A reanalysis of (non-)exceptional patterns in Bondu-so tongue root harmony

Jade J. Sandstedt
jsandstedt@gmail.com
jsandstedt.hcommons.org

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1 Introduction

- Topic: unusual vowels and vowel harmony in Bondu-so (Dogon)
  - Hantgan & Davis (2012), Heath (2014), Green & Hantgan (2019)
- Problem: crucial data have been misinterpreted
  - Specifically, the direction of harmony in ambiguous cases: dɔ̀gɛ́
- Solution: all suffix-controlled harmony
  - Eliminates all typologically and theoretically controversial generalisations
  - Easily accomodated with the standard phonological toolkit

1.1 Background

Basic generalisations

(1) **Bidirectional [+ATR] and [−ATR] harmony in Bondu-so**

	UR of root		Underspecified suffix (perfective)	[+ATR] suffix (infinitive)	[−ATR] suffix (mediopassive)
[+ATR] root	/noj-/	‘sleep’	[nòj-è]	[nój-ílòŋ]	[nɔ̀j-íjɛ́]
[−ATR] root	/dɔg-/	‘leave’	[dɔ̀g-ɛ̀]	[dɔ̀g-ílòŋ]	[dɔ̀g-íjɛ́]

According to the data above,

1. roots are contrastive for [ATR] and trigger harmony on suffixes
   - e.g. [+ATR] [nòj-è] vs. [−ATR] [dɔ̀g-ɛ̀]
2. non-harmonising suffixes determine the [±ATR] value on roots

- dominant [+ATR] harmony: e.g. INF. /dɔ̀g-ílòŋ/→[dòg-ílòŋ]
- dominant [−ATR] harmony: e.g. MED-PASS. /nòj-íjɛ́/→[nɔ̀j-íjɛ́]

Summary and implications:

1. ternary contrast on mid-vowel suffixes
    - [+ATR] /-(i)loŋ/, [−ATR] /-ijɛ/, ∅ (underspecified) /-E/
2. incompatible with privative features (e.g. [ATR] /e, o/ vs. ∅ /ɛ, ɔ/)
    - symmetric [+ATR] *and* [−ATR] suffix-controlled harmony
    - neither feature is dominant/recessive (marked/unmarked)
3. directionally asymmetric bidirectional harmony
    - leftwards harmony bleeds rightwards harmony

Abstract contrasts?
Bondu-so vowel harmony is not always surface true

- displays 7V surface contrasts:
    - paired [e, ɛ, o, ɔ]
    - unpaired [i, u, a] – lacking *[ɪ, ʊ, ə]
- therefore do not display harmony alternations (*harmonically neutral*)
    - [dòg-ílòŋ] vs. [dɔ̀g-íjɛ́], not *[dɔ̀g-íjɛ́]

What happens following unpaired /i, u, a/ harmony triggers?
Unpaired high/low vowels trigger both [±ATR] harmony (2)

(2) **Distinct high/low vowel [±ATR]-harmony in Bondu-so**

[+ATR] root			[−ATR] root		
/bij-/	[bìj-è]	‘s/he laid down’	/gɪj-/	[gìj-ɛ̀]	‘s/he killed’
/sug-/	[sùg-è]	‘s/he went down’	/ʤʊg-/	[ʤùg-ɛ̀]	‘s/he recognised’
/bər-/	[bàr–è]	‘s/he helped’	/pag-/	[pàg-ɛ̀]	‘s/he tied’

Symmetric [±ATR] harmony following [ATR]-unpaired /i, u, a/ has been interpreted as evidence of abstract [±ATR] /i, ɪ, u, ʊ/ and low /a, ə/ contrasts

- neutralised on the surface
    * Harmony opacity via neutralisation: /gɪj-E/ → /gɪj-ɛ/ → [gìj-ɛ̀]

Interim summary – the received story
Bondu-so displays:

- bidirectional harmony
    * directionally asymmetric
- ternary contrasts on mid-vowel suffixes
    * not compatible with privative features
- abstract contrasts on high/low vowels
    * phonologically active but never surface

1.2 Problems with previous analyses

Bondu-so involves a case of *counterbleeding opacity* (cf. Kiparsky 1973; Baković 2009, 2011):

- /ɪ, ə/ can trigger harmony but can't surface
    – neutralisation always fails to bleed harmony (counterbleeding)
- surface [αATR]-harmony without obvious [αATR]-trigger (3)

(3) **Bondu-so harmony opacity via neutralisation**

	/bij-E/	/gɪj-E/	/pag-E/	/bər-E/
Harmony	bij-e	gɪj-ɛ	pag-ɛ	bər-e
Neutralisation	–	gij-ɛ	–	bar-e
	[bìj-è] 's/he laid down'	[gìj-ɛ̀] 's/he killed'	[pàg-ɛ] 's/he tied'	[bàr-è] 's/he helped'

Acquisition of opaque patterns
Vaux (2008: p. 32) argues opaque patterns are fine:

- the processes simply need to be independently motivated, as in (4)

(4) **Hypothetical counterbleeding opacity**

		/te/	/to-u/	/ti-u/
Palatalisation	t → ʧ / { _i, _e }	ʧe	–	ʧi-u
Deletion	V → ∅ / _V	–	tu	ʧ-u
		[ʧe]	[tu]	[**ʧu**]

In (4) we have a hypothetical language with palatalisation of /t/→[ʧ] before front vowels and vowel deletions in vowel hiatuses.

- crucially palatalisation and vowel deletions occur transparently in independent contexts: e.g. /te/→[ʧe] and /to-u/→[tu].

In opaque patterns like [ʧu], palatalisation appears to have applied but without motivation (just like vowel harmony in Bondu-so [gìj-ɛ̀]).

- à la Vaux (2008) (and others) language learners should be able to recover the simple counterbleeding interaction because the two processes are independently motivated
  - they have independent evidence for both processes and therefore should be able to generalise underlying representations like /ti-u/ which satisfy the conditions for both palatalisation (/**ti**-u/) and vowel deletions (/t**i**-**u**/).

The problem with opacity via absolute neutralisation
Requirement of independent motivation is a 'handicap for abstract analyses' (Baković 2009: p. 11)

* neutralisation is not independently motivated, cf. (5)

(5) **Counterbleeding opacity in Bondu-so**

	/dɔg-E/	/m?n/	/gɪj-E/
Harmony	dɔg-ɛ	–	gɪj-ɛ
Neutralisation	–	??	gij-ɛ
	[dɔ̀g-ɛ̀] 's/he left (it)'	[mín] 's/he waited'	[gìj-ɛ̀] 's/he killed'

Consequences of absolute neutralisation

* **Non-falsifiable**: no independent way to confirm/disprove abstract /i, ɪ, u, ʊ, a, ə/ contrasts
  - Can't be observed; don't turn up in acoustic analysis
  - Don't figure in any other linguistic pattern
* **Circular**: abstract contrasts only evidenced by distinct patterns in (2), which they're supposed to explain

(2) **Distinct high/low vowel [±ATR]-harmony in Bondu-so**

[+ATR] root			[−ATR] root		
/bij-/	[bìj-è]	's/he laid down'	/gɪj-/	[gìj-ɛ̀]	's/he killed'
/sug-/	[sùg-è]	's/he went down'	/ʤʊg-/	[ʤùg-ɛ̀]	's/he recognised'
/bər-/	[bàr–è]	's/he helped'	/pag-/	[pàg-ɛ̀]	's/he tied'

* **Theoretically/typologically irregular implications**:
  - bidirectional harmony
    * directionally asymmetric
  - ternary contrasts on mid-vowel suffixes
    * not compatible with privative features
  - abstract contrasts on high/low vowels
    * phonologically active but never surface

Where have we gone wrong?

