Pushing the boundaries

Selected papers from the 51–52 Annual Conference on African Linguistics

Edited by

James Essegbey
Brent Henderson
Fiona McLaughlin
Michael Diercks

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Introduction: The pandemic ACAL

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ACAL 51–52 was not what we originally planned it to be. In fact, there was not supposed to be ACAL 51–52. The University of Florida was going to host ACAL 52 in 2021 after Rutgers hosted ACAL 51 in 2020. The last year we hosted ACAL at the University of Florida was in 2007. Therefore, when it was announced at ACAL 50 in Vancouver that we would be hosting it after Rutgers, we decided to make a big deal out of it and set to work for what we thought was going to be a memorable in-person conference. After all, there is no better place to be in the spring than Gainesville, Florida! Our main preoccupation at the outset was where to get funding to host the conference. We had lined up five places to go to for funding, two of which are our home departments. These are the Linguistics Department and the Department of Languages, Literatures and Cultures. The other three are the Center for African Studies, the University of Florida International Center (UFIC) and the Office of Sponsored Research. Based on promises from the heads of the first three places and our belief that we could get some funds from the other two, we felt that our plans would run smoothly without a hitch. Alas, we planned without knowing that the worse pandemic of the century was just about to strike.

On March 20, 2020, shortly before ACAL 51 was due to start, the World Health Organization (WHO) declared COVID-19 a pandemic. All in-person events were canceled. Rutgers had already finalized preparations for an in-person conference by then and had incurred expenses that could not necessarily be recouped without the conference taking place. This included the acquisition of the conference tote bags below on which had a beautiful African-themed design with ACAL 51 written on them:

The Executive Committee proposed that we merge ACAL 51 with ACAL 52 and organize a joint conference. At the time, we thought that the pandemic would be

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Figure 1: Conference tote bags for ACAL 51 at Rutgers

gone by the end of 2020, and we would be able to go back to holding in-person conferences. For that reason, in addition to accepting the papers that Rutgers had accepted for presentation at ACAL 51, we thought we could help them cut their losses by accepting the tote bags. One of the earliest discussions we had with the Rutgers team, therefore, was how much we were going to pay for the bags and how to we would add 52 to the writing on them.

We soon realized that even if the pandemic went away and we got the clearance to organize an in-person conference, travel restrictions at the time were going to prevent many people from traveling to Gainesville. This was particularly the case for our colleagues traveling from overseas. Nevertheless we wanted to have some people, however few, attend the conference in person, and, therefore, decided to plan for a hybrid conference. We had all become experts in Zoom discussions by then, and most of us had even participated in virtual conferences. The challenge with such a decision was determining how to budget for such a conference. Fortunately for us, the hotels were very flexible at the time, and gave us the most loosely binding contract. The size of the conference rooms were another problem. Since we could not tell how many people would show up, it was difficult to decide on which rooms to request for. The decision was taken out of our hands when the university declared that they were not yet open for in-person conferences. This was how come we became the first ACAL institution to organize a virtual ACAL. Needless to say, this killed our plans to go in for the beautiful tote bags that Rutgers had acquired.

Once we decided on a fully virtual conference, the main question we had to deal with was how to manage the different time zones of the presenters. For the United States, the main time zones were the Eastern Time for Florida and the Pacific Time in California. For Europe, it was the Central European Time and British Time, and for Africa, we had the Greenwich Meridian Time for participants from West Africa, East African Time for participants from that East Africa, and South African Standard Time for our colleagues in South Africa. We also had a paper from Japan and, therefore, had to take Japan Standard Time into consideration. In the end, we decided to start the presentations at 10:00 am so as to ensure that our colleagues on the West Coast who were three hours behind the time in Florida would have time for coffee (it was 7:00 am). We were also compelled to end presentations at 4:15 for the sake of colleagues in East and South Africa and Europe. In addition to three plenary talks, 90 papers were presented that were spread over 23 panels. These range from phonetics and phonology of segments and suprasegments and various topics in syntax and semantics. There were a few papers in morphology, morphosyntax, sociolinguistics, typology and language documentation. Generally, considering that this was a first for us, the conference went much better than we had expected. One advantage of a virtual conference is that participants have to submit recordings of the papers beforehand so we know which presenters will be present. Only a couple of presenters were not able to show up after the presentation to answer questions due to technical constraints.

In the first of two papers on phonetics, Lindsay Hawtof, Fridah Gam and Kathryn Franich analyze the acoustic properties of implosives and voiced and voiceless stops in the Rɨ̀kpàʔ, a Bantu language spoken in the Center Region of Cameroon. In the second phonetic paper, Jae Weller, Matthew Faytak, Jeremy Steffman, Connor Mayer, G Teixeira and Rolain Tankou discuss the use of acoustic and ultrasound data to examine tongue position in vowels that follow stop consonants in Yemba, a Bamileke language of the larger Grassfields family spoken in the West Province of Cameroon. The third paper by Yaqian Huang straddles phonetics and phonology. In it, Huang uses elicited data with instrumental suffixation and valence-changing structures to undertake an acoustic analysis of the vowel system in Rere with the aim to capturing the phonetic characteristics of vowel quality in phonological distributions and phonetic processes. Rere belongs to the Heiban group of Kordofanian languages spoken in in the Nuba mountains of southern Sudan. There are four phonology papers. The first by Mary Paster and Jackson Kuzmik discusses vowel hiatus resolution (VHR) as well as present a rule-based phonological analysis of the VHR) in Kikuyu, a Bantu language spoken in Kenya. In the second, Lee Bickmore provides an overview of the verbal tonology in Town Nyanga, a Bantu language spoken in Zambia, and contrasts it at various points with Chichewa. Kenneth S. Olsen then discusses the change of labial-velar plosives to labial consonants in Luto and its retention in Nduga, a dialect of Luto. Luto belongs to the Sara-Bongo-Bagirmi (SBB) sub-group of Central Sudanic, spoken in northern Central African Republic and southern Chad. The final phonology paper by Mike Cahill also explores the changes that labial velars undergo.

There are nine papers on syntax. The first paper by Liliane Hodieb provides a description and an analysis of the interaction between syntax and prosody in Wushi, a Ring Grassfields Bantu language spoken in Cameroon. Using Selkirk's Match theory, Hodieb discusses simple indicative sentences and modal constructions that express possibility in the language. The next paper by Katherine Russel proposes a unified account of grammatical tone and length in Gã. Makoto Furumoto then follows with an examination of the contracted forms of the demonstrative in the Kimakunduch dialect of Swahili, and suggests that it is at an early stage of grammaticalizing into a pronominal suffix. In the next paper, Leora Barel and Malin Petzell discuss aspect in East Ruvu languages, a subset of the Great Ruvu languages of the Bantu family spoken in the Tanzania. Unlike other Bantu languages, the East Ruvu languages have a reduced set of temporal and aspectual morphemes. Bar-el and Petzell focus on the behavior of the morpheme –ag- which functions as the imperfective in Bantu languages. In the following paper, Ronald Schaefer and Francis Egbokare examine tense-related adverbs across a range of West African languages, and co-occurrence restrictions between various temporal adverbs and grammatical morphemes that express tense values in Emai, an Edoid language in south-central Nigeria. Next, Crisófia Langa da Câmara, Michael Diercks, Madelyn Colantes, Brendan Ly, Jackson Kuzmik and Hannah Lippard take an initial look at object marking and related properties of the postverbal domain in Cinyungwe, a Bantu language spoken in Mozambique. José Armando Fernández Guerrero then discusses three complementation strategies in Rere, a Kordofanian language spoken in the Nuba mountains in Southern Sudan. In the eighth syntax paper, Colin Davis examines limitations of extraposition using fieldwork data on relative-clause extraposition in Wolof, a language spoken in Senegal. The ninth and final paper by Aron Finholt and John Gluckman shows that the choice of *kwamba* and *kuwa* in Tanzanian Swahili is sensitive to factors like lexical class of the embedding predicate, person features of the main clause subject, and mood of the embedded clause which are known to cross-linguistically affect complementizer choice. The one sociolinguistic paper in the volume by Bert van Pinxteren proposes 5 principles to consider in determining a limited number of languages that would be used in higher education. The final paper in the volume is a typology paper. In it, Mathew Harley discusses the findings of a survey of 247 vowel systems in Nigerian languages from 23 sub-families. He shows that they constitute 45 basic vowel inventories.

Chapter 1

Acoustic analysis of implosives in the Rɨkpàʔ language

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This study analyzes the acoustic properties of implosives and voiced and voiceless stops in the Rɨkpàʔ language, located in the Center Region of Cameroon (Guthrie Zone A.53). Three female native speakers produced lexical items with word-initial and word-medial bilabial and alveolar implosives /ɓ/ and /ɗ/, voiced plosives /b/ and /d/, and voiceless plosives /p/ and /t/. We measured and compared the fundamental frequency *(f0)* of the vowel following the target consonant, the plosive prevoicing or closure duration, and closure intensity between the three segment types. Overall, vowels following implosives have a significantly higher *f0* than those following voiced plosives and slightly lower *f0* than those following voiceless plosives. We also find that implosives, contrary to previous studies, have shorter closure durations than voiced plosives in word-initial position, though this pattern was reversed in word-medial position. Finally, while these implosives show no overall difference in intensity of prevoicing in word-initial position compared to voiced plosives, we see that implosives, unlike voiced plosives, have a rising intensity slope. In word-medial position, implosives have a significantly higher prevoicing intensity than voiced plosives, but a more uniform intensity profile.

1 Introduction

A variety of studies have considered the phonetic patterning of implosive consonants in the world's languages both from a theoretical perspective and from an acoustic-instrumental perspective. Descriptions of implosive production traditionally posit a *glottalic ingressive airstream mechanism* in which the speaker's larynx moves downward while the oral cavity is closed, causing a decrease in air

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pressure within the oral cavity and a subsequent ingressive airflow into the oral cavity once opened. This is in contrast with the more common pulmonic egressive airstream mechanism, in which sound is created through subglottal pressure buildup and airflow from the lungs outward through the larynx and either the oral or nasal cavity.

