

## Cyclic rule application

One example of rule cyclicity in Icelandic is provided in the general discussion of cyclicity; here, additional cases are discussed.

### Odawa (Kaye and Piggott 1973)

Cyclicity in Odawa involves the following rule:

#### *T-Palatalization*

$t \rightarrow \check{c} / \_ +i$       a sibilant in the next syllable blocks the rule

A following strident (sibilant) consonant prevents palatalization — this condition cannot be easily formalised in the standard notation so it is expressed by a verbal condition. Examples of palatalization are seen in the following data, with the alternating consonant being underlined>.

pimā <u>t</u> isi	‘to live’	pēmā <u>t</u> isi <u>t</u>	‘he who lives’
pēmā <u>t</u> isi <u>č</u> -ik	‘they who live’		
oših <u>t</u> -ōn	‘build inanimate obj.’	oših <u>č</u> -ikē	‘build unspecified obj.’
ki <u>t</u> -āšikā	‘pour out’	ki <u>č</u> -ihkon	‘cut out inanimate obj.’

In the following examples, stem final /t/ becomes  $\check{c}$  before *i*, as long as the triggering vowel isn't followed by *s*.

kākī <u>č</u> -inin <u>č</u>	‘have a sore hand’	kākī <u>č</u> -ipwāmē	‘have a sore thigh’
kākī <u>t</u> -isitē	‘have a sore foot’	kākī <u>t</u> -isi	‘be sore’
āpa <u>č</u> -ih	‘put s.t. to use’	āpa <u>t</u> -isi	‘be useful’
kān <u>č</u> -ipin	‘push s.o. by hand’	kān <u>t</u> -ih sah	‘urge s.o. on’

A rule which interacts with palatalization is Final Lax Vowel Deletion, which deletes any word-final lax vowel (tense vowels are marked with a macron, so vowels without a macron are lax).

#### *Final Lax Vowel Deletion*

V  
[-tns]  $\rightarrow \emptyset / \_ \#$

Various stems underlyingly end in a lax vowel, which is deleted unless a suffix follows

nipakiso	$\rightarrow$	nipakis	‘I swim’
nipakiso+min	$\rightarrow$	nipakisomin	‘we (excl.) swim’
kipakiso	$\rightarrow$	kipakis	‘you (sg.) swim’
kipakiso+m	$\rightarrow$	kipakisom	‘you (pl.) swim’

niwīhsini	→	niwīhsin	‘I eat’
niwīhsini+min	→	niwīhsinimin	‘we (excl.) eat’
kiwīhsini	→	kiwīhsin	‘you (sg.) eat’
kiwīhsini+m	→	kiwīhsinim	‘you (pl.) eat’

Now we consider the cyclic application of palatalization in [pēmātisit], where only final lax vowel deletion is applicable.

[ [ [ pēm [ ātis+i ] ] t ] i	‘he who lives’
ātis+i	Cycle 1
NA	FLVD
NA	T-Pal
pēm ātisi	Cycle 2
pēmātisi t	Cycle 3
pēmātisit i	Cycle 4
pēmātisit	FLVD
NA	T-Pal
[pēmātisit]	

There are various reasons why *t* of the root does not palatalized: the rule is stated to require the triggering vowel to be separated from *t* by a morpheme boundary; the Strict Cycle Condition (see below) would not allow the rule to apply since this is not a derived environment; the consonant is followed by a sibilate. The reason why the final /t+i/ sequence does not undergo palatalization is that final lax vowel deletion first deletes the triggering vowel, depriving palatalization of the required context.

The following derivation shows an instance where palatalization *precedes* final lax vowel deletion, involving a lexical affix (‘by cold’) plus the animate intransitive suffix *-i* which are concatenated earlier in the derivation

[ ni [ miškaw [ at + i ] ] ]	‘I am frozen’
at i	Cycle 1
NA	FLVD
ač i	T-pal
miškaw ači	Cycle 2
ni miškawači	Cycle 3
ni miškawač	FLVD
NA	T-Pal
[ni miškawač]	

Here, the combination /t+i/ arises on the first cycle: palatalization this applies. After prefixes are added, we arrive at the word level where the final vowel is in the required context for deletion (it

is visibly “word-final” only on the last cycle when it can be seen that there is no further material in the word. Note then that the /i/ which triggered palatalization is deleted — thus Palatalization precedes FLVD and FLVD precedes Palatalization. Cf. [ miškaw [ at + n ] ] → *miškawatin* ‘it is frozen’ via epenthesis, for evidence that the final consonant of /at/ is *t* and not *č*.