(1) **Bidirectional [+ATR] and [−ATR] harmony in Bondu-so**

	UR of root		Underspecified suffix (perfective)	[+ATR] suffix (infinitive)	[−ATR] suffix (mediopassive)
[+ATR] root	/noj-/	'sleep'	[nòj-è]	[nój-ílòŋ]	[nɔ̀j-íjɛ́]
[−ATR] root	/dɔg-/	'leave'	[dɔ̀g-ɛ̀]	[dòg-ílòŋ]	[dɔ̀g-íjɛ́]

The only variable we can play with is the representation of root vowels (and therewith the direction of harmony in perfective contexts):

- 'correlation doesn't imply causation'

  - [nɔ̀j-ɛ̀] and [dɔ̀g-ɛ̀] are correlated for the harmony feature
  - but what's the trigger and what's the target?

- Is it /dɔ̰g-E/ → [dɔ̰g-ɛ̀]?
- or /dOg-ɛ̰/ → [dɔ̀g-ɛ̰]?

No root-controlled harmony?
The question comes down to where the underlying contrast is – root or suffix?

- the near minimal pairs [bìj-ɛ̀] and [gìj-ɛ̀] suggest the suffix is contrastive

1. ~~/dɔ̰g-E/ → [dɔ̰g-ɛ̀]~~

2. /dog-ɛ̰/ → [dɔ̀g-ɛ̰]

Preview: reanalysis implications

(6) **Harmony variation across Bondu-so verbal classes**

	UR of root		perfective	infinitive	mediopassive	imperative
Class A	/noj-/	'sleep'	[nɔ̀j-ɛ̀]	[nój-ílɔ̰ŋ]	[nɔ̀j-íjɛ́]	[nój-ó]
Class B	/dog-/	'leave'	[dɔ̀g-ɛ̰]	[dɔ̀g-ílɔ̰ŋ]	[dɔ̀g-íjɛ́]	[dóg-á]

Important differences:

1. ~~directionally asymmetric bidirectional harmony~~
   - only uni-directional suffix-controlled harmony
2. ~~ternary contrast on mid-vowel suffixes~~
   - ~~[+ATR] /-(i)lo~~ŋ~~/, [−ATR] /-ij~~ɛ~~/, ∅ (underspecified) /-E/~~
   - only [RTR] /ɛ, ɔ/ ~ (non-RTR) /e, o/
   - fully compatible with privative or monovalent features
3. ~~Abstract contrasts on high/low vowels~~
   - ~~/bij-E/ and /gɪj-E/~~
   - only concrete or non-abstract /i, u, a/ in (7)
4. ~~Harmony counterbleeding opacity via neutralisation~~
   - ~~/gɪj-E/ → /gɪj-ɛ/ → [gìj-ɛ̀]~~
   - only transparent harmony neutrality: /gij-ɛ̰/ → [gìj-ɛ̰]

(7) **No abstract contrasts: non-contrastive high/low vowels are harmonically neutral non-targets of tongue root harmony**

ATR class /-e/			RTR class /-ɛ/		
/bij-e/	[bìj-è]	's/he laid down'	/gij-ɛ/	[gìj-ɛ̀]	's/he killed'
/sug-e/	[sùg-è]	's/he went down'	/ʤug-ɛ/	[ʤùg-ɛ̀]	's/he recognised'
/bar-e/	[bàr-è]	's/he helped'	/pag-ɛ/	[pàg-ɛ̀]	's/he tied'

☞ all controversial generalisations hinge upon misinterpretation of the direction of harmony

In sum:

- reinterpreting the direction of harmony in ambiguous cases (dɔ̀gɛ́)
  - eliminates all typologically and theoretically controversial generalisations

2 The reanalysis

2.1 High/low vowel harmony neutrality

If high/low vowels don't trigger harmony (e.g. /gɪj-E/ → /gɪj-ɛ/ → [gìj-ɛ̀])

- then what is their actual behaviour?

Harmonically unpaired /i, u, a/ vowels are harmonically neutral

(8) **Bondu-so high and low vowel transparency**

a.	/keʤ-ilɔŋ/	[kéʤ-ìlɔ̀ŋ]	'cut'-INF.
b.	/keʤ-ijɛ/	[kéʤ-íjɛ́]	'cut'-MED-PASS.
c.	/sem-anʤ-e/	[sém-ánʤ-è]	'slaughter'-IMPERF.-2.PL.
d.	/sem-anʤ-ɛɛ/	[sém-ánʤ-ɛ́ɛ̀]	'slaughter'-IMPERF.-3.PL.

High and low vowels are in other words phonologically *inactive* and *invisible*

- non-targets and non-triggers (transparent segments)

Bondu-so harmony is active [RTR]-spreading
Transparent segments (e.g. /i, u, a/) co-occur with non-RTR /e, o/ vowels

- e.g. /bèl-áà/ → [bèl-áà], *[bɛ̀l-áà] (9)

(9) **Low/high vowel non-triggers**

[bèl-ää̀]	*[bɛ̀l-ää̀]	'edible leaves (cooked)'-SG.
[ɔ̀b-ää̀]	*[ɔ̀b-ää̀]	'flexible liana branch'-SG.
[ʤɔ́ŋ-ándʒ-ójì]		'heal'-IMPERF.-1.PL.
[sém-ándʒ-ójì]	*[sɛ́m-ándʒ-ójì]	'slaughter'-IMPERF.-1.PL.

☞ The marked value is [RTR] in Bondu-so

- i.e. [RTR] /ɛ, ɔ/ vs. (non-RTR) /e, o/

Bondu-so high/low vowels:

- **harmonically transparent**: phonologically inactive and invisible to tongue root harmony
  - [sém-ándʒ-è] vs. [sɛ́m-ándʒ-ɛ́ɛ̀] 'slaughter'-IMPERF.-3.PL.
- **reveal markedness aymmetries**: [RTR] /ɛ, ɔ/ vs. (non-RTR) /e, o/
  - /bèl-ää̀/ → [bèl-ää̀], *[bɛ̀l-ää̀]

☞ theoretically and typologically fully consistent with other harmony languages

- cf. typological surveys in Nevins (2010); Rose & Walker (2011); Sandstedt (2018)

2.2 Inflectional classes

Distinct inflectional classes are not controversial
Hantgan & Davis (2012) and Green & Hantgan (2019) have demonstrated distinct nominal inflections and harmony patterns in (10)

- Class A [kɔ́b-ɔ̀ɔ̀] and Class B [kób-áá]