In spite of the glottalic ingressive label given to implosives as a class of sounds, studies have found that implosives have different means of production across Sub-Saharan Africa, resulting in variable acoustic patternings in fundamental frequency, prevoicing intensity, durational value, etc. This variability suggests the potential for differences in key articulatory variables such as larynx lowering, glottal constriction, and vocal fold tension when it comes to the production of implosives (Ladefoged 1968, Lindau 1984, Wright & Shryock 1993). Understanding the acoustic and articulatory patterns of implosives in a wider variety of languages will help to paint a more complete picture of their phonetic typology, and to help us better situate them in terms of their phonological status. The present work aims to explore phonetic and phonological patterns of implosives in Rɨkpàʔ, a Cameroonian Bantu language. The primary aim of our study is therefore to understand the acoustic patterns of implosives in Rɨkpàʔ from an instrumental perspective. To that end, we present acoustic data from three native female Rɨkpàʔ speakers in order to determine how fundamental frequency (*f0*), closure duration, and closure intensity differs between Rɨkpàʔ implosives, voiced plosives, and voiceless plosives. A secondary goal of our paper is to use these acoustic results in conjunction with observed distributional patterns of implosives in order to gain a better understanding of their phonological status in the language.

1.1 Acoustic and articulatory patterns of implosive production

A number of different acoustic variables have been examined in an effort to understand the primary cues which differentiate implosive consonants from pulmonic egressive stops, as well as to better understand the articulatory mechanisms involved in implosive production. Fundamental frequency is one variable which has been considered in some depth. As previously mentioned, implosives have been described as having a glottalic ingressive airstream which overlaps with an egressive airstream flow. According to Wright & Shryock (1993), this transition from ingressive to egressive flow of air creates a burst of atmospheric pressure, subsequently increasing the velocity of the airflow. This should theoretically correlate with a higher fundamental frequency in implosive production. Additionally, implosives are thought to be produced with greater vocal fold tension, which also should relate to a higher acoustic measure of fundamental frequency (Painter 1978). On the other hand, implosives generally involve larynx lowering to produce the characteristic ingressive airflow. This, theoretically, should cause a slight *decrease* in the fundamental frequency of an implosive or surrounding segments. Therefore, the articulatory mechanisms involved in implosive production have potential opposing effects on fundamental frequency.

Voiced and voiceless plosives, conversely, are both pulmonic egressive consonants, meaning that the airstream involved in production is only traveling out through the oral cavity. Voiced and voiceless plosives differ, however, in that "true" voiced plosives (of the kind that are found in Rɨkpàʔ) are produced with prevoicing, which can be associated with a host of articulatory maneuvers which serve to increase supraglottal volume, such as larynx lowering (Bell-Berti 1975, Westbury 1983). As mentioned previously, larynx lowering can lead to f0 lowering. In contrast, voiceless plosives do not have prevoicing, so the fundamental frequency should be significantly higher than for voiced plosives (House & Fairbanks 1953). Past studies have presented results in accordance with these theories of implosive production. For example, Wright & Shryock (1993), conducting a study on SiSwati, a Southern Bantu language (region S.43), found that vowels following implosives were significantly higher in f0 than those following voiced plosives, but still lower than those following voiceless plosives. It appears, therefore, that although larynx lowering is attested for both implosives and voiced plosives, its effect on f0 lowering is less pronounced in implosives, perhaps due to competing effects of vocal fold stiffening and velocity of egressive airflow following implosive release. Assuming that Rɨkpàʔ implosives are produced similarly to those in SiSwati, we hypothesized that implosive fundamental frequency should be between that of voiced and voiceless egressive plosives.

In addition to predicted differences between implosive and explosive f0, studies have provided evidence that implosives involve longer prevoicing or closure duration than voiced plosives. Studies by Nagano-Madsen & Thornell (2012) on the Bantu language Mpiemo (A.86) and by Sande & Oakley (2020, 2023) for Guébie, a Kru language, found overall longer duration of closure/prevoicing for implosives than for voiced plosives. These authors also found that intensity of voicing during closure increases over time in implosives while staying relatively stable or even decreasing for voiced plosives. These acoustic variables can be indirectly attributed to the extent of cavity expansion and laryngeal constriction; therefore, these results are consistent with traditional theories of implosive production with rapid larynx lowering and increased laryngeal constriction leading up to the release. If Rɨkpàʔ implosives are produced in this same fashion, we should ideally see these acoustic patterns in our results as well.

1.2 Phonological patterning of implosives

In terms of their phonological patterning, implosives are intriguing in that they have been difficult to situate within the sonority hierarchy (1).

(1) Sonority Hierarchy per Clements (1990); ">" indicates "more sonorant than"

vowels > glides > liquids > nasals > obstruents

Catford (1939) description refers to implosives as "glottal suction stops," suggesting that implosives fit directly into an obstruent classification, on the right-most side of the hierarchy. This account was well-established for many years; however, newer studies showed that implosives vary considerably across languages. There is the potential for modifications in which the atmospheric pressure can be zero, slightly negative, or slightly positive, meaning that implosives in some languages may not involve any ingressive airflow (Ashby 1990). These phonetic variations consequently put Catford's account into question, which led to Clements & Osu's study on the Ikwere language (2002). In this analysis, Clements and Osu proposed that these implosives had features that fit both sonorant and obstruent phonological qualities due to an absence of oral air pressure. Because of this, they concluded the implosives should be labeled as nonexplosive stops, classified as [−obstruent, −sonorant] within a binary feature system.

Recent work by Sande & Oakley (2020, 2023) has looked closer at the phonological patterning of implosives in order to better understand this cross-linguistic variation. They found that certain phonological patterning was characteristic of more obstruent-like implosives cross-linguistically vs. more sonorant-like implosives. For example, a large proportion of languages from their study which allow implosives in coda position tended to pattern phonologically with obstruents. Similarly, if implosives could be prenasalized in a language, they tended to form a natural class with obstruents. Based on these and other results, they concluded that in some languages, like Hausa, implosives pattern phonologically like obstruents, while in other languages, such as Guébie (Sande & Oakley 2020), implosives pattern phonologically like sonorants. Finally, a third group of languages, exemplified by Ikwere (Clements & Osu 2002), show mixed patterning between obstruent and sonorant. Instead of placing implosives within the class of obstruents, Sande and Oakley approach the treatment of implosives from a gradient features perspective (c.f. Smolensky & Goldrick 2016). Specifically, they argue that implosives should be located between obstruents and sonorants on the sonority scale, and that cross-linguistic variation in phonological patterning of implosives could be captured through language-specific constraint weighting.

Our work seeks to examine how distributional patterns of implosives in Rɨkpàʔ align with phonetic measurements in order to understand how the language might fit into such a typology.

2 Language background and distribution of implosives

Rɨkpàʔ, Kpɑ̀ʔ, or Bafia is a Bantu language (region A.53) spoken in the Center Region (Mbam and Inoubou divisions) of Cameroon. Rɨkpàʔ is classified as a Northwest Narrow Bantu language and is surrounded by Lefa, another Bantu language from the A.50 group, and Yambeta, and Gunu, two Southern Bantoid languages in the Mbam subgroup. Rɨkpàʔ has approximately 25,000 speakers and has four different dialects: Kpàʔ, Bape, Bə̀kpàk, and Rɨ̀péy. All participants in our study (as well as the second author of this paper) speak the Kpàʔ dialect.

Consonant and vowel charts are given in Tables 1 and 2 reproduced from Guarisma (2003: 308).

Table 1: Consonants of Rɨkpàʔ, based on Guarisma 2003: 308

	Anterior		Central			Posterior	
ORAL	Bilabial	Labio-dental	Apical	Post-apical	Palatal	Velar	Labio-velar
Implosives	ɓ		ɗ				
−voice	p	f	t	s	c	k	kp
+voice	b	v	d	z	j	g	gb
Continuants	w		l	r	y	ɣ	
NASAL	m		n		ɲ	ŋ	

Rɨkpàʔ is analyzed as having a two-way tonal contrast between high and low, though low tones before pause are realized with one of two surface patterns: low-falling, or low-level. These patterns are thought to be remnants of formerly L.L and L.H disyllabic stems, respectively (Guarisma 2003).

Zooming in to the set of plosive and implosive consonants, Rɨkpàʔ has two implosives, the bilabial /ɓ/ and alveolar /ɗ/, which contrast with voiced /b/ and /d/ and voiceless /p/ and /t/, respectively (2).

(2) Near-minimal triplets with implosives, voiced plosives, and voiceless plosives by place of articulation.

a.	ɓàm	‘bag’	bàn	‘town’	pán	‘dish’
b.	ɗú	‘fire’	dúŋ	‘mold’	tú	‘spit’

Table 2: Vowels of Rɨkpàʔ, based on Guarisma 2003: 308

[−back]		[+back]
i	ɨ	u
e	ə	o
ɛ	ʌ	ɔ
a		ɑ
[−round]		[+round]

Word stems in Rɨkpàʔ are largely monosyllabic, though prefixation is common, with prefixes used to express noun class and concord within various types of constructions (e.g., possessives, demonstratives, and diminutives/augmentatives), as well as tense and aspect on verbs (see Guarisma-Popineau 1992 and Guarisma 2000, 2003 for further details). A number of verb extensions and suffixes can also be used to express tense, aspect, and mood.

Syllable structure in the language is (N)CV or (N)CVC. Distributional patterning of implosives in Rɨkpàʔ is quite varied: in addition to initial position, we find that both implosives may occur in medial position, and bilabial implosives may also occur in final positions (3).

(3) Implosives can occur in word-medial and word-final positions

a. ɓé**ɓ**è**ɓ**
   'ugly'
b. ʀɨ̀**ɗ**í
   'to eat'
c. tù**ɓ**
   'pour from a can'

Of interest is the fact that the other consonants allowed in coda position in Rɨkpàʔ are mostly obstruents; nasals are the only sonorant consonants allowed in coda position (4).

(4) Other possible coda consonants include obstruents and nasals

a. kò**p**
   'partridge'

b. tú**ʔ**
'pull'

c. ŋwó**s**
'day/sun'

d. ntè**n**
'stubbornness'

Our findings are consistent with Guarisma (2003) in showing that several sonorants, such as /w/, /ʁ/, /j/, occur in onset position only, as in (5).

(5) Sonorants /w/, /ʁ/, and /j/ limited to onset position

a. ɓə̀ŋ**w**í
'moons'

b. **ʁ**ɨ̀ɗí
'to eat'

c. pé**j**ɨ́
'pay (habitual imperative)'

Both implosives and plosives can be prenasalized in Rɨ̀kpàʔ (6), one of the strongest indicators of "obstruent-like behavior" in Sande and Oakley's typology. We note, however, that most sonorants in Rɨ̀kpàʔ can also be prenasalized (7).

