Epenthesis or deletion? CVCV~CCV alternations in Kru languages

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Introduction

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  - $\text{bala}^{3.3}$ ~ bla^{3}, 'hit' in Guébie (Eastern Kru)

Introduction

- Kru languages, spoken in Liberia and Côte d'Ivoire, show a variable CVCV~CCV alternation.
  - $\text{bala}^{3.3}$ ~ bla^{3}, 'hit' in Guébie (Eastern Kru)
- In some Kru languages this alternation has been analyzed as V epenthesis, while in others it has been called V deletion.

Goals of this talk

The aims of this talk are to

1. Describe the CVCV~CCV alternation in a number of Kru languages.
2. Diagnose for each language whether the alternation involves deletion or epenthesis.
   - Preview: the answer is not the same for all Kru languages
3. Provide an analysis that accounts for V epenthesis in some Kru languages and deletion in others.

Along the way, we will also come to some comparative and historical conclusions.

Overview

Background on CVCV ~ CCV alternations

/CCV/ → [CVCV] alternations are often analyzed as copy epenthesis (Dorsey's Law):

- A vowel is inserted in a CCV word to break up the cluster (Miner and Dorsey, 1979; Miner, 1989; Hale and White Eagle, 1980; Hayes, 1995; Clements, 1986, 1991; Halle et al., 2000; Kawahara, 2007; Stanton and Zukoff, 2018)
- The epenthetic vowel matches the quality of the following one.
  - Winnebago /*prás*/ → [*parás*] (Miner and Dorsey, 1979, 27)
- The epenthetic vowel is often short, and lacks its own prosody (e.g. no independent stress or tone).

CVCV ~ CCV alternations in the literature

Epenthetic vowels have also been analyzed as due to retiming of articulatory gestures (cf. Hall (2003, 2006, 2011)).

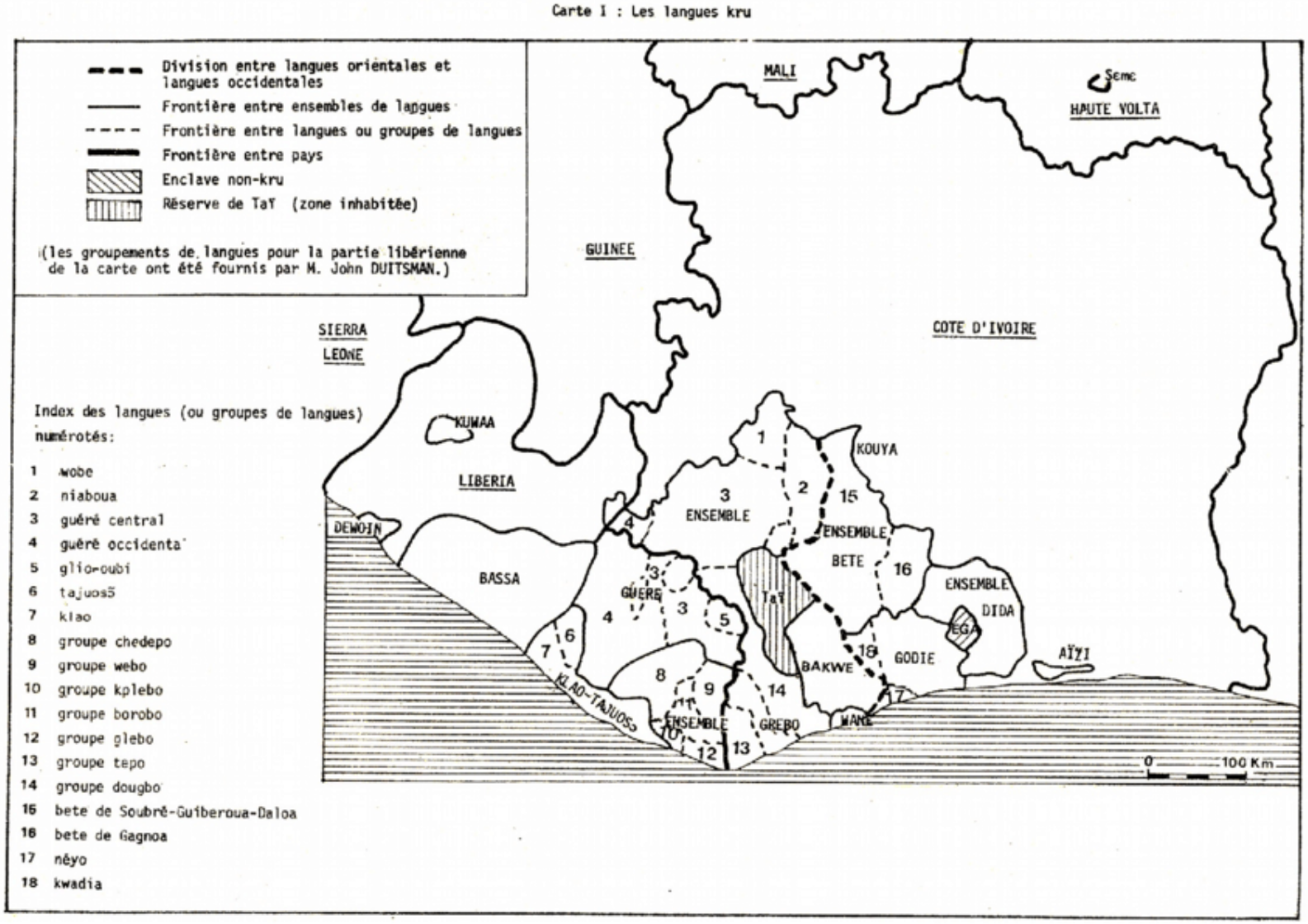
- There is a distinction between phonologically epenthesized vowels repairing a marked structure, and intrusive vowels which are phonologically invisible and involve a rearrangement of articulatory targets.