(10) **Distinct noun classes in Bondu-so**

	SING.	PLUR.	
CLASS A	kɔ́b-ɔ̀ɔ̀	kɔ́b-ɛ̀ɛ̀	'sheath'
	nɛ́nd-ɔ̀ɔ̀	nɛ́nd-ɛ̀ɛ̀	'tongue'
CLASS B	kób-áá	kɔ́b-ɛ́ɛ́	'brick mold'
	cénd-ää̀	cɛ́nd-ɛ̀ɛ̀	'heart/liver'

Suffixes are contrastive
Hantgan & Davis (2012) and Green & Hantgan (2019) have demonstrated minimal ATR/RTR distinctions on suffixes

- which define important morphological distinctions (11)

(11) **Person and number inflections in Bondu-so: 'heal'-IMPERF.**

	SING.	PLUR.
1.	ʤɔ́ŋ-ɔ́nʤ-ɔ̀m	ʤɔ́ŋ-ɔ́nʤ-ɔ́jɪ̀
2.	ʤɔ́ŋ-ɔ́nʤ-ɔ̀ɔ̀	ʤɔ́ŋ-ɔ́nʤ-ɛ̀
3.	ʤɔ́ŋ-ɔ́nʤ-ɔ̀	ʤɔ́ŋ-ɔ́nʤ-ɛ́ɛ̀

2.3 Reorganisation of the data

In their conclusion, Hantgan & Davis (2012: 24):

> We leave it as a challenge as to whether the full range of vowel harmony data considered in this article can be accounted for just as insightfully without positing abstract vowels or the ternary use of [ATR].

To show that this is indeed possible, I have recorded the full range of data provided by Hantgan & Davis (2012) in a .csv file

- Available online at http://dx.doi.org/10.17613/p0sp-yj29

Reorganised assuming suffixes are underlyingly contrastive for [±ATR]

(12) **Example data**

	Form	Morph.	Gloss	Ex.No	Class
a.	kédʒ-ìlòŋ	infinitive	'cut'	6	1
b.	kédʒ-á	imperative	'cut!'	9	1
c.	kɛ́dʒ-íjɛ́	mediopassive	'be cut'	7	1
d.	kɛ̀dʒ-ɛ̀	perfective	's/he cut'	1	1
e.	gí-ílòŋ	infinitive	'kill'	6	1
f.	gíj-á	imperative	'kill!'	9	1
g.	gɪ̀j-ɛ̀	perfective	's/he killed'	1	1
	...				

Bondu-so revised inflectional classes
In this dataset, four verbal and three nominal inflectional classes emerge.

	Class 1	Class 2	Class 3
SING.	/-oo/	/-ɔɔ/	/-aa/
PLUR.	/-ee/	/-ɛɛ/	/-ɛɛ/

Table 1: Nominal inflections in Bondu-so

	Class 1	Class 2	Class 3	Class 4	Personal endings	
PERF.	/-e/	/-ɛ/	/-e/	/-e/	1.SG	/-om/
INF.	/-(i)loŋ/	/-(i)loŋ/	/-(i)loŋ/	/-(i)loŋ/	2.SG	/-oo/
IMP.	/-o/	/-a/	/-a/	/-o/	3.SG	/-o/
MED-PASS.	/-ije/	/-ijɛ/		/-ijɛ/	1.PL	/-oji/
IMPERF.	/-ondʒ-/	/-andʒ-/			2.PL	/-e/
					3.PL	/-ɛɛ/

Table 2: Verbal classes in Bondu-so

2.3.1 Morphological approach captures missed generalisations

Previously assumed that the MED-PASS. suffix is non-alternating /-ijɛ/ (1)

- this leaves unexplained ATR mediopassive suffixes in (15)
- Hantgan & Davis (2012: 9, fn. 8): nasals contribute to [+ATR] realisations
  - but this too admits exceptions: e.g. [jàmb-íjɛ́] 'cover'

(15) **Exceptional ATR MED-PASS. [-íjé]**

RTR [-íjɛ́]		ATR [-íjé]	
[kɛ́dʒ-íjɛ́]	'cut'	[nèmbìl-íjé]	'beg'
[dɔ̀g-íjɛ́]	'leave'	[sòŋg-íjé]	'curse'
[jàmb-íjɛ́]	'cover'	[dàŋ-íjé]	'be stuck'

Coherent patterns across inflectional classes
These 'exceptions' are evidence of subregularities between inflectional classes (16)

- e.g. Class 1 ATR [-è, -íjé] and labial [-ó, -óndʒ-]
- e.g. Class 2 RTR [-ɛ̀, -íjɛ́] and non-labial [-á, -ándʒ-]

(16) **Class 1–2 regular correspondences**

	Class 1	Class 2
PERF.	-è	-ɛ̀
MED-PASS.	-íjé	-íjɛ́
IMP.	-ó	-á
IMPERF.	-óndʒ-	-ándʒ-

Inflectional class summary
We have clear evidence for:

1. Distinct inflectional classes
    - Class 2 [kɔ́b-ɔ̀ɔ̀] 'sheath'-SG. vs. Class 3 [kób-áá] 'brick mold'-SG.
2. Suffixes are contrastive for the tongue root feature
    - e.g. ATR [ʤóŋ-óndʒ-è] vs. RTR [ʤɔ́ŋ-ɔ́ndʒ-ɛ́ɛ̀] 'heal'-IMPERF.-2.PL./3.PL.
3. Regularities across inflectional patterns explain exceptions
    - e.g. Class 1 ATR [-è, -íjé] and labial [-ó, -óndʒ-]
    - e.g. Class 2 RTR [-ɛ̀, -íjɛ́] and non-labial [-á, -ándʒ-]

Bondu-so vowel and vowel harmony generalisations
Bondu-so vowels and vowel harmony summarised:

- 7 concrete /i, e, ɛ, a, ɔ, o, u/
- leftwards [RTR]-spreading
- harmonically transparent non-contrastive high/low vowels

(17) **Bondu-so [RTR]-harmony and high/low vowel transparency**

a.	/kedʒ-ilo̲ŋ/	[kédʒ-ìlò̲ŋ]	'cut'-INF.	i	u
b.	/kedʒ-ije̲/	[kédʒ-íjɛ́]	'cut'-MED-PASS.	e	o
c.	/sem-andʒ-e̲/	[sém-ándʒ-è]	'slaughter'-IMPERF.-2.PL.	ɛ	ɔ
d.	/sem-andʒ-ɛɛ̲/	[sɛ́m-ándʒ-ɛ́ɛ̀]	'slaughter'-IMPERF.-3.PL.	a	

2.4 Talk conclusions

Bondu-so has been previously analysed as displaying:

* a complex, directionally-asymmetric tongue root harmony system
* ternary [ATR] feature specifications on mid vowels
* abstract or covert [ATR] contrasts on high/low vowels
* harmony counterbleeding opacity via neutralisation

In addition to these theoretical/typological irregular implications

* lack of independent motivation for neutralisation
  - results in circular and non-falsifiable conclusions

☞ suggesting the locus of explanation lies elsewhere

Crux of the problem:

- misinterpretation the direction of harmony in ambiguous cases (dɔ̀gɛ̀)
  - ignored neutral harmony insights (e.g. [bìj-è] and [gìj-ɛ̀])

Reanalysis:

- Unidirectional suffix-controlled [RTR] harmony with harmonically transparent non-contrastive vowels
  - eliminates all the problems identified in this talk
  - compatible with any existing harmony framework

The 'Abstractness Controversy'
This reanalysis of Bondu-so has important implications for abstract phonology
Do other languages display abstract segments?