(6) Prenasalization of implosives and plosives

a. **nɗ**óŋ
'lock'

b. **m̀ɓ**àŋ
'red brown colour'

c. **nd**ém
'heart'

d. **nt**èn
'stubbornness'

e. **mp**ó
'wait'

(7) Prenasalization of sonorants

a. **mj**ɔ́m
'mouths'

b. **ŋw**ós
   'day/sun'

We have seen that Rɨkpàʔ implosives show quite flexible distribution in the language in terms of word position. Implosives are found to display two distributional properties associated with the phonological status of implosives as obstruents per Sande & Oakley, Sande & Oakley's (2020, 2023) typology, including occurrence in coda position and propensity for prenasalization. However, we also find that at least some sonorant consonants can also occur as codas and be prenasalized. We now move on to explore phonetic properties of implosives through an acoustic analysis of these speech sounds.

3 Acoustic study design and method

3.1 Participants and procedure

This study included three female native Rɨkpàʔ speakers, ages 22, 29, and 43. Each speaker produced three repetitions of each target word in isolation and in a sentence context. Example (8) shows a sample of how each word was consistently recorded across all participants for /kɨɗén/ 'meat.'

(8) Lexical and sentence elicitation contexts

a. Lexical context
   kɨɗén, kɨɗén, kɨɗén
   'meat, meat, meat'

b. Sentence context

mə	ǎ	ɣɛ́	kɨɗén	kɨ́	dʒè	á	ɸjè.	
1SG	SM	saw	meat	ASSOC	pig	PREP	market	

   'I saw a piece of pig meat at the market.'

Table 3 summarizes the list of stimuli in terms of segment type, word position, and place of articulation; Table 4 summarizes stimuli by position and tone of the vowel following the target segment.

Attempts were made to balance the number of segments of each type in each position in terms of the following tone, though there were somewhat fewer voiceless segments preceding low tones, perhaps a result of a depressor effect in the language (Kingston & Diehl 1994). Most target segments preceded back vowels [u] and [o], though there were a few tokens where the segment preceded a front vowel [e] or [i]. Examples of stimuli with target consonants in word-initial and word-medial position are shown by tone in Table 5.

Table 3: Frequency of target segments in corpus, by word position (initial vs. medial) and place of articulation

Initial			Medial		
ɓ / ɗ	b / d	p / t	ɓ / ɗ	b / d	p / t
3 / 4	13 / 6	5 / 5	8 / 4	2 / 2	5 / 8

Table 4: Frequency of target segments in corpus, by word position (initial vs. medial), place of articulation, and tone of following vowel

	Initial		Medial	
	Preceding high	Preceding low	Preceding high	Preceding low
Implosive	4	4	7	5
Voiced	10	7	3	3
Voiceless	7	3	9	3

Table 5: Stimuli in word-initial vs. word-medial positions, high vs. low tone

Word-initial position				Word-medial position			
High Tone		Low Tone		High Tone		Low Tone	
ɗú	‘fire’	***ɗ****ùm*	‘belly’	*ʀɨ̀**ɗ**óŋ*	‘to lock’	*ʀɨ̀**ɗ**ù*	‘to struggle
d*úŋ*	‘mold’	***d****ùŋ*	‘bush’	*ʀɨ̀**d**úʀɨ́*	‘tomorrow’	*ɓɨ̀**d**ìlàʔ*	‘food’
t*újá*	‘to pull’	***t****ìɓíʔ*	‘excrements’	*ʀɨ̀**t**úʔ*	‘to pull’	*ʀɨ̀**t**ùɓ*	‘to pour from can’
ɓ*óŋá*	‘wait’ (imperative form)	***ɓ****òʀá*	‘bra’	*ʀɨ̀**ɓ**óŋ*	‘to wait’	*tɨ̀**ɓ**òmí*	‘brain’
b*ú*	‘dog’	***b****ù*	‘hole’	*bô**b**ó*	‘medicine’	*kɨ̀m**b**òŋ*	‘prisoner’
p*éjɨ́*	‘to pay’ (imperative form)’	***p****ɨ̀ɣá*	‘to launch’ (imperative form)’	*ʀɨ̀**p**úpsɨ̀*	‘to pay’ (infinitive form)	*ʀɨ̀**p**ùʀɨ̀*	‘to launch’ (infinitive form)

3.2 Data processing and statistical analysis

After recording, data were segmented in Praat. We segmented and annotated the plosive/implosive closure, release, and the vowel following each target segment. Closure duration for voiced plosives and implosives was measured based on the period of prevoicing. For voiceless plosives, closure duration was only measured in word-medial position and was measured in terms of the silent portion following a preceding vowel and preceding plosive release. Figure 1 below depicts the acoustic landmarks used to annotate the word *bàm* 'button.'

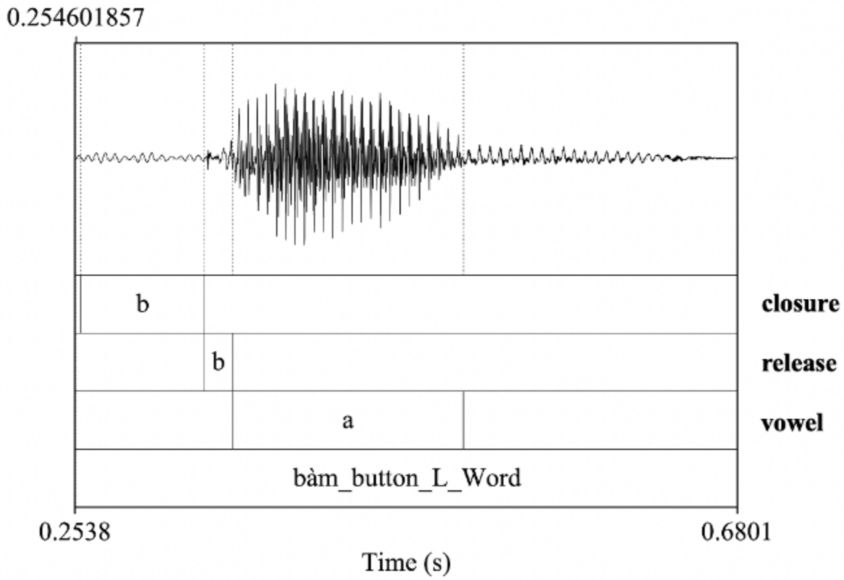

Figure 1: Sample acoustic annotation for the word *bàm* 'button,' including plosive closure (prevoicing), plosive release, and following vowel

Next, Praat scripts were used to extract acoustic measures of fundamental frequency (f0) of the vowel following the target plosive/implosive in Hertz (Hz), plosive closure duration in milliseconds (ms), and plosive closure intensity value in decibels (dB). In order to control for inter-speaker differences in vocal tract size, f0 values were z-scored by subject.

Data were analyzed with linear mixed effects models using the *lmer* package for *R* statistical software (Bates et al. 2015). Two separate models were run to test the effects of the variables' *segment type* (three levels: implosive vs. voiced plosive vs. voiceless plosive) and *position* (two levels: initial vs. medial) on intensity during the segment closure and closure duration. Models included by-subject random slope for position. A third model was run to test the effects of the variables' segment type and tone (two levels: high vs. low) on vowel fundamental frequency following the target consonant. This model included a by-subject random slope for tone. Given the as yet relatively small scale of this study, data were collapsed over place of articulation and context (isolation vs. sentence context). Categorical variables were treatment-coded. Posthoc paired comparisons were carried out using the *emmeans* package in R (Lenth 2021).

4 Results

4.1 Intensity

Our results revealed no main effect of segment type on intensity during closure between implosives and voiced plosives in initial position ($F(2, 839) = 3.00$, $p = 0.05$), but, consistent with previous studies (Lindau 1984, Nagano-Madsen & Thornell 2012), a rising intensity slope for implosives compared with voiced plosives (Figure 2).

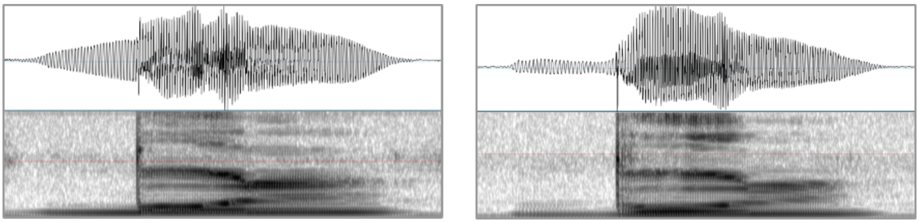

Figure 2: Acoustic signal for *ɓúl* 'snail' (left) and *búl* 'goat' (right); initial implosive shows a steady intensity rise into the release, while initial voiced plosive shows slight decrease.

There was a significant interaction between segment type and word position ($F(2, 776) = 18.54$, $p < 0.0001$). Posthoc testing confirmed that while there was no difference in closure intensity in initial position, implosives had slightly higher intensity than voiced plosives in medial position ($\beta = 3.03$, $t = 2.19$, $p < 0.05$, Figure 3), though intensity slope was flatter for implosive segments in this position (Figure 4). Voiced plosives had significantly higher closure intensity than voiceless plosives in medial position ($\beta = 4.01$, $t = 2.12$, $p < 0.05$).

