feeling 1975:92+97)*

a.	ꭡí-dlo:-híh-a	b.	ꭡi-ꭡagal-íh-a
	1SG-strap-PRS-IND		1SG-rip-PRS-IND
	‘I am stapping it’		‘I am ripping it’

②	Root-to-Affix	Root-to-Prefix	←	Length	Vowel Length

Other Cherokee verb roots condition lengthening of a preceding pronominal prefix (121-a). (121-b) is an example for a non-lengthening verb root:

(121) *Cherokee root-triggered vowel lengthening (Scancarelli 1987:56+57)*

a.	kà:-ꭡàjò:híh-a	b.	kà-lò:nʌ̀hě:-ʔa
	1SG-prick-PRS		3SG-cheat-PRS
	‘he is pricking it’		‘he is cheating’

C.14 Chichewa – Africa – Niger-Congo (Bantu) [chew1246] (4 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Tone	High
	~=	~ =	~ =		
②	Tautomorphemic Root	Tautomorphemic Root	↻		

The Bantu language Chichewa exhibits an interesting length- and position-dependent variant of parallel tauto- and heteromorphemic mutation similar to the Anywa case in appendix C.6. The language has two tonal verb classes dubbed ‘H-toned’ and ‘toneless’ by Downing & Mtenje (2017). Abstracting away from the possible interference of tonally specified affixes, toneless verbs are low-toned throughout, whereas the high-toned class imposes a H on the ‘final vowel’ (122) – an obligatory final suffix in verb forms.[7] While this describes the phrase-internal forms of verbs, two general phonological processes affect the position of this H for verb tones in isolation (which are hence at the end of a minimal prosodic phrase): lengthening of phrase penultimate vowels (indicated here by vowel doubling) and ‘retraction’ – spreading of a H on the phrase-final mora to the preceding one, i.e., here the second mora of the lengthened vowel. In effect, isolated verb forms of longer H-roots show pure anticyclic Root-to-Affix mutation (interestingly even across tone-less derivational suffixes such as Applicative /-il/ and Causative /-its/), whereas for shorter roots without suffixes such as /péz/, the H surfaces both on the root itself and the final vowel /-a/, as can be seen in (122).

(122) *Chichewa Imperatives (Downing & Mtenje 2017:139)*

Ø-Root		Phrase internally		H-Root		Phrase internally	
a. mèèŋ-à	‘hit!’	mèŋ-à	√-FV	pèéz-á	‘find!’	pèz-á	√-FV
b. jàŋààn-à	‘look!’	jàŋàn-à	√-FV	nàmìíz-á	‘deceive!’	nàmìz-á	√-FV
c. fòtòkòòz-à	‘explain!’	fòtòkòz-à	√-FV	xùlùlùk-ìíl-á	‘pardon!’	xùlùlùk-ìl-á	√-APPL-FV
d. tèmbènùùz-à	‘turn around!’	tèmbènùz-à	√-FV	tàmàŋg-ìíts-á	‘chase!’	tàmàŋg-ìts-á	√-CAUS-FV

③	Affix-to-Affix	Suffix-to-Suffix	→	Tone	High

The same type of alternation is not only found for roots but also for affixes. For example, the intensive suffix /-íts/-éts/ has basically the same effect on the final vowel as a high-toned verb root Thus the Intensive form of [jàŋààn-

[7] See Hyman & Mtenje (1999) for an explicit analysis where the H introduced by verb roots is underlyingly floating. This straightforwardly distinguishes this tone from preassociated tones which don’t shift to the final vowel, as in nouns (e.g., [címààŋgà]/*[cimàáŋgá] ‘maize’ and [kàtúùndù]/*[kàtùúndú] ‘luggage’, Downing & Mtenje 2017:117)), and verbal prefixes such as the Simple Past marker /-ná/ in [mù-ná-mèèŋ-a] S2PL-TNS-hit-FV ‘you hit’ (Downing & Mtenje 2017:145). See Trommer (2024) for an explanation of the fact that some floating H tones also target the penultimate instead of the final vowel.

à] look-INT-FV in (122-b) is [jàŋààn-ìts-á] phrase-internally and [jàŋààn-ìíts-á] phrase-finally (Downing & Mtenje 2017:141). See South Kyungsang Korean C.38 for a similar system with more pitch-accent-like properties.

④	Affix-to-Affix	Prefix-to-Prefix	←	Tone	High

The Remote Past prefix which itself has a consistent L enforces a H on preceding subject agreement affixes. In (123), this is contrasted with the Simple Past where the agreement prefixes have L, and the Recent Past which has a low-toned tense prefix but (cyclically) introduces a H on the following stem vowel.

(123) *Chichewa prefix-to-prefix mutation (Remote Past) (Downing & Mtenje 2017:159)*

Remote Past	*Simple Past*	*Recent Past*	
ndí-**naa**-jaŋán-a [ndínáajaŋáana]	ndi-ná-jaŋan-a [ndinájáŋaana]	ndi-**na**-já ŋan-a [ndinajáŋaana]	S1SG-TNS-look.at-FV 'I looked at'
á-**naa**-fotokóz-a [ánáafotokóoza]	a-ná-fotokoz-a [anáfótokooza]	a-**na**-fótokoz-a [anafótókooza]	S3PL-TNS-explain-FV 'they explained'
tí-**naa**-tembenúz-a [tínáatembenúuza]	ti-ná-tembenuz-a [tinátémbenuuza]	— —	S1PL-TNS-explain-FV 'we explained'

C.15 Chimila – South America – Chibchan [cbg] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Consonantal Features	nasal	↜ Malone (2010)

Specific roots trigger nasalization of initial stop consonants in adjacent suffixes such as the suffix /-ta/ 'towards/up', as shown in (124).

(124) *Chimila Root-to-Affix nasalization (Malone 2010:11-12)*

Plain Roots		*Nasalizing Roots*	
a. ūú-ta	'to sit up'	ú-n·à	'drink toward'
b. há-ta	'to come'	ʔa-nà	'to return'
c. moo-ta	'to carry upslope'	kúū-n·à	'milk toward'
d. ká·-ta	' to open toward'	tó-nà	'to shuck corn'

Nasalizing roots also seem to systematically affect other suffixes which are susceptible to nasalization. For example, the plural suffix /-ke/, which shows up faithfully after plain roots (cf. [ūú-ta] ' to sit up' (124-a) and [ū-ke-wa̰raʔ] sit-PL-MPPL-up), roots nasalizing /-ta/ also nasalize /-ke/ (e.g., [hí·-nā-kɾi] go-up-elevated 'to go up a slope' and [hí·-ŋē-tá-kɾi] go-PL-up-elevated 'let's go up!).

At the same time, nasalization is codependent on the identity of the suffix, i.e., there are suffixes which consistently resist nasalization by nasalizing roots such as the stem formative /-ko/-ku/ (e.g., [ú-n·à] 'drink toward' (124-a) vs. [u-k·u] 'drink' and [ⁿdi·-na] 'remove hair from goat carcass' vs. [ⁿdi·-ko-ta] 'take the hair off!', p.15. The last example also shows that nasalization of /-ta/ is blocked if other suffixes intervene).

Malone captures the double conditioning of nasalization by the assumption that affixes may be specified or unspecified for nasality and nasalization is triggered by floating phonological material. Malone also provides detailed arguments that this pattern is not allomorphy (based, e.g., on the fact that nasalizing roots trigger the effect on all affixes which are in principle eligible for nasalization).

C.16 Chukchee – Eurasia – Chukotko-Kamchatkan [ckt] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Vocalic Features	Vowel height	↜ Wolf (2005)

(see section 2.2 for data and discussion)

C.17 Ciyao – Niger-Congo (Bantu) [yao] (2 patterns)

①	Affix-to-Word	Suffix-to-Word	→	Tone	High	↜ Hyman & Ngunga (1994)

(| Affix-to-Root | Prefix-to-Root | → | Tone | High | ↜ Hyman & Ngunga (1994) |)

Hyman & Ngunga (1994) is a classical study on cases of purely tonal Affix-to-Word morphology without concomitant segmental affixes in the Bantu language Ciyao. Ciyao verbs have cyclic as well as anticyclic TAM inflection whose docking seems to be governed mainly by directionality. Tonal prefixes associate to the left edge of the verb stem (e.g., the LH in the Negative Remote Past (P2) tense /nga-ni-ju-Ⓛ Ⓗ-telek-a NEG-TNS-S3SG-TNS-forget-FV → [nga-ni-ju-__-tèlék-a] 'he didn't forget', p.29), whereas the (suffixal) H of the Negative Imperative consistently shows up on a following word as shown in (125) for the noun /cìló/ 'night'.[8]

(125) *Ciyao Negative Imperative (Hyman & Ngunga 1994:43)*

	Bare Verb	*Verb + noun*		
a.	n-ká-mìl-à	n-ká-mìl-à__	cíló	'don't swallow (at night)!'
b.	n-ká-kàmùl-à	n-ká-kàmùl-à__	cíló	'don't hold (at night)!'
c.	n-ká-dìvàdìl-à	n-ká-dìvàdìl-à__	cíló	'don't forget (at night)!'
	IMP-NEG-V-FV	IMP-NEG-V-FV	night	

(Affix-to-Root	Suffix-to-Root	←)	Tone	High	↜ Hyman & Ngunga (1994)
② ~ Affix-to-Word	~ Suffix-to-Word	~ →			

C.18 Finnish – Eurasia – Uralic [fin] (3 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Length	consonant gemination	↜ Kiparsky (2003)
② ~	Root-to-Word	~ Root-to-Word	~ →			

(data are given in Finnish orthography, apart from segmental length which we mark by the IPA symbol 'ː')

In Finnish, specific nouns such as *liːke* 'movement, shop' have a final 'ghost consonant', i.e., they trigger gemination of following consonant-initial affixes, clitics (e.g., */liːke/* + */-tä/* 'part:sg' → *liːke-*[*tː*ä] 'of a shop' and */liːke/* + */-ko/kö/* '(question enclitic)' → *liːkekːö* 'the shop?', Kiparsky 2003:119), and independent words (e.g., */liːke/* + */menestyi/* 'flourished' → *liːke* [*mː*enestyi] 'the shop flourished', Kiparsky 2003:119).

③	Affix-to-Word	Suffix-to-Word	→	Length	consonant gemination	↜ Kiparsky (2003)

The Finnish ghost consonant triggering gemination on following consonants is also found on suffixes. An example is the Infinitive *-ta* which results in initial gemination on following words (126-a+b). As can be seen in the examples (126-c+d), the suffix has no effect if it does not precede a consonant.