- e.g. Standard Yoruba (Ọla Orie 2001, 2003)
  * **harmony exceptions**:
    [e-bi̱] 'hunger' vs. [ɛ̀-bi̱] 'guilt'
  - **abstract harmony**:
    /e-bɪ̱/→/ɛ-bɪ̱/→[ɛ-bi̱]
- e.g. Esimbi (Hyman 1988)
  * **7-affixal contrasts > 3-root contrasts**:
    [u-mu] 'drink' vs. [o-mu] 'go up' vs. [ɔ́-mu] 'sit'

– **abstract height transfer**:

/u-mɔ/→/ɔ-mɔ/→[ɔ́-mu]

* the same counterbleeding opacity via absolute neutralisation

If not here then where?

- What would satisfactory evidence of abstract contrasts look like?
- How can abstract segments be independently motivated?
- What do language learners need to acquire them?
- How might they arise diachronically?
- Are they diachronically stable, or is non-abstract reanalysis inevitable?

☞ regardless of the authenticity of abstract contrasts, these questions are worth exploring

3 Appendix I: A representational account of Bondu-so vowels and harmony

I provide a new account of Bondu-so vowels and vowel harmony, rooted in the contrastivist approach advocated in Sandstedt (2018).

This framework is particularly well suited to the Bondu-so problems:

1. specifically informed by vowel harmony typology,

   ☞ makes explicit predictions regarding the causes of harmony neutrality

2. provides a bottom-up approach to the emergence and acquisition of phonological features and a top-down account of how features are organised and combine to produce individual segments, phonological classes, and whole sound inventories

   ☞ makes specific predictions regarding the generalisation of contrasts

3.1 Theoretical preliminaries

Sandstedt (2018: §2.3) assumes emergent and substance-free features (Mielke 2008, Iosad 2017)

- generalised as required by the phonological component to define and label language-specific contrasts and alternations.

3.1.1 Emergence of sound inventories

The size and shape of the language's inventory (i.e. the number of contrasts) is defined by the set of generalised features and feature co-occurrence restrictions.

- as expressed by the so-called Correlate Contrastivist Hypothesis (CCH) in (18)

(18) **Correlate Contrastivist Hypothesis** (Sandstedt 2018: 35)
The phonemes of a language *L* are equal to the sum of features and feature co-occurrence restrictions which are minimally necessary for the expression of phonological regularities in *L*.

According to the CCH,

- the accurate generalisation and acquisition of segmental phonology requires some minimal set of features and feature co-occurrence restrictions

  1. [a…a…a] vs. [b…b…b]
     ☞ evidence of some [F]-harmonic correspondence (e.g. [F] /a/ vs. non-F /b/)
  2. [a…c…a] vs. [b…c…b] – not *[a…c…a] or *[b…d…b]
     ☞ some [G] feature which is incompatible with [F]
     i.e. prohibited *[G, F] resulting in harmonically neutral [G]-specified /c/

- the sum of the acquired set of active features (i.e. [F] and [G]) and their permitted co-occurrences (i.e. *[F, G]) defines a set of phonemes:

  – [F] /a/
  – [G] /c/
  – [ ] /b/ (i.e. non-F and non-G)
  – *[G, F] */d/

3.1.2 Nature of phonological features

I assume phonological features are principally phonetically arbitrary ('substance-free')

- from the bottom-up must be extracted from the data

The CCH acts as a kind of null hypothesis – setting top-down limitations on inventory size/shape

- no more features/contrasts are posited than required

3.1.3 Acquisition of phonological features

As a model of phonological acquisition, this contrastivist approach adapts certain insights from Westergaard's (2009, 2013, 2014) model of micro-cues.

- **main idea**: language learners are sensitive to fine linguistic distinctions and generalise small pieces of abstract linguistic structure ('micro-cues') when parsing linguistic input
  - e.g. a micro-cue for VO word order would be generalised as $_{\text{VP}}$[V DP]

Phonological micro-cues
When parsing phonological contrasts and alternations, language learners posit representational micro-cues of two types:

- privative, substance-free features (e.g. [F], [G], [H])
- obligatory/prohibited feature co-occurrence restrictions (e.g. [F, G]; *[F, H])

These micro-cues accumulate over the course of language acquisition, the sum of which defines the language's permitted sound inventory.

3.2 A contrastivist approach to Bondu-so features

The set of surface generalisations and representational micro-cues evidenced by Bondu-so vowel harmony alternations and contrasts are outlined below in (19). For simplicity's sake, we will ignore labial contrasts.

- Six representational micro-cues are minimally necessary for the accurate generalisation and acquisition of the patterns in (19)
  - three features (e.g. [RTR], [close], [open])
  - three feature co-occurrence restrictions (*[close, RTR], *[open, RTR], *[open, close])

(19) **Generalising Bondu-so vocalic representational micro-cues**

	Patterns	Surface generalisations			Micro-cue
a.	dɔ̀g-ɛ̀ nɔ̀j-è	[ɛ, ɔ] [RTR]	vs. vs.	[e, o] non-RTR contrasts/harmony	[RTR]
b.	gì̀j-ɛ̀ bì̀j-è	[i, u] [close]	vs. vs.	[ɛ, ɔ, e, o] non-close contrasts	[close]
c.	pàg-ɛ̀ bàr-è	[a] [open]	vs. vs.	[i, u, ɛ, ɔ, e, o] non-open contrasts	[open]

d.	kɛ́ʤ-íjɛ́	[i, u]	vs.	*[ɪ, ʊ]	*[close, RTR]
	nèmbìl-íjé	[close]	vs.	*[close, RTR] contrasts/harmony	
e.	sém-ándʒ-è	[a]	vs.	*[ə]	*[open, RTR]
	sɛ́m-ándʒ-ɛ́ɛ̀	[open]	vs.	*[open, RTR] contrasts/harmony	
f.	gíj-á	[a]	vs.	[i, *ə]	*[open, close]
	ʤúg-á	[open]	vs.	*[open, close] contrasts	

Bondu-so language learners must posit the followign features:

- some feature, which we may label [RTR], to express [RTR] [ɛ, ɔ] vs. non-RTR [e, o] contrasts and harmony alternations in (19a)
- some second feature, which we may label [close], to define [close] /i/ vs. non-close /e, ɛ/ distinctions
- some third feature, which we may label [open] (or [low]), to describe [open] [a] vs. non-open [i, u, ɛ, ɔ, e, o] contrasts in (19a–c)
- some prohibited *[close, RTR] restriction to prohibit [close] /i, u/ vs. *[close, RTR] */ɪ, ʊ/ contrasts
- some prohibited *[open, RTR] restriction to prohibit [open, (RTR)] /a, *ə/ contrasts[1]
- some prohibited *[open, close] restriction to prohibit [open] /a/ vs. *[open, close] */ə/ vs. [close] /i/ contrasts.

