# Surface-to-Surface Correspondence and Emergent Reduplication in a Tigrinya Language Game

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## 1. Introduction

(1) Language games have been documented for a variety of languages and cultures (Pound 1964, Laycock 1972, Bagemihl 1988, Botne and Davis 2000).

- *Ludlings* are a particular type of language game (term coined by Laycock 1972).
  - Ludling and natural language have identical lexicons.
  - Encryption rules can be defined that convert natural language forms into ludling forms.
  - Natural language outputs (NLOs) influence ludling outputs.
    - NLOs may serve as inputs to ludling formation (Laycock 1972: 61; Piñeros 1998; Ito et al. 1996)
    - We propose both NLOs and URs are in correspondence with ludling outputs.

(2) data of analysis: two ludlings of Tigrinya (Afro-Asiatic, South Semitic language spoken primarily in Eritrea; ludling data from Bagemihl 1987, 1988)[1]

| | NLO | LUD1 | LUD2 | |
|---|---|---|---|---|
| CVCV | bɨtʃ'a | bɨgɨtʃ'agɨa | bɨgɨtʃ'agɨa | *yellow* |
| CVC | ʃɨm | ʃɨgɨm | ʃɨgɨmɨgɨ | *name* |
| CVC:V | sɨnni | *no data* | sɨgɨnnɨgɨ | *tooth* |

- LUD1: A fixed consonant [g] and a reduplicative vowel occur for every syllable in the NLO.
- LUD2: Same as LUD1, plus a [ɨgɨ] sequence occurs after every non-geminate coda consonant.
- The ludling sequences (g*V* and ɨgɨ) are referred to as the Tigrinya *crypteme* (i.e. the phonological exponent of encryption).
- preview of analysis: Anchor constraints and FootBinarity account for the iterative infixation pattern of these ludlings.
  - NoCoda is ranked differently in the two ludlings.

(3) outline of talk
a) Theoretical proposals
b) Ludling 1 analysis
c) Ludling 2 analysis
d) Previous analyses
e) Conclusions

1 Throughout this handout, we use IPA symbols in the transcription of Tigrinya. This involves retranscription of data from some of our sources.

## 2. Theoretical Proposals

(4) **Surface-to-Surface Correspondence**

- More complex data with polymorphemic words (see §4.2) sheds light on the role of NLOs:
  - Language game outputs are influenced by both URs and NLOs.

- Surface-to-surface correspondence has been used to analyze reduplication (BR-correspondence, McCarthy & Prince 1993, 1995), words formed through derivation (OO-correspondence, Benua 1997; cf. Burzio 1994), words formed through inflection (OP-correspondence, McCarthy 2005), and loanwords (SB-correspondence, Smith 2006).

- There is a surface-to-surface correspondence relation that holds between the output of unencrypted speech and the output of encrypted speech; Faithfulness constraints are defined for the **natural language-ludling language (NL)** correspondence relation (cf. Piñeros 1998).

| <u>natural language</u> | | <u>ludling</u> |
|---|---|---|
| /ʃɨm/ | | /ʃɨm/ |
| ↓ *IO-correspondence* | | ↓ *IO-correspondence* |
| [ʃɨm] | → | [ʃɨgɨm] |
| | *NL-correspondence* | |

(5) **Natural language grammar may differ from ludling grammar.**

- Language games make use of the same (universal) constraints or constraint architecture, but constraint rankings can differ between the natural language grammar and the game grammar.

- Unlike NLOs and LUD1 in Tigrinya, LUD2 has no codas.
  This is captured best by promoting NoCoda.

- The crypteme consonant [g] is best treated as an unmarked epenthetic consonant.
  [g] is not the least marked consonant in the natural language.

- Extra vowels are supplied by reduplication when possible, by epenthesis only when necessary.
  Vowel epenthesis is the preferred repair of the natural language.

(6) **Reduplication is emergent.**

- Reduplication is a repair process which may occur in morphological or purely phonological contexts (Saba Kirchner 2010).

- Reduplication results from the ranking Dep » Integrity.

- There is no red morpheme.

- Because reduplication is emergent, ludlings with reduplicative segments do not require a morphological component.