[8] The affirmative P2 in Ciyao has a pattern where verb forms have a H consistently associated to the final vowel, e.g., [jw-àː-cí-tèm-àg-á] TNS-S3SG-TNS-break-IPFV-FV 'he was breaking it', p.35 which seems to contradict this generalization. Since the final vowel itself is an exponent of TAM, we assume that this H is preassociated to the final vowel, and hence not subject to the constraints governing association of floating tones. See Hyman & Ngunga (1994) for controversial discussion on the morphotonological structure of this paradigm.

(126) *Finnish Affix-to-Word gemination (Kiparsky 2003:119)*

a.	ei	se	tuo-ttaC	voi-ta	→	ei se tuo-ta [v:]oita
	Aux.Neg.3sg	it	produce-Inf	butter-PRT		'it does not produce butter'
b.	ei	se	voi-ttaC	tuo-ta	→	ei se voi-ta [t:]uota
	Aux.Neg.3sg	it	beat-Inf	that-PRT		'it won't beat that one'
c.	ei	se	voi-ta	tuo-ttaC	→	ei se voita tuota
	Aux.Neg.3sg	it	butter-PRT	produce-INF		'it does not produce *butter*'
d.	ei	se	tuo-ta	voi-ttaC	→	ei se tuota voita
	Aux.Neg.3sg	it	that-PRT	beat-INF		'it won't beat *that one*'

C.19 Fula Africa – Niger-Congo (Central Atlantic) [ful] (2 patterns)

Root-to-Affix	Root-to-Suffix	→	Consonanal Features	① continuancy ② nasalization	↜ Paradis (1992)

Fula is well-known for its consonant gradation or mutation pattern that is prominent in the class marking for nouns (Paradis 1992). As can be seen in (127), the initial consonants of the nouns alternate depending on the noun class and are realized as either stops or nasals. Crucially, the initial consonant of the following noun class suffix alternates as well and is realized as stop, nasal, continuant, or zero. This choice of consonant grade for the suffix depends idiosyncratically on the stems preceding them and cannot be predicted from any additional semantic or morphological factor. We can hence conclude that the nouns in (127) trigger an anticyclic consonantal mutation on the class suffix directly following them, in parallel to the Korean data discussed in section 2.2.

(127) *Alternating noun class suffixes in Fula (Churma 1988, 40)*

wor- 'man' *stop*	wa:- 'monkey' *nasal*	hufine- 'cap' *continuant*	da:g- 'sleeping mat' *zero*
gor-gel$_{CLS.3}$	ba:-ngel$_{CL.3}$	kufine-jel$_{CLS.3}$	da:g-el$_{CLS.3}$
gor-gum$_{CLS.5}$	ba:-ngum$_{CLS.5}$	kufine-jum$_{CLS.5}$	da:g-um$_{CLS.5}$
ngor-ga$_{CLS.7}$	mba:-nga$_{CLS.7}$	kufine-wa$_{CLS.7}$	nda:g-a$_{CLS.7}$
gor-ɗo$_{CLS.1}$	wa:-ndu$_{CLS.11}$	hufine-re$_{CLS.9}$	da:g-o$_{CLS.14}$

C.20 Gã – Africa – Niger-Congo (Kwa) [gaa] (2 patterns)

Affix-to-Affix	Prefix-to-Prefix	←	Tone	① High ② Low	↜ Paster (2003)

(| Affix-to-Root | Suffix-to-Root | ← | Tone | High | ↜ Paster (2003) |)

(see section 2.3 for data and discussion)

C.21 Gaahmg – Africa – Eastern Sudanic [tbi] (1 pattern)

① | Affix-to-Affix | Suffix-to-Suffix | → | Tone | Mid |

The Eastern Sudanic language Gaahmg (Stirtz 2011) has tonal Affix-to-Affix mutation similar to the Gã case discussed in section 2.3, but more restricted in scope. The Continuous suffix /-án/ has a consistent H (e.g., /fír/ 'smell' + /án/ + Ⓜ '1sg' → [fírə́n̄] 'I smell', and /fír/ 'smell' + /án/ + Ⓛ '3pl' → [fír-◌̂-n] 'they smell', p.199). The Past form of the Continuous carries an additional Mid tone *preceding* the H of Continuous /-án/. (e.g., /fír/ 'smell' + Ⓜ 'Past' + /án/ + Ⓜ '1sg' → [fírə̋n̄] 'I smelled', and /fír/ 'smell' + Ⓜ 'Past' + /án/ + Ⓛ '3pl' → [fír-◌̄-ə̀n̄] 'they smelled', p.196). If this M is not a tonal infix (a phenomenon, to our knowledge, not attested otherwise), this is again anticyclic inside-out mutation.

C.22 Gadsup – Papuanesia – Nuclear New Guinea [gaj] (1 pattern)

① Root-to-Word | → | Tone || High-Low

In Gadsup, specific modifiers trigger a change in the tone pattern of following nouns (Cahill 2011:18, see also Frantz & Frantz 1973). Cahill describes this as an initial High and concomitant simplification of underlying contour tones, but the data he provides exhibit more specifically a H^+ L pattern, as can be seen in (128).

(128) *Gadsup Root-to-Word mutation (Cahill 2011:18)*

Word in Isolation		*After mutation trigger*		
nòmî	'water'	éná	nómì	'another water'
ùnămì	'bag'	àmúʔnà	únámì	'many bags'
jòkánì	'work'	nùrànkéná	jókánì	'yesterday's work'
kùkùnî	'fence'	kàmàn	kúkúnì	'sweet potato garden (lit. fence)'

Other prenominal modifiers don't trigger tonal changes on nouns (e.g., [tìjă nkàn kùkùnî] 'ten fences').

C.23 German – Eurasia – Indoeuropean (Germanic) [deu] (3 patterns)

①	(Affix -to-Root ~ Tautomorphemic Affix	Suffix -to-Root ~ Tautomorphemic Suffix	← ~ ↻	Vocalic Features) ~ Consonantal Features	Coronal	↜ Trommer (2021)

As shown in detail by Trommer (2021), Standard German has a complex pattern, where noun plurals are expressed by affixing an underspecified segment and a coronal feature. The segment may surface either as as a mid central vowel ([maːt] ~ [maːtə] 'steward(s)'), a central low vowel ([bɪlt] ~ [bɪldɐ] 'picture(s)') or as a coronal nasal consonant ([p^haːtə] ~ [p^haːtən] 'godfather(s)'). The coronal feature, on the other hand, triggers umlaut (vowel fronting) when possible ([ʀat] ~ [ʀɛdɐ] 'wheel(s)'). Now, whereas both the segmental shape and umlaut exhibit a complex distribution due to morphological and phonological factors, a central restriction of the system is that the [n]-realization of the segmental suffix never cooccurs with umlaut (thus monosyllabic feminine nouns might show [n]-affixation ([zaːt] ~ [zaːtn̩] 'seed(s)') or umlaut ([naːt] ~ [nɛːtə] 'seam(s)') but not both. There are hence no alternations such as *[laːt] ~ [lɛːtn̩]. This fact follows naturally if the [n]-allomorph can only be formed with the tautomorphemic Coronal feature, unavailable whenever this docks to the base vowel in umlaut.

② Root-to-Affix | Root-to-Suffix | → || Vocalic Features | Pharyngeal | ↜ Trommer (2021)

③ Root-to-Affix | Root-to-Suffix | → || Consonantal Features | Nasal | ↜ Trommer (2021)

In certain cases, the specific segmental realization of plural also result from floating root material docking anti-cyclically to outer affixes even in the absence of alternation with mutation. This is found in a number of noun roots which idiosyncratically select the 'wrong' allomorph. Thus the expected plural realization for a monosyllabic masculine noun is suffixed [ə] ([maːt] ~ [maːtə] 'steward(s)'). However there are exceptional roots which take [ɐ] and [n] instead (e.g., [gɔt] ~ [gœtɐ] 'god(s)' and [gʀaːf] ~ [gʀaːfn̩] 'count(s)'). Trommer (2021) shows that this can be naturally derived by positing specific floating features (nasal for [n], and pharyngeal for [ɐ]) which are part of the lexical specification of these nouns and associate to the featurally underspecified segment of the plural affix, as shown in (129) (abstracting away from the [Coronal] feature of the affix triggering cyclic mutation on the root):

(129) a. /gʀaf^{nas} + •/ → [gʀaf- n]
b. /gɔt^{phar} + •/ → [gœt- ɐ]

C.24 Greek – Eurasia – Indoeuropean [ell] (2 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Stress	↜ Revithiadou (1999)

(see section 2.2 for data and discussion)

②	Affix-to-Affix	Suffix-to-Suffix	→	Stress	↜ Revithiadou (1999)

(see section 2.3 for data and discussion)

C.25 Guébie – Africa – Niger-Congo (Kru) [dic] (2 patterns)

①	Root-to-Word	Proclitic-to-Word	→	Tone	Lowering	↜ Trommer (to appear)
	~	~	~		~	
②	Root-to-Word	Enclitic-to-Word	←		Raising	

(see Sande 2018 for an alternative analysis in terms of construction-specific phonology)

A case of alternating different word-target mutation outside of the DP domain is identified in work by Sande (2018) in Guébie, a language with an underlying 4-tone system (in Sande's notation, 4 is the highest and 1 the lowest tone). Most tenses of the language are expressed by second-position auxiliaries, with the verb in clause-final position, as can be seen in (130).

(130) *Guébie Future and Irrealis auxiliaries (Sande 2018:259)*

a. e^{4} ji^{3} ɟa^{31} li^{3}
1SG.NOM FUT coconuts eat
'I will eat coconuts'

b. e^{4} ka^{3} ɟa^{31} li^{2}
1SG.NOM IRR coconut eat
'I would eat coconuts'

In perfective and imperfective forms, there is no segmental auxiliary and the verb appears in the V2 position. While the Perfective is thus effectively zero-marked (131-a), the imperfective is realized as a complex tonal modification (131-b). For most inputs the initial tone of the verb undergoes a chain shift where every tone is lowered by one degree (4 → 3, 3 → 2, 2 → 1).

(131) *Guébie: Imperfective verb tone lowering (Sande 2018:260)*

a. e^{4} li^{3} ɟa^{3}-ɓə^{1}
1SG.NOM PFV eat coconuts-SG
'I ate a coconut'

b. e^{4} _ li^{2} ɟa^{3}-ɓə^{1}
1SG.NOM IPFV eat coconuts-SG
'I am eating a coconut'

The only exception are verbs with the lowest tone, 1, where – apparently to avoid a superlow tone, there is instead raising of the final tone in the preceding subject (132).

