# On iterative infixation

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## Ludlings

- Language games and disguises (also known as ludlings) may come in various different forms.
- Bagemihl (1988) identifies three types of ludlings in the world's language: templatic, reversing, and infixing.

## Infixing ludlings

- The insertion of a fully or partially specified sequence of segments into the string of some source forms.

## Non-iterative infixing ludling

Estonian word game (Lehiste, 1985)

| | | | |
|---|---|---|---|
| a. | saɑ̯a | saˈpiɑ̯a | 'Q1, hundred' |
| b. | laulus | laˈpiulus | 'Q2, in the song inessive sg.' |
| | seadus | seˈpiaɑ̯us | 'Q3, law, nom. s.g.' |
| | kauɯ̯a | kaˈpiuɯ̯a | 'Q2, for a long time, adv.' |
| | haige | haˈpiːge | 'Q3, sick, nom. sg.' |
| | maiɰ̯as | maˈpiːɰ̯as | 'Q2, fond of sweets, nom. sg.' |

## Iterative infixing ludling

Tigrinya (Bagemihl, 1988)

| Natural Lg | Play Lg 1 | Play Lg 2 | |
|---|---|---|---|
| s'ähifu | s'ägähigifugu | s'ägähigifugu | 'he wrote' |
| bïč'a | bïgïč'aga | bïgïč'aga | 'yellow' |
| ʔintay | ʔigïntagay | ʔigïnïgitagayigï | 'what' |
| k'arma | k'agarmaga | k'agarigïmaga | 'gnat' |

## Goals

- To provide a general theory of iterative infixation, particularly within a non-derivational declarative framework.
- Case study: *hábà*~*ʔábà* iterative infixal ludling in Hausa

## Diversity of iterative infixes

| | | | |
|---|---|---|---|
| a. | Cuna | *ottukkuar sunmakke* | -ppV- |
| | merki 'American' | ⇒ | me**pper**ki**ppi** |
| | perkwaple 'all' | ⇒ | pe**pper**kwa**ppa**ple**ppe** |
| | pia 'where' | ⇒ | pi**ppia**ppa |
| | ua 'fish' | ⇒ | u**ppua**ppa |
| b. | Greek (Cyprus) | | -kVkVrdVrVkVkV- |
| | alékos 'Alec' | ⇒ | a**kakárdarakaká**le**kekérderekeké**kos**kokórdoroskokó**s |
| c. | Latvian | | -hVlefVC- |
| | erschlug | | er**herlefe**schlug**huglefug** |
| | Abel | | a**halefabel**hellefel |

## Hausa iterative ludlings (Alidou 1997)

| | | *hábà ʔábà* | |
|---|---|---|---|
| a. | gidaa | gi**bì**da | 'house' |
| | màskii | má**bà**skii | 'oily' |
| | màimúnà | mái**bà**imú**bù**ná | 'Maimuna (name)' |
| | hátsíi | há**bà**tsí | 'millet' |
| | tàabármáa | tá**bà**bá**bà**rmá | 'mat' |
| b. | *ʔásàdásà* | | |
| | nóonòo | nó**sò**nó**sò** | 'milk' |
| | sàndáa | sán**sà**dá**sà** | 'stick' |
| | kwáryáa | kwár**sà**yá**sà** | 'calabash' |
| | bíngèl | bín**sì**gél**sè** | 'personal name' |

## Hausa iterative ludlings

| | | | |
|---|---|---|---|
| a. | -gVdV- | | |
| | kàasúwáa 'market' | ⇒ | kà**gà**dà**sú**gú**dú**wá**a** |
| | búuláalàa 'whip' | ⇒ | bù**gù**dù**lá**gá**dá**là**a** |
| | tàakàlmíi 'shoe' | ⇒ | tà**gà**dà**ká**gá**dá**lmí**i** |
| | màimúnàa 'person name' | ⇒ | mà**gà**dà**i**mú**gú**dú**n**à**a** |
| b. | -ʔVsVdV- | | - |
| | ráabìyáa 'personal name' | ⇒ | rà**a**ʔà**sà**dà**a**bí**i**ʔí**sí**dí**i**yà**a** |
| | kàasúwáa 'market' | ⇒ | kà**a**ʔà**sà**dà**sú**u**ʔú**sú**dú**wá**a** |

## Main points of interests

- What is the input to iterative infixation?
- What determines the location of the infix?