## 3. Tigrinya Ludling 1

(7) Tigrinya background (Leslau 1941, Pam 1973, Kenstowicz 1982)

- syllable structure
  - only CV and CVC syllables allowed
  - epenthesis of [ɨ] repairs ill-formed syllables (see (B.1))
    /kfat/ → [kɨfat] *open!*

- vowel quality alternations
  - [ɨ] fronted word finally, i.e. /ɨ/ → [i] / __# (see (B.2))

/kælb/ → [kælbi] *dog*

- *iCi never occurs, i.e. /iCi/ → [iCi]
  [kægælbigi] *dog* (LUD1 form)

(8) Basic LUD1 data:

| | NLO | LUD1 | |
|---|---|---|---|
| CVCV | bɨtʃa | bɨgɨtʃaga | *yellow* |
| CVC | ʃɨm | ʃɨgɨm | *name* |

(9) **Crypteme placement:**

- ANCHOR constraints on the NL correspondence relation get the crypteme to the right place:

  ANCHOR(σ/Φ)L-NL: The leftmost element of a syllable in the NLO corresponds to the leftmost element of a foot in the ludling output.

  ANCHOR(σ/Φ)R-NL: The rightmost element of a syllable in the NLO corresponds to the rightmost element of a foot in the ludling output.

- High-ranking ANCHOR(σ/Φ)L/R and FOOTBIN(σσ) force each syllable in the NLO to be mapped onto a disyllabic foot in the ludling output.

(10) CV syllable:

NLO: [**C** **V** ]σ
↓ ↓
ludling: [**C** *V* *C* **V** ]Φ

hypothetical CV input (LUD1 = LUD2):

| UR: /ba/ NLO: [$b_1a_2$] | FOOTBIN | ANCHORL -NL | ANCHORR -NL |
|---|---|---|---|
| a. ☞ ($b_1a_2$g$a_2$) | | | |
| b. (g$a_2b_1a_2$) | | *! | |
| c. ($a_2b_1a_2$g) | | * (!) | * (!) |
| d. (ba) | *! | | |

(11) CVC syllable:

NLO: [**C** **V** **C** ]σ
↓ ↓ ↓
ludling: [**C** **V** *C* *V* **C** ]Φ

hypothetical CVC input (LUD1 only):

| UR: /bam/ NLO: [$b_1a_2$m] | FOOTBIN | ANCHORL -NL | ANCHORR -NL |
|---|---|---|---|
| a. ☞ ($b_1a_2$g$a_2$m) | | | |
| b. (g$a_2b_1a_2$m) | | *! | |
| c. ($b_1a_2$mg$a_2$) | | | *! |
| d. (bam) | *! | | |

(12) **Crypteme shape:**

- Minimal syllable in Tigrinya is CV.
  Inserting a syllable requires inserting a consonant and a vowel.

- Why is the consonant [g]?

  - Option 1: /g/ is the underlying form of the crypteme

  - Option 2: [g] is emergent due to the rankings
    DEP[lab], DEP[cor] » DEP[dors]; DEP[-voi] » DEP[+voi]
    (see B.3)

  - In option 2, all properties of the crypteme are emergent from the grammar.
    - There is no evidence for this ranking in the natural language; it must be a ludling-specific ranking.
    - We show independent evidence for ludling-specific rankings.
    - Option 2 used by Piñeros (1998) for Spanish *Jerigonza*.
    - Emergent crypteme avoids the problem of stipulating why a specified morpheme reoccurs for every syllable/mora.

  - Either option is compatible with our analysis, but only option 2 allows for a crypteme with no underlying structure.

- All crypteme vowels in LUD1 are reduplicative

  - Following the Minimal Reduplication framework (Saba Kirchner 2010), reduplication is chosen as a repair strategy (instead of epenthesis, etc.) due to the ranking DEP » INT.

  - The LUD1 crypteme always follows a vowel and the ranking DEP-V » INT-V predicts the vowel of a crypteme to always be a copy of that preceding vowel.

(13) CVCV in LUD1

| /bɨ$_1$tʃ'a$_2$/ | INT-C-IO | DEP-C-IO | DEP-V-IO | INT-V-IO |
|---|---|---|---|---|
| a. ☞ (bɨ$_1$gɨ$_1$)(tʃ'a$_2$ga$_2$) | | ** | | ** |
| b. (bɨ$_1$gɨ$_3$)(tʃ'a$_2$gɨ$_4$) | | ** | **! | |
| c. (bɨ$_1$bɨ$_1$)(tʃ'a$_2$tʃ'a$_2$) | **! | | | ** |

- INT-C-IO » DEP-C-IO causes epenthesis to fill crypteme onsets.
- DEP-V-IO » INT-V-IO causes reduplication for crypteme vowels.