(132) *Guébie: Imperfective subject tone raising (Sande 2018:263)*

a. ɟaci$^{23.1}$ pa^{1}
Djatchi PFV run
'Djatchi ran'

b. ɟaci$^{23.2}$ _ pa^{1}
Djatchi IPFV run
'Djatchi runs'

Just as verb lowering, subject raising is chain-shifting. Every tone is replaced by the next-higher tone in the inventory, summarized in (133). A natural interpretation of this pattern worked out in Trommer (to appear) is that the imperfective auxiliary consists only of tonal register features. These are realized on the following or preceding tonal root node, dependent on phonological well-formedness, in the latter case a clear instance of anticyclic mutation.

(133) *Guébie tonal chain shifts (Sande 2018:260+261)*

a. *Verb tone lowering*

Underlying tone		*Imperfective tone*
4		3
3	→	2
2		1
1		1

b. *Subject tone raising*

Underlying tone		*Imperfective tone*
4		5
3	→	4
2		3
1		2

C.26 Hungarian – Eurasia – Uralic – [hun] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Vocalic Features	low	↜ Abrusan (2005), Siptár & Törkenczy (2000)

Hungarian has vocalic [+low] mutation. Noun stems in the language can be classified into different types that trigger idiosyncratic changes on the suffixes that may follow them (Vago 1980, Wunderlich & Stiebels 1999). The two classes of interest are the so-called shortening and lowering stems (Abrusan 2005) that both cause an otherwise mid suffix vowel to be low[9], shown in (134-a+b). (134-c) shows stems that are phonotactically quite similar to those in (134-a+b) but do not trigger any change: this vowel lowering is hence an idiosyncratic feature of certain stems and not predictable from general phonological restrictions.

(134) *Stems triggering lowering in Hungarian (Abrusan 2005, 1+2)*

		Plural
a. *Shortening stems*		
nyaːr	'summer'	nyar-ak
madaːr	'bird'	madar-ak
b. *Lowering stems*		
haːz	'house'	haːz-ak
fog	'tooth'	fog-ak
c. *Non-shortening/non-lowering stems*		
paːr	'pain'	paːr-ok
tanaːr	'teacher'	tanaːr-ok
jog	'law'	jog-ok

C.27 Igbo – Africa – Niger-Congo [ibo] (4 patterns)

①	Root-to-Word	Proclitic-to-Word	→	Tone	High	(Associative Marking)
	~ =	~ =	~ =			
②	Root-to-Word	Enclitic-to-Word	←			

(see section 2.5 for data and discussion)

③	Root-to-Word	Proclitic-to-Word	→	Tone	Low	(Question Lowering)
	~ =	~ =	~ =			
④	Root-to-Word	Enclitic-to-Word	←			

The second case of alternating tone is similar to the Igbo patterns ①+②, but applies at the clausal level: Question formation lowers the initial H of a verb (135-a), the immediately preceding subject (135-b), or both (135-c,d,e). Again this pattern includes not only pronouns (135-b), but also full noun phrases.

[9]The shortening stems additionally undergo shortening of their final long vowel before certain suffixes.

(135) *Igbo tonal question marking (Clark 1990:48-49,175)*

a. ó-mèchìrì ánjá → _ ò-mèchìrì ánjá
3SG-closed eyes 'Did (s)he close his/her eyes?'

b. há mèchìrì ánjá → hà _ mèchìrì ánjá
they closed eyes 'Did they close their eyes?'

c. ófé ɔ́-dì ɔ̀-tɔ́ → ɔ̀fè _ ɔ̀-dì ɔ̀-tɔ́
soup 3SG-is good.tasting 'Is the soup good?'

d. ùwé ɔ́chá ɔ́-dì né-bé à → ùwɔ̀ ɔ̀chɔ̀ _ ɔ̀-dì né-bá à
shirt clean 3SG-is in.place this 'Is there a clean shirt here?'

e. ɔ́mɔ̀ tàkírí h̃á ázàálá á↓má → ɔ́mɔ̀ tàkìrì h̃à _ àzàálá á↓má
children they have.swept yard.ASS 'Have the children swept the yard?'

The crucial datum is (135-e). It shows that questions trigger not simply lowering of complete noun phrases, but of the final H-span in a noun phrase (here: kírí). The initial ɔ́ is immune to lowering because it is separated from this High-span by the sequence mɔ̀ tà, which is underlyingly (and on the surface) Low, and thus interrupts this span.

C.28 Ik – Africa – Eastern Sudanic [ikx] (2 patterns)

① | Affix-to-Affix | Suffix-to-Suffix | → | Vocalic Features | [+ATR] | ↜ Schrock (2014) |

(see section 2.3 for data and discussion)

② | Root-to-Affix | Root-to-Suffix | → | Vocalic Features | [+ATR] | ↜ Schrock (2014) |

In addition to pattern ①, suffixes triggering anticyclic [+ATR] mutation, Ik also exhibits this phenomenon for roots. Thus whereas many roots with [-ATR] [a] trigger vowel harmony on following suffixes such as Intransitive Infinitive [-ɔn/-on] and Transitive Infinitive [-és/-és] (136-a), a subset triggers changing the affix vowel to [+ATR] (136-b). We give here only examples for verbs, but Schrock provides similar data for nouns.

(136) *Ik Root-to-affix [+ATR] mutation (Schrock 2014:85)*

a. *Harmonic a-verbs: [-ATR] suffixes*

áts'	→	áts'-és	'to gnaw'
kán	→	kán-és	'to lick'
tam	→	tam-és	'to think'
bar	→	bar-ɔn	'to be rich'
ŋwaʃ	→	ŋwaʃ-ɔn	'to be lame'

b. *Mutating a-verbs: [+ATR] suffixes*

tsáŋ	→	tsáŋ-és	'to smear'
táb	→	táb-és	'to touch'
raʃ	→	raʃ-es	'to return'
ák'áf	→	ák'áf-on	'to yawn'
ats	→	ats-on	'to come'

C.29 Italian – Eurasia – Indoeuropean (Romance) [ita] (1 pattern)

① | Root-to-Word | → | Length | consonant gemination | ↜ Chierchia (1982), Passino (2013) |

(see section 2.5 for data and discussion)

C.30 Izon – Africa – Ijoid [ijc] (3 patterns)

Root-to-Word	→	Tone	① High ② Low High ③ Low

(see section 2.5 for data and discussion)

C.31 Kashaya – N America – Hokan (Pomoan) [kju] (2 patterns)

① Root-to-Word | → | Stress

Postaccentuation across word boundaries is diagnosed for the Pomoan language Kashaya by Buckley (2018). Kashaya has regular iambic stress with initial syllable extrametricality spanning phonological phrases as in (137-a+b) (only the head of the first foot is phonetically marked by pitch accent). Specific roots such as /k'abat/ 'madrone' trigger postaccentuation, i.e., shifting of the pitch accent to the following foot (137-c+d).

(137) *Kashaya postaccentuation (Buckley 2018:180)*

a. bihʃe 'deer' + boʔoʔ-k^{h}e 'will hunt' → <bih>(ʃebó)(ʔoʔ)k^{h}e 'will hunt deer'

b. bihʃe 'deer' + hc^{h}ojic'-ʔ 'died' → <bih>(ʃéh)(c^{h}ojiʔ) 'the deer died'

c. k'abat 'madrone' + ʃihp^{h}a 'leaf' → <k'a>(baʔ) (ʃíh)p^{h}a 'madrone leaf'

d. k'abat 'madrone' + q^{h}ale 'tree' → <k'a>(baʔ)(q^{h}alé) 'madrone tree'

② Affix-to-Root ~ = Affix-to-Affix | Suffix-to-Root ~ = Suffix-to-Suffix | ← ~ = → | Consonantal | palatalization

Kashaya also has a segmental anticyclic mutation pattern. The language expresses plural agents by palatalization which applies to the segment [d] in suffixes (138-a) and final root consonants (138-b). Mutation also can affect multiple suffix consonants (138-c):[10]

(138) *Plural agent palatalization in Kashaya (Buckley 1994:140-141 based on Oswalt 1961:153,186)*

a. p^{h}il-__-a̍c̍-mé=ʔ
p^{h}ila-Ø-ad-me=ʔ
come-PL-here-IMP=PL
'come here!'

b. du-hlu-__-c̍-a:c̍-
du-^{h}lud-Ø-ad-
INSTR-pick-PL-DUR
'keep picking'

c. du-hlu-__-c̍-a:c̍-a c̍-
du-^{h}lud-Ø-ad-ad-
INSTR-pick-PL-DIR-DUR
'keep picking while moving'

C.32 Ket – Eurasia – Yeniseian – [ket] (1 pattern)

① Affix-to-Affix | Prefix-to-Prefix | ← | Vocalic Features | round

In Ket (Vajda 2001), past tense prefixes trigger labialization (rounding) of preceding low-vowel prefixes to [o] (139-b,d). (139-a,c) show the corresponding present forms, where the underlying /a/ surfaces. The affected prefix-

[10] Glosses are provided by us based on the detailed prose description by Buckley. We have also added a line with underlying forms. Following Buckley (2023), we posit /d/, not /n̍/ as the underlying phoneme undergoing palatalization.

/a/ is an agreement affix in (139-a,b), and a prefixal stem formative in (139-c,d) (glossed as 'L' following Vajda). Epenthetic segments ([j],[i], [ɣ]) are glossed 'Ø' (see Vajda's paper on the intricate morphophonological conddi-tioning of these elements).

(139) *Ket Labialization (Vajda 2001:380)*

a. d-a-j-s-i-n
1-3-Ø-dress-Ø-PL.AN
'we dress him'

b. d-o-l-s-i-n
1-3-PST-dress-Ø-PL.AN
'we dressed him'

c. di-ɣ-a-daq
1-Ø-L-live
'I live'

d. d-o-l-daq
1-L-PST-live
'I lived'

C.33 Kikuyu – Africa – Niger-Congo (Bantu) [kik] (1 pattern)

① Root-to-Word | → | Tone | High | ↜ Clements & Ford (1981), Clements (1984)

Besides the basic patterns of Root-to-Word tone described in section 2.5, Kikuyu also provides a striking demonstration that anticyclic mutation might have rather differentiated and global effects. If the last syllable of a floating-L noun has a H and is followed by a low-toned syllable, the language doesn't simply downstep the latter (plausibly to avoid a maximal phonetic pitch fall from a H to a downstepped L). Instead the L and all immediately following L's are raised to H, and the downstep is realized on the first following high-toned syllable even if this involves multiple words (140-c,d).