Determining the underlying form

Questions to consider in Kru:

- Is the first vowel in CVCV forms that alternate with CCV entirely phonologically predictable?
  - If it is not entirely phonologically predictable, how much of the pattern can be accounted for by phonology? And what is the best analysis of cases that are not phonologically predictable?
- Can the first vowel host its own tone?
- Can the first vowel trigger or participate in phonological processes independently from the second vowel?

Kru languages



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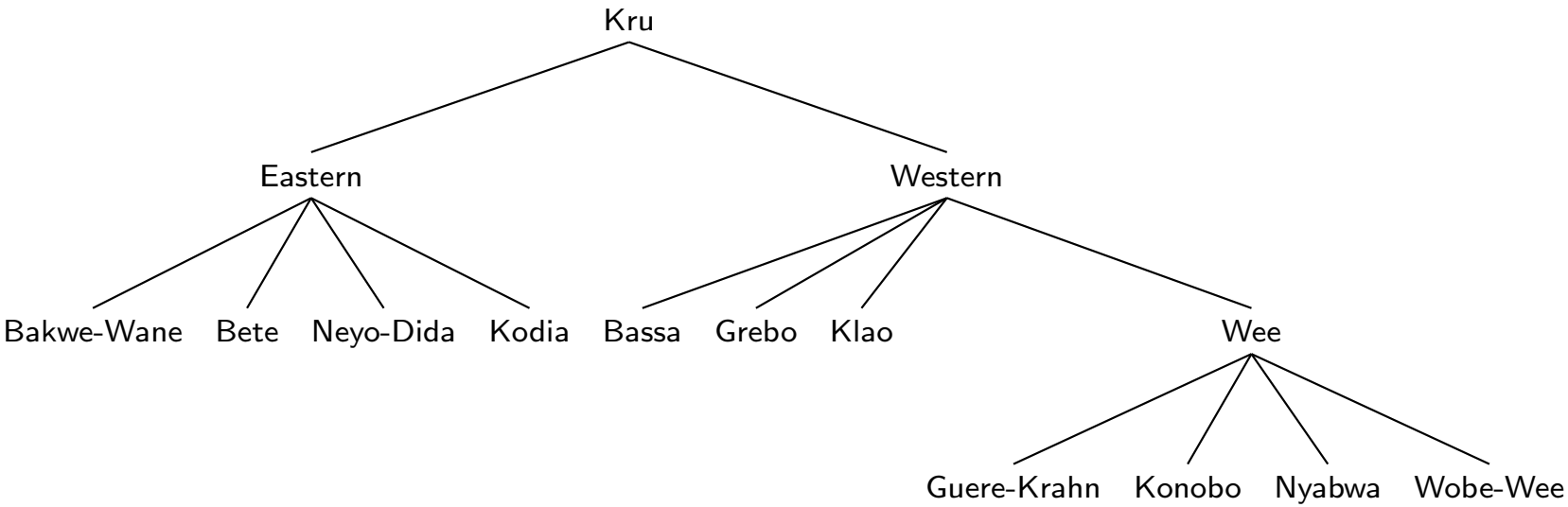


- Not included are Aizi, Kuwaa, and Seme, whose relationship to the rest of Kru is unclear.
- The languages we'll be looking at closely are both within the Neyo-Dida group.

Kru phonology

Consonants

- Labiovelar and labialized velar stops, in addition to other voiced + voiceless stops.
- There is a bilabial implosive that patterns with sonorants, and evidence of a proto-alveolar implosive, which has since merged with /l/.
- Nasal consonants are sometimes analyzed as non-contrastive in Kru languages that have contrastive nasal vowels (e.g. /l/ → [n] / _[+nasal])

Vowels

- Western Kru languages tend to have contrastive nasal vowels, while Eastern Kru do not.
- All Kru languages show vowel harmony, often ATR harmony, and sometimes also height harmony.

Kru phonology

Tone

- 3-4 contrastive tone heights in each language, plus contour tones made up of sequences of level tones.
- Grammatical tone that marks tense/aspect, nominative/accusative/genitive case, and negation.
- Tone here will be marked as in the source, sometimes with numeral superscripts, and sometimes with diacritics on vowels.

Syllable structure

- Syllables are almost exclusively CV, with some V syllables in pronouns and loan words.
- No underlying codas, but they can appear phrase-finally in certain derived contexts.
- No consonant clusters except in the CVCV ~ CCV alternation in question.

Epenthesis in Dida

Dida language background

Dida is a dialect cluster spoken in south-central Côte d'Ivoire.

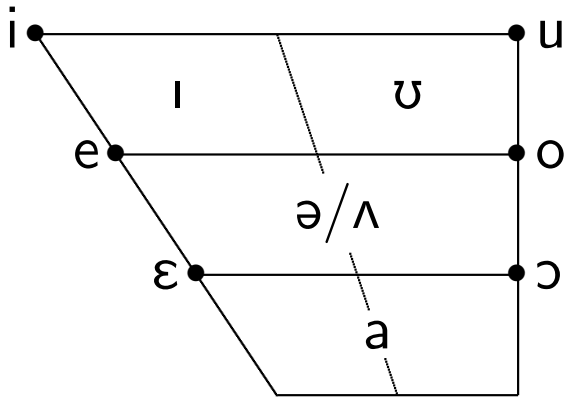
- This section focuses on the Lakota cluster of Dida, which itself is made up of three varieties: Lakota, Abou, and Vata.
- Dida Lakota is spoken in the town of Lakota and surrounding village communities by about 93,800 people in 1993, according to Ethnologue (Eberhard et al., 2020).