The set of Bondu-so phonemes evidenced by the six micro-cues in (19) are illustrated below in Table 4.

Micro-cue	Phonemes	
[close]	i	u
*[close, RTR]	*ɪ	*ʊ
*[close, open]	*ə	
(unmarked)	e	o
[RTR]	ɛ	ɔ
*[open, RTR]	*ə	
[open]	a	

Table 4: Permitted Bondu-so vocalic contrasts evidenced by phonological activity

[1]Though [a] may be articulatorily/acoustically retracted in Bondu-so, it is *phonologically* non-RTR (9). In substance-free approaches, where phonological features are not defined by articulatory / acoustic correlates, such non-contrastive differences in the realisation of [RTR]/non-RTR segments are attributed to phonetic implementation and do not necessarily reflect underlying phonological feature specifications.

3.2.1 Bondu-so feature summary

This exploration of Bondu-so harmony patterns and vocalic contrasts illustrates the key insight of the CCH

- regularities in phonological activity (i.e. contrasts and alternations) in the data in (19) inform phonological representations

Following the surface generalisations in (19), Bondu-so displays the active features and non-abstract vocalic contrasts [close] /i, u/, [RTR] /ɛ, ɔ/, unmarked (non-close, non-RTR, non-open) /e, o/, and [open] /a/ vowel contrasts.[2]

3.2.2 CCH, Micro-cues, and abstract contrasts?

An important corollary of this approach to Bondu-so vowels and vowel harmony is that if features emerge, are generalised, and acquired in a similar way to the micro-cue approach in (19)

☞ then language learners are predicted to produce non-abstract or non-covert representations.

According to the CCH, a language's set of contrasts are informed in a transparent way by both positive and negative surface phonological evidence.

- Overt phonological inactivity – e.g. surface harmony neutrality as in (19de) – evidences feature co-occurrence restrictions which rule out certain possible contrasts, as in *[close, RTR] */ɪ, ʊ/ in Bondu-so.
  - Truly abstract or covert contrasts which undergo absolute neutralisation are not recoverable from surface generalisations without additional layers of abstraction.

3.3 Bondu-so feature geometry

Following the CCH, Bondu-so displays a seven-vowel inventory

- tongue root contrasts on mid (non-close and non-open) /e, o, ɛ, ɔ/ vowels
  - prohibited on [close] /i, u/ and [open] /a/ vowels

What remains to be explored is the relation between Bondu-so height and tongue root features.

[2] For simplicity's sake, I have not illustrated labial distinctions, but they are easily incorporated assuming the additional feature [labial] which is permitted to co-occur with every other feature except [open] (i.e. [close, labial] /u/, [labial] /o/, [RTR, labial] /ɔ/, but *[open, labial] */ɒ/).

3.3.1 Contrastive hierarchies

Sandstedt (2018) models the organisation and relation between phonological features using a version of Contrastive Hierarchy Theory (CHT; Dresher, Piggott & Rice 1994; Hall 2007; Dresher 2003, 2009; Mackenzie 2013, 2016; Iosad 2017) which incorporates emergent features and feature-nodes.

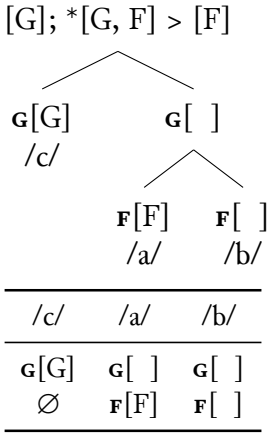
Key idea: While the existence and co-occurrence of features in a language is evidenced by its phonological activity (i.e. contrasts and alternations)

- the language-particular organisation and shape of feature classes is informed by phonological visibility (i.e. locality asymmetries such as harmony transparency vs. blocking).

In CHT, segmental and featural relations are defined via hierarchically nesting featural contrasts within the scope of other featural contrasts.

- A simple abstract example is provided in Fig. 1
  - assumes the ordered set of micro-cues [G]; *[G, F] > [F]
    - producing three segments [G] /c/, [F] /a/, and non-G/non-F /b/

Figure 1: Classes and sub-classes in a privative contrastive feature hierarchy



Sandstedt's (2018) version of CHT assumes nesting relationships between a language's featural contrasts which depend on feature-specific nodes **F** and **G**.

- e.g. [F]-contrasts in Fig. 1 are a sub-distinction of non-G segments.

Contrastivity for the feature [F] is defined by bearing an **F** feature-node

- distinguishing the (contrastive) set of segments **F**[(F)] /a, b/ from non-contrastive underspecified (**F**-node-less) /c/ segments.

Sub-inventories of the contrastive set /a, b/ are distinguished by feature specifications:

- the marked or dominant sub-inventory /a/ is specified [F]
- the unmarked or recessive (non-F) /b/ sub-inventory is non-specified for [F]

3.3.2 Successive Division Algorithm

Feature inventories and sub-inventories are derived by the Successive Division Algorithm (SDA), defined in (20), adapted from Hall (2007: 31).

(20) **Successive Division Algorithm** (Sandstedt 2018: 42)

a. The input (I) to the algorithm is one or more ordered feature and feature co-occurrence micro-cues.

b. If I is found to contain a feature, then it is divided into two (non-empty) sub-inventories: a marked set M, to which is assigned F[F], and its unmarked complement set $\bar{M}$, to which is assigned F[ ], obeying *[F, G]/[F, H] co-occurrence restrictions.

c. M and $\bar{M}$ are then treated as the input to the algorithm; the process continues until all feature cues are divided

The SDA consists of three important components:

1. Representational micro-cues are hierarchically divided into binary-branching feature classes (hierarchical organisation of features)

2. each sub-inventory is associated with an emergent feature-node (geometric grouping into classes)

3. the relative hierarchical ordering of features is cross-linguistically variable (emergent or cross-linguistically varying phonological classes)

Sub-inventories of each feature contrast (e.g. in Bondu-so [RTR] /ɛ, ɔ/ vs. non-RTR /e, o/) are differentiated by feature non-/specifications

- the marked (dominant) class is assigned a feature-node F as well as a privative feature specification [F]
  - e.g. RTR[RTR] /ɛ, ɔ/
- the unmarked (recessive) class bears an empty or bare node F[ ] and is non-specified for the feature
  - e.g. RTR[ ] /e, o/

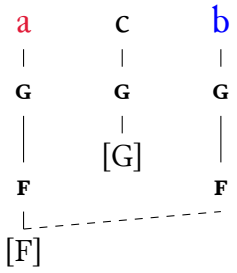
3.3.3 Feature scope asymmetries

Following the representations in Fig. 1, harmony locality can be accounted for in a traditional way by assuming strictly local feature spreading between [F]-specified and non-specified segments.

- Feature-nodes provide the landing sites for harmonic spreading (Fig. 2; cf. Avery & Rice 1989, Odden 1994)

Fig. 2 illustrates feature spreading between harmony triggers and targets across transparent or non-contrastive, underspecified segments.