(140) *Kikuyu raising + downstep (Clements & Ford 1981:321+322)*

a. kàŋèríⓁ ɔ̀níré → kàŋèrí ɔ́↓níré 'Kangeri saw'
Kangeri saw

b. mwàɣáhìŋáⓁ àrètáhá → mwàɣáhìŋá áré↓táhá 'a weakling will draw (water)'
weakling will.draw

c. mòcé:ɣèníⓁ nà kèŋàŋí → mòcé:ɣèní ná kéŋá↓ŋí 'blackjack and crocodile'
'blackjack and crocodile'

d. mwàɣáhìŋáⓁ nà mòɣèrànjá → mwàɣáhìŋá ná móɣérán↓já 'weakling and examiner'
'weakling and examiner'

If all following syllables are Low, these are raised without an overt downstep (141). However, Clements & Ford argue that the displaced L is still at the right edge of the H-span since words with non-downstepped final H in Kikuyu which are not followed by a floating tone are regularly lowered (e.g., 'examiner' with an underlying final H surfacing in [mòɣèrànjá ná mò:ŋgài] 'examiner and Mungai' which is lowered if pronounced in isolation: [mòɣèrànjà], Clements & Ford 1981:321+322).

(141) *Kikuyu raising without downstep (Clements & Ford 1981:315+333)*

a. áhɛ̀ìrɛ́ mwàɣáhìŋáⓁ βìrìβìrì → áhɛ̀ìrɛ́ mwàɣáhìŋá βíríβírí (L)
he.gave weakling chillies 'he gave the weakling chillies'

b. áhɛ̀ìrɛ́ mwàɣáhìŋáⓁ ìrìɣò ìrìtò → áhɛ̀ìrɛ́ mwàɣáhìŋá íríɣó írító (L)
he.gave weakling banana heavy 'he gave the weakling a heavy banana'

C.34 Kinande – Africa – Niger-Congo (Bantu) [nnb] (1 pattern)

Root-to-Affix | Root-to-Prefix | ← | Tone | High | ↜ Black (1995)

(see section 2.2 for data and discussion)

C.35 Kipsigis – Africa – Eastern Sudanic (Southern Nilotic) [sgc] (1 pattern)

① | Root-to-Affix | Root-to-Prefix | ← | Length | vowel lengthening | ↜ Kouneli (2022) |

(see section 2.2 for data and discussion)

② | Affix-to-Affix | Prefix-to-Prefix | ← | Length | vowel lengthening | ↜ Kouneli (2022) |

(see section 2.3 for data and discussion)

Note that Kouneli interprets both patterns ① and ② as reflexes of a mora realizing the little v-head assumed as a general verbal category marker in Distributed Morphology. For Kouneli, this is structurally closer to the root in the cases in ① without transparent semantics, and merged outside of a second little v with predictable causative meaning in the cases in ②. We believe that our interpretation of the data, where the intransparent combination v+root is understood as a single root morpheme, is the closest possible translation of Kouneli's DM-analysis into the less abstract terms of a lexicalist approach.

C.36 Kisi – Africa – Niger-Congo [kss] (1 pattern)

① | Affix-to-Word ~ Affix-to-Root | Suffix-to-Word ~ Suffix-to-Root | → ~ ← | Tone | High |

(see section 3.2 for data and discussion)

C.37 Kɔnnɪ – Africa – Niger-Congo (Gur) [kma](4 patterns)

① | Root-to-Affix | Root-to-Suffix | → | Tone | ↓High | (142-c)

| Root-to-Affix | Root-to-Suffix | → | Tone | ② ↓High ~ ③ Low | (142-d) |

The Gur language Kɔnnɪ provides a case where register and full-tone mutation form a partial contrast with two classes of lowering nouns, shown here with the high tone suffix /-ká/ and the tonally variable (underspecified) suffix /-si/. With non-mutating noun roots (142-a,b), /-ká/ remains unchanged, and /-si/ adopts the H or L root tone. The first type of lowering roots (142-c) leads for both suffixes to a downstepped H, the second class downsteps a H-toned suffix but imposes a simple L on a tonally variable one.

(142) *2 Types of root-final floating tones in Kɔnnɪ (Cahill 1999:340-41)*

	Singular Definite	*Plural*	
a. *Low*	jʊ̀lì-ká	jʊ̀lì-sì	'whydah' (bird)
b. *High*	kpíá-ká	kpíá-sí	'chicken'
c. *High*+ ①	cíː-↓ká	cíː-↓sí	'squirrel'
d. *High*+ Ⓛ	líá-↓ká	líá-sì	'axe'

A natural interpretation of this difference in terms of tonal features is that the root in (142-c) carries a low-register feature which modifies the underlying H of suffixes like /-ká/ and triggers epenthesis of a H for underspecified suffixes like /-si/ since only H's can carry downstep in Kɔnnɪ . If a root as in (142-d) carries a full L instead, this explains immediately the L on /-si/. Under the standard feature-geometric assumption that the l-register feature is part of the representation of a full L (Yip 1989, 2002, Snider 2018), the downstep on /-ká/ can then be understood as the partial residue of this tone. Note finally that besides the lowering nouns there are also raising nouns in a different inflectional class argued by Cahill to confer a floating H. Thus the plural suffix /-a/ is low-toned after most

high-toned nouns (e.g., /mú̀g-ìŋ/ ‘river’ → [mú̀g-à] ‘rivers’), but raising nouns exhibit a Fall (/ʤá̀g-íŋ/ ‘shade’ → [ʤá̀g-â] ‘shades’ (Cahill 2004:7).

④

Root-to-Word	←	Tone	High↓

Kɔnnɪ also exhibits a minor pattern of tonal root-to word mutation. 1sg, 2sg, and 2pl possessive pronouns in the language usually surface with L’s (143-a). A small set of kinship nouns, however, imposes a H with a following downstep on the preceding pronoun (143-b).[11]

(143) *Kɔnnɪ Possessor High + downstep (Cahill 1999:375)*

	1SG		2SG		1PL		
a.	ǹ	dàáŋ	fì	dàáŋ	tì	dàáŋ	‘stick’
b.	ń↓	ná:	fi↓	ná:	ti↓	ná:	‘mother’

C.38 Korean – Eurasia – Korean [kor] (4 patterns)

Root-to-Affix	Root-to-Suffix	→	Consonantal Features	① aspiration ② glottalization

(see section 2.2 for data and discussion)

③	Root-to-Affix	Root-to-Suffix	→	Tone	Low
	~	~	~		
④	Tautomorphemic Root	Tautomorphemic Root	↻		

South Kyungsang Korean exhibits root-to-affix tone mutation alternating with tautomorphemic tone docking on the root in a system with pitch-accent-like properties. In this dialect, both monosyllabic high-toned roots (144) and bisyllabic LH-roots (145) trigger minimally different tonal patterns on specific suffixes such as Nominative *-i* and Conditional *-imjen* Where the H1 and LH1 roots extend their final H to the first syllable of these suffixes, H2 and LH2 roots trigger a L. A natural assumption in a concatenativist account is that the initial TBUs of these affixes are underlyingly toneless and receive a tone either by spreading of the root-H or by association to a final floating L which is part of the lexical specification of H2 and LH2 roots. Crucially, with monosyllabic roots and a suffix such as *-mánkhùm* which doesn’t alternate (plausibly because its initial syllable is associated to a H), the L appears on the root itself.

(144) *Monosyllabic H-roots in South Kyungsang Korean (Lee & Zhang 2014:73)*

	H1		H2 Ⓛ	
a.	nwún	‘eye’	mún	‘door’
b.	nwún-í	‘eye’ (nom.)	mún-ì	‘door (nom.)’
c.	nwún-ímjèn	‘if eye’	mún-ìmjèn	‘if door’
d.	nwún-mánkhùm	‘as much as eye’	mùn-mánkhùm	‘as much as door’

(145) *Bisyllabic LH-roots in South Kyungsang Korean (Lee & Zhang 2014:74)*

	LH1		LH2 Ⓛ	
a.	sàlám	‘person’	pàlám	‘wind’
b.	sàlám-í	‘person’ (nom.)	pàlám-ì	‘wind (nom.)’
c.	sàlám-ímjèn	‘if person’	pàlám-ìmjèn	‘if wind’
d.	sàlám-mánkhùm	‘as much as person’	pàlùm-mánkhùm	‘as much as wind’

[11] Interestingly with other possessive pronouns, Kɔnnɪ uses suppletive forms for these kinship nouns, which don’t have a mutating effect (e.g., [ù nûŋ]/*[ú↓ nûŋ] ‘his mother’), which shows that anticyclic mutation (floating features) are characteristic of allomorphs, not necessarily of morphemes. This is similar to cyclic mutation as in the German plural, where the plural suffix allomorph [ɐ] triggers almost exceptionless umlaut (e.g., [ʀaːt] ~ [ʀɛːdɐ] ‘wheel(s)’) whereas the allomorph [n] never does (e.g., [naːdl̩] ~ [naːdl̩n] ‘needle(s)’).

C.39 Koryak – Eurasia – Chukotko-Kamchatkan [kpy] (4 patterns)

① ②	Root-to-Affix ~ = Root-to-Affix	Root-to-Prefix ~ = Root-to-Suffix	→ ~ = ←	Vocalic Features	Height	↜ Abramovitz (2021)

Koryak is a language with an especially pervasive vocalic mutation system both from affixes to roots and from roots to affixes, as revealed by recent fieldwork of Abramovitz (2021). Abramovitz shows stringently that Koryak has two classes of mutating affixes, where the first class lowers non-reduced mid vowels to low (146-b), while the second class adds to this effect the lowering of high to mid vowels (146-c). (146-a) shows the same root emerging faithfully with a non-trigger morpheme.

(146) *Affix-to root mutation in Koryak (Abramovitz 2021:56+57+60)*

a. *No Mutation*	b. *Mutation 1*	c. *Mutation 2*
[ujetikik]	[ujatik-piλ]	[ojateke-ŋ]
ujetiki-k	ujetiki-piλ	ujetiki-ŋ
sled-LOC	sled.DIM.ABS.SG	sled-DAT
'in a sled'	'little sled'	'to a sled'

Abramovitz captures this difference by assigning to the first class a floating [+low] feature, and to the second class the features [-high +low] (see Abramovitz 2021 for his detailed OT analysis which also derives the chain-shift effect in pattern 2 where /e/ shifts to [a] but /i/ shifts to [e] and not further to [a]). Crucially the same classes of mutation-triggering morphemes are also found among roots, thus instantiating anticyclic Root-to-Affix mutation on prefixes and suffixes (147).