(14) CVC in LUD1

| UR: /ʃɨm/<br>NLO: [.ʃɨm.] | ANCHORR-NL | NOCODA | DEP-C-IO | INT-V-IO |
|---|---|---|---|---|
| a. ☞ (ʃɨgɨm) | | * | * | * |
| b. (ʃɨgɨ)(mɨgɨ) | *! W | L | ** W | ** W |
| c. (ʃɨgɨ)(mɨg) | *! W | * | ** W | * |
| d. (ʃɨmgɨ) | *! W | * | * | * |

- NOCODA is crucially dominated

(15) **LUD1 summary:**

- FOOTBIN, ANCHORR, and ANCHORL are undominated.

- Each syllable in unencrypted outputs must be mapped onto a disyllabic foot in encrypted outputs such that the left and right edges of each syllable/foot pair are identical.

- To fill out each foot, a default consonant [g] is inserted and the vowel is reduplicated.

- This analysis is essentially identical to Piñeros's analysis of the Spanish ludling *Jerigonza* (see §5.3).

# 4. Tigrinya Ludling 2

## 4.1 Monomorphemic Words

(16) Basic data:

| | NLO | LUD2 | |
|---|---|---|---|
| CVCV | bɨtʃ'a | bɨgɨtʃ'agɨa | *yellow* |
| CVC | ʃɨm | ʃɨgɨmɨgɨ | *name* |
| CVC:V | sɨnni | sɨgɨnnɨgɨ | *tooth* |

(17) **Crypteme placement:**

- CVCV forms are identical in LUD1 and LUD2.
- In LUD2, all non-geminate codas are prohibited.
  The Anchor constraints are crucially dominated.
- CVC in LUD2:

| UR: /ʃɨm/<br>NLO: [.ʃɨm.] | No Coda | Max-C -IO | AnchL -NL | AnchR -NL | Dep-C -IO | Int-V -IO |
|---|---|---|---|---|---|---|
| a. ☞(ʃɨgɨ)(mɨgɨ) | | | * | * | ** | ** |
| b. (ʃɨgɨm) | *! W | | L | L | * L | * L |
| c. (ʃɨgɨ) | | *! W | L | * | L | L |

- NoCoda » AnchorR/L requires [ɨgɨ] to appear after all codas.

(18) **Crypteme shape:**

- Vowels in LUD2 are reduplicative or default:
  - When a LUD2 crypteme occurs after a vowel, the same pattern occurs as in LUD1.
  - When a LUD2 crypteme occurs after a consonant, two epenthetic [ɨ]s must be inserted to maintain well-formed syllable structure (i.e. C]σ → CɨgɨC):

    k'arma → k'agarɨgɨmaga *gnat*

  - Reduplication must be prohibited by a constraint that penalizes spreading across a foot boundary.
    - Integrity/foot: All output correspondents of an input segment must be in the same foot.

(19) Epenthesis in LUD2 when no V available for reduplication

| /k'a$_1$r.../ | Int-V/Φ | Dep-V | Int-V |
|---|---|---|---|
| ☞ (k'a$_1$ga$_1$)(rɨgɨ) | | ** | * |
| (k'a$_1$ga$_1$)(ra$_1$ga$_1$) | **! | | *** |

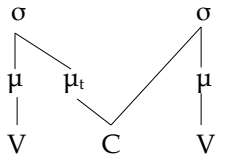
- Int-V/Φ » Dep-V prevents reduplication across foot boundaries

(20) Geminates are protected instead of being split by vowel epenthesis to avoid codas:[2]

| | NLO | LUD2 | |
|---|---|---|---|
| CVC:V | sɨnni | sɨgɨnnɨgi | *tooth* |

- A geminate is protected via the nature of the mora that dominates it.

geminate C:




  - A *timing mora* dominates some segment that is also directly dominated by some other element of the prosodic hierarchy.
  - A geminate is dominated by both a mora and a syllable node; hence that mora is a timing mora.
    - Max-μt-NL (cf. Campos-Astorkiza 2004):
      Assign a violation mark for every timing mora in an

2 See Schein (1981) on the nature of geminates in Tigrinya.

NLO that has no correspondent in the ludling output.