The sibilant blocking condition can be seen in the next two derivations. When the triggering vowel and blocking sibilant are contained in the same morpheme, there is no palatalization.

[ [ [ kākīt ] isi ] w ]	‘be sore’
kākīt	Cycle 1
kākit isi	Cycle 2
NA - sibilant effect	T-Pal
kākītisi w	Cycle 4
[kākītisi]	(other rules)

This follows from the fact that when the rule sees the following *i*, it also sees the following *s*. On the other hand, if the sibilant is in a separate following morpheme from the triggering vowel, it has no effect on palatalization.

[ [ [ akat + i ] ški ] w ]	‘be naturally shy’
akat i	Cycle 1
akač i	T-pal
akači ški	Cycle 2
akačiški w	Cycle 3
akačiški	(other rules)

Cf. *akat-ěntam* ‘be ashamed’ for evidence that the consonant is /t/. The combination of /t+i/ arises on the first cycle, whereas the sibilant which would block palatalization would only be visible on the second cycle.

## Kimatuumbi

Cyclic application can also be demonstrated for the Glide Formation rule of Kimatuumbi. In this language, high vowels become glides before other vowels, triggering the compensatory lengthening of the following vowel. (In these data, <ᵢ> and <ᵤ> represent tense or higher high vowels, and <i, u> represent lax or lower high vowels). Basic alternations motivating this rule are seen below involving the noun class prefix /kᵢ/.

kᵢ-líbé	‘thing’	/kᵢ-úlá/ → kyuúlá	‘frog’
ka-úlá	‘small frog’		
kᵢ-ᵤᵤndó → ky-ᵤᵤndó	‘knot’		
ma-ᵤᵤndó	‘large knots’		

The stem /úlá/ has a initial short vowel, as shown by [kaúlá] where glide formation does not apply. The examples *ky-úundó*, *ma-úundó* show that compensatory lengthening is a neutralizing process — there are underlying long vowels in the same position.

There are some complications in the application of glide formation to consider. First, the rule is optional if the target vowel is preceded by another syllable. Thus *ku-tu-ákya* optionally becomes *ku-tw-aákya* ‘to hunt for us’, since a syllable precedes /u-á/. Second, glide formation does not apply to a long vowel, cf. *muu-áte* ‘in the banana hands’. Third, in a three-vowel sequence with high vowels in the first two syllables, Glide Formation applies to the leftmost of these vowels. This renders the following vowel (*i*) long, which prevents that vowel from undergoing Glide Formation. Thus /mɔ-ɨ-uté/ surfaces as [mwɨjɨtɛ́] ‘you should pull them (Cl. 9)’: Glide Formation affects the leftmost visible syllable, /mɔ/ and since no syllable precedes it, the rule applies obligatorily. That generates the surface form [mwɨjɨtɛ́] (which is only transcriptionally different from [mwɨ:utɛ́]), and the derived long vowel, which is prevocalic, cannot undergo Glide Formation. Compare this with /ba-ɨ-uté/ which surfaces either as [baɨtɛ́] ‘they should pull them (Cl. 9)’ since Glide Formation is optional if a noninitial syllable is scanned, or [bayɨtɛ́] if the rule does apply.

The morphological structure of the word is relevant to determining how Glide Formation applies. The locative form [mɔyuúlá] ‘in the frogs’ derives from /mɔ-ɨ-úlá/, where -úlá is the root ‘frog’, -ɨ- is the lexical noun class prefix (conveying plurality), and /mɔ-/ is the locative prefix. In terms of relevant segmental makeup, this form is analogous to /mɔ-ɨ-uté/ which surfaces as [mwɨjɨtɛ́]. The question is then why we do not find \*[mwɨjɨúlá]. The answer resides in the different morphological structures of the words. The word [mɔyuúlá] ‘in the frogs’ derives from the word /ɨ-úlá/ → [yuúlá] ‘frogs’ by a word-formation process that adds a locative prefix to a word, and creates another word. On the other hand, \*ɨ-uté/ is not a well-formed word (except insofar as it is a rather *different* word [yɨtɛ́] ‘it (cl. 9) should pull’). Verbs in the language require a subject prefix to be complete, thus /ɨ-uté/ is morphosyntactically incomplete — whereas /ɨ-úlá/ is complete. The morphology provides a basis for establishing domains of cycling, where in Kituumbi, a word must be well-formed in order to constitute a cyclic domain. Accordingly, Glide Formation applies cyclically to derive [mɔyuúlá] as follows.