Dida language data

- The data presented here from Dida is based on existing descriptions in the literature.
  - Guéhoun (1993) (Dida Lakota)
  - Kaye (1981, 1982) (Dida Lakota/Vata)
  - Masson (1992) (Dida Yocoboué)

Vowel inventory

(1) **Vowel inventory**



Tone + syllable structure

Tone

- The Vata variety is analyzed as having four distinct lexical tones (Kaye, 1982).
- Other Dida varieties have three contrastive tone heights (Guéhoun, 1993, p. 68), written with diacritics on vowels (the diacritic on mid-toned vowels is often left off).
- Grammatical tone differentiates tense/aspect and case, as in other Kru languages.

Syllables

- Guéhoun (1993) analyzes /g^w, k^w, ŋ^w/ as sequences of two consonants, but they distributionally function as singletons.
- Otherwise, the only consonant clusters in the language are found in alternating CVLV/CLV forms.

CVCV ~ CCV

(2) **Dida Lakota CVCV ~ CCV alternations** (Guéhoun, 1993, p. 56)

a.	wʊ̀lʊ̀lɪ	wlʊ̀lɪ	'to leave'
b.	ŋɛlɛ	ŋlɛ	'smell'
c.	ɟulu	ɟru	'salt'
d.	kpokele	kpokle	'stool/chair'
e.	dugbulu	dugblu	'village center'

Epenthesis or deletion?

All synchronic facts point to the CVCV ~ CCV in Dida Lakota being a case of epenthesis: /CCV/ → [CVCV].

- All cases of alternating CVCV ~ CCV sequences in Dida exhibit a V1 identical in features to V2.
- Additionally, all cases exhibit identical tone on V1 and V2.
- V1 cannot host distinct features from V2, nor can it host its own distinct tone, though sequences of distinct tones on non-alternating CVCV sequences are quite common (e.g. [tʊtʊ̀àli] 'to argue something')

Possible analyses

The CCV → CVCV alternation in Dida resembles that of *intrusive* or *excrescent* vowels in the literature.

- Possible analyses:
  - Dorsey's Law (CCV → CVCV) (Miner and Dorsey, 1979; Miner, 1989)
  - Gestural realignment (Hall, 2003, 2006)
  - Feature spreading (Kawahara, 2007)
  - Correspondence + identity (Stanton and Zukoff, 2018)

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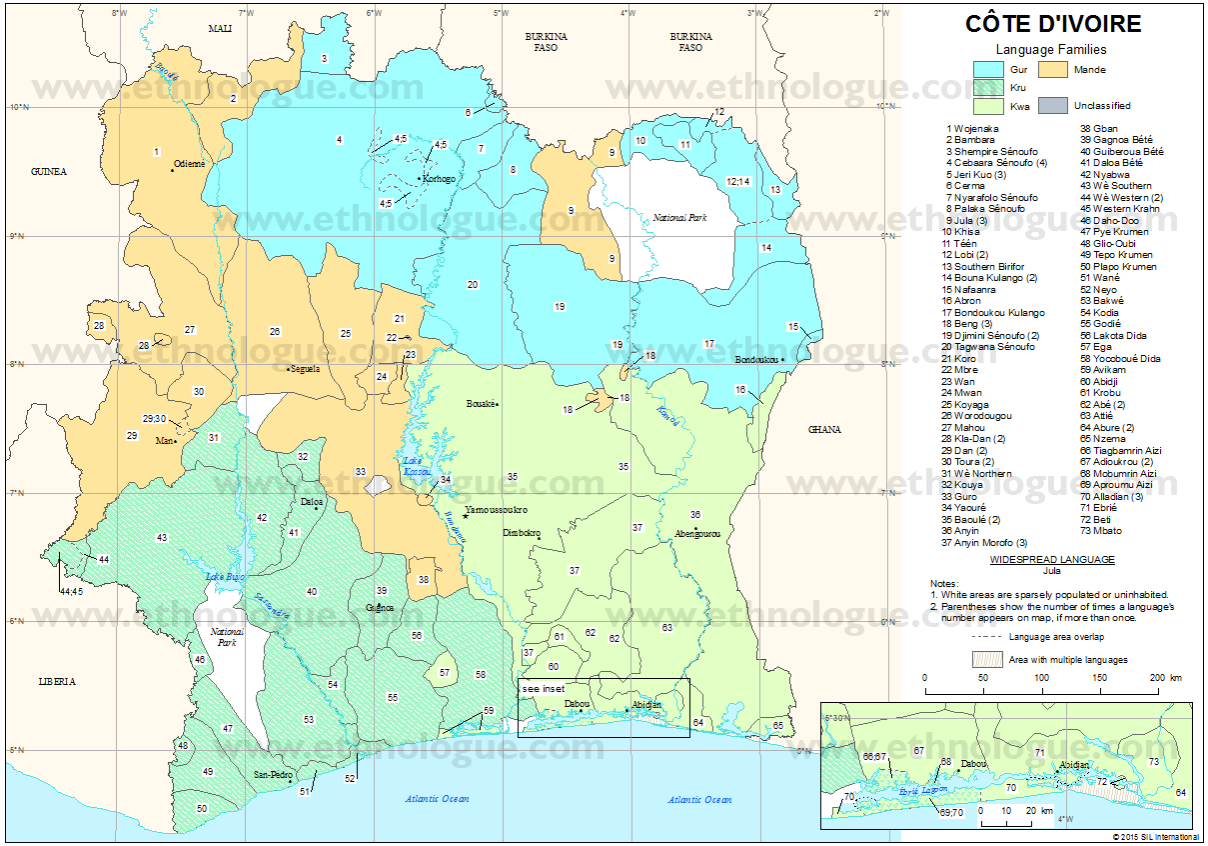
- The variation in surface form as CVCV or CCV can be modeled using Stochastic OT (Boersma, 1998; Boersma and Hayes, 2001) or MaxEnt Harmonic Grammar (Goldwater and Johnson, 2003).
- In all of the above accounts, non-alternating CVCV roots are analyzed as underlyingly /CVCV/ whereas alternating roots are analyzed as /CCV/. The representational difference results in distinct surface patterns.