(147) *Root-to-Affix mutation in Koryak (Abramovitz 2021:60+64, 2019:5)*

a. *No Mutation*	b. *Mutation 1*	c. *Mutation 2*
[ɣečečkejuŋlinet]	[nakun-kaλičit-aɲŋənaw]	[nakon-vet-awŋənaw]
ɣe-čečkejuŋ-line-t	ne-ku-n-kaλičit-et-ŋ-ne-w	ne-ku-n-vet-ew-ŋ-ne-w
UW.PST-think-3.UW.PST-3DU	INV-PRS-CAUS-study-VBLZ-PRS-O3-3PL	INV-PRS-CAUS-work-3DU-VBLZ-PRS-O3-3PL
'they two thought'	'they are making them study'	'they are making them work'

③	Affix-to-Affix ~ = Affix-to-Root	Suffix-to-Suffix ~ = Suffix-to-Root	→ ~ = ←	Vocalic Features	Height	↜ Abramovitz (2021)

④	Affix-to-Affix ~ = Affix-to-Root	Prefix-to-Prefix ~ = Prefix-to-Root	← ~ = →	Vocalic Features	Height	↜ Abramovitz (2021)

Both classes of lowering affixes may also trigger the same types of mutation in more peripheral affixes than they do in roots. Thus the diminutive prefix /qaj-/ in (148-b) (carrying [+low] in Abramovitz' analysis) besides lowering the two mid vowels of the root /-čečkejuŋ-/ also triggers lowering in the more peripheral 'Unwitnessed' circumfix /ɣe- -line/. The same outwards effects is shown for a suffix in the second lowering pattern (carrying [-high +low] under Abramovitz' analysis).

(148) *Affix-to-Affix (+concomitant Affix-to-Root) mutation (Abramovitz 2021:60 +61)*

a. *No Mutation*	b. *Mutation 1*	c. *Mutation 2*
[ɣečečkejuŋlinet]	[ɣa-qaj-čačkajuŋlinat]	[ɣ ačačkajoŋ-ŋəvo-lenat]
ɣe-čečkejuŋ-line-t	ɣe-qaj-čečkejuŋ-line-t	ɣe-čečkejuŋ-ŋvo-line-t
UW.PST-think-3.UW.P-3DU	UW.PST-DIM-think-3.UW.PST-3DU	UW.PST-think-INC-3.UW.PST-3DU
'they two thought'	'they two thought a bit'	'they two began to think'

C.40 Kpelle – Africa – Mande [kpel1252] (2 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Tone	High
	~	~	~		
②	Root-to-Word	Root-to-Word	→		

(see section 3.1 for data and discussion)

C.41 Kunama – Africa – isolate [kun] (2 patterns)

Root-to-Affix	Root-to-Suffix	→	Tone	① High ② Mid	↜ Ashkaba et al. (2000)

Kunama in the description of Ashkaba et al. (2000) exhibits Root-to-Affix mutation for tone. Nouns in the language are directly followed either by an obligatory theme vowel (/-ā/ in the singular and /-ɐ̄/ in the plural) or by a determiner suffix such as /-àm/ 'this' (149-a,b). Nouns like /tōm/ 'fire' exhibit a high tone which appears on the suffix vowel immediately following the root (149-c). As Ashkaba et al. point out, the most parsimonious account for these nouns is a final floating H-tone which is part of their lexical specification. Strikingly, there are also nouns of this class which consist only of consonants (149-d), highlighting that this H-component is likely to be underlyingly floating. Realization of this floating H is fully transparent for the singular (Ⓗ + M → HM) whereas tonal sandhi processes apply in the two other forms. On the plural theme vowel, the Mid component is deleted between H and L (Ⓗ + ML → HML → HL) since the language disallows 3-tone contours. On the demonstrative affix, the resulting HL is flattened to HM triggered by a following M (Ⓗ + L + M → HL + M → HM + M), another regular sandhi process (Ashkaba et al. 2000:21).

Finally, there is an additional class of vowel-less roots which appear to have a contrastive floating Mid-tone which emerges on the demonstrative suffix (149-e) but also on possessive suffixes (cf. e.g., [el-àːŋ-ā] 'my tree' and [m-āːŋ-ā] 'my tooth', p.26+27).

(149) *Root-to-suffix tone mutation in Kunama (Ashkaba et al. 2000:20+21+23)*

	a. 'land'	b. 'water pot'	c. 'fire'	d. 'love'	e. 'tooth'
Sg	làg-ā	āgūd-ā	tōm-á̄	m-á̄	m-ā
Pl	làg-ɐ̄	āgūd-ɐ̄	tōm-ê	m-ê	m-ɐ̄
'this'	làg-àm-ā	āgūd-àm-ā	tōm-á̄m-ā	m-áːm-ā	m-āːm-ā

C.42 Kuria – Africa – Niger-Congo (Bantu) [kuj] (3 patterns)

Affix-to-Root	Prefix-to-Root	→	Tone	① Low High	↜ Trommer (2024)
~ =	~ =	~ =		② Low Low High	
Affix-to-Word	Prefix-to-Word	→		③ Low Low Low High	

(see section 3.2 for data and discussion, and Trommer 2024 for a detailed OT-analysis.)

C.43 Lango – Africa – Eastern Sudanic (Western Nilotic) [lno] (1 pattern)

①	Root-to-Word	→	Tone	↓

Monosyllabic H-initial nouns in Lango (Noonan 1992) show a 3-way contrast in tonal behavior. Besides H (150-a) and HL (falling) tone nouns (150-c), there is a third group which Noonan calls the H(L) class (150-b). Phrase-finally (and hence also in isolation), these nouns exhibit a simple H but triggers downstep on a following high-toned noun. Furthermore, they block H-spreading to a low-toned noun just as for HL-nouns do (150-c).

(150) *Lango monosyllabic H-initial nouns (Noonan 1992:63+64)*

	Phrase-final	*+ H-noun*	*+ L-noun*	
a. H	dʒ́g	dʒ́g gʊ́r	dʒ́g ɲə̂ŋ	'mouth'
b. H(L)	wúm	wúm ↓gʊ́r	wúm ɲə̀ŋ	'nose'
c. HL	gwôk	gwôk ↓gʊ́r	gwók ɲə̀ŋ	'dog'
		'ground squirrel'	'crocodile'	

C.44 Makaa – Africa – Niger-Congo (Bantu) [mcp] (2 patterns)

① Root-to-Word ~ ② Root-to-Word	Proclitic-to-Word ~ Enclitic-to-Word	→ ~ ←	Tone	High	↜ Cahill (2000)

In Makaa, the H exponent of the possessive relation appears on the second noun if this has a prefix (151-a) (hence, presumably a prosodically weak position), and otherwise on the first noun when this ends in an open syllable (151-b).

(151) *Possessor-possessum alternation in Makaa (Cahill 2000:59, Heath 1991)*

a. bùdɛ̀ + mɛ̀-kwì꞉ndjè → bùdɛ̀ _ mɛ́-kwì꞉ndjè
potato posts 'potato of the posts'

b. bùdɛ̀ + ɟùgà → bùdɛ̌ _ ɟùgà
potato plug 'potato of the plug'

See Cahill (2000) for more data and a detailed analysis in terms of a floating H clitic.

C.45 Mao – Africa – Blue Nile Mao [myf] (4 patterns)

Root-to-Affix ~ ③ Root-to-Word	Root-to-Suffix ~ Root-to-Word	→ ~ →	Tone	① Low ② High ~ Downstep

Nouns in Mao, as described by Ahland (2012), provide a further simple tonal example for Root-to-Affix mutation. Most nominal affixes in Mao don't carry distinctive tone but are 'assigned' tone by the root to which they attach. Besides nominals such as (152-a-c) where the final (or only) tone of the root-final syllable spreads to these affixes, there are other nouns for which the affix tone is not identical to the tone appearing on the root itself (152-d-g). However, it is consistent across tone-variable suffixes including the 'thematic affix' /-e/ which is attached to nominal roots in most contexts where they don't carry a more specific suffix. Note that all these affixes are even segmentally maximally uniform.

(152) *Root-to-Affix mutation in Mao (Ahland 2012:133)*

		Citation Form	*Subject Form*	*Object Form*	
a.	L	kàl-è	kàl-ìʃ	kàl-là	'porridge'
b.	M	pʼīʃ-ē	pʼīʃ-īʃ	pʼīʃ-nā	'child'
c.	H	íʃ-é	íʃ-íʃ	íʃ-ná	'that'
d.	H Ⓛ	íʃ-è	íʃ-ìʃ	íʃ-nà	'(s)he'
e.	H Ⓛ	múnts'-è	múnts'-ìʃ	múnts'-nà	'woman'
f.	M Ⓗ	kān-é	kān-áʃ	kān-ná	'dog'
g.	M Ⓛ	ēs-è	ēs-ìʃ	ēs-nà	'person'

A straightforward interpretation under a GNA approach is to posit that nouns such as /múnts'/ and /kān/ carry a floating tone at their right edge which associates to the affix syllable to provide it with a tone. Since Mao allows contour tones only under highly specific contexts (in compounding), the floating tone is otherwise deleted (or stays floating). Independent evidence for the floating tones is found in possessive constructions where the possessor nominals appear without any thematic suffix. Here, high-toned nominals with floating L trigger downstep on following high and mid tone nouns as is shown in (153-b) with the 3sg pronoun /íʃⓁ/ (152-d). It forms a minimal pair with the distal demonstrative /íʃ/ (153-c) that doesn't carry a floating tone.[12]

[12] As shown in detail by Ahland, downstep in Mao, as in many other languages, appears only after overt H's and is triggered by floating L elements.

(153) *Downstep triggered by floating Low (Ahland 2012:110+111)*

a.	íʃ	p'īʃ-ìʃ	hā-jé:ts'-↓á	b.	íʃ	↓p'īʃ-ìʃ	hā-jé:ts'-↓á
	that	child-SBJ	AFF-run-DECL		3sg	child-SBJ	AFF-run-DECL
	'the child ran'				'her/his child ran'		

④	Affix-to-Word	Suffix-to-Word	→	Tone	Downstep

The Mao (Omotic) Genitive suffix /-iŋ/ triggers downstep on following words, as can be seen in (154).

(154) *Mao Genitive (Ahland 2012:328)*

tí-ŋ	↓māgèw	…	'my friend …'
1SG-GEN	'friend'		

C.46 Margi – Africa – Afro-Asiatic (Chadic) [mrt] (1 pattern)

①	Affix-to-Affix	Suffix-to-Suffix	→	Tone	Low

(see section 2.3 for data and discussion, and section 4.2 for an OT-analysis)

C.47 Mayo – N America – Uto-Aztecan [mfy] (2 patterns)

①	Root-to-Affix	Root-to-Prefix	←	Stress	↜ Hagberg (2006)
	~	~	~		
②	Tautomorphemic Root	Tautomorphemic Root	↻		

While postaccentuation is a relatively familiar phenomenon from Indoeuropean languages, the Uto-Aztecan language Mayo (Hagberg 2006) instantiates a second slightly different type of Root-to-Affix stress mutation. In Mayo, roots are idiosyncratically specified for stress on the initial or the second syllable (155). However, this contrast is not a property of underlying accent prespecified for particular syllables but positions. This can be seen under prefixation where stress is enforced onto the resulting first and second syllable respectively, even where both of them are affixal. Following Hagberg (2006), we will assume that peninitial accent in the language is the default pattern and initial accent is the effect of mutation – under Hagbergs analysis association of floating accent gridmarks which are part of the lexical reperesentations of specific roots (the forms in (155-f) exhibit habitual reduplication).