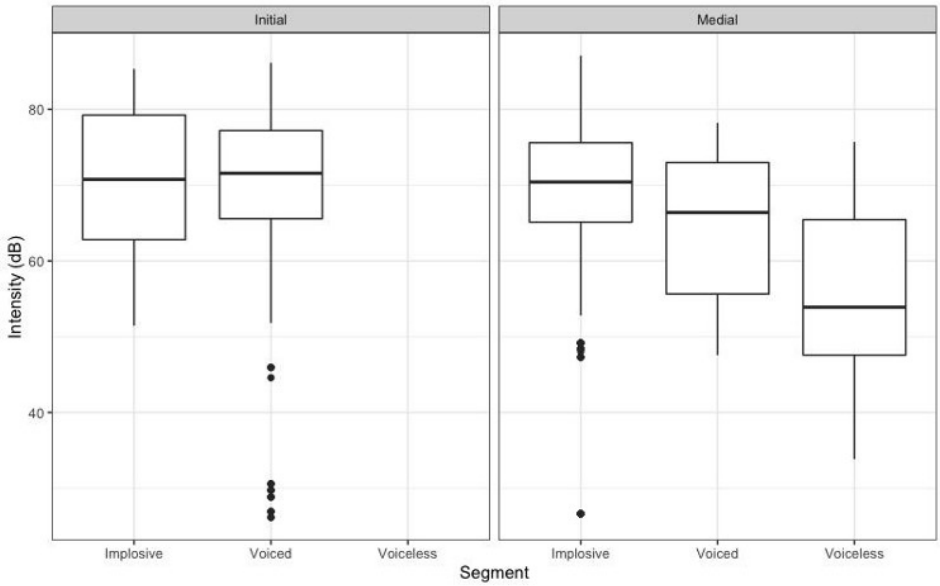

Figure 3: Intensity by segment type and position

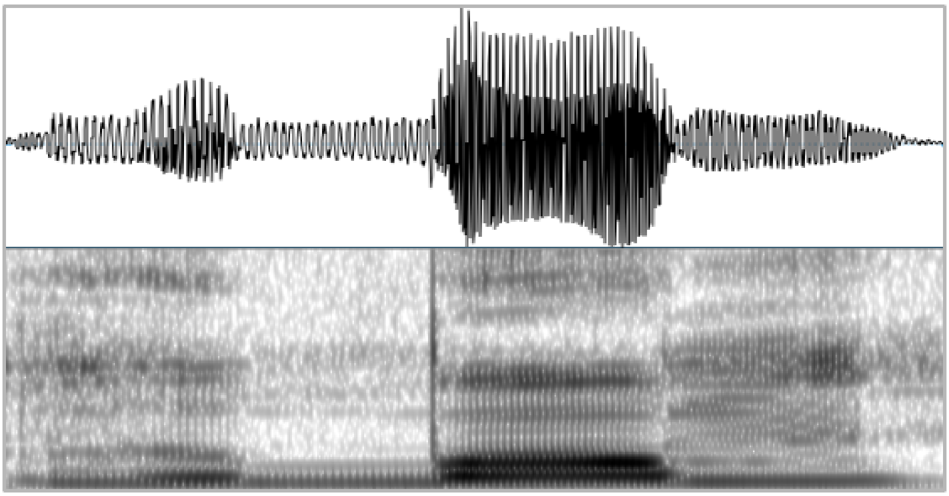

Figure 4: Acoustic signal for *ʀìɓóm* ‘furrow’; implosive in medial position shows relatively flat intensity profile

4.2 Closure duration

While there was a main effect of segment type on closure duration ($F(2,332) = 3.84$, $p < 0.0001$), contrary to some prior research (Nagano-Madsen & Thornell 2012, Sande & Oakley 2020), closure duration was shorter for implosives than voiced plosives in initial position ($\beta = -20.04$, $t = -5.75$, $p < 0.0001$). A significant interaction between segment type and position was also found ($F(2,403) = 25.67$, $p < 0.0001$), and posthoc tests revealed that voiced plosives trended toward having shorter closure duration compared with implosives in medial position, though this difference did not reach significance ($\beta = -10.00$, $t = -1.75$, $p = 0.08$). In medial position, voiceless plosives showed longer closure duration than implosives or voiced plosives ($\beta = 22.26$, $t = 4.05$, $p < 0.001$) (Figure 5)

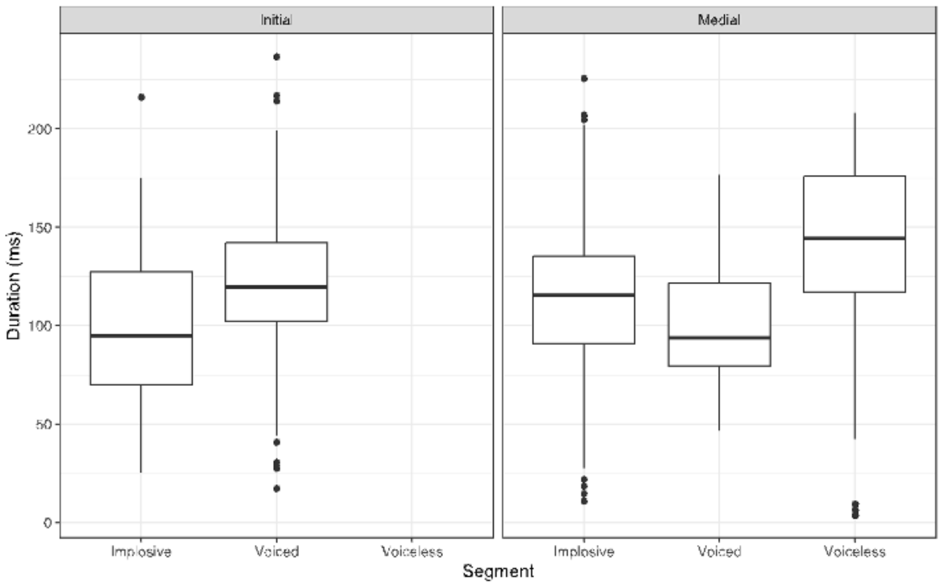

Figure 5: Closure duration by segment type and position

4.3 Vowel fundamental frequency

Finally, a main effect of segment type was found for vowel fundamental frequency ($F(2,780) = 7.47$, $p < 0.001$), as well as an interaction between segment type and tone ($F(2,781) = 3.12$, $p < 0.05$). For high-toned syllables, vowels following implosives were realized with significantly higher f0 than vowels following voiced plosives ($\beta = 9.55$, $t = 3.66$, $p < 0.001$), while no difference was observed between vowels following implosives and those following voiceless plosives ($\beta = 9.24$, $t = 1.92$, $p = 0.05$) (Figure 6). For low-toned syllables, however, vowels following implosives and voiced plosives patterned similarly ($\beta = 0.40$, $t = 0.14$, $p = 0.88$), while vowels following voiceless plosives trended towards having higher f0 than those following voiced plosives, though this difference did not reach significance ($\beta = 8.83$, $t = 1.30$, $p = 0.20$).

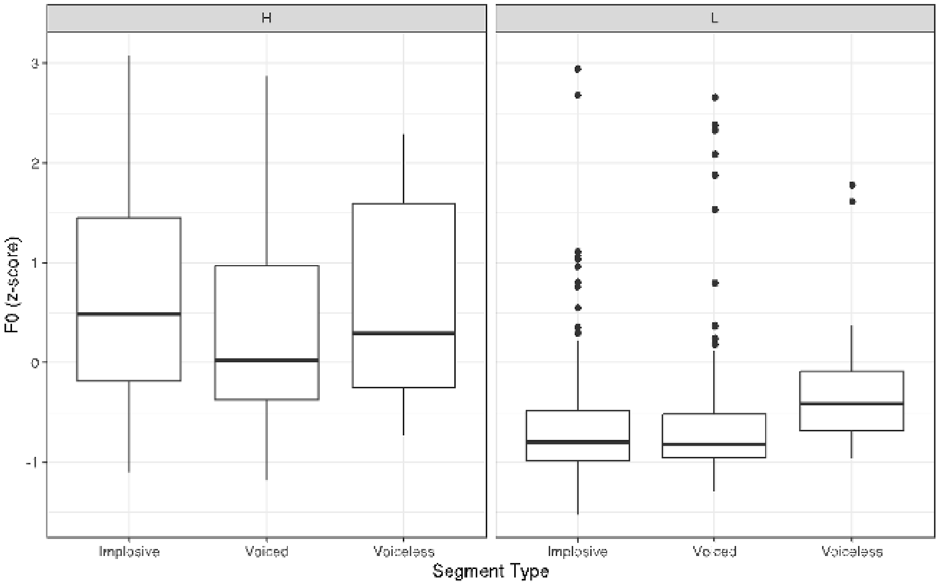

Figure 6: Fundamental frequency of following vowel by segment type and tone

5 Discussion

5.1 Phonetic patterning and articulation of implosives

To sum up, for prevoicing intensity, there was no significant difference in overall intensity during prevoicing between implosives and voiced plosives. However, similar to previous findings, implosives had a rising slope in prevoicing intensity building up to the release in initial position of the word. Voiced plosives, on the other hand, showed no change or a small decrease in intensity leading up to the release. These results are consistent with traditional theories of implosive production, where rapid larynx lowering and increased laryngeal constriction leading up to the release are thought to condition an increase in vocal intensity. Interestingly, in word-medial position, implosives had a significantly greater closure intensity compared to voiced plosives; however, both implosives and voiced plosives had relatively flat intensity slopes for intensity closure leading up to the stop release in this position. It appears, therefore, that the way in which intensity acts as an acoustic cue to implosive production varies across word positions. This is possibly a result of aerodynamic factors restricting prevoicing intensity in word-initial position vs. word-medial position, where (in our stimuli) the vocal folds were already vibrating from the preceding vowel when the implosive was initiated.

Initial prevoicing duration for implosives was found to be significantly shorter than for voiced plosives in word-initial position. This contrasts with past findings from Nagano-Madsen & Thornell on the Mpiemo language (2012), as well as from Sande & Oakley on the Guébie language (2020), both of which found that implosives had a significantly longer duration than voiced plosives. In word-medial position, implosives did have a slightly longer closure/prevoicing duration than voiced plosives; however, this was not a significant difference. Voiceless plosives had significantly longer closure duration than both implosives and voiced plosives. We take up this issue in more depth in §5.2.

As for fundamental frequency of the vowel following target consonants, f0 was higher overall after implosives than voiced plosives, similar to some previous studies. We also found that there was no significant difference between f0 following implosives and voiceless stops. It has been suggested that implosives involve relatively high vocal fold tension, which may counter the effects of larynx lowering in implosives, leading to similar values of f0 following implosives and voiceless plosives. Our overall results suggest that this is also the case in Rɨkpàʔ. However, an interaction between segment type and tone revealed that differences in f0 after implosives and voiced stops were diminished in the context of low tone vowels; both had relatively lower following f0 as compared with voiceless stops. We hypothesize that the larynx lowering and vocal fold slackening necessary for low tone production may override any potential tensing of the vocal folds during implosive production; further articulatory studies will be necessary in order to fully understand the ways in which these articulatory mechanisms operate across segment types and tones.

5.2 Distributional patterns of implosives in Rɨkpàʔ

Sande & Oakley (2020, 2023) propose, through an analysis of a diverse array of Sub-Saharan African languages, that implosives should be analyzed in terms of gradient features, allowing them to behave relatively more like obstruents or like sonorants. As mentioned in §1, there are various aspects of phonological patterning of Rɨkpàʔ implosives that suggest more consistent patterning with obstruents, per Sande & Oakley's diagnostics. For example, Rɨkpàʔ allows implosive codas, and most other segments allowed in coda position in the language are obstruents (with the exception of nasals). Furthermore, implosives in Rɨkpàʔ can be prenasalized, which is one of the strongest predictors of obstruent-like patterning in Sande & Oakley's typology.