Deletion in Guébie

Guébie language background

- Guébie is an endangered Kru language spoken in southwest Côte d'Ivoire by about 7000 people.
- The data presented here comes from field work in collaboration with the Guébie community between 2013-2021.

Where is Guébie spoken?

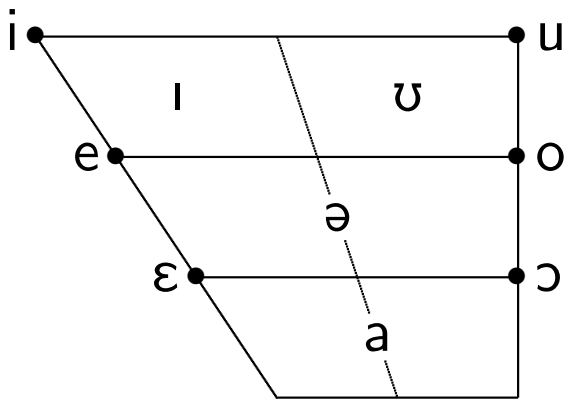


Gnagbodougnoa

Field elicitation

Vowel inventory

(3) **Vowel inventory**



Tone + syllable structure

Guébie has four distinct tone heights marked here with numerals 1-4, where 4 is high.

- Multiple level tones can surface on a single short vowel.
- Each morpheme is associated with a tone melody underlyingly (except the definite enclitic), and the tone melody associates one-to-one with vowels in the word, from left-to-right.

Syllables are CV or V

- The vowel of a phrase-final /NV/ sequence can be unpronounced, resulting in a phrase-final nasal coda, in which case the tone of the unpronounced vowel is produced on the preceding vowel.
- A subset of CVCV forms alternate with CCV on the surface.

CVCV~CCV in Guébie

Certain roots can surface as either CVCV or CCV in Guébie.

(4) **CVCV reduced to CCV** (syl_20161207)

	CVCV	*CCV*	*Gloss*
a.	bala$^{3.3}$	bra^{3}	'hit'
b.	tulu$^{4.4}$	tru^{4}	'chase'
c.	wʊlʊ$^{3.3}$	wrʊ^{3}	'granary'
d.	munu$^{3.3}$	mnu^{3}	'bite/sting'
e.	mana$^{3.3}$	mna^{3}	'meat'
f.	jɪla$^{2.3}$	jra^{23}	'ask'
g.	sija$^{2.3}$	sja^{23}	'be defeated'
h.	kuɓə$^{3.1}$	kɓə^{31}	'yesterday'
i.	duɓuɓili$^{3.1.1.2.2}$	dɓuɓri$^{3.1.2}$	'mourning'

Alternation is always optional, but CCV productions are more common in fast, casual speech than in slow, careful speech. Morphosyntactic environment does not play a role.

Non-alternating roots

- All roots that can surface as CCV have a corresponding CVCV form.
- Not all CVCV sequences can surface as CCV.

(5) **Non-alternating roots** (syl_20161207, syl_20170315)

	CVCV	*CCV*	*Gloss*
a.	ɟʊla$^{3.2}$	*ɟra^{32}	'take/borrow'
b.	tɛlɪ$^{3.3}$	*trɪ^{3}	'carve'
c.	sijo$^{2.3}$	*sjo^{23}	'wipe'
d.	ɲɛpɛ$^{3.1}$	*ɲpɛ^{31}	'sweep'

Deletion or epenthesis?

It is not immediately clear whether the Guébie facts are best analyzed as deletion or epenthesis.

- V1 of the alternating CVCV ~ CCV sequences need not have the same features as V2.
- V1 can host its own tone.
- V1 in alternating CVCV sequences is not shorter in duration than V1 in non-alternating CVCV sequences.

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Question: Can V1 be determined phonologically based on /CCV/? If not...

- Are there other phonological processes or phonotactic traits that differentiate alternating and non-alternating roots?
- What is the best analysis of the CVCV ~ CCV alternation in Guébie?