Figure 2: Local [F]-spreading between contrastively specified triggers and non-specified targets



☞ Note that the feature specifications and order of feature nodes in Fig. 2 are defined by the specifications and order of featural divisions in Fig. 1.

For an exploration of the full typology of vowel harmony behaviour types predicted by this framework, see Sandstedt (2018: §3,4).

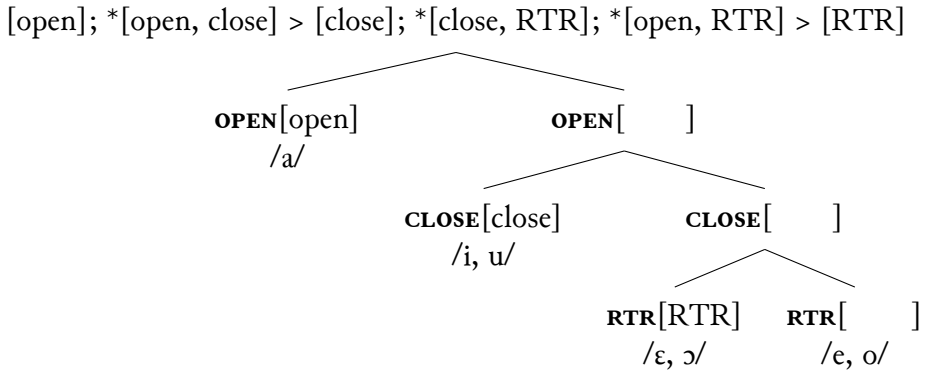
3.3.4 Bondu-so vocalic contrastive hierarchy

With the contrastive hierarchy toolkit outlined above, we can now infer the relationship between vocalic features in Bondu-so using its neutral harmony patterns as diagnostics. As observed in (19de), [open] and [close] vowels are invisible to Bondu-so tongue root harmony.

- e.g. [kɛ́ʤ-íjɛ́] 'cut'-MED-PASS. and [sɛ́m-ándʒ-ɛ́ɛ̀] 'slaughter'-IMPERF.-3.PL.
  - cf. INF. [kɛ́ʤ-ìlɔ̀ŋ] and IMPERF.-2.PL. [sɛ́m-ándʒ-ɛ̀]

☞ This indicates that [open]/[close] feature contrasts are ordered before [RTR] contrasts (Fig. 3)

  - [open]/[close] segments are outside the scope of [RTR] divisions and therefore non-contrastively underspecified for the harmony feature



non-open	[close]		i	u
	non-close	non-RTR	e	o
		[RTR]	ɛ	ɔ
[open]			a	

Figure 3: Bondu-so vowel contrasts and feature classes

Fig. 3 demonstrates the contrastive hierarchy for Bondu-so, which illustrates that vowels are divided most broadly into [open]/[close] contrasts and most narrowly into the respective harmony classes [RTR] /ɛ, ɔ/ vs. non-RTR /e, o/.

3.4 Bondu-so harmony analysis

We can account for all the data in Hantgan & Davis (2012) using only the representations in Fig. 3 and the simple harmony licensing principle in (21) – adapted from Iosad (2017: 52–54) and Walker (2005).

- This account recapitulates the basic insights of Nevins' (2010) recipient-oriented Search-and-Copy framework
  - harmony is driven by harmony targets

The principle in (21) states that non-final vowels which are contrastive for the harmony feature [RTR] should be associated with [RTR] where possible.

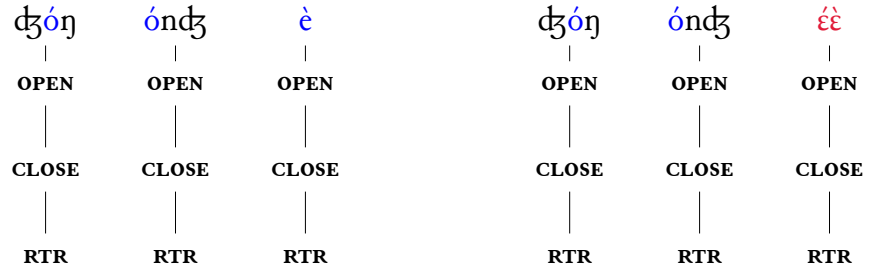
(21) License(Non-Final-V–**RTR**, [RTR]):
'Non-final vowels which are contrastive for [RTR] should be associated with [RTR]'

3.4.1 Privative [RTR]-licensing

The licensing principle in (21) is limited by the representations output by the SDA.

According to the harmony principle in (21), non-final vowels in Bondu-so are 'needy' in the sense of Nevins (2010)

- where a local [RTR] source is available, [RTR] spreads (4b)
  - e.g. /ʤoŋ-onʤ-ɛ̱ɛ̱/ → [ʤɔ́ŋ-ɔ́nʤ-ɛ́ɛ̀]
- where no local [RTR] source is available, no change occurs (4a)
  - e.g. /ʤoŋ-onʤ-e̱/ → [ʤóŋ-ónʤ-è]



(a) [ʤóŋ-ónʤ-è] 'heal'-IMPERF.-2.PL. (b) [ʤɔ́ŋ-ɔ́nʤ-ɛ́ɛ̀] 'heal'-IMPERF.-3.PL.

Figure 4: Bondu-so tongue root harmony is [RTR]-dominant

3.4.2 Harmony transparency via underspecification

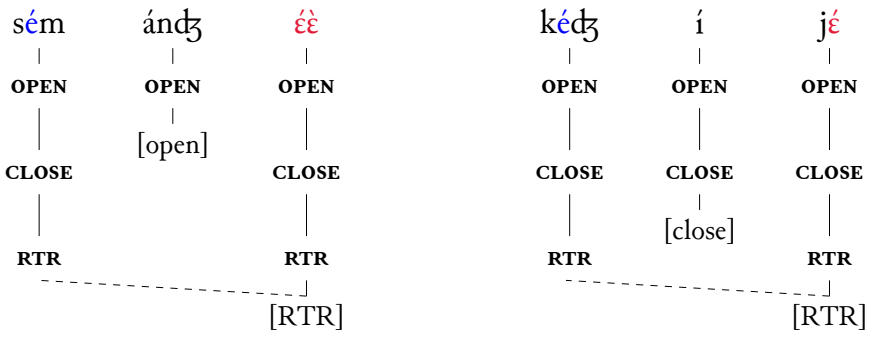
Tongue root harmony in Bondu-so involves active [RTR] spreading from [RTR]-specified vowels to the nearest contrastively non-specified segment

- i.e. to the nearest **RTR**-node

Because [open] and [close] features are prohibited from co-occurring with [RTR] (e.g. *[open, RTR], *[close, RTR]) and are categorised outside the scope of [RTR] in Bondu-so

- /i, u, a/ are underspecified for [RTR] and have no **RTR**-node

  ☞ [open] and [close] vowels therefore behave like consonants, being invisible to RTR vowel harmony (Fig. 5)



(a) [sɛ́m-ándʒ-ɛ́ɛ̀] 'slaughter'-IMPERF.-3.PL. (b) [kɛ́dʒ-íjɛ́] 'cut'-MED-PASS.