## Approaches to infixation

- Phonological readjustment
  Infixes are "defective" adfixes (i.e. prefixes and suffixes), and that their underlying prefixing or suffixing nature is obscured by synchronically motivated (morpho-)phonological factors (e.g., Halle, 2001; McCarthy and Prince, 1993; Moravcsik, 1977; Prince and Smolensky, 1993).
- Phonological subcategorization
  Infixation is a matter of the morpho-phonological mismatch that occurs when an affix subcategorizes for a phonological element, rather than a morphological one (e.g., Broselow and McCarthy, 1983/1984; Inkelas, 1990; Kiparsky, 1986; McCarthy and Prince, 1986; Paster, 2006; Yu, 2003; Yu, To appear).

## Infixation as phonological readjustment

- *Transformational approaches* (Halle, 2001; Moravcsik, 1977)

  Infixation as a morphological process does not exist. Apparent infixation is the outcome of transformational phonological operations on morphosyntactically well-formed strings.
- Affix displacement (e.g., McCarthy and Prince, 1993; Prince and Smolensky, 1993)

  Infixes do not exist. Apparent infixation results when an adposition affix is "pushed" away from the edges to avoid phonotactic or morphotactic violations.

## Phonological readjustment vs. Iterative infixation

- What is the input to iterative infixation?

  Not clear. Presumably, the number of affixes must be stipulated.

- What determines the location of the infix?

  Not clear. Since this type of edge avoidance approach presupposes that all infixes are underlyingly adpositional, it should predict infix-stacking.
  (e.g., /gV-, gV-, k'arma/ → *ʔk'a-ga-ga-rma*)

## Infixation as edge misalignment (Yu 2003, To appear)

- Infixation is a by-product of Phonological Subcategorization (e.g., Broselow and McCarthy, 1983/1984; Inkelas, 1990; Kiparsky, 1986; McCarthy and Prince, 1986; Paster, 2006; Yu, 2003; Yu, To appear).
- Subcategorization requirements are stated in the formalism of Generalized Alignment (GA, McCarthy and Prince 1993a: 80).
  Unlike the traditional formulation of GA, the set of PCat includes units on the CV skeletal tier as well as categories within the Prosodic Hierarchy including the mora.

Align ($Cat_1$, $Edge_1$, $Cat_2$, $Edge_2$) $=_{def}$
$\forall$ $Cat_1$ $\exists$ $Cat_2$ such that $Edge_1$ of $Cat_1$ and $Edge_2$ of $Cat_2$ coincide.
Where $Cat_1$, $Cat_2 \in$ PCat $\cup$ GCat
$Edge_1$, $Edge_2 \in$ {Right, Left}

## Pivot Theory

(Yu, 2003; Yu, To appear; see also Fitzpatrick, 2006; Fitzpatrick, To appear; Paster, 2006)

| ***Edge pivots*** | ***Prominence pivots*** |
|---|---|
| First consonant | Stressed foot |
| First vowel | Stressed syllable |
| (First syllable) | Stressed vowel |
| Final syllable | |
| Final vowel | |
| (Final consonant) | |

- Phonological Subcategorization obtains when a designated edge of a morphological constituent (Cat1) coincide with a designated edge of a phonological pivot (Cat2).

## What is infixation?

- The subcategorization frame of an infix is formally no different from regular prefixes and suffixes.
- Infixation obtains when two conditions are satisfied:
  - (i) when the domain of affixation, be it the root, the stem or the word, is larger than the size of the phonological constituent, i.e. the pivot, subcategorized by the affix
  - (ii) when the language tolerates morpheme interruptions.

## What is iterative infixation?

- Iterative infixation is fundamentally no different from the treatment of grammatical infixation.
- All infixes are associated with some phonological subcategorization requirement.
- Unlike grammatical infixes, the co-phonology of iterative infixation requires its output to conform to certain rhythmic/prosodic requirements (cf. Pinheiros, 1998; see also Broselow & McCarthy 1982/3).
- The appearance of multiple infixes in the output is the result of compensatory reduplication as a means to satisfy certain construction-specific rhythmic/prosodic requirements.

## Hausa *hábà ʔábà* game

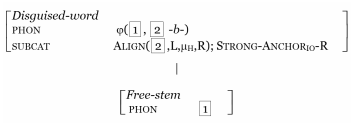
A case study

# Hausa *hábà ʔábà* game

| | | |
|---|---|---|
| gidaa | gibìda | 'house' |
| màskíi | mábàskí | 'oily' |
| màimúnà | máibàimúbùná | 'Maimuna (name)' |
| hátsíi | hábàtsí | 'millet' |
| tàabármáa | tábàbábàrmá | 'mat' |

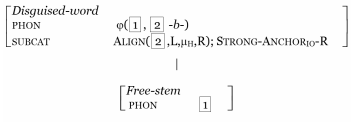
- Add *-bV-* after each CV of the word except the last.
- All long monophthongs are shorten, including the last.
- An alternating high-low tone pattern is imposed with the assignment of high tone to the syllable of the source word while the inserted *-bV-* carries a low tone.