Determining which roots can alternate

- The class of alternating roots does not seem to be defined by any set of semantic features, but many of them share a number of phonological traits.
  - C2 (consonant) is /l/ or /ɓ/ (/l/ → [n] in a nasal root)
  - V1 (vowel) and V2 are identical
  - T1 (tone) and T2 are identical

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  - C2 (consonant) is /l/ or /ɓ/ (/l/ → [n] in a nasal root)
  - V1 (vowel) and V2 are identical
  - T1 (tone) and T2 are identical
- However, not every root with these features alternates, and not every alternating root has (some subset of) these features.

I attempt to determine whether the status of a root as alternating or not is phonologically determined, and whether the quality of the initial vowel in an alternating root is predictable.

Methodology for determining alternation status

1. Extract all di- and trisyllabic words in a Guébie corpus, as well as all words produced as CCV in the corpus.
2. Train one native Guébie speaker to sort through the 3554 extracted words, marking each CVCV string as either alternating with a CCV string or not.
   - For alternating words, the speaker provided the CCV form of the word. For the CCV words in the corpus, he provided the full CVCV form.
3. Ask a second speaker to independently confirm the judgments (the second speaker only worked through 1869 of the words).
   - Speakers agreed on the alternation status of 98% of words.
4. Of the 1840 disyllabic words judged the same way by both speakers, they agreed that 33.5% of them have both CVCV and CCV variants. This set of 1840 words is used as the basis for the generalizations throughout the remainder of this section.

Properties of V1

In Guébie, unlike cases of copy epenthesis, the first vowel in a CVCV word is not predictable given its CCV counterpart.

- *jɛla*$^{2.3}$, 'appear', and *jɪla*$^{2.3}$, ask', both surface as *jra*^{23} in their CCV form.
  - Given the surface form *jra*^{23}, the CVCV form is not predictable.
- V1 and V2 are of identical quality in 329 of the 617 alternating CVCV roots.
- Additionally, we do not find the same prosody on both syllables; each vowel in an alternating CVCV word can bear its own independent tone:
  - *jili*$^{2.3}$, 'steal'; *jɪla*$^{2.3}$, 'ask'
- Only 270 of the 617 alternating roots have the same tone on both syllables.

Minimal pairs

There are minimal pairs of roots, where one member of the pair alternates and the other does not.

(6) **Minimal pairs of alternating and non-alternating roots** (syl_20161207)

	CVCV	CCV	Gloss
a.	jili$^{2.2}$	jri^{2}	'be fat'
b.	jili$^{2.2}$	*jri^{2}	'fish'
c.	gɔlɔ$^{3.3}$	grɔ^{3}	'pain'
d.	gɔlɔ$^{2.3}$	*grɔ^{23}	'canoe'
e.	kpolo$^{3.1}$	kpro^{31}	'be clean'
f.	kpoke$^{2.4}$	*kpke^{24}	'crocodile'
g.	ɟulu$^{3.3}$	ɟru^{3}	'salt'
h.	ɟʊla$^{3.2}$	*ɟra^{32}	'take/borrow'

The existence of minimal pairs and unpredictable V1s means that at least some information about subjectivity to alternation must be lexically specified.

Underlying /CVCV/ with optional deletion in Guébie

These three pieces of evidence point to a *deletion* analysis in Guébie:

- Unpredictable V1 from CCV
- V1 can have distinct features and tone from V2
- There are minimal pairs of alternating and non-alternating forms

Phonotactic traits of alternating roots

The more of the relevant features a given root shows, the more likely it is to be in the alternating class.

(7) **Factors influencing alternation** (Sande, 2017)

	None	T1=T2	C2=l	V1=V2	T&C2	T&V	C2&V	All
Alternating	157	269	287	328	145	208	199	127
Total	751	614	536	611	244	339	244	154
Percent	20.9	43.8	53.5	53.7	59.4	61.4	81.6	82.5

Though no combination of phonotactic traits exclusively and exhaustively predicts whether a root falls into the alternating or non-alternating class.

A MaxEnt-HG model

A MaxEnt-HG Goldwater and Johnson (2003) analysis confirms that these three properties are the most relevant in determining whether a given root falls into the alternating class.

- MaxEnt-HG is a weighted-constraint model that produces a probability distribution over output candidates.
- It can correctly predict the proportion of each type of root that falls into the alternating class.

Constraints

(8) **Reduce(T1=T2)**
Assign one violation if the tone on two consecutive syllables is identical (reduce if T1=T2).

(9) **Reduce(C2=l)**
Assign one violation if a vowel intervenes between [l] and a preceding consonant (reduce if C2=l).

(10) **Reduce(V1=V2)**
Assign one violation if vowels in two consecutive syllables are identical (reduce if V1=V2).

(11) **Max**
Assign one violation for every input segment that lacks a corresponding output segment.

- A candidate violates one of the REDUCE constraints if it has not deleted V1, and shows the specified surface property, T1=T2, C2=l, or V1=V2.

Constraint weights

- Constraint weights were determined by the MaxEnt Grammar Tool (Hayes et al., 2009), providing a model of the distribution of alternation in the Guébie lexicon.
- In this model, candidates are groups of roots that share phonotactic properties.