Various aspects of our acoustic results are also consistent with the status of implosives in Rɨkpàʔ as more obstruent-like. For example, contrary to findings from Guébie, a language in which implosives are thought to behave more like sonorants, closure duration of implosives in Rɨkpàʔ was shorter, not longer, than that of voiced plosives. We also found that intensity profiles of medial implosives in Rɨkpàʔ revealed only slightly greater intensity than for voiced plosives. Medial implosives also had a similarly flat intensity slope to voiced plosives, rather than the characteristic steady increase in intensity during prevoicing. Sande & Oakley point out that intensity and duration are correlates of resonance more generally, with longer/louder segments tending to fall toward the more sonorous side of the sonority continuum. It is therefore striking that Rɨkpàʔ showed somewhat more obstruent-like patterning of these two variables.

Additional phonetic evidence for more obstruent-like behavior of implosives in Rɨkpàʔ comes from f0 patterning: in low tone contexts, implosives showed similar patterning of f0 on the following vowel to what was found for voiced stops. This would seem to suggest that some characteristic articulatory features of implosives–such as increased vocal fold tension–are sacrificed preceding a low tone vowel, leading to a greater level of acoustic similarity between implosives and other voiced obstruents.

6 Conclusion

All in all, our analysis of implosives from the Rɨkpàʔ language gave us insight into their phonetic patterning and phonological tendencies. Our acoustic results showed certain traditional markers of implosive production such as lowering of the larynx through observations of a rising intensity slope for implosive prevoicing. Also, we saw through our analysis that these implosives are produced with relatively stiff vocal fold tension, shown through the f0 analysis where implosives were significantly higher than voiced plosives and equivalent to voiceless plosives in high tone conditions.

However, we also saw that these implosives tended to be produced more similarly to voiced plosives in certain environments through our acoustic analysis. First of all, implosive f0 dropped to similar levels in comparison to voiced plosives in low tonal conditions. Also, we saw certain acoustic similarities in word-medial positions such as similar prevoicing durations and no rising intensity slopes. Along with these phonetic results, we observed certain phonological patterns in accordance with obstruent-like patterning. We found that Rɨkpàʔ implosives can occur in coda syllable positions, a common trait of other languages that have obstruent-like implosives based on Sande & Oakley's study. Furthermore, we observed that implosives were able to be prenasalized, another predictor of obstruent-like behavior from their study.

Based on these phonetic and phonological patterning observations, our assessment is that implosives in Rɨkpàʔ pattern mainly with obstruents. We note, however, that our study has some limitations. First off, we have thus far only examined implosives' phonetic patterning relative to obstruents in Rɨkpàʔ, but have not yet taken sonorants into consideration. Second, our word-medial implosives were largely stem-initial, following a CV prefix. Therefore, there may be additional prosodic considerations which we have not captured here in the patterning of implosive consonants in Rɨkpàʔ

Although further investigation into the acoustic and articulatory properties of implosives and a more in-depth survey of their phonological patterning will be important for corroborating this observation, these preliminary results support the idea that implosives do not form a unified class across languages either phonetically or phonologically; future research into the historical roots of this variation will also be useful in establishing a more comprehensive typology for implosives.

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Chapter 2

Supralaryngeal articulation across voicing and aspiration in Yemba vowels

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Both prevoicing and aspiration are thought to affect supraglottal cavity size during and following the production of stop consonants. However, many languages implement stop laryngeal contrasts using both prevoicing and aspiration, making it difficult to independently link observed tongue position differences to one effect or the other. Yemba (Grassfields Bantu) offers a unique opportunity to separately study these two effects, as the language contains stop consonants which independently vary in prevoicing and aspiration. The current study examines tongue position in vowels following Yemba stop consonants using acoustic and ultrasound data. Formant frequencies of vowels following stops suggest that stop prevoicing conditions tongue root advancement and tongue body lowering, resulting in an expansion of the supraglottal cavity; the same data suggest that stop aspiration conditions tongue root retraction, resulting in an opposing contraction of the supraglottal cavity. Ultrasound data for a subset of acoustic study participants was not entirely consistent with the acoustic data, showing tongue body lowering and root retraction after aspirated stops, but no consistent lingual adjustments after prevoiced stops. These findings, from the first phonetic study of a Bamileke language's laryngeal contrasts, lend support to active cavity constriction as a supporting mechanism for aspiration.

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1 Introduction

1.1 Stop laryngeal contrast and tongue position

Sustaining voicing during stop closure presents a well-documented challenge in speech production: in order to sustain voicing, there must be a sufficient negative pressure gradient across the glottis, with a lower supraglottal pressure compared to subglottal pressure. During a stop, a complete supraglottal closure must be made, blocking airflow out of the vocal tract and rapidly causing the pressure differential critical to maintaining voicing to dissipate (Ohala 1983, 2011, Westbury 1983). While a sufficient pressure gradient can be achieved for a short time during stop closure with no articulatory adjustments, voicing cannot be sustained long enough to account for the extent of prevoicing in most voiced stops (Ohala 1983).

To maintain a sufficiently large negative pressure gradient in support of voicing production, a wide range of adjustments to the articulators can be used to enlarge the supraglottal cavity, thereby decreasing supraglottal pressure. Venting into the nasal cavity through an incompletely sealed velum (Rothenberg 1968, Solé 2018) and lowering the larynx (Hombert et al. 1979, Kirby & Ladd 2016, Ohala & Riordan 1979) also act to maintain this pressure gradient. A range of adjustments to the pharyngeal walls and tongue have also been observed. One long-noted strategy is increasing tongue or vocal tract wall tissue compliance so that the oral or pharyngeal cavities can passively expand during voiced stop closure (Bell-Berti 1975, Kent & Moll 1969, Rothenberg 1968, Sprouse et al. 2008). The stiffness of lingual constrictions is also known to be reduced to increase lingual tissue compliance: voiced stops tend to have lighter constrictions with a smaller area of tongue-palate contact (Dixit 1990, Fletcher 1989, Fujimoto et al. 2021, Kochetov & Kang 2017).

An additional strategy for supraglottal cavity expansion is the primary focus of this study: active expansion of the supraglottal cavity through tongue body lowering and/or tongue root advancement. Such modifications to lingual articulation have been observed during phonologically voiced stops in a range of languages including English, Ikema Miyako, Oromo, Portugese, and Russian (Ahn 2015, 2018, Fujimoto et al. 2021, Matsui & Kochetov 2018, Percival et al. 2018, Westbury 1983). Constriction location itself is also thought to be slightly more anterior for prevoiced stops compared to their voiceless counterparts, particularly in prevoiced geminate stops (Krishnaswamy et al. 2018, Percival et al. 2018).

The production of aspiration, on the other hand, has been associated with a smaller supraglottal cavity, though there has been relatively little research on this topic. Reduced supraglottal cavity size may facilitate the production of aspiration because it allows for more pressure buildup, and thus a more intense burst of air on release (Ahn 2018). A potentially analogous result was observed for voiceless fricatives, which may exhibit an active constriction of the pharyngeal cavity (Proctor et al. 2010). This has been speculated to aid in pressure regulation, with a more constricted vocal tract allowing more turbulence to be produced with less airflow. This finding may extend to aspirated stops: a more constricted supraglottal cavity might enable the speaker to more reliably produce noisier aspiration.

The two phonetic features at issue here, aspiration and prevoicing, are not independently distributed across the stop inventories of many languages. That is, although some phonological "voicing" contrasts are implemented solely using consistent prevoicing in "voiced" stops (Benguerel et al. 1978, Kirby & Ladd 2016), and others solely using aspiration in "voiceless" stops (Deterding & Nolan 2007), many of the most commonly studied languages employ both, realizing "voiced" stops with prevoicing and "voiceless" stops with aspiration (Beckman et al. 2013, Keating 1984). This is the case in English and German, for example, where voiced stops may lack prevoicing but are never aspirated, and where voiceless stops are realized with aspiration in many contexts. The literature on laryngeal contrast and tongue position discussed above primarily concerns English and a series of "true voicing" languages with consistent prevoicing in voiced stops.

The lack of independence between the occurrence of prevoicing and the occurrence of aspiration in such languages makes it difficult to isolate their respective effects on the vocal tract: as discussed in Ahn (2018), if a relatively retracted tongue position is associated with voiceless (aspirated) stops in such a language, then it is not clear if the cause of this difference is retraction due to the presence of stop aspiration, or the absence of a tongue-advancing effect caused by stop prevoicing. In the next section we will introduce Yemba, a language in which prevoicing and aspiration are unusually independent, which facilitates research addressing the influence of these features on vocal tract state.

1.2 Yemba laryngeal contrasts

Yemba (ISO 369-3 [ybb]), also known as Dschang or Dschang Bamileke, is a Bamileke language (in the larger Grassfields Bantu family) spoken in the West Province of Cameroon (Hammarström et al. 2021) and in diaspora communities primarily located in North America and Europe. It is spoken by at least 300,000 to 400,000 speakers, most of whom are bi- or trilingual in French, Cameroonian

Pidgin English, English, and one or more other languages of non-colonial origin such as other Bamileke varieties (Eberhard et al. 2021).

Table 1: Example words for alveolar stops varying orthogonally by voicing and aspiration. The top item in each cell contains an onset preceded by a nasal consonant.

	voiceless		voiced	
aspirated	ń-tí	‘INF-write’	ǹ-d̏ì	‘CL1-lord’
	tí-í	‘write-IMP’	*[−nas]-di	
unaspirated	ń-ꜜt^{h}í	‘INF-host’	ǹ-d^{h}ì	‘CL1-descendant’
	mə̀-t^{h}í	‘CL6-saliva’	*[−nas]-d^{h}i	

Yemba is of general interest to phonetics and phonology for the complexity of its laryngeal contrasts. Like most Grassfields Bantu languages, Yemba has a surface contrast between stops with and without prevoicing. A phonemic aspiration contrast cross-cuts the voicing contrast (Bird 1999). Aspiration may be associated with both voiceless and prevoiced segments, including most sonorants and fricatives. Unusually, aspiration is always voiceless, even when associated with a prevoiced segment. The Yemba surface inventory thus includes a four-way laryngeal contrast in stops between voiceless unaspirated, prevoiced unaspirated, voiceless aspirated, and prevoiced aspirated (Table 1).