(155) *Mayo accent (Hagberg 2006:73*

Accent on 1st σ *(accented)*		*Accent on 2nd* σ *(unaccented)*	
a. chúpnake	'will harvest' TRNS	ponnáke	'will play' TRNS
b. hí-chupnake	'will harvest' INTR	hi-pónnake	'will play' INTR
c. hí-hi-chupnake	'will always harvest'INTR HAB	hi-hí-ponnake	'will always play' INTR HAB
d. chíknake	'will sweep' TRNS	wiséka	'sawing' TRNS
e. hí-chiknake	'will sweep' INTR	hi-wíseka	'sawing' INTR
f. hí-hi-chiknake	'will always sweep' INTR HAB	hi-hí-wiseka	'always sawing' INTR HAB

C.48 Mixtec – N America – Oto-Manguean [mig] (1 pattern)

①	Root-to-Word	→	Tone	High	↜ McKendry (2013)

(see section 2.5 for data and discussion)

(Affix-to-Root | Prefix-to-Root | → | Tone | High | | ↜ McKendry (2013))

(see section 1 for data and discussion)

C.49 Miya – Africa – Afro-Asiatic (West Chadic) [mkf] (1 pattern)

①	Affix-to-Word	Suffix-to-Word	→	Tone	Low

Similarly to the Gã case discussed in the main text (section 2.3), the Afroasiatic language Miya (Schuh 1998) has a functional morpheme triggering Affix-to-Word tone mutation without a segmental affix component. All fully 'verbal' verb forms (i.e., those not employing a participle in their formation) enforce a L-tone on a following object noun (156-b) as can be seen from the contrast to the nominal/participial subjunctive forms (e.g., the Subjunctive form [də màrá mə́ɗə́] 'that he get a goat'). An interesting complication of the Miya pattern is that it is restricted to verbs with a lexical H (156-c).[13]

(156) *Miya Suffix-to-Word Low (Schuh 1998:56)*

	a. Underlying Noun	*b. Perfective H-Verb + Noun*	*c.Perfective L-Verb + Noun*	
H	mə́ɗə́	à már-__ mə̀ɗə̀	à zàr mə́ɗə́	'castrated goat'
H-H	dérwétlí	à már-__ dèrwétlí	à zàr dérwétlí	'leopard'
L	mbə̀rgù	à már-__ mbə̀rgù	à zàr mbə́rgù	'ram'
Ø	ʒaːkə	à már-__ ʒàːkə̀	à zàr ʒàːkə̀	'donkey'
		'he got a . . .'	'he called a . . .'	

A natural interpretation of this dependency in a floating-feature account would be to assume that in forms with a L-toned verb, the affix-L can fuse phonetically vacuously with this root-L whereas this option is blocked for high-toned roots where the floating L alternatively docks on the following noun (if there is one).

C.50 Moro – Africa – Kordofanian [mor] (2 patterns)

①	Root-to-Affix ~ =	Root-to-Prefix ~ =	← ~ =	Vowel Features	Height
②	Root-to-Afffix	Root-to-Suffix	→		

The Kordofanian language Moro (Ritchart & Rose 2017) instantiates vowel height harmony as can be seen in (157). Considerably simplifying, morphemes of the higher set {ɜ, i, u} trigger raising of morphemes of the lower set of vowels {a, e, o}. See Ritchart & Rose 2017 on detailed discussion on whether the involved feature is [ATR] or [high] (the prefix /a-/ RTCL marks finite root clauses, and CLS.g /g-/ concord with nouns of the g-class).

(157) *Moro verb roots (Ritchart & Rose 2017:170)*

a.	é-g-a-vað-ó	'I shaved'	b.	í-g-ɜ-vɜg-ú	'I miscarried'
	é-g-a-veð-ó	'I knocked'		í-g-ɜ-kið-ú	'I opened'
	1SG-RTCL-CLS.g-√-PFV			1SG-RTCL-CLS.g-√-PFV	

Unexpectedly, the same root contrast is also found with verbal and adjectival roots consisting of single consonants such as /-k-/ 'hear' or /-p-/ 'beat' both triggering higher vowels (158-a). The roots in (158-c,d) form a minimal pair with /t̪/ 'drink' triggering raising and /t̪/ 'get lost' failing to do so.

(158) *Moro vowelless roots (Ritchart & Rose 2017:170)*

a.	é-g-a-nː-ó	'I heard'	b.	í-g-ɜ-p-ú	'I beat'
c.	é-g-a-t̪-ó	'I got lost'	d.	í-g-ɜ-t̪-ú	'I drank'
	1SG-RTCL-CLS.g-√-PFV			1SG-RTCL-CLS.g-√-PFV	

Since this process extends to all affixes also undergoing regular harmony, this is unlikely to be suppletive allomorphy and provides thus compelling evidence for Root-to-Affix mutation.

[13] The underlying forms assumed here follow the analysis of Schuh, implying default insertion of Low on toneless syllables, and insertion of a H on low-toned words ("Low-Raising", p.54).

C.51 Neve'ei – Papuanesia – Austronesian (Oceanic) [vnm] (1 pattern)

①	Root-to-Affix	Root-to-Prefix	←	Vocalic Features	[+low]

In Neve'ei (Musgrave 2007), specific prefixes show complete harmony with either the first vowel of the base (159-a) or an initial glide (159-b) (making the standard assumption that [i] ≈ [j], and [u] ≈ [w]). However, for an idiosyncratic group of roots with an initial high-vowel syllable, the prefix is low, not high (159-c).

(159) *Neve'ei 1sg Realis prefix nV- (Musgrave 2007:23-25)*

a.	ni-vi	'I make'
	ne-veh	'I carry'
	na-gah	'I chase'
b.	ni-johjoh	'I vomit'
	nu-wahan	'I look for'
c.	na-sido	'I remember'
	na-tur	'I stand'

C.52 Nimboran – Papuanesia – Nimboran [nir] (4 patterns)

①	Affix-to-Affix	Suffix-to-Suffix	→	Vocalic Features	[-back]	↜ Inkelas (1993)
	~ =	~ =	~ =			
②	Tautomorphemic Affix	Tautomorphemic Suffix	↻			
	~ =	~ =	~ =			
③	Affix-to-Affix	Suffix-to-Suffix	←			

In section 2.3 we discuss data for the purely consonantal particle suffix /-N/ (see section 4.2 for an OT-analysis). Here we give additional data from syllabic and non-segmental affixes triggering vowel mutation, also providing evidence that the patterns are iterative and bidirectional.

Across-the-Board Mutation: (160) shows an example where another affix triggering the same mutations, Durative /-ta/ has a vowel causing fronting of vowels in multiple affixes (and of its own vowel) and additional raising of the final vowel.

(160) *Affix-to-Affix mutation in Nimboran (Anceaux 1965:186+234)*

a.	ŋgedúo-man-t-ám	→	ŋgedúo-man-t-ám
	draw-SINCL.DU-PRS-INCL		'you (sg.) and I draw here '
b.	ŋgedúo-ta-man-t-ám	→	ŋgedúo-te-men-t-ím
	draw-DUR-SINCL.DU-PRS-INCL		'you (sg.) and I are drawing here '

Bidirectional Mutation: Our next example shows that Affix-to-Affix mutation in Nimboran is bidirectional, causing fronting also in preceding suffixes. This is shown for the mutating Dual agreement suffix /-se/ in (161) that also causes fronting of the preceding Inclusive /-man/ (cf. the faithful appearance of /-man/ in (160-a)). This fronting, however, does not extend to verbal roots (cf. (20)-b) in the main text) which doesn't surface as *[seimberɨ]). As pointed out by Tebay (2019), this is plausibly due to the fact that the root forms an independent initial foot which is protected by positional faithfulness.

(161) *Bidirectional mutation in Nimboran (Anceaux 1965:188, Inkelas 1993:565)*

ŋgedúo-man-sa-t-ám	→	ŋgedúo-men-se-t-ím
draw.sg-SINCL.DU-7.LOC-INCL		'you and I draw from here to below'

④	Affix-to-Affix	Suffix-to-Suffix	→	Vocalic Features	[-back]	↜ Inkelas (1993)

Inkelas (1993) shows that there is also a derivational particle suffix without segmental content, consisting only of the mutating features. This is shown in (162-b+d) that contrast with non-mutating contexts for the same final suffixes (162-a+c). Since particles appear relatively close to the verb stem, there are no examples showing whether this mutation also (expectedly) affects preceding suffixes.

(162) *Mutation-trigger without segmental content in Nimboran (Anceaux 1965:87+124+125, Inkelas 1993:564+565+576)*

a.	dɨ́-k-d-u roast-SDU-FUT-1	→	dɨ́kedú 'we two will roast (here)'
b.	u-k-[-back]-d-u say-SDU-PART-FUT-1	→	uk-__-edɨ́ 'we two will say (here)'
c.	krí-<i>-dár-k-e close-<SPL>-PART-PST-2	→	krídiáke 'you (many) closed (here)'
d.	krí-k-[-back]-t-e flee-SDU-PART-PRES-2	→	krík-__-etí 'you two flee (here)'

C.53 Russian – Eurasia – Indoeuropean (Slavic) [rus] (2 patterns)

① ②	Root-to-Affix ~ Tautomorphemic Root	Root-to-Suffix ~ Tautomorphemic Root	→ ~ ↻	Stress	↜ Revithiadou (1999)

It is well known that Russian has roots where stress is fixed on one of the root syllables (163-a,b), a second class where it alternates between the initial root and a suffix syllable (163-c), and a third 'postaccenting' class where stress is on the post-root suffix if there is one and otherwise on the root-final syllable (163-d). Under a classical interpretation (Melvold 1989), both roots and affixes may have underlyingly specified accent, where root (or equivalently: leftmost) specifications systematically win out over later/suffixal ones. Thus, all stresses in (163-a,b) correspond to underlying root stress, the stressed affixes in (163-c) to underlying affix stress (e.g., Genitive Plural *-óv*) that surfaces in combination with roots like *ostrov* are underlyingly accent-less. The postaccenting class in (163-d) is the most contentious in the literature but a straightforward interpretation is that it triggers Root-to-Affix mutation for stress (Revithiadou 1999).