[ mɔ [ ɨ - úlá ]]	
ɨ - úlá	Cycle 1
yuúlá	Glide Formation
mu yuúlá	Cycle 2
NA	Glide Formation

The reason why Glide Formation applied obligatorily to the medial vowel is that on the cycle where the class prefix and root are combined, no syllable precedes it, and the leftmost prevocalic high vowel is that in /ɨ/.

A similar example which focuses on the optionality condition, is the form /aalɔ́andjike/ which optionally becomes [aalwáandjike] ‘he wrote it’, contrasted with /pa-lɔ-áanjú/ which obligatorily becomes palwáanjú ‘at the firewood’. In the former example, the verb is not well-formed until it has a subject prefix, which is the initial morpheme in the string. Therefore, one cyclic domain is defined for this word, and all phonological material is visible when Glide Formation applies.

a a lʊ aandjʃke  
 3SG SUBJ PAST Cl. 11 OBJ wrote

[ a a lʊ aandjʃke ]

a a lʊ aandjʃke                      Cycle 2  
 a a lʊ aandjʃke ~                      Glide Formation (optional)  
 a a lw aandjʃke

In comparison, the locative *palwáanjú* is based on the well-formed word [lwáanjú] ‘firewood’. Two cyclic domains are rule defined.

\*pa-lʊ-áanjú → (oblig) palwáanjú                      ‘at the firewood’

pa lʊ áanjú  
 LOC Cl 11 firewood

[ pa [ lʊ-áanjú ] ]

lʊ-áanjú                      Cycle 2  
 lw áanjú                      Glide Formation (condition for optionality not visible)

pa lwáanjú                      Cycle 3

### Palestinian Arabic (Brame 1972)

A classic argument for the cycle derives from the interaction of stress and epenthesis in Palestinian Arabic. In this language, stress is assigned to the rightmost heavy syllable, with the proviso that a single consonant at the end of a word is ignored. The 1s perfect subject suffix is underlyingly /t/, which results in a final underlying consonant cluster, which is split up on the surface by insertion of *i*.<sup>1</sup>

kátab	‘he wrote’	kátab-at	‘she wrote’
katáb-na	‘we wrote’	katáb-tu	‘you pl. wrote’
katáb-(i)t	‘I wrote’		

A similar pattern of stress and epenthesis is found in the stem /fihim/, which presents a further rule of Apocope that deletes an unstressed high vowel in an open syllable.

fíhim	‘he understood’	fíhmat	‘she understood’
fhímna	‘we understood’	fhímtu	‘you pl. understood’
fhímit	‘I understood’		

<sup>1</sup> There are a number of other arguments that this suffix is /t/, not /it/, because it behaves like a consonant-initial affix with respect to rules such as shortening of long vowels in hollow stems and insertion of *i*: in lame stems.

There are certain clitics which are added to the end of a verb, illustrated below, which includes the object clitic *-na* ‘1pl object’ and the negative suffix *-š*.

ḡárab	‘he beat’	ḡárabat	‘she beat’
ḡarábna	‘he beat us’	ḡarabátna	‘she beat us’
ḡarábiš	‘he didn’t beat’	ḡarábatiš	‘she didn’t beat’

Like the 1sg subject suffix, an epenthetic vowel is inserted before the negative suffix /š/.

The following examples from the root /fihim/ pose a problem: notice that the (underlined) unstressed high vowels in the root-initial open syllable below are not deleted.

fíhim	‘he understood’	fíhmat	‘she understood’
<u>fí</u> hímna	‘he understood us’	fíhmátna	‘she understood us’
<u>fí</u> hímiš	‘he didn’t understand’	fíhmatiš	‘she didn’t understand’

This is explained by cyclic application of stress. The word *fíhímna* is composed of *fíhim* plus the object clitic *-na*. Under the cyclic hypothesis, the word *fíhim* is first derived, then the affix *-na* is added. This results in a reassignment of stress to the penultimate syllable; the pre-existing stress on the first vowel prevents it from being deleted. The form *fhímna* ‘we understood’, on the other hand, is not compositionally derived from ‘he understood’ plus ‘us’, i.e. as with Kimatuumbi, the verb is not well-formed until it has a subject inflection. Similarly, *fíhímiš* derives from combining the fully-formed word *fíhim* plus *-š*.