This four-way laryngeal contrast also occurs in several other Bamileke languages, including varieties of Ngyemboon (Anderson, 2008), Fe’fe’ (Hyman 1972), Nda’nda’ (Ngueyep 1988), Ngomba (Ngouagna 1988), and Ghomálá’ (Nissim 1981). While superficially similar to the four-way contrast attested in many Indo-Aryan languages, voiced aspirates in Indo-Aryan languages typically have breathy-phonated release (Berkson 2013, Dmitrieva & Dutta 2020, Schertz & Khan 2020, Schwarz et al. 2019). Bamileke voiced aspirates are crucially distinct from this stop type in that they are produced with a sequence of prevoicing followed by voiceless aspiration, a characteristic noted in impressionistic descriptions of Bamileke languages (Anderson 1982, Bird 1999, Hyman 1972, Nissim 1981) and supported by more recent instrumental work (Faytak & Steffman 2021).

Two additional considerations must be mentioned here. First, as Table 1 shows, the Yemba voiced stops [b(^{h}) d(^{h}) g(^{h})] are always preceded by a nasal, though fricatives exhibit voicing contrasts whether or not they are preceded by a nasal. Second, standard phonological analyses of Yemba have treated the prevoiced stops [b(^{h}) d(^{h}) g(^{h})] as allophones of /p(^{h}) l(^{h}) ɰ(^{h})/, respectively (Bird 1999). This

Table 2: Example alternations in the presence of a prefixal nasal.

Oral preceding		Nasal preceding	
lə̀-lʰʉ̏	‘cl5-wrestle’ (‘wrestling’)	ń-ꜜdʰʉ́	‘inf-wrestle’
lə̀-ꜜlí	‘cl5-sleep’ (‘sleeping’)	ń-dí	‘inf-sleep’
à-ꜜpú	‘cl7-hand’ (sg.)	m̀-ꜜbú	‘cl6-hand’ (pl.)
lə̀-ꜜpʰʉ́	‘cl5-hole’ (sg.)	m̀-ꜜbʰʉ́	‘cl6-hole’ (pl.)

has been motivated by alternations triggered by the addition of a tone-bearing, syllabic nasal prefix as shown in Table 2. We return to the connection between voicing and preceding nasality in more detail in the discussion section.

In a sense, then, voicing is not an underlying contrast in stops, but rather one that is contingent on the presence of a preceding nasal. This is not a significant concern for the present study. First, many forms, such as those in the voiced column of Table 1, do not exhibit these alternations at all, which casts doubt on whether they can be analyzed as underlying a prefixal nasal followed by /p l ɰ/. In addition, voicing alone indicates a meaningful phonological contrast elsewhere in the language, with fricatives contrasting for voicing in the absence of a preceding nasal (e.g. /s/ vs. /z/). Finally, the surface phonetic contrast between voiceless stops preceded by a nasal (e.g. [nt]) and voiced stops preceded by a nasal (e.g. [nd]) is robust. Thus, whether or not they correspond to a true phonological voicing contrast at a more abstract level, the dimensions of this surface contrast are aspiration and prevoicing. The relative independence between these dimensions in Yemba provides a unique test case for isolating the effects of prevoicing and aspiration on supraglottal cavity size.

1.3 The present study

In languages whose two-way phonological voicing contrasts are based on some combination of both prevoicing and aspiration, such as English, the causality of differences in tongue position related to laryngeal activity is difficult to work out. It is difficult to specifically attribute observed effects of phonological “voicing” on tongue position to either aspiration or prevoicing, since each phonological category – “voiced” and “voiceless” – can be characterized by the presence of one, and the absence of the other, phonetic event. The laryngeal contrasts present in Yemba provide a unique opportunity to disentangle the effects of prevoicing and aspiration on tongue position, since the surface inventory of the language contains prevoiced stops, aspirated stops, and stops with *both* associated prevoicing *and* voiceless aspiration.

Given these facts, the present study aims to use acoustic and ultrasound data to establish the effects of prevoicing and aspiration on tongue position in vowels following Yemba stops. Based on prior studies, we expect voicing to condition cavity expansion via tongue root advancement or tongue body lowering of the following vowel. Conversely, we expect aspiration to condition cavity contraction via tongue root retraction or tongue body raising. Some aspects of tongue position can be inferred from formant frequency measurements: advancement/expansion due to voicing may be reflected in *raised* F1 or F2, and retraction/contraction due to aspiration may be reflected in *lowered* F1 or F2. Analysis of ultrasound video subsequent to acoustic analysis is used to confirm or deny the existence of the lingual adjustments suggested by the acoustic analysis, not all of which may be straightforwardly reflected in the acoustic signal (Atal et al. 1978, Stevens 1989, Stevens & Keyser 2010).

2 Methods

2.1 Acoustic study

2.1.1 Participants and materials

Four native Yemba speakers' speech was analyzed. Two speakers (1M, 1F) were recorded in the UCLA Phonetics Lab. Audio recordings of two additional Yemba speakers (2M) were taken from a multimedia lexicon which had previously been recorded in Cameroon (Bird 2003). Speakers were between the ages of 31 and 45 at the time of recording. We describe the materials collected separately for each group below since the circumstances of data collection differed.

2.1.2 In-lab recordings

Speakers 1 and 2 were recorded with a head-mounted Shure SM10A microphone (32-bit audio, 44.1 kHz sampling rate) in a sound-attenuated booth at the UCLA Phonetics Lab. Stimuli for in-lab recordings were selected in collaboration with the last author, a native speaker and member of the Yemba speech community. Stimuli consisted of near-minimal sets contrasting minimally in aspiration and voicing (but sometimes differing in tone and prefixal morphology). Open-syllable words with the following onsets were selected: voiceless stops [p], [t], [k], voiced stops [b], [d] , and their aspirated counterparts [p^h], [t^h], [k^h], [b^h], [d^h]. Words containing the voiced velar onsets [g] or [gʰ] were omitted from the data due to difficulties in finding words with a balanced set of following vowels. Target onset consonants were followed by one of three high vowels /i/, /u/, or /ʉ/, since aspirated stops only precede high vowels (Bird 1999).

Stimuli were produced in the frame sentence in (1), which was presented on a laptop screen using an ad hoc orthography developed in collaboration with the last author.

(1) mə́ŋ ꜜlíɛ́ ɰ̍ʰə̀ ____ ǹ-bù ʉ̏
1SG.SBJ say COMP ____ INF-give 2SG.OBJ
'I say ____ to you'

A total of 35 word types were recorded per speaker (see Appendix for full list); each word containing a voiced stop (aspirated or unaspirated) was repeated 6 times. The number of repetitions of voiceless unaspirated stop items varied by speaker: each word with a voiceless unaspirated stop was repeated 3 times by Speaker 1, and 2 times by Speaker 2. After excluding speech errors and misreadings, this resulted in a total of 227 tokens for both speakers combined: 62 voiced and aspirated, 77 voiced and unaspirated, 44 voiceless unaspirated, and 54 voiceless unaspirated.

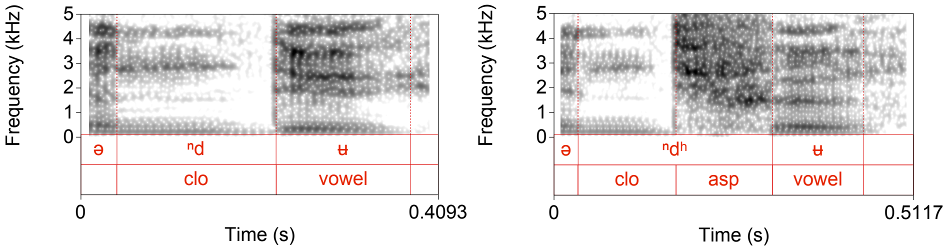
2.1.3 Data selection from Bird (2003)

To augment the lab recordings, a total of 277 stop tokens were taken from the audio lexicon in Bird (2003). The lexicon was reviewed for words that contained open syllables with the onsets used to select lab stimuli of interest. Since Bird (2003) was not constructed with the current analysis in mind, the balance of stop types is not even between the four voicing and aspiration categories: there are more unaspirated than aspirated tokens, and more voiceless than voiced tokens. Specifically, 14 prevoiced aspirated stop tokens, 56 voiceless aspirated stop tokens, 51 prevoiced unaspirated stop tokens, and 156 voiceless unaspirated stop tokens were collected.

Some minor differences exist between the lab and lexicon materials. The lexicon recordings are all read in isolation due to the format of the material, as opposed to the lab-recorded material, which was recorded in a frame sentence. The lexicon recordings contain more word types (139) compared to the lab recordings, with fewer tokens for each type: both speakers produce a large variety of words one or two times. Several word types selected for even coverage of onset types had a glottal stop coda. Tokens were not excluded on the basis of the number of syllables in the word; tokens were taken from words of varying lengths.

2.1.4 Analysis

All recordings, regardless of origin, were segmented manually in Praat. The beginning of modal phonation after stop release was used to determine the beginning of each token's vowel, as signaled by the appearance of periodic F1 and F2 . Likewise, the end of each token's vowel was determined by the cessation of periodic F1 and F2 structure. Example segmentations for an aspirated and unaspirated token are shown in Figure 1. F1 and F2 measures at the acoustic midpoint of the resulting vowel interval (e.g., the midpoint of both tokens' [ʉ] in Figure 1) were automatically extracted in Praat (Boersma & Weenink 2021) using a custom script (Lennes 2003).



[ǹdʉ̏] 'raffia string'   [ǹd^{h}ʉ̏] 'boundary'

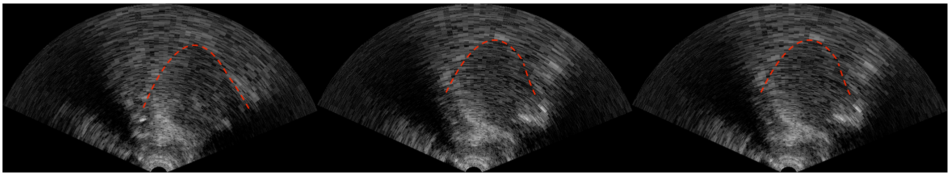
Figure 1: Waveform and spectrogram of prevoiced unaspirated (left) and prevoiced aspirated (right) items showing segmentation of onset and following vowel events for acoustic and ultrasound analysis.