A MaxEnt-HG model

(12) MaxEnt HG weights: Vowel deletion

	R(T)	R(C2)	R(V)	Max			
	.662	1.02	1.23	1.15	**H**	**Obs (%)**	**Pred (%)**
T1=T2							
CVCV	1				.662	57.2	61.9
CVCV/CCV				1	1.15	43.8	38.1
C2=l							
CVCV		1			1.02	46.5	53.1
CVCV/CCV				1	1.15	53.5	46.9
V1=V2							
CVCV			1		1.23	46.3	48.0
CVCV/CCV				1	1.15	53.7	52.0
T, C2							
CVCV	1	1			1.682	40.6	36.9
CVCV/CCV				1	1.15	59.4	63.1
T, V							
CVCV	1		1		1.892	38.6	32.3
CVCV/CCV				1	1.15	61.4	67.7
C2, V							
CVCV		1	1		2.25	18.4	24.9
CVCV/CCV				1	1.15	81.6	75.1
T, C2, V							
CVCV	1	1	1		2.912	17.5	14.6
CVCV/CCV				1	1.15	82.5	85.4
None							
CVCV					0	79.1	75.9
CVCV/CCV				1	1.15	20.9	24.1

A MaxEnt-HG model

The fact that the predicted amount of reduction for each type of root in the MaxEnt analysis in (12) so closely mirrors the observed pattern supports the analysis of the proposed parameters (T1=T2, C2=I, V1=V2) as those most relevant in determining whether a given root alternates.

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- Note that this model *cannot* be used to make predictions about how a particular root will surface.
  - 38.1% of /CVCV/ roots with the same tone on both syllables are predicted to always optionally be able to surface as CCV.
  - Nothing about this model predicts which T1=T2 roots will alternate and which will not, nor the frequency with which a specific alternating root will surface as CCV.
- The existence of minimal pairs and the inability to predict the V1 in an alternating CVCV~CCV form from V2 means that some lexical specification is needed to differentiate alternating from non-alternating roots.

Variation, gradience, and lexical specificity

The CVCV ~ CCV alternation in Guébie is categorical, optional, and lexically specific. An analysis must be able to account for these three facts.

- Deletion of the initial vowel applies *optionally*.
- Deletion is *categorical* in that it does not involve partial reduction of a vowel (it is not *gradient*); the vowel is either present or not.
- Deletion is *lexically specific* in that it does not apply across the board to all lexical items equally.

Modeling lexically specific phonology

There must be some lexically specific difference between alternating and non-alternating roots.

- **Possible analyses:**
  1. Weak or partially activated V1 in alternating roots, but a strong or fully activated V1 in non-alternating roots.
     - Lexical specificity built into the underlying representations (partially versus fully activated V1).
  2. Lexically sensitive cophonologies, where one prevents alternation and one is associated with multiple possible surface forms: CVCV and CCV.
     - Lexical specificity through into multiple morpheme-specific phonological grammars.
  3. Alternating forms that *do* exhibit the same features and tone on V1 and V2 are /CCV/, while the unpredictable alternating forms are /CVCV/.
- How to determine between these analyses?
  - Phonological evidence: Rules out option 3.
  - Psycholinguistic evidence: Also seems to support 1 or 2.

Phonological evidence

The same set of roots that show a CVCV~CCV alternation in Guébie show another phonological alternation: Vowel replacement determined by a subset of suffixes/enclitics.

(13) **Object enclitics trigger vowel harmony on alternating roots**

	Bare verb	$3\text{SG.HUM} =ɔ^2$	$3\text{SG} =ɛ^2$	$3\text{PL} =ɪ^2$	*Gloss*
a.	jili$^{2.3}$	jɔl=ɔ$^{2.32}$	jɛl=ɛ$^{2.32}$	jɪl=ɪ$^{2.32}$	'steal'
b.	jɪla$^{2.3}$	jɔl=ɔ$^{23.2}$	jɛl=ɛ$^{23.2}$	jɪl=ɪ$^{23.2}$	'ask'
c.	bala$^{3.3}$	bɔl=ɔ$^{3.2}$	bɛl=ɛ$^{3.2}$	bɪl=ɪ$^{3.2}$	'hit'
d.	wʊla$^{3.1}$	wɔl=ɔ$^{3.12}$	wɛl=ɛ$^{3.12}$	wɪl=ɪ$^{3.12}$	'look at'

Non-alternating roots in object enclitic contexts

(14) **Non-alternating roots in object contexts**
(syl_20161207, syl_20170315)

	Root	*Root=ɔ*^{2}		*Gloss*
a.	sumu$^{2.2}$	sum=ɔ$^{2.2}$,	*sɔmɔ$^{2.2}$	'boil him'
b.	ɟʊla$^{3.2}$	ɟʊl=ɔ$^{3.2.2}$,	*ɟɔlɔ$^{3.2}$	'take him'
c.	tɛlɪ$^{3.3}$	tɛl^{3}=ɔ^{2}		'carve him'
d.	sijo$^{2.3}$	sij^{2}=ɔ^{32}		'wipe him'
e.	ɲɛpɛ$^{3.1}$	ɲɛp^{3}=ɔ^{12}		'sweep him'

Evidence for vowel replacement, not harmony

Most pronouns have the shape of a single vowel, but the 3PL pronoun is /=ʊa^{2}/, produced [=wa^{2}].

(15) **3pl object pronoun as evidence for vowel replacement** (syl_20170315, syl_20210817, oli_20210727)

	Root	*Root=wa^{2}*	*Gloss*
a.	bala$^{3.3}$	bʊla$^{3.2}$	'hit them'
b.	jɪla$^{2.3}$	jʊla$^{2.32}$	'ask them'
c.	wʊla$^{3.1}$	wʊla$^{3.12}$	'look at them'
d.	ɓatɛ$^{3.1}$	ɓat=wa$^{3.12}$	'search for them'

Phonological evidence in favor of full lexical specification

The phonological evidence provided suggests that there is a vowel slot in alternating CVCV words, which can be filled in with the first vowel of a /ʊa/ 3PL.ACC object in vowel replacement contexts.