(163) *Russian stress classes (Molczanow et al. 2019:64)*

	a. *Fixed* σ1 *stress*	b. *Fixed* σ2 *stress*	c. *Alternation* *Affix*/σ1	d. *Postaccenting*
NOM SG	ávtor	moróz	óstrov	kulák
GEN SG	ávtor-a	moróz-a	óstrov-a	kulak-á
DAT SG	ávtor-u	moróz-u	óstrov-u	kulak-ú
ACC SG	ávtor-a	moróz	óstrov	kulák
INSTR SG	ávtor-om	moróz-om	óstrov-om	kulak-óm
LOC SG	ávtor-e	moróz-e	óstrov-e	kulak-é
NOM PL	ávtor-i	moróz-i	ostrov-á	kulak-í
GEN PL	ávtor-ov	moróz-ov	ostrov-óv	kulak-óv
DAT PL	ávtor-am	moróz-am	ostrov-ám	kulak-ám
ACC PL	ávtor-ov	moróz-i	ostrov-á	kulak-í
INSTR PL	ávtor-ami	moróz-ami	ostrov-ámi	kulak-ámi
LOC PL	ávtor-ax	moróz-ax	ostrov-áx	kulak-áx
	'author'	'frost'	'island'	'fist'

C.54 Samoan – Papuanesia – Austronesian (Oceanic) [smo] (1 pattern)

①	Root-to-Word	Enclitic-to-Word	←	Tone	High	↜ Yu (2021)

(see section 2.5 for data and discussion)

C.55 Seenku – Africa – Niger-Congo (Mande) [samo1309] (2 patterns)

①	Root-to-Word	→	Consonantal Features	nasal	↜ McPherson (2017)
②	Tautomorphemic Root	↻			

Seenku has nouns for which McPherson (2017) argues that they have a final floating [nasal] feature which nasalizes following sonorant consonants such as /sâ/ 'rabbit' in (164-b) which nasalizes the initial /l/ of the subordinator /lɛ̀/ (which surfaces faithfully in (164-a)).

(164) *Seenku nasalization (McPherson 2017:245)*

a. sɔ̀-bɛ́-sǎ lɛ̀ bɔ̀ɔ̀ŋ lɛ́ nɛ̀
beautiful-NOM-thing SUBORD bag REL in
'the bag in which there is an important thing'

b. sâ nɛ̀ njṵ̋i̯ nɛ́ ɟîo
rabbit SUBORD honey REL see. REAL.PFV
'the honey that the rabbit found'

Stops are prenasalized if preceded by the floating [nasal] (165-b). If there is no following word, the nasal feature is lost (166-a). The examples in (165-a',b',c') show the behaviour of a minimally distinct noun which lacks floating [nasal]. In plural forms of nasalizing nouns (165-c), there is no nasalization of a following word, and the nasal feature is realized instead on the vowel of the noun itself:

(165) *Seenku nasalization (McPherson 2017:244)*

Nasalizing		*Non-nasalizing*
a. kâ 'hut'	a'.	kâ 'griot'
b. kâ ᵐbəlɛ̌ 'big hut'	b'.	kâ bəlɛ̌ 'big griot'
c. kɛ̰̃̋ 'big huts'	c'.	kɛ́ bu-bəlɛ̌ 'big griots'

See McPherson (2017) for an analysis which derives the plural pattern from a generalized ban on tautomorphemic docking. The nasal feature is not allowed to associate to the purely lexical vowel of a singular noun, but may do so in the plural where the stem vowel of the noun has already associated to floating material of the plural affix resulting in raising.

C.56 Shilluk – Africa – Eastern Sudanic (Western Nilotic) [shk] (2 patterns)

①	Affix-to-Word	Suffix-to-Word	→	Length	vowel length	↜ Remijsen & Ayoker (2020)

See section 2.4 for data and discussion of nominal plural cases. (166) shows analogous data for nominal demonstrative forms.

(166) *Shilluk demonstrative Affix-to-Word lengthening (Remijsen & Ayoker 2020:145)*

a.	kùl	á-lîːd̪-à	b.	kùl	ʊ́-lîːd̪-ɔ̀	c.	kùl	ʊ̀-lîːd̪-ɔ̀
	warthog	PAST-look-1SG		warthog	NEVP-look-NEVP		warthog	IPFV-look
	'I looked at the warthog'			'Sb. apparently looked at the warthog'			'Sb. is looking at the warthog'	
d.	kùl-__	ǎː-lîːd̪-à	e.	kùl-__	ʊ̌ː-lîːd̪-ɔ̀	f.	kùl-__	ʊ̀ː-lîːd̪-ɔ̀
	warthog-DEM	PST-look-1SG		warthog-DEM	NEVP-look-NEVP		warthog-DEM	IPFV-look
	'I looked at this warthog'			'Sb. apparently looked at this warthog'			'Sb. is looking at this warthog'	

②	Root-to-Word	→	Length	vowel length	↜ Remijsen & Ayoker (2020)

Shilluk not only has Affix-to-Word mutation but also mutation triggered by noun roots on other words. This is shown by the examples in (167-a,b,c) which trigger lengthening on the initial vowel of the following numeral modifier. The nouns in (167-d,e,f) show that this effect is not a general property of this construction but lexeme-specific.

(167) *Root-to-Word length mutation: Shilluk (Remijsen & Ayoker 2020:147)*

a.	pǔk	áː-kjɛ̀l	b.	kǐt	áː-kjɛ̀l	c.	kʌ̌ːːk	áː-kjɛ̀l
	storage.pot	CRD-first		mountain	CRD-first		harpoon	CRD-first
	'one storage pot'			'one mountain'			'one harpoon'	
d.	bàt	á-kjɛ̀l	e.	wāŋ	á-kjɛ̀l	f.	ʊ́gǐːk	á-kjɛ̀l
	arm	CRD-first		eye	CRD-first		buffalo	CRD-first
	'one arm'			'one eye'			'one buffalo'	

C.57 Shoshoni – Uto-Aztecan [shh] (3 patterns)

①	Root-to-Word	→	Consonantal Features	[-voice]

Shoshoni has lexical roots which are vowel-final in isolation but trigger devoicing (in addition to regular phonological spirantization) on obstruents in following words, as can be seen in (168).

(168) *Shoshoni devoicing (and spirantization) (Crum & Dayley 1993:250)*

a.	kapːɨ	+	paʔa	→	kapːɨ̥ ɸaʔḁ	'on top of the pine cone'
b.	kapːɨ	+	tukːa	→	kapːɨ̥ θukːḁ	'under the pine cone'
c.	kapːɨ	+	kupːa	→	kapːɨ̥ xupːḁ	'in the pine cone'
	pine.cone		POSTP			

That this behavior is root-specific can be seen from minimal pairs of devoicing noun roots (169-a) with other vowel-final noun roots where spirantization applies to the same incorporating verb /paʔi/ 'have', but the intervocalic consonant is voiced (169-b).

(169) *Shoshoni spirantization with and without devoicing (Crum & Dayley 1993:251)*

a.	hai	+	paʔi	→	hai-ɸaʔi̥	'have an uncle/crow'
	siːpːɨ	+	paʔi	→	siːpːɨ-ɸaʔi̥	'have urine'
b.	kahni	+	paʔi	→	kahni-βaʔi̥	'have a house'
	tsoː	+	paʔi	→	coː-βaʔi̥	'have a grandparent'
	N		have			

(170) shows that the [-voice] feature of roots which trigger this alternation surfaces as the full segment [h] before sonorants.[14]

[14]The [-voice] feature remains inert before geminates and consonant clusters, which seem to be generally voiceless (Crum & Dayley 1993:251)

(170) *Shoshoni segmental realization of mutation feature (Crum & Dayley 1993:250)*

a.	kapːɨ	+	ma	→	kapːɨ̥	hma	‘with the pine cone’
b.	kapːɨ	+	ni	→	kapːɨ̥	hni	‘like a pine cone’
c.	kapːɨ	+	waʔih	→	kapːɨ̥	hwaʔi̥h	‘like a pine cone’
	pine.cone		POSTP				

③	Root-to-Affix	Root-to-Suffix	→	Length	Gemination
	~	~	~		
④	Root-to-Word	Root-to-Word	→		

Sapir (1930:111,142) shows that specific nouns and verbs in Shoshoni also trigger unpredictable gemination on following affixes or independent words. Thus the root /jaː/ ‘carry, take’ induces gemination on different following suffixes (171).

(171) *Root-to-Affix gemination in Shoshoni (Pycha 2008:150,Crum & Dayley 1993:253)*

jaː‘carry/take-SG’

jaː	+	-taipeh (COMPL)	→	jaː-	tːaipeh	‘taken completely’
jaː	+	-kan (STAT)	→	jaː-	kːan	‘hold’
jaː	+	-kin (here)	→	jaː-	kːin	‘bring here’
jaː	+	-kwantoʔin (going.to)	→	jaː-	kːwantoʔin	‘going to take away’

The noun /tua/ ‘son triggers gemination on following postpositions:

(172) *Root-to-Word gemination in Shoshoni (Crum & Dayley 1993:248+249)*

a.	kapːɨ	+	ma	→	tua	mːaʔai	‘with the son’
b.	tua	+	ni	→	tua	nːi	‘like a son’
c.	tua	+	kupːan	→	tua	kːupːan	‘in side the son’
	son		POSTP				

C.58 Supyire – Africa – Niger-Congo (Senufo) [spp] (3 patterns)

①	Affix-to-Word	Suffix-to-Word	→	Tone	Low	↜ Carlson (1994)

(see section 2.4 for data and discussion)

②	Root-to-Word	→	Tone	Low	↜ Carlson (1994)
	~	~			
③	Tautomorphemic Root	↻			

(see section 3.3 for data and discussion)

C.59 Tagalog – Papuanesia – Austronesian (Malayo-Polynesian) [tgl] (2 patterns)

①	Root-to-Affix	Root-to-Suffix	→	Stress	↜ Hagberg (2006)
	~	~	~		
②	Tautomorphemic Root	Tautomorphemic Root	↻		

Tagalog shows the mirror image of Mayo (appendix C.47). Roots determine whether stress is final or penultimate (173), a pattern which is preserved under suffixation, as shown in (174). Following Hagberg (2006), we assume that penultimate accent is the default pattern, and final accent is the effect of Root-to-Affix mutation alternating with tautomorphemic root mutation triggered by floating accent grid marks.