Figure 5: Harmony transparency via non-contrastive [RTR]-underspecification

Figs. 4–5 illustrate how a simple licensing approach applied to the privative representations in Fig. 3 produces all reported Bondu-so harmony and neutral harmony patterns, without the need for any additional grammatical architecture, bidirectional harmony, or abstract contrasts.

☞ Bondu-so vowels and vowel harmony are typologically consistent with other tongue root harmony languages and non-exceptionally simple to derive

3.5 Conclusions

Bondu-so has been previously analysed as displaying:

- a complex, directionally-asymmetric tongue root harmony system
- ternary [ATR] feature specifications on mid vowels
- abstract or covert [±ATR] contrasts on high and low vowels which trigger distinct harmony patterns but which never surface

I have shown that this analysis results in circular, non-falsifiable conclusions, suggesting the locus of explanation lies elsewhere.

I have advocated an alternative solution

- differences in [+ATR] and [−ATR] harmony dominance observed in Bondu-so follow from morphological differences in the distribution of retracted /ɛ, ɔ/ and advanced /e, o/ vowels.
  - Hantgan & Davis' (2012) data display evidence for at least three nominal and four verbal classes
- once Bondu-so inflectional classes are correctly identified, the harmony patterns are very easily characterisable as simple leftwards [RTR]-spreading with harmonically transparent non-contrastive high/low vowels

I have advocated a simple licensing approach (Walker 2005) applied to representations defined using a version of Contrastive Hierarchy Theory which incorporates emergent features and feature-nodes (Sandstedt 2018)

- provides a straightforward bottom-up approach to the emergence and acquisition of Bondu-so vocalic features as well as the right top-down architecture to account for their specification and organisation, as informed by Bondu-so phonological activity and visibility

4 Appendix II: Bondu-so full data

In this section, I provide the raw data from Hantgan & Davis (2012) organised according to the inflectional classes outlined in Tables 1–2. There is one important note regarding the verbal classes: Hantgan & Davis (2012) have only provided 56 inflected forms and do not always provide full paradigms. Thus, we do not know the mediopassive or imperfective forms for all lexemes. For this reason, a number of verbs which I have categorised as class 1 may actually belong to class 4 since they have identical infinitive, perfective, and imperative inflections. This ambiguity can be cleared up with additional data collection.

4.1 Verbs – class 1

Apart from person/number suffixes, class 1 verbs display only non-RTR suffixes and predictably only roots with non-RTR [i, u, e, o]. Class 1 verbs display a relationship between non-RTR perfective/mediopassive [e] and round [o] imperative/imperfective suffixal vowels. This pattern contrasts with class 2 verbs where we observe corresponding [ɛ] and [a] endings. The inclusion of [o]-imperfective inflections in class 1 is, however, technically ambiguous since none of the roots inflected for the imperfective are provided with other inflections. However, Hantgan & Davis (2012: §2.4) assume that [o] vs. [a] imperative and imperfective inflections is the result of an independent raising process triggered by [+ATR] specifications on roots. Ergo, since all the roots in class 1 are assumed to be [+ATR] by Hantgan & Davis (2012), the implication is that they should display round [-ónʤ-] imperfective suffixes. As mentioned above, further data collection will be required to fully clarify the relevant inflectional classes in Bondu-so.

(22) **Verb class 1**

	Form	Morph.	Gloss	Ex.No.
a.	némbíl-lòŋ	infinitive	‘beg’	6
b.	némbíl-ó	imperative	‘beg!’	9
c.	nèmbìl-íjé	mediopassive	‘beg’	footnote8
d.	nèmbìl-è	perfective	‘s/he begged’	1
e.	súg-ílòŋ	infinitive	‘go down’	6
f.	súg-ó	imperative	‘go down!’	9
g.	sùg-è	perfective	‘s/he went down’	1
h.	bí-ílòŋ	infinitive	‘lie down’	6
i.	bíj-ó	imperative	‘lie down!’	9

j.	bìj-è	perfective	‘s/he laid down’	1
k.	ʤóŋ-óndʒ-òm	imperfective-1.sg.	‘heal’	12
l.	ʤóŋ-óndʒ-òò	imperfective-2.sg.	‘heal’	12
m.	ʤóŋ-óndʒ-ò	imperfective-3.sg.	‘heal’	12
n.	ʤóŋ-óndʒ-ójì	imperfective-1.pl.	‘heal’	12
o.	ʤóŋ-óndʒ-è	imperfective-2.pl.	‘heal’	12
p.	ʤɔ́ŋ-ɔ́ndʒ-ɛ́ɛ̀	imperfective-3.pl.	‘heal’	12
q.	pɛ́b-ɔ́ndʒ-ɛ́ɛ̀	imperfective-3.pl.	‘whistle’	footnote 10
r.	sòŋg-íjé	mediopassive	‘curse’	footnote8
s.	dàŋ-íjé	mediopassive	‘be stuck (to something)’	footnote8

4.2 Verbs – class 2

Class 2 verbs display a non-RTR infinitive /-(i)loŋ/ but [RTR] perfective /-ɛ/ and mediopassive /-ijɛ/ suffixes. In this class we therefore observe predictable [RTR]/non-RTR alternations on verbal roots: e.g. (23ad) non-RTR /keʤ-il̲oŋ/ → [kéʤ-ìl̲òŋ] vs. [RTR] /keʤ-ɛ̲/ → [kɛ̀ʤ-ɛ̲̀]. In contrast to class 1 where we find non-RTR [-è, -íjé, -ó, -óndʒ] endings, class 2 verbs display [-ɛ̀, -íjɛ́, -á, -ándʒ] suffixes – evidencing a general, coherent class division in [e]/[o] and [ɛ]/[a] inflectional vowels.

(23) **Verb class 2**

	Form	Morph.	Gloss	Ex.No
a.	kéʤ-ìlòŋ	infinitive	‘cut’	6
b.	kéʤ-á	imperative	‘cut!’	9
c.	kɛ́ʤ-íjɛ́	mediopassive	‘be cut’	7
d.	kɛ̀ʤ-ɛ̀	perfective	‘s/he cut’	1
e.	gí-ílòŋ	infinitive	‘kill’	6
f.	gíj-á	imperative	‘kill!’	9
g.	gìj-è	perfective	‘s/he killed’	1
h.	dòg-ílòŋ	infinitive	‘leave’	6
i.	dóg-á	imperative	‘leave!’	9
j.	dɔ̀g-íjɛ́	mediopassive	‘be left’	7
k.	dɔ̀g-è	perfective	‘s/he left (it)’	1
l.	ʤúg-ílòŋ	infinitive	‘recognize’	6
m.	ʤúg-á	imperative	‘recognize!’	9
n.	ʤùg-íjɛ́	mediopassive	‘be recognized’	7
o.	ʤùg-è	perfective	‘s/he recognized’	1
p.	pág-ílòŋ	infinitive	‘tie’	6
q.	pág-á	imperative	‘tie!’	9
r.	pàg-è	perfective	‘s/he tied’	1
s.	sém-ándʒ-òm	imperfective-1.sg.	‘slaughter’	12

t.	sém-ándʒ-òò	imperfective-2.SG.	‘slaughter’	12
u.	sém-ándʒ-ò	imperfective-3.SG.	‘slaughter’	12
v.	sém-ándʒ-ójì	imperfective-1.PL.	‘slaughter’	12
w.	sém-ándʒ-è	imperfective-2.PL.	‘slaughter’	12
x.	sɛ́m-ándʒ-ɛ́ɛ̀	imperfective-3.PL.	‘slaughter’	12

4.3 Verbs – classes 3 and 4

Hantgan & Davis (2012) include one lexeme which displays an irregular pattern with a perfective [-e] suffix like class 1 but imperative [-a] suffix like class 2, displayed in (24). This may represent a third class. Likewise, there is one verb which displays [-e, -o] perfective/imperative suffixes like class 1 but an [RTR] [-ijɛ] mediopassive suffix like class 2, reproduced in (25). From this limited data-set, it is unclear how widespread or unique these exceptions are.