(21) Geminates preserved in LUD2:

| UR: /sɨnni/<br>NLO: [ sɨnni] | MAX-$\mu_t$-NL | NOCODA |
|---|---|---|
| ☞ (sɨgɨn)(nɨgi) | | * |
| (sɨgɨ)(nɨgi) | *! | |

- Singleton coda consonants are not dominated by a timing mora, and so with these codas MAX-$\mu_t$-NL is vacuously satisfied and NOCODA can assign fatal violation marks.

## 4.2 POLYMORPHEMIC WORDS

(22) A natural language process of regressive total assimilation creates geminates from underlying homorganic $C_1C_2$ clusters in polymorphemic forms:
/sælit' + do/ → [sæliddo] *Is it (black) sesame?*

- LUD2 encrypts these forms in an unexpected way:

| | *UR* | *NLO* | *LUD2* | |
|---|---|---|---|---|
| | sælit'-do | sæliddo | sægæligit'ɨgɨddogo | *Is it (black) sesame?* |
| | kæbbæd-ti | kæbbætti | kægæbbægædɨgɨttɨgi | *heavy (pl.)* |
| cf. | sɨnni | sɨnni | sɨnnɨgi | |

(23) Both input $C_1$ and NLO geminate $C_2$ appear in encrypted outputs.

| | | | | |
|---|---|---|---|---|
| UR: | sæ | li | t' | do |
| NLO: | sæ | li | | ddo |
| LUD2: | sægæ | ligi | t'ɨgɨ | ddogo |

(24) MAX-IO protects input $C_1$; MAX-$\mu_t$-NL protects NLO geminate $C_2$.

| | UR: /sælit' + do/<br>NLO: [sæliddo] | MAX-IO | MAX-$\mu_t$-NL | NOCODA |
|---|---|---|---|---|
| a. | ☞ (ligi)(t'ɨgɨd)(dogo) | | | * |
| b. | (ligi)(t'ɨgɨ)(dogo) | | *! | |
| c. | (ligid)(dogo) | *! | | * |

- This pattern can only be accounted for by the simultaneous use of input-output faithfulness and surface-to-surface faithfulness.

(25) A stratal analysis that allows for reranking at different levels cannot account for the appearance of both [t'] and [dd]:

- Stratal analysis, option 1: Natural language grammar (NLG) is one stratum, and the output of NLG is the input to the ludling stratum (cf. Bagemihl 1988, Piñeros 1998, Itô et al. 1996):

  NLG stratum
  /sælit' + do/ → [sæliddo] *regressive assimilation applies*

  Ludling stratum
  [sæliddo] → [sægæligiddogo]
  - [t'] is not present in the input
  - no reason for [t'] to appear in the ludling output

- Stratal analysis, option 2: Ludling stratum occurs after each morphological level of the NLG, and output of ludling stratum is passed to the next stage of morphology:

  NLG level 1 stratum
  /sælit'/ → [sælit']

  ludling level 1 stratum
  [sælit'] → [sægæligit'ɨgɨ]

NLG level 2 stratum

[sægæligiṯ'ɨgɨ] + /do/ → [sægæligiṯ'ɨgɨdo]

ludling level 2 stratum

[sægæligiṯ'ɨgɨdo] → [sægæligiṯ'ɨgɨdogo]

- [d] is not in the right environment to condition assimilation/gemination
- no reason for [dd] to appear in the ludling output.

- The ludling stratum cannot be ordered in a way that allows ludling forms to retain both an underlying segment that does not appear on the surface and a surface geminate that is underlyingly a singleton.

(26) OCP effects:

- Uniquely, underlying /g/ does not return in LUD2 forms when lost to gemination (e.g. /ʔaʔdug + ka/ *your (masc. sg.) donkeys*):

| | | | | | |
|---|---|---|---|---|---|
| UR: | ʔa | ʔ | du | g | ka |
| NLO: | ʔa | ʔ | du | | kka |
| LUD2: | ʔaga | ʔɨgɨ | dugu | | kkaga |
| cf. | *ʔaga | ʔɨgɨ | dugu | gɨgɨ | kkaga |

- No general rule against multiple [gV]s in LUD2 grammar.
  If an NLO has a [g], three [g]s surface in the ludling:

| UR | NLO | LUD1/LUD2: | |
|---|---|---|---|
| ʔaga | ʔaga | ʔagagaga | *towards* |

- Having two adjacent identical consonants incurs an OCP violation.
  OCP(C): Assign a violation mark for any sequence of adjacent identical segments. (Rose 2000, as "OCP-[C-Adj]", follows principle of *consonant adjacency*)

(27) /g/ in input, but no [g] in NLO

| UR: /...dug + ka/<br>NLO: [...dukka] | OCP(C) | DEP[lab]/[cor]/[-voi] | MAX-IO |
|---|---|---|---|
| a. ☞ (duguk)(kaga) | | | * |
| b. (dugu)(guguk)(kaga) | *! | | |
| c. (dugu)(gupuk)(kaga) | | *! | |
| d. (dugu)(gukuk)(kaga) | | *! | |

- OCP(C), DEP[lab]/[cor]/[-voi] » MAX-IO prohibits reappearance of [g] lost to assimilation.