# Phonological Subcategorization in Sign-Based Morphology



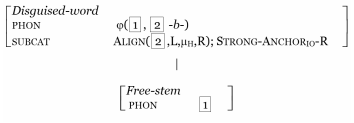

- The present theory of Phonological Subcategorization is couched within the larger framework of Sign-Based Morphology (SBM: Orgun, 1996; 1998; 1999; Orgun & Inkelas, 2002).
- SBM is a declarative, non-derivational theory of the morphology-phonology interface which utilizes the basic tools one finds in any constituent structure-based unificational approach to linguistics (e.g., Construction Grammar (Fillmore & Kay, 1994) and HPSG (Pollard & Sag, 1994).

# Phonological Subcategorization in SBM




- It assumes that terminal and non-terminal nodes bear features and that non-terminal nodes also include phonological information along with the usual syntactic and semantic information (e.g., co-phonology (Inkelas, 1998; Inkelas, Orgun, & Zoll, 1997; Inkelas & Zoll, 2005; Orgun, 1995, 1999; Orgun & Inkelas, 2002; Yu, 2003); and similar co-phonological approaches (Antilla, 1997, 2002; To appear; Kiparsky, 2000).
- Affixes are represented as fixed arguments to the phonological function (i.e., the φ-function), specified in affixational constructions.

# Phonological Subcategorization in SBM




- Phonological Subcategorization, when implemented properly in SBM, provides a restrictive account of the morphology-phonology interface.
- In particular, the phonological function is strictly evaluative; it interprets the phonological exponents of a morpheme in accordance to the phonotactics of the language, but does not alter the morph's underlying distributional restriction.
- The categorical nature of subcategorization constraints follows naturally from the declarative nature of a sign-based grammar.

# An overview of the analysis

- The infix is *-b-*, which is left-subcategorizing for a head mora of a foot (i.e., Align(*-b-*,L,$\mu_{HEAD}$,R)).
- The *hábà ʔábà* game imposes the following prosodic well-formedness restrictions on the transformed words.
  - Outputs of the *hábà ʔábà* game must be parsed into disyllabic trochaic tonal feet.
  - Since the head of a tonal foot in Hausa must carry a high tone (cf. Leben, 2001), syllables inherited from the source words are invariably associated with a high tone on the surface, while the inserted *-bV-*, which always occupied the weak position of a tonal foot, always carries a low tone.
- The *V* in *-bV-* is epenthesized via the mechanism of compensatory reduplication in order satisfy a FootBinarity requirement (Bissell, 2002; Goad, 2001; Inkelas, 2005; Inkelas & Zoll, 2005; Kawu, 2000; Nelson, 2003; Rose, 1997; Yu, 2004, 2005b; Zuraw, 2002).

# An overview of the analysis

- The multiple copies of *-bV-* in the transformed output is also the result of compensatory reduplication,
- Since a source syllable must serve as the head of a foot and since a foot must be binary, *-bV-* is copied to serve as the weak syllable of a binary foot.

## Constraints on foot parsing

Anchor(σ)L

The leftmost element of a syllable in the source form corresponds to the leftmost element of a foot in the output.

Anchor(σ)R

The rightmost element of a syllable in the source form corresponds to the rightmost element of a foot in the output.

FootBinarity

All feet are binary at the syllabic level.

Parse-σ

Every syllable must be footed.

*VV

Long vowels are penalized.

## Source word: *màs.kíi* 'oily'

| | | *VV | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|---|
| F a. | (mábàs)kí | | | * | | *! |
| b. | (mábàs)kíi | * | | | | |
| c. | má(bàskí) | | | **! | | * |
| d. | (másbà)kí | | | * | *! | * |
| e. | (mábàs)(kí) | | *! | | | |

Note: Inputs to word games are assumed to be well-formed words, i.e., syllabified (cf. Piñeros 1998).

## Why so many -*bV*-?

| | *mài.mú.nà* | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|
| F a. | (mái.bài.)(mú.bù)ná | | | | * |
| b. | (mái.bài.)(mú.ná) | | * | *! | |
| c. | mái.(mú.bù.)ná | | | | **! |
| d. | (mái.bài.)(mú.)(ná) | *!* | | | |

- In order to maximize the number of footed syllables, every non-final syllable may serve as the head a foot.
- Candidates with more than one unparsed syllable are automatically ruled out by the excessive violations of Parse-σ relative to the winning candidate.