- If (some) alternating words were underlyingly /CCV/, there would be no vowel slot for the first vowel of the 3PL.ACC marker to associate to.
- However, if all alternating morphemes are underlyingly /CVCV/, the vowel replacement facts can be straightforwardly accounted for as non-concatenative association of vowels (or features) to a CV template.

This rules out option 3, where some alternating roots are underlyingly CCV.

Psycholinguistic evidence

Another type of evidence to consider is whether speakers extend the option of CVCV~CCV or vowel replacement alternations productively to new words.

- If so, do they do so at the frequency predicted by the MaxEnt model?

Preview: The current results are inconclusive, but subtly point towards arbitrary lexical specificity over phonological determinedness.

Psycholinguistic evidence

I ran a psycholinguistic experiment in the Guébie community in Summer 2019 to test whether speakers use phonotactic information about nonce words to determine whether they alternate or not.

- Worked with 22 speakers, each introduced to 44 nonce words and asked to produce them in a vowel replacement context.
- 9 of the participants' data were usable.
- Of the 9, 4 never extended alternation to nonce words, suggesting that alternation is lexically specified and learned separately for each given morpheme.
- 3 produced the alternation in 1/44 words, 1 in 2/44 words, and 1 in 4/44 words.

Psycholinguistic evidence, cont.

Of the 9 total words across all 9 participants that showed an alternation (2% of the data), 8 had the same vowel in both syllables, and in 7 the second consonant was /l/.

- All test words had the same level tone melody, so we cannot determine whether tone had an effect on speaker behavior.
- Two of the words were produced as alternating by more than one speaker: jɔlɔ (2 speakers), wɛlɛ (3 speakers).

There is too little data on any given word type to run stats, but it seems that some speakers extend alternation at low rates to nonce words, suggesting a small amount of phonological determinedness, while other speakers do not extend the alternation, suggesting lexical determinedness.

- When travel is again possible, I hope to run additional experiments in the Guébie community.

Analytical summary

- The phonological and psycholinguistic evidence suggest that the difference between alternating and non-alternating CVCV roots in Guébie is lexically specified or listed.
- Here I don't differentiate between possible analyses of lexical specification, but some options include:
  - Gradient strength-based representational differences
  - Cophonologies

Areal findings

CVCV~CCV across Kru

Language	*CVCV ~ CCV?*	*V1 predictable?*	*Possible C2s*
Dida/Vata	✓	✓	/l/
Nyabwa	✓	✓	/l, ɓ, w/
Neouolé	✓	✓	/l/
Guébie	✓	–	/l, ɓ/
Grebo	✓	–	/l/
Bété	✓	–	/l/
Godié	✓	–	/l/
Déwoin	–	–	
Kuwaa	–	–	

Historical consequences

From a diachronic perspective, the data point to Proto-Kru /CVCV/ forms alternating with [CCV]. This was reinterpreted as epenthesis (underlying /CCV/ with predictable [CVCV] variants) in a few languages.

- The languages that show evidence for deletion are not all closely related, so positing that *CCV ≫ CVCV would require the same change to have occurred separately multiple times.
- A single, systematic change can result in underlying /CCV/ from *CVCV, but not the other way around (because of unpredictable V1s in some languages).
- Kru isolates like Kuwaa do not show any CVCV~CCV alternation, but have non-alternating CVCV forms that correspond with alternating forms in Eastern and Western Kru, suggesting that Kuwaa may have split off from the rest of Kru before the CVCV~CCV alternation.

CVCV~CCV in Mande

In nearby Mande languages, we see a similar CVCV~CCV alternation.

- In Southern Mande, /CLV/ can be realized as CvLV, where the first vowel always matches the features of the second, is very short, and is easily elided (Vydrine, 2004).
- (Bearth, 1971, 54-56) says the V1 of CVCV forms in Toura (Eastern Mande) is very short and always identical to V2.
- In Western Mande, some disyllabic morphemes have a single tone level and act phonologically similarly to CLV morphemes in Southern Mande (as a single foot).
  - In Bambara, specifically, /CVLV/ can be pronounced [CLV].
  - According to Green (2018), there is a drive for monosyllabic words (minimality) in Western Mande, so /CVCV/ surfaces as [CCV] when phonotactics allow.

Historical situation in Mande

- Proto-CVCV have become /CCV/ in Southern Mande.
- Proto-CVCV forms are moving towards CCV in Western Mande.
- In Southern Mande, a copy epenthesis analysis makes sense of the occasional production of /CCV/ as [CvCV], with a short V1, identical to V2.

Hall (2006) discusses a historical change of intrusive vowels becoming phonological, but the opposite seems to be happening in Mande and Kru, possibly with a drive towards minimality (Green, 2010, 2015, 2018).

Conclusions

Conclusions

There is not a single, unified synchronic analysis of the CVCV~CCV alternation in Kru languages:

- In Dida, alternating roots are /CCV/ and undergo epenthesis or vowel intrusion or gesture rearrangement.
- In Guébie, alternating roots are /CVCV/ and lexically specified as alternating (optionally deleting V1).

Evidence in favor of deletion in Guébie comes from...

- The unpredictability of V1 from the CCV form of alternating roots.
- The phonological vowel replacement alternation found in the same set of alternating roots.
- Additional (weak) evidence from nonce-word tests.