(173) *Lexical root stress in Tagalog (Hagberg 2006:176, French 1988)*

Penultimate Stress Roots			*Final Stress Roots*		
a.	pú:noʔ	'trunk of a tree'	d.	punóʔ	'full'
b.	bá:soh	'drinking glass'	e.	basóh	'target practice'
c.	bú:kas	'tomorrow'	f.	bukás	'open'

(174) *Root-to-Affix stress in Tagalog (Hagberg 2006:176, French 1988)*

Penultimate Stress Roots				
a.	ʔá:ral	'study'	ʔa rá:l-an	'place for studying'
b.	bá:sa	'read'	basá:-hin	'to read'
c.	pá:sok	'enter'	pa sú:k-an	'(someone) places (something) inside of X'
Final Stress Roots				
d.	dugóʔ	'blood'	dugu-án	'bloody'
e.	ʔupóʔ	'sit'	ʔupoʔ-án	'(someone) sits on X'
f.	bilíh	'to buy'	bilih-ín	'to buy X'

C.60 Tamil – Eurasia – Dravidian [tam] (1 pattern)

①	Affix-to-Affix ~ Affix-to-Root	Suffix-to-Suffix ~ Suffix-to-Root	→ ~ ←	Length	consonant gemination

(see section 2.3 for data and discussion)

C.61 Tauya – Papuanesia – Nuclear Trans New Guinea [tya] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Consonantal Features	[-continuant]

Tauya shows Root-to-Affix hardening. The initial /r/ of the topic suffix /-ra/ is plosivized to [t] after certain pronominal bases, as is shown in (175).

(175) *Tauya personal pronoun topic forms (MacDonald 2011:62)*

	1	2	3	'this (one)'	'that (one)'
sg.	ja-ra	na-ta	ne-ta	me-ta	ʔe-ra
pl.	se-ta	te-ta	ne-ta	——	

C.62 Tenyidie – Eurasia – Sino-Tibetan [njm] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Tone	high register	↜ Meyase (2020)

(see section 2.2 for data and discussion)

C.63 Tetsǫ́t'iné – Na-Dene (Athabaskan) [chp] (1 pattern)

①	Affix-to-Affix	Prefix-to-Prefix	←	Tone	High	↜ Jaker & Kiparsky (2020)

Jaker & Kiparsky (2020) describe and analyze in detail the tonal behavior of two conjugational markers in Tetsǫ́t'iné, /θe-/ and /ɲe-/, which trigger a H-tone on preceding prefixes with rhythmically and stratally conditioned alternations. (176) shows data for /θe-/ but the pattern for /ɲe-/ is mostly parallel. If the affix is preceded by two syllables, its High surfaces on the immediately preceding syllable (176-a), if preceded by three syllables, two syllables to the left (176-b). If only one syllable precedes, the H is deleted (176-c).

(176) *Tetsǫ́t'iné Affix-to-Affix H-tone (Jaker & Kiparsky 2020:630)*

Input	*Intermediate output*	*Surface*	
a. *Preceded by 2 syllables: left-adjacent association*			
/ʔede-^{H}(θ-ˈkáːr)/ REFL-CONJ-slap	(ʔe.ˈdé θ)(ˈkáːr)	(ʔe.ˈdéh)(ˈkáːr)	'he slapped himself'
/ʔede-^{H}(ˈθ-tsʼə́r)/ REFL-CONJ-scratch	(ʔe.ˈdé θ)(ˈtsʼə́r)	(ʔe.ˈdéh)(ˈtsʼə́r)	'he scratched himself'
/ʔede-^{H}(ˈθtθíː)/ REFL-CONJ-pinch	(ʔe.ˈdé θ)(ˈtθíː)	(ʔe.ˈdéh)(ˈtθíː)	'he pinched himself'
b. *Preceded by 3 syllables: left-association and shifting*			
/ʔede-he-^{H}(θ-ˈkáːr)/ REFL-S3PL-CONJ-slap	(ʔe.ˈdé)(heθ.ˈkáːr)	(ʔe.ˈdé)(heh.ˈkáːr)	'they slapped themselves'
/ʔede-he-^{H}(ˈθ-tsʼə́r)/ REFL-S3PL-CONJ-scratch	(ʔe.ˈdé)(heθ.ˈtsʼə́r)	(ʔe.ˈdé)(heh.ˈtsʼə́r)	'they scratched themselves'
/ʔede-he-^{H}(ˈθ-tθíː)/ REFL-S3PL-CONJ-pinch	(ʔeˈ.dé)(heθ.ˈtθíː)	(ʔeˈ.dé)(heh.ˈtθíː)	'they pinched themselves'
c. *Preceded by 1 syllable: H-deletion*			
/he-^{H}(θe -ˈkáːr)/ S3PL.CONJ-slap	(he.ˈθe)(ˈkáːr)	(ˈhee)(ˈkáːr)	'they slapped'
/he-^{H}(θe-ˈtsʼə́r)/ S3PL-CONJ-scratch	(he.ˈθe)(ˈtsʼə́r)	(ˈhee)(ˈtsʼə́r)	'they scratched'
/he-^{H}(θe-ˈgor)/ S3PL-CONJ-stab	(he.ˈθe)(ˈgor)	(ˈhee)(ˈgor)	'they stabbed'

Note that these data don't violate phonological locality of anticyclic mutation as formulated in section 5.3 since, as shown by Jaker & Kiparsky, the dislocation of the H-tone to a non-adjacent syllable follows from a general phonological process in the language, the attraction of H-tones to stressed syllables. See their paper for an analysis in terms of floating H's and further effects of stratal organization.

C.64 Tiriki – Africa – Niger-Congo (Bantu) [luy] (1 pattern)

①	Affix-to-Word	Prefix-to-Word	←	Tone	High	↜ Paster & Kim (2011)

(see section 2.4 for data and discussion)

C.65 Tlapanec – N America – Oto-Manguean [tcf] (1 pattern)

①	Affix-to-Root ~ Tautomorphemic Affix	Prefix-to-Root ~ Tautomorphemic Prefix	→ ~ ↻	Tone	Low	↜ Uchihara & Cano (2019)

(see section 3.3 for data and discussion)

C.66 Turkana – Africa – Eastern Sudanic (Eastern Nilotic) [tuv] (1 pattern)

①	Root-to-Affix	Root-to-Suffix	→	Vocalic Features	[+ATR]	↜ Noske (1996)

(see section 2.2 for data and discussion)

C.67 Urarina –South America – Isolate [urn] (4 patterns)

Root-to-Word	→	Tone	① High ② Low High Low ③ Low High ④ Low

In Urarina (Olawsky 2006), there are four classes of nouns which have different tonal mutation effects on following words such as verbs and adjectives (177). Under Olawsky's classification, type A nouns trigger an initial High on the target word, type B nouns a High on the second or third syllable (depending on the length of the word), type C a final High, and type D an all-Low pattern. Note that this difference in H-positioning is similar to the one triggered by word-internal affixes in Kuria.

(177) *Urarina phrasal tone (Olawsky 2006:128)*

Type A	*Initial High*	rà:nà	hérìà	'he wants the white-lipped peccary'
Type B	*Medial High*	òbànà	hèríà	'he wants the collared peccary'
Type C	*Final High*	rè:màè	hèrìá	'he wants the dog'
Type D	*All Low*	màkùsàjàrí	hèrìà	'he wants the pepper'
		N	want.3SG	

C.68 Uspanteko – N America – Mayan [usp] (1 pattern)

①	Affix-to-Affix ~ Affix-to-Root	Prefix-to-Prefix ~ Prefix-to-Root	← ~ →	Tone	High

Bennett & Henderson (2013) show that the Mayan language Uspanteko has a general nominal possessive head realized exclusively by a High Tone while specific phi-features of the possessor are marked by segmental prefixes (178). As all H's in the language, it shows up on the penultimate vocalic mora of the word (1sg here is [w-] before vowel-initial and [in-] before consonant-initial roots, Bennett & Henderson 2013:605).

(178) *Uspanteko Possessor High (Bennett & Henderson 2013:604)*

a. aqan 'leg'
b. w-__-áqan 'my leg'
c. aw-__-áqan 'your leg'
d. pix 'tomato'
e. ín-__-pix 'my tomato'
f. qá-__-pix 'our tomato'

That the H is independent from the pronominal prefixes is particularly clear from the fact that the same affixes are used in predicative constructions but *without* a concomitant High, as can be seen in (179).

(179) *Uspanteko: lack of High in predicative position (Bennett & Henderson 2013:604)*

a.	b.	c.
kar	ín-__-kar	in-kar
'fish'	'my fish'	'I am a fish'

In Bennett & Henderson's syntactic analysis, (but, as far as we can see, also in plausible lexicalist alternatives), the general Possessor morpheme is structurally inside the pronominal prefixes it licenses. Thus with monomoraic nouns where the Possessive High appears on the prefix, this instantiates anticyclic mutation (178-b-c). With longer nouns mutation cyclically affects the noun itself (178-e-f).

C.69 Welsh –Eurasia – Indoeuropean (Celtic) [cym] (2 patterns)

Root-to-Word	→	Consonantal Features	① lenition ② spirantisation	↜ Iosad (2012) and references cited there

(see section 2.5 for data and discussion)

C.70 Yoruba – Africa – Niger-Congo [yor] (1 pattern)

①	Root-to-Affix	Root-to-Prefix	←	Vocalic Features	[-ATR]	↜ Archangeli & Pulleyblank (1994)

In Yoruba, prefixes harmonize in [ATR] with the first vowel of their base, as shown in (180) with prefixes nominalizing verbs.

(180) *[ATR]-harmony in Yoruba (Archangeli & Pulleyblank 1989:188,210)*

Verb		**Nominalization**	
a. rò	'think'	è-rò	'thought'
b. rɔ́	'fabricate'	è-rɔ́	'machine'
c. tá	'shoot'	ɔ́-tá	'person who is a good shot'
d. kú	'die'	ò-kú	'corpse of a person'
e. pín	'come to an end'	ò-pín	'end/termination'

However, there is a handful of roots with an initial high [+ATR] vowel which render their prefixes [-ATR], illustrated in (181). Archangeli & Pulleyblank (1994) capture this by assuming a floating [-ATR] feature.

(181) *[-ATR]-Mutation in Yoruba (Archangeli & Pulleyblank 1994:148+149)*

Verb		**Nominalization**	
a. mú	'drink'	ɔ̀-mú	'drinker'
b. bí	'give birth to'	è̩-bí	'birth'
c. wù	'please person'	é̩-wù	'a pleasurable feeling'
d. rí	'exhibit a certain appearance'	è̩-rí	'evidence'

D Abbreviations

AFF	Affirmative
ASSOC	Associative marker
AUG	Augmentative
CONJ	Conjugation marker
CONT	Continuous
CLS	(Noun) class
COOR	Coordination
CRD	Cardinal
CURR.PST	Current past
DEC	Declension marker
DER	derivational affix
FV	Final vowel
HAB	Habitual
IPFV	Imperfective
INT	Intensive
IV	Initial vowel
INV	Inverse
MAL	Malefactive
MOD	Modal
NEVP	nonevidential past
O	Object
OBV	Obviative
PART	Particle
POSTP	Postposition
PF	Prefinal
RPST	Remote past
RTCL	Root clause
S	Subject
SPST	Simple past
SUBORD	subordinator
TNS	Tense
UW.PST	Unwitnessed past
VBLZ	Verbalizer
√	lexical root
Ø	(in glosses) epenthetic material

E References (for the Appendix)

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