(28) /g/ in input and NLO

| UR: /ʔaga/<br>NLO: [ʔaga] | MAX-NL | OCP(C) | MAX-IO |
|---|---|---|---|
| ☞(ʔaga)(gaga) | | * | |
| (ʔaga) | *! | | * |

- MAX-NL » OCP(C) protects [g]s that have an NLO correspondent.

(29) Ranking summary:

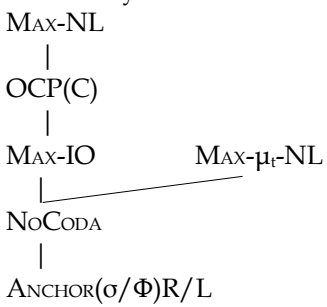
- LUD1 and LUD2:

  INTEGRITY/FOOT
  |
  INT-C — DEP-V
  | |
  DEP-C — INT-V

  FOOTBIN(σσ) undominated.

- LUD1 only:
  ANCHOR(σ/Φ)R/L undominated.
  NOCODA crucially dominated.

- LUD2 only:




## 5. Previous Analyses

### 5.1 Bagemihl (1988)

(30) Stratal rule-based framework.

- Ludling phonology is a stratum between word-level and phrase-level phonology.
- To account for the fact that input segments lost to gemination reappear in LUD2, Bagemihl assumes that input segments are delinked at stem or word level but survive as floating segments and may be reinserted in ludling phonology.
- Non-reappearance of input /g/ due to OCP with /g/ of crypteme.

(31) Excessive stipulations.

- Placement of ludling stratum.
- Use of floating segments (without any connection made between NLOs and ludling forms).
- OCP targets consonant [g] instead of generalizing to any consonant; floating [g] + crypteme violates OCP, while anchored [g] + crypteme does not.
- Ludlings rely on an unconstrained morphological component.

### 5.2 Frazier and Gil (2007)

(32) OT analysis succeeds for most data, but remains stipulative.

- Successes:
  - Use of both IO and surface-to-surface correspondence constraints accounts for lost segments.
  - Use of Max-$\mu_t$ accounts for geminate inalterability.

- Shortcomings:
  - Relies on Alignment constraint for crypteme placement; predicts that cryptemes could be positioned anywhere.
  - Relies on unconstrained morphological component.
  - No account of special behavior of deleted [g].

### 5.3 Piñeros (1998)

(33) Analysis of Spanish *Jerigonza*, not the Tigrinya ludling.

- Much of his analysis applies to Tigrinya and has been imported here.

- Differences in data:

  - *Jerigonza* crypteme consonant is variable and relatively unmarked.
    - Tigrinya crypteme consonant is fixed and marked.

  - No behavior in J*erigonza* similar to Tigrinya gemination, geminate inalterability or reappearance of lost segments.

- Differences in analysis:

  - Piñeros introduces a language-specific 'surface form-Jerigonza' correspondence relation.
    - We generalize this relation as 'natural language-ludling

language' correspondence and propose this relation is applicable to all language games.

- Piñeros assumes that input to ludling formation is a natural language surface form; IO-faithfulness is ignored.
  - We show that both IO- and NL-faith play a role in ludling formation.

- Piñeros and Bagemihl both identify the morphological domain as that which differs between natural languages and ludlings.
  - We have shown that such differences can be captured with OT morphophonological and phonological constraints; ludlings differ in the phonology from natural language.

## 6. Conclusions

(34) We analyzed two ludlings in Tigrinya and made the following claims:

- Ludlings have a grammar that is distinct from natural language grammars, but built from the same tools/materials.

- Ludling phonology must have access to both NLOs and URs.
  - LUD2 shows presence of underlying segment that does not appear in the NLO and an NLO geminate that is a singleton underlyingly.
  - High-ranking IO and NL Faithfulness allows for ludlings outputs that can be transparently linked to both URs and NLOs

- Fixed phonological elements in ludlings may arise from their distinct grammar rather than lexical specification.