(24) **Verb class 3**

	Form	Morph.	Gloss	Ex.No.
a.	bàr-è	perfective	‘s/he helped’	1
b.	bàr-lòŋ	infinitive	‘help’	6
c.	bár-á	imperative	‘help!’	9

(25) **Verb class 4**

	Form	Morph.	Gloss	Ex.No.
a.	nój-ílòŋ	infinitive	‘sleep’	6
b.	nój-ó	imperative	‘sleep!’	9
c.	nɔ̀j-íjɛ́	mediopassive	‘be asleep’	7
d.	nòj-è	perfective	‘s/he slept’	1

4.4 Verbs – unclassified

Finally, in the mediopassive data Hantgan & Davis (2012) provide, they include a number of verbs not otherwise cited in the article (26). On the basis of the current data, they could belong either to class 2 or class 4. Since we do not have other suffixes to go on here, I leave them unclassified for now.

(26) **Verb class uncertain**

	Form	Morph.	Gloss	Ex.No.
a.	dàg-íjɛ́	mediopassive	'be locked'	7
b.	gìbír-íjɛ́	mediopassive	'wrap is tied'	7
c.	ìn-íjɛ́	mediopassive	'went'	7
d.	ìr-íjɛ́	mediopassive	'be forgotten'	7
e.	jàmb-íjɛ́	mediopassive	'be covered'	7
f.	pɔ̀r-íjɛ́	mediopassive	'let escape'	7

4.5 Nouns – class 1

There are three classes of nouns attested in the data. Class 1 nouns in (27) take non-RTR suffixes and predictably display only non-RTR root vowels [i, u, (e?), o].

(27) **Noun class 1**

	Form	Morph.	Gloss	Ex.No.
a.	ól-òò	singular	'house'	5
b.	ól-èè	plural	'house'	5
c.	gómbór-óò	singular	'mountain'	5
d.	gómbór-éè	plural	'mountain'	5
e.	gùnʤò gùnʤ-óò	singular	'hunched back'	5
f.	gùnʤò gùnʤ-éè	plural	'hunched back'	5
g.	gìr-óó	singular	'eye'	5
h.	gìr-éé	plural	'eye'	5
i.	sìʤ-òó	singular	'line'	5
j.	sìʤ-èé	plural	'line'	5

4.6 Nouns – class 2

Class 2 nouns take [RTR] suffixes and display predictably [RTR] root vowels (high and low vowels are underspecified for [RTR]).

(28) **Noun class 2**

	Form	Morph.	Gloss	Ex.No.
a.	bɔ́ŋg-ɔ̀ɔ̀	singular	'belly button'	5
b.	bɔ́ŋg-ɛ̀ɛ̀	plural	'belly button'	5

c.	kɔ́b-ɔ̀ɔ̀	singular	‘sheath’	5
d.	kɔ́b-ɛ̀ɛ̀	plural	‘sheath’	5
e.	nɛ̌nd-ɔ̀ɔ̀	singular	‘tongue’	5
f.	nɛ̌nd-ɛ̀ɛ̀	plural	‘tongue’	5
g.	nùmà sɛ́nd-ɔ̀ɔ̀	singular	‘finger’	5
h.	nùmà sɛ́nd-ɛ̀ɛ̀	plural	‘finger’	5
i.	ùʤùp-ɔ̀ɔ́	singular	‘road’	5
j.	ùʤùp-ɛ̀ɛ́	plural	‘road’	5
k.	dúl-ɔ̀ɔ̀	singular	‘tail’	5
l.	dúl-ɛ̀ɛ̀	plural	‘tail’	5
m.	ìn-ɔ̀ɔ́	singular	‘tooth’	5
n.	ìn-ɛ̀ɛ́	plural	‘tooth’	5
o.	tìm-ɔ́ɔ̀	singular	‘tree’	5
p.	tìm-ɛ́ɛ̀	plural	‘tree’	5

4.7 Nouns – class 3

Finally, class 3 nouns are similar to class 2 nouns, but feature a singular /-aa/ instead of /-ɔɔ/ suffix. Since /a/ is underspecified for the harmony feature, it does not trigger [RTR]-harmony, instead co-occurring with non-RTR vowels (the unmarked class). This inflectional class therefore displays roots not only with [i, u, ɛ, ɔ, a], but also [e, o] (e.g. [kób-áá] / [kɔ́b-ɛ́ɛ́] ‘brick mold’-SG./PL.).

(29) **Noun class 3**

	Form	Morph.	Gloss	Ex.No.
a.	òb-áà	singular	‘flexible liana branch’	8
b.	ɔ̀b-ɛ́ɛ̀	plural	‘flexible liana branch’	8
c.	kób-áá	singular	‘brick mold’	8
d.	kɔ́b-ɛ́ɛ́	plural	‘brick mold’	8
e.	bɛ̀l-áà	singular	‘edible leaves (cooked)’	8
f.	bɛ̀l-ɛ́ɛ̀	plural	‘edible leaves (cooked)’	8
g.	cènd-àà	singular	‘heart/liver’	8
h.	cɛ́nd-ɛ̀ɛ̀	plural	‘heart/liver’	8
i.	nùm-àá	singular	‘hand’	8
j.	nùm-ɛ̀ɛ́	plural	‘hand’	8
k.	kìnʤ-áà	singular	‘nose’	8
l.	kìnʤ-ɛ́ɛ̀	plural	‘nose’	8
m.	gìʒ-áà	singular	‘dance’	8
n.	gìʒ-ɛ́ɛ̀	plural	‘dance’	8
o.	tárb-àá	singular	‘hunting shelter’	8
p.	tárb-ɛ̀ɛ́	plural	‘hunting shelter’	8

q.	dán-àà	singular	'crown of head'	8
r.	dàn-ɛ̀ɛ̀	plural	'crown of head'	8
s.	kàà kár-áá	singular	'armpit, underarm'	8
t.	kàà kár-ɛ́ɛ́	plural	'armpit, underarm'	8
u.	nàà páɣ-áá	singular	'back of leg'	8
v.	nàà páɣ-ɛ́ɛ́	plural	'back of leg'	8

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