## Why so many -*bV*-?

| | *mài.mú.nà* | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|
| F a. | (mái.bài.)(mú.bù)ná | | | | * |
| b. | (mái.bài.)(mú.ná) | | * | *! | |
| c. | mái.(mú.bù.)ná | | | | **! |
| d. | (mái.bài.)(mú.)(ná) | *!* | | | |

- Since FootBinarity is undominated, an input syllable cannot form its own foot.
- Disyllabic feet are made possible via the duplication of the nucleus of the source syllable. (The infix *-b-* is duplicated to supply an onset for the inserted nucleus. More soon.)

## Why so many -*bV*-?

| | *mài.mú.nà* | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|
| F a. | (mái.bài.)(mú.bù)ná | | | | * |
| b. | (mái.bài.)(mú.ná) | | * | *! | |
| c. | mái.(mú.bù.)ná | | | | **! |
| d. | (mái.bài.)(mú.)(ná) | *!* | | | |

- The expansion is not motivated by the subcategorization requirement of *-b- per se*.
- The morphological realization requirement of *-b-* is fulfilled as soon as there is one instantiation of *-b-* in the output.

## Why so many -*bV*-?

| | *mài.mú.nà* | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|
| F a. | (mái.bài.)(mú.bù)ná | | | | * |
| b. | (mái.bài.)(mú.ná) | | * | *! | |
| c. | mái.(mú.bù.)ná | | | | **! |
| d. | (mái.bài.)(mú.)(ná) | *!* | | | |

- Nothing in the construction requires that *-b-* to be present after every head mora.
- However, when it does appear in the output, every instance of *-b-* is subject to the same subcategorization requirement.

## Why compensatory reduplication?

| | | Dep-Seg | Integrity |
|---|---|---|---|
| F a. | (máibài)(múbù)ná | | **** |
| b. | (máibài)(mú?a)ná | *!* | ** |
| D c. | (máibài)(mɻúmɻù)ná | | **** |

- Expansion via non-reduplicative epenthesis is ruled out due to the high ranking of DepIO.
- What remains unclear is why candidates like *C* are impossible.

## Why compensatory reduplication?

| | | Dep-Seg | Integrity |
|---|---|---|---|
| F a. | (máibài)(múbù)ná | | **** |
| b. | (máibài)(mú?a)ná | *!* | ** |
| D c. | (máibài)(mɻúmɻù)ná | | **** |

- The disguised word construction imposes no requirement of iterative insertion of *-b-*.
- As long as *-b-* is properly realized somewhere in the output, why shouldn't foot expansion elsewhere in the transformed word be realized through the full copying?
- This is especially curious since the rhyme of the inserted syllable is a direct copy of the rhyme of the preceding syllable anyway; it seems to be a natural step to copy the onset consonant as well.

## S-Anchor to the rescue

S-Anchor(σ)L (cf. Ussishkin, 1999)

$\forall x, y, [(x = \text{Edge}(\sigma_F, L)) \& (x \mathrel{R} y)] \rightarrow [y = \text{Edge}(\Sigma_\sigma, L)]$

'If the leftmost element of an input syllable corresponds with the leftmost element of a foot in the output, the corresponding output element must be unique.'

- The idea behind Strong-Anchor is that relations between Strong-Anchor-ed segments must be unique. That is, no segments regulated by Strong-Anchor can have exponents elsewhere in the output.
- While Strong-Anchor mimics the effect of Integrity, it is more restrictive than Integrity since Strong-Anchor localizes its ban to just segmental fission.

## S-Anchor to the rescue

| | | Dep-Seg | S-Anchor(σ)L | Integrity |
|---|---|---|---|---|
| F a. | (máibɻài)(múbɻù)ná | | | **** |
| b. | (máibɻài)(mɻúmɻù)ná | | *! | **** |

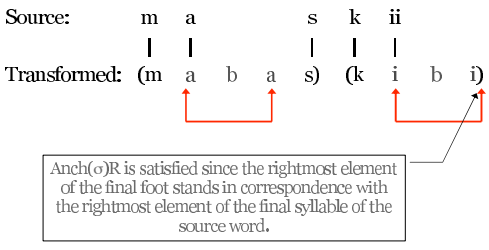
- Onset copying is prevented due to S-Anchor(σ)L.
- This constraint states that if the leftmost element of an input syllable corresponds with the leftmost element of a foot in the output, the corresponding output element must be unique.