- Minimal Reduplication helps explain why ludlings will sometimes employ reduplication and sometimes other repairs.

(35) Implications for ludling typology:

- The NL correspondence relation predicts ludlings should show the same range of overapplication/underapplication of natural language phonological processes as seen in words formed through derivation when analyzed with output-output correspondence (see Benua 1997).

- Ludlings can end up less marked than NLOs via the promotion of markedness constraints
  - example: promotion of NoCoda in LUD2

- Ludlings can end up more marked than NLOs via the use of surface-to-surface correspondence.
  - example: Max-NL » OCP(C) » Max-IO[3]

- Reranking of Faithfulness leads to different repairs.
  - example: vowel epenthesis in natural language; vowel reduplication in ludlings

3 While general OCP(C) does not dominate Max-IO in Tigrinya, there is evidence that OCP violations of certain segment classes are not allowed (Rose 2000).

## Appendix A: Constraint Definitions

(A.1) Anchor(σ,Φ,L)-NL:
Assign a violation mark if the leftmost element of a syllable in NL does not have a correspondent at the leftmost element of a foot in L.

(A.2) Anchor(σ,Φ,R)-NL:
Assign a violation mark if the rightmost element of a syllable in NL does not have a correspondent at the rightmost element of a foot in L.

(A.3) FootBinarity(σσ):
Assign a violation mark for any foot that is not composed of exactly two syllables.

(A.4) Max($\mu_t$)
Assign a violation mark for every timing mora in the input that has no correspondent in the output.

(A.5) Integrity/foot-IO
Assign a violation mark for any multiple output correspondents of an input segment that are not in the same foot.

(A.6) OCP(C) (Rose 2000)
Assign a violation mark for any sequence of adjacent identical segments.
The principle of consonant adjacency indicates that two consonants in sequence are adjacent irrespective of intervening vowels.

## Appendix B: Complete Tableaus

(B.1) natural language epenthesis: /kfat/ → [kɨfat] *open!*

| /kfat/ | *Complex Ons | Max | Int-V | Dep [-hi] | Dep [-bk] | Dep [+rd] | Dep [+hi] | Dep [+bk] | Dep [-rd] |
|---|---|---|---|---|---|---|---|---|---|
| ☞ kɨfat | | | | | | | * | * | * |
| kfat | * W | | | | | | L | L | L |
| fat | | * W | | | | | L | L | L |
| kifat | | | | | * W | | * | L | * |
| kafat | | | | * W | | | L | * | * |
| kufat | | | | | | * W | * | * | L |
| $ka_1fa_1t$ | | | * W | | | | L | L | L |

(B.2) word-final epenthesis uses [i]: /kælb/ → [kælbi] *dog*

| /kælb/ | *ComplexCoda | *ɨ# | Dep[-bk] | Dep[+bk] |
|---|---|---|---|---|
| kælbɨ | | *! | | * |
| ☞ kælbi | | | * | |
| kælb | *! | | | |

*ɨ# (*ad hoc*) penalizes word-final occurrences of [i]

(B.3) insertion of fixed consonant [g] in ludling formation:

| /$b_1a_2$ / | Max | Int -C | Dep(lab) Dep(cor) | Dep (-voi) | Dep -C | Dep (dors) | Dep (+voi) |
|---|---|---|---|---|---|---|---|
| ☞ ($b_1a_2g_3a_2$) | | | | | * | * | * |
| ($b_1a_2b_1a_2$) | | * W | | | L | L | L |
| ($b_1a_2k_3a_2$) | | | | * W | * | * | L |
| ($b_1a_2d_3a_2$)/ ($b_1a_2b_3a_2$) | | | * W | | * | L | * |
| -- | ** W | | | | L | L | L |

(all faithfulness constraints are on the IO correspondence relation)

(B.4) reduplication of vowels in ludling formation :

| /$b_1a_2$ / | MAX | DEP -V | DEP (+hi) | DEP (+bk) | DEP (-rd) | INT -V |
|---|---|---|---|---|---|---|
| ☞ ($b_1a_3g_4a_2$) | | | | | | * |
| ($b_1i_3g_4a_2$) | | * W | * W | * W | * W | L |
| -- | ** W | | | | | L |

(all faithfulness constraints are on the IO correspondence relation)

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