Formant measures were modeled using Bayesian mixed effects regressions in the BRMS package in R (Bürkner 2017) predicting F1 and F2 as a function of vowel type, preceding aspiration, voicing, and their interaction, with random intercepts for speaker, and for vowel. A separate regression analysis was carried out for each formant. We employed weak uninformative priors for both the model intercept and fixed effects, with a normal distribution. Intercept priors were based on the mean and standard deviation of F1 and F2, while fixed effect priors were set as Normal(0,100), that is, with no prior expectation of an effect on either F1 or F2, and an SD of 100, i.e., the expectation that effects should be fairly small. Fixed effects were deviation coded (voiced mapped to 0.5, voiceless mapped to −0.5; aspirated mapped to 0.5, unaspirated mapped to −0.5).

2.2 Ultrasound study

2.2.1 Participants and materials

One of the participants in acoustic data collection (1M, participant S1) also provided ultrasound data. Midsagittal ultrasound tongue imaging was recorded for this speaker at a frame rate of 83 Hz using a Telemed Micro ultrasound device. A Telemed convex MC-4 probe was used, held in place submentally by an Articulate Instruments UltraFit stabilization headset (Spreafico et al. 2018). An example of the raw data is shown in Figure 2. Stimuli contained the labial and coronal stops analyzed in the acoustic study, namely [p(ʰ) b(ʰ) t(ʰ) d(ʰ)], followed by the same high vowels /i/, /u/, and /ʉ/, and were read in the frame sentence indicated above in (1). A total of 120 tokens from this recording are analyzed here, with 5 tokens per stimulus type. The full list of ultrasound stimuli is provided in the Appendix.



[ǹdì] 'lord' [ǹdʉ̀] 'raffia string' [ǹdù] 'river'

Figure 2: Raw midsagittal ultrasound frames from the acoustic midpoint of a token of each vowel. Approximate tongue surface contours are highlighted with red dashed lines. Right is anterior.

2.2.2 Analysis

Tongue surface contours for each token, extending roughly from tongue blade to tongue root, were extracted using EdgeTrak software (Li et al. 2005) using default settings. While the entire time series of contours was extracted, contours occurring closest to the acoustic midpoint of the vowel were chosen for analysis. The selected contours were submitted to smoothing-spline ANOVA (SSANOVA) to model the typical tongue position for groups of stimulus items (Davidson 2006) using the gss package in R (Gu 2014). The Cartesian coordinates of the extracted tongue surface contours were converted to polar coordinates for analysis and converted back to Cartesian coordinates for display in order to reduce distortion of modeled tongue positions in the area of the tongue root (Mielke 2015).

An initial SSANOVA was first carried out to confirm tongue position differences associated with each of the vowels /i ʉ u/. Two further SSANOVA comparisons were carried out within the data collected for each vowel; a within-vowel design is used here since the size of any prevoicing- or aspiration-related effect on lingual articulation is expected to be much smaller than the difference in tongue position among vowels. The first analysis compares all prevoiced and all voiceless tokens (pooling across aspiration), and the second compares all aspirated and unaspirated tokens (pooling across prevoicing). SSANOVA splines are generated with 95% confidence intervals; confidence intervals for two splines which fail to overlap indicate a statistically significant difference in tongue position at that point for $\alpha = 0.05$. Overlap or non-overlap of splines for prevoiced versus voiceless and aspirated versus unaspirated subsets of the data thus indicate whether tongue position differences beyond those expected by chance are associated with prevoicing or aspiration.

2.3 Results

2.3.1 Acoustic results

The Bayesian analysis used for the formant data allows us to estimate the size of an effect and our certainty about that estimate, which we present here as 95% credible intervals (CrI). In a Bayesian model, each estimate is drawn from a distribution, and CrIs represent the interval of that distribution in which a certain proportion of the estimates fall (most often 95%). To assess whether a certain factor has a reliable or *credible* impact on formants, we examine whether the 95% CrI includes or excludes zero. Inclusion of zero in the CrI would indicate substantial variation in the directionality of the estimate of the effect, leading to uncertainty. For example, we would be unable to say with much certainty that voicing lowers F1 if the CrI for the effect of voicing on F1 included zero. On the other hand, a CrI which excludes zero gives us clear evidence for the directionality of an effect. Using the same example, a CrI that is entirely negative (excluding zero) suggests that the presence of prevoicing in the preceding stop lowers F1. Thus, when we state an effect is credible we mean that it has a consistently estimated directionality, making us confident that it is robust. This can be considered similar to, though conceptually different from, assessing an effect as *significant* in frequentist models.

First, in Figure 3, we visualize F1 and F2 for all tokens in the analysis, split by vowel and by speaker. As can be seen, each speaker differentiates the vowel categories in F1/F2 space in the expected way. The vowels exhibit a relatively low

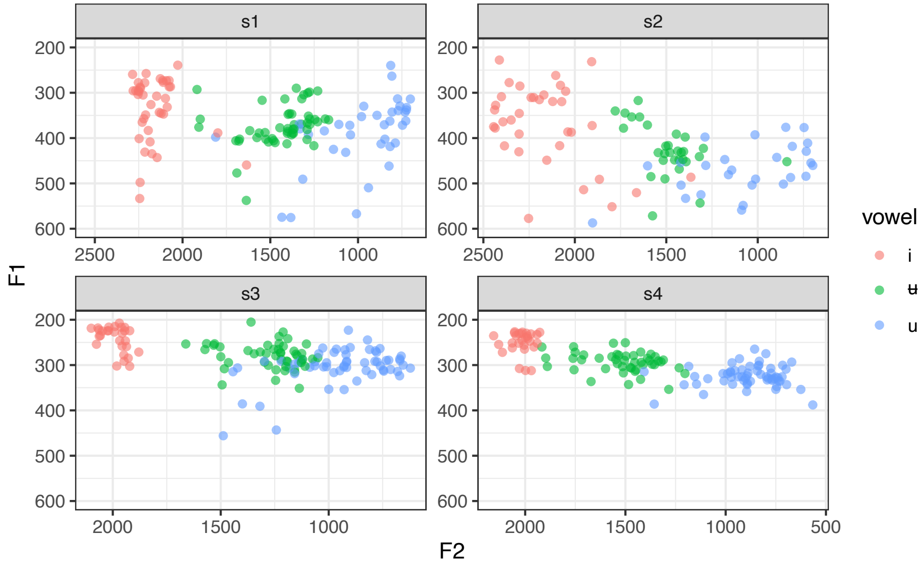


Figure 3: Scatterplot of formant measurements by speaker and vowel.

F1 as expected for their height, though S1 and S2 show more F1 variation than S3 and S4. F2 frequency varies as expected with the frontness of the three vowels.

Table 3: Model summary for fixed effects modeling the effect of voicing and aspiration on F1 (left) and F2 (right). Credible estimates are marked with an asterisk (*).

	F1 model			F2 model		
	β	error	95% CrI	β	error	95% CrI
Intercept	347.2	45.3	[256.2, 438.1]*	1464.3	291.4	[889.0, 2031.4]*
Voicing	25.5	9.2	[7.8, 43.6]*	66.6	20.5	[26.1, 106.7]*
Aspiration	−3.1	8.7	[−19.9, 13.8]	−61.3	11.4	[−101.9, −20.5]*
Voi:Asp	7.3	16.9	[−25.6, 40.4]	−60.1	37.1	[−133.0, 11.4]

With this, we turn to the effect of voicing and aspiration on F1 and F2, as shown in Figure 4. Figure 4 plots both F1 and F2, with each measure split by aspiration and voicing. Table 3 additionally contains the output of the fixed effects for the F1 and F2 model, summarizing the model estimate, and lower and upper 95% CrI. Looking first at the effect of voicing on both F1 and F2, we see that voicing credibly raised both F1 ($\beta = 25.5$, 95 %CrI $= [9.2, 43.6]$) and F2 ($\beta = 66.6$,

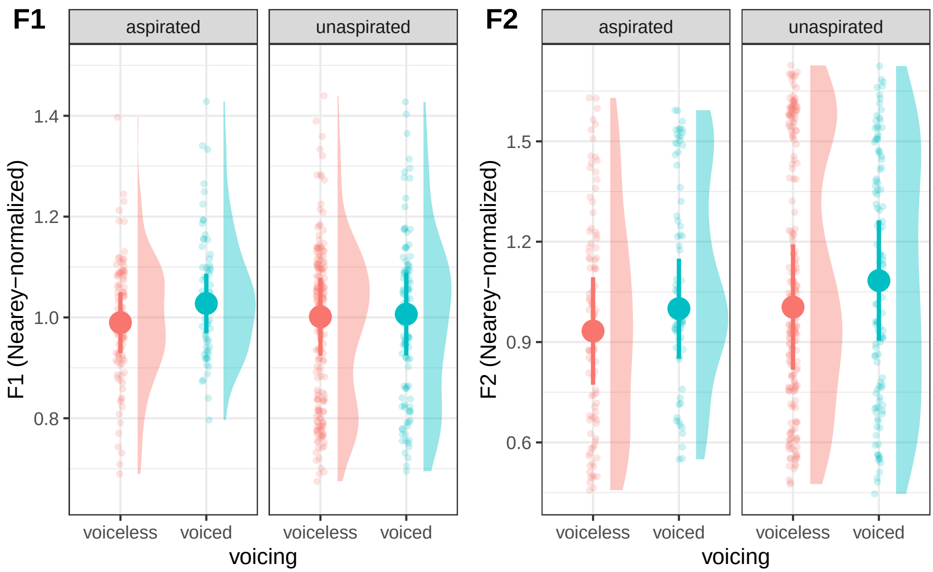


Figure 4: Nearey-normalized vowel midpoint F1 (left) and F2 (right) frequencies by voicing and aspiration of onset consonant.

95 %CrI = [26.1, 106.7]). These two effects are consistent with a lowered tongue body and tongue root advancement, respectively, giving us acoustic evidence for cavity expansion associated with voicing. Aspiration, in contrast, had no credible effect on F1, but did credibly lower F2 ($\beta = -61.3$, 95 %CrI = $[-101.9, -20.5]$), consistent with tongue root retraction. The model did not find any credible evidence of an interaction of voicing with aspiration for either formant. Together, these results show acoustic effects consistent with known effects in voiced stops, while also showing an influence of aspiration on F2. We take these results to suggest independent effects of voicing and aspiration on tongue position: root advancement for voicing and root retraction for aspiration.