Diachronic implications

From a diachronic perspective, we have learned that...

- Before Eastern and Western Kru split, there was likely a CVCV~CCV alternation best analyzed as deletion.
  - This was reinterpreted as /CCV/ in some languages (Dida, Nyabwa)
- In an earlier stage of Kru, before Kuwaa split off, there was likely no CVCV~CCV alternation.
- In related Mande, Proto-/CVCV/ is moving towards /CCV/.
- One possible explanation is an areal drive towards monosyllabicity (cf. Green 2015).
- Additionally, this is perhaps the first concrete case of phonological, underlying V1s in *CVCV forms being reanalyzed as intrusive, as opposed to the other way around (cf. Hall 2006).

Synchronic implications

From a synchronic perspective, we have learned that...

- Evidence for epenthesis versus deletion may come from language-specific phonological processes seemingly unrelated to epenthesis.
- So, it's useful to understand the full phonological (+morphological) system of a language, rather than only examining data from a single paradigm.

Thank you!

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References I

Bearth, Thomas. 1971. L'énoncé toura (côte d'ivoire). *Summer Institute of Linguistics* .

Boersma, Paul. 1998. Functional phonology. Doctoral Dissertation, Netherlands Graduate School of Linguistics.

Boersma, Paul, and Bruce Hayes. 2001. Empirical tests of the gradual learning algorithm. *Linguistic inquiry* 32:45–86.

Clements, Nick. 1986. Syllabification and epenthesis in the Barra dialect of Gaelic. In *The phonological representation of suprasegmentals*, ed. Koen Bogers, Harry van der Hulst, and Marten Mous, 317–336. Dordrecht: Foris publications.

Clements, Nick. 1991. Place of articulation in consonants and vowels: A unified theory. In *Working papers of the Cornell phonetics library*, volume 5, 677–123.

Eberhard, David M., Gary F. Simons, and Charles D. Fenning, ed. 2020. *Ethnologue: Languages of the world*. Dallas: SIL International.

References II

Goldwater, Sharon, and Mark Johnson. 2003. Learning OT constraint rankings using a maximum entropy model. In *Proceedings of the Stockholm workshop on variation within Optimality Theory*, 111–120.

Green, Christopher R. 2015. The foot domain in Bambara. *Language* 91:e1–e26.

Green, Christopher R. 2018. Headedness and prosodic restructuring in Mande. *Presentation at the 49th Annual Conference on African Linguistics* .

Green, Christopher Ryan. 2010. Prosodic phonology in Bamana (Bambara): Syllable complexity, metrical structure, and tone. Doctoral Dissertation, Indiana University.

Guéhoun, N. Augustin. 1993. Description systématique du dida de lakota (langue kru de côte d'ivoire). Doctoral dissertation, Université Stendhal (Grenoble 3).

References III

Hale, Kenneth, and Josie White Eagle. 1980. A preliminary metrical account of Winnebago accent. *International Journal of American Linguistics* 46:117–132.

Hall, Nancy. 2006. Cross-linguistic patterns of vowel intrusion. *Phonology* 23:387–429.

Hall, Nancy. 2011. Vowel epenthesis. *The Blackwell companion to phonology* 1576–1596.

Hall, Nancy Elizabeth. 2003. Gestures and segments: Vowel intrusion as overlap. Doctoral Dissertation, University of Massachusetts Amherst.

Halle, Morris, Bert Vaux, and Andrew Wolfe. 2000. On feature spreading and the representation of place of articulation. *Linguistic Inquiry* 31:387–444.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. University of Chicago Press.

References IV

Hayes, Bruce, Colin Wilson, and Anne Shisko. 2009. MaxEnt grammar tool. URL `http://www.linguistics.ucla.edu/people/hayes/MaxentGrammarTool/`.

Kawahara, Shigeto. 2007. Copying and spreading in phonological theory: Evidence from echo epenthesis. In *University of Massachusetts occasional papers in linguistics 32: Papers in Optimality Theory iii*, ed. Leah Bateman, Michael O'Keefe, Ehren Reilly, and Adam Werle. GLSA Publications.

Kaye, Jonathan. 1982. Les dialectes dida. In *Projet sur les langues Kru*, ed. Jonathan Kaye, Hilda Koopman, and Dominique Sportiche, 233–295. Montreal: Quebec University.

Kaye, Jonathan D. 1981. La sélection des formes pronominales en vata. *Revue québecoise de linguistique* 11:117–135.

References V

Masson, Denis. 1992. Esquisse phonologique du dida de Yocoboué. In *Esquisses phonologiques de trois langues ivoriennes: beng, dida, yaouré*, ed. Ingeborg Egner, 1–56. Abidjan: Inst. de Linguistique Appliquée (ILA).

Miner, Kenneth L. 1989. Winnebago accent: The rest of the data. *Anthropological Linguistics* 148–172.

Miner, Kenneth L, and Dorsey. 1979. Dorsey's law in Winnebago-Chiwere and Winnebago accent. *International journal of American linguistics* 45:25–33.

Sande, Hannah. 2017. Distributing morphologically conditioned phonology: Three case studies from Guébie. Doctoral Dissertation, UC Berkeley.

Stanton, Juliet, and Sam Zukoff. 2018. Prosodic identity in copy epenthesis. *Natural Language & Linguistic Theory* 36:637–684.

Vydrine, Valentin. 2004. Areal and genetic features in West Mande and South Mande phonology: In what sense did mande languages evolve. *Journal of West African Languages* 30:113–126.