## Why not-*bV*- word-finally?

| | | *VV | FtBin | Anch(σ)L | Anch(σ)R | Parse |
|---|---|---|---|---|---|---|
| F a. | (mábàs)kí | | | * | | *! |
| D b. | (mábàs)(kíhì) | | | | | |

- Candidate *b* satisfies Anch(σ)R since the rightmost segment of this candidate (i.e., the nucleus of the inserted *-bV-*) stands in correspondence with the rightmost segment of the source word.
- This correspondence relation is licensed by the fact that the nucleus of the inserted -bV- is epenthesized via the mechanism of compensatory reduplication.

## Schematic representation



## Hausa iterative ludlings

| | *hábà*ʔ*ábà* | | |
|---|---|---|---|
| a. | gidaa | gìbìda | 'house' |
| | màskíi | mábàskíi | 'oily' |
| | màimúnà | máibàimúbùná | 'Maimuna (name)' |
| | hátsíi | hábàtsí | 'millet' |
| | tàabármáa | tábàbábàrmá | 'mat' |
| b. | ʔásàdásà | | |
| | nóonòo | nósònósò | 'milk' |
| | sàndáa | sánsàdásà | 'stick' |
| | kwáryáa | kwársàyásà | 'calabash' |
| | bíngèl | bínsìgélsè | 'personal name' |

Non-finality is a ludling specific phenomenon

## Non-finality

Strong-Anchor$_{IO}$-R

$\forall x, y, [(x = Edge(S_1, R)) \& (x \mathrel{R} y)] \rightarrow [y = Edge(S_2, R)]$

'No internal correspondence of input-right-edge element'

| | SAnchor$_{IO}$-R |
|---|---|
| ☞ a. (mábàs)kí | |
| b. (mábàs)(kíbì) | * |

- Since non-finality is an intrinsic property of the *hábà*ʔ*ábà* game, the Strong-Anchor requirement is stated as part of the declarative component of the construction.

## Schematic representation

| Source: | m | ai | | | m | u | | | n | a |
|---|---|---|---|---|---|---|---|---|---|---|
| | \| | \| | | | \| | \| | | | \| | \| |
| Transformed: | (m | ai | b | ai) | (m | u | b | u) | n | a |

## Discussion

- The treatment of iterative infixing ludling is, at its core, no different from treatments of other phonological affixes.
- The infix in question is subcategorizing for a phonological pivot.
- The multiple appearances of an infix in the output are the by-product of other prosodic requirements independently imposed by the ludling game.
- Iterative infixation is the result of compensatory reduplication.

## Some speculations

- Iterativity is impossible as a stand-alone feature of any linguistic phenomenon unmotivated by prosodic or rhythmic factors.
- Rhythmicity may be a strategy to reduce the cognitive burden of processing disguised words in infixing ludling.
- This proposal is motivated by the observation that iterative ludling infixation appears to correlate with a reduction of phonological complexity.
- Outputs of iterative infixing ludling often carry less contrastive information than their source word counterparts.

## Some speculations

- For example, the Hausa *hábà*ʔ*ábà* game not only requires the insertion of *-bV-* after the nucleus of each non-final syllable in the source word, long monophthongal vowels in the source word are also shortened as a result of infixing ludling.
- The vowel length contrast in Hausa is suspended in the transformed word.
- More important is the fact that the tonal pattern of the source word is ignored in favor of an alternating high-low tone pattern such that the high tones always fall on syllables of the source word.
- Contrastive tonal information in the source words is therefore suspended as well in favor of a predictable alternating tone pattern.

## Some speculations

- The dispreference for direct onset copying might also be a reflection of this facilitative disposition of iterative infixing ludling.
- If the inserted syllable is a full copy of its preceding syllable, recovery of the source word might be hindered by the need to factor out duplicated materials at every turn.
- The insertion of a fixed consonant provides a level of contrast between the inherited source word materials and the extraneous inserted materials.
- In particular, the inserted consonant functions as the onset. It not only demarcates the boundary of the inserted syllable, but it might also serve as an invitation to the listener to ignore the content of that syllable.

## Some speculations

- This type of complexity reduction is characteristic of iterative infixing ludlings only, not of infixing ludlings in general.
- Complexity reduction might be a strategy to reduce the processing costs of severely disguised words.
- Obviously, this claim about the complexity reduction aspect of iterative infixing ludling must be tested against a larger corpus of iterative infixing ludling games.

## Thank you for listening

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