2.4 Ultrasound results

Next, we turn to the ultrasound data to determine whether the acoustic differences among vowels following different stop types in the full four-speaker set are reflected in the lingual articulation of one speaker. The results of the by-vowel SSANOVA are shown in Figure 5. As expected, there are large differences among the three vowels in the position of the tongue root and dorsum relating to the vowels' backness. As described in §2.2.2, the SSANOVA analyses which follow are within-vowel owing to the larger expected size of this effect compared to the effect of aspiration or prevoicing on tongue position.

SSANOVAs for aspiration within vowel are shown in Figure 6. Recall that in the acoustic results, aspiration has a credible F2-lowering effect on the following vowel. Data for all three vowels /u/, /ʉ/, and /i/ shows some tongue body lowering following aspirated stops. Data for /i/ also has clear tongue root retraction following aspirated items, while /u/ and /ʉ/ do not obviously show this effect. In fact, the superior part of the tongue root for /u/ is slightly advanced following aspirated items. These results are partly consistent with the acoustic study: backing of the tongue is expected from the acoustics, but not tongue dorsum lowering.

SSANOVAs for prevoicing within vowel are shown in Figure 7. Recall that the acoustic results suggest that voicing slightly raises both F1 and F2, leading us to expect a fronter, lower tongue position which could be interpreted as a consequence of cavity expansion. However, cavity expansion is not obviously reflected in the ultrasound data. Only /u/ shows limited voicing-associated tongue root advancement in the most posterior portions of the extracted contours; /i/ unexpectedly shows slight root retraction, counter to predictions. /u/ also shows some degree of tongue body raising. No other significant differences are observed based on stop prevoicing in Figure 7. To summarize the findings from the two studies, while there is a consistent dorsum-lowering (and, for /i/, root-retracting) effect associated with preceding aspiration for the speaker analyzed here, there is no single obvious effect of voicing on lingual articulation.

3 Discussion

The present study examined acoustic and articulatory data from four speakers of Yemba to determine the effects of prevoicing and (consistently voiceless) aspiration on tongue position during the production of the following vowel. The acoustic study with the full set of four speakers provided evidence that prevoicing is associated with an increase in F1 and F2 in the following vowel, suggesting tongue body lowering and advancement, with the latter possibly connected to tongue root advancement. The acoustic study also showed that aspiration is associated with lowered F2 in the following vowel, suggesting tongue body retraction which could relate to root retraction. This generally appeared to support the predictions that voiced stops are associated with an increase in oral cavity volume and aspirated stops are associated with a decrease in oral cavity volume.

The results of the ultrasound study, with data from a single speaker, partially contradicted the findings from the acoustic study. Midsagittal ultrasound frames

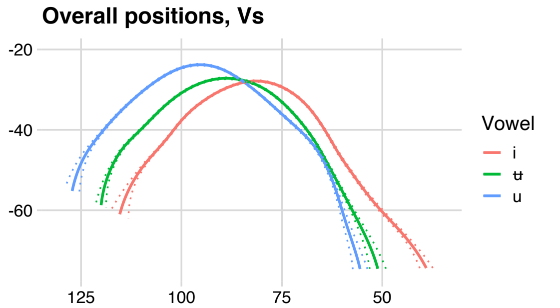


Figure 5: SSANOVA by vowel, pooling across all preceding laryngeal states. Right is anterior.

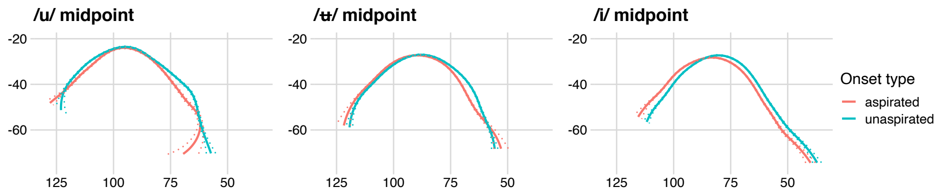


Figure 6: SSANOVA for aspirated versus unaspirated data by vowel. Right is anterior.

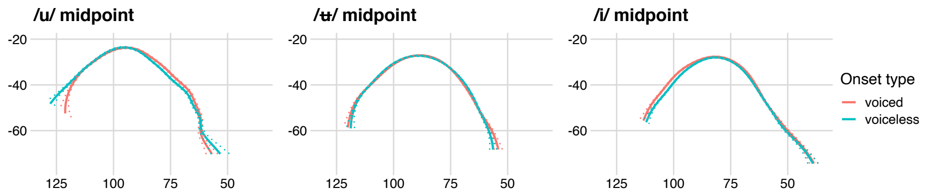


Figure 7: SSANOVA for prevoiced versus voiceless data by vowel. Right is anterior.

at the midpoint of target vowels showed that aspiration is associated with tongue root retraction and tongue dorsum lowering during the following vowel, in line with the observed acoustic differences and suggesting a role for the tongue root in producing this difference. Aspiration may coincide with tongue root retraction because a reduced cavity volume facilitates the buildup of pressure in the oral cavity, increasing the reliability and intensity of aspiration at stop release, as suggested directly by Ahn (2018). This is analogous to Proctor et al.'s (2010) finding that voiceless fricatives involve active constriction of the pharyngeal cavity. Further research on the effects of aspiration on tongue position independent of phonetic voicing contrasts is needed to establish if this might be the case.

Prevoicing was not found to have any consistent effect on the lingual articulation of the following vowel, contradicting the acoustic results where small but clear effects on F1 and F2 frequencies were observed, and at odds with previous findings, e.g. (Ahn 2015, 2018, Westbury 1983). The ultrasound study involved a single participant, so this finding should be treated with caution: further study of more speakers is needed to establish if similar changes in tongue position are generally present in Yemba beyond the study's limited population. This is particularly true since there is known to be considerable idiosyncrasy in the extent to which individual speakers modify the volume of the supralaryngeal cavity during the production of voiced obstruents, and which muscular mechanisms they use (Bell-Berti 1975, Proctor et al. 2010, Westbury 1983). The particular speaker investigated in the ultrasound study may undergo cavity expansion but implement it mainly in the lateral portions of the pharyngeal cavity, away from the portion of the vocal tract accessible to midsagittal ultrasound imaging. We note, however, that prevoicing has been found not to affect tongue root position in some other languages, such as in Matsui & Kochetov's (2018) study of Russian voiced stops, where contrastive secondary palatalization is argued to take priority over reinforcement of voicing in dictating the movements of the tongue root. So, there remains the possibility that Yemba lacks prevoicing-related cavity expansion altogether for language-specific structural reasons.

One possible structural explanation for the apparent lack of prevoicing-related cavity expansion in the stops examined here is that all prevoiced stops in Yemba are also immediately preceded by a nasal consonant (see §1.2). Since nasal venting also facilitates the production of voicing during stop closure (Rothenberg 1968, Solé 2018), it may not be necessary for Yemba speakers to facilitate the production of prevoicing by adjusting the position of the tongue during and after stop articulation. As alluded to in §1.2, Yemba's aspiration contrast extends to the voiced fricative pairs /v/-/vʰ/, /z/-/zʰ/, and /ʒ/-/ʒʰ/ and voiced continuant pairs /l/-/lʰ/, /ɰ/-/ɰʰ/, and /w/-/wʰ/; all of these pairs of phones are voiced but not obligatorily preceded by a nasal, and all three fricatives contrast with voiceless counterparts. Future studies of the voicing contrast in this set of continuant phones may shed light on what lingual adjustments might occur in the absence of a preceding nasal.

4 Conclusion

In this study we aimed to examine how prevoicing and aspiration in stops impact the lingual articulation of following vowels in Yemba, a Grassfields Bantu language with a typologically unusual orthogonal distinction in voicing and aspiration. In an acoustic analysis, formant frequency data suggested tongue root advancement and tongue body lowering following voiced stops, consistent with expansion of the supraglottal cavity. Conversely, formant frequency data indicated that aspiration has the effect of tongue root retraction, consistent with contraction of the supraglottal cavity. In an ultrasound analysis of one participant's data, we found that while there is a consistent dorsum-lowering effect in aspirated stops, and some signs of root retraction, there is no clear effect of voicing on lingual articulation.

Importantly, because Yemba stops (and Bamileke stops more generally) vary independently in voicing and aspiration, we can see that aspiration has a distinct connection to cavity contraction, though evidence for an independent voicing effect is less clear. Taken as a whole, our results suggest that even for "true-voicing" languages with phonetically prevoiced stops, aspiration can coincide with a modification of tongue position, offering an extension of past work in which aspiration and prevoicing do not pattern independently. The present study thus contributes to our cross-linguistic understanding of the effects of laryngeal contrast on supralaryngeal articulation, and represents the first extension of this method to the Bamileke languages, a potentially fruitful area for research on phonation contrasts.

Abbreviations

CL#	noun class # agreement	ꜝ	downstep
CrI	credible interval	́	high tone
F*n*	*n*th formant frequency	̀	low level tone
β	model estimate	̏	low falling tone

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We thank Henry Tehrani of the UCLA Phonetics Lab for technical help, as well as Harold Torrence and all the other members of the UCLA field methods course on Yemba (2018–2019), where the preliminary observations that inspired this paper were made. Thanks also go to Steven Bird for providing a copy of Bird (2003) gratis to the research group.

Appendix

Stimuli for lab-recorded speakers are shown in Table 4 in both the ad hoc orthographical versions used for display and corresponding IPA values. All stimuli were used for the acoustic study; if also used in the ultrasound study, this is indicated in the rightmost column.

Table 4: Stimuli for lab recording.

Orthography	IPA	Gloss	Ultrasound?
le pie	lə̀pȉ	liver	yes
le peuh	lə̀ꜝpʉ́	breast	yes
le pi-he	lə̀pʰì	kola nut	yes
le peu-he	lə̀ꜝpʰʉ́	hole	yes
mbie	m̀bȉ	knife	yes
mbeuh	m̀ꜝbʉ́	breasts	yes
mbouh	m̀ꜝbú	hands	yes
mbie-he	m̀bʰȉ	before	yes
mbeu-he	m̀ꜝbʰʉ́	dog	yes
tie	tíí	write! (imp.)	yes
teuh-a	tʉ̀ꜝə́	be strong! (imp.)	yes
ma-touh	mə̀ꜝtú	intestines	yes
ma-ti-he	mə̀tʰí	saliva	yes
a teu-he	àtʰʉ́	tree	yes
a tou-he	àꜝtʰú	head	yes
ntie	ńtí	write (inf.)	
nteuh	ǹꜝtʉ́	heart	
ntouh	ńꜝtú	scoop water (inf.)	
nti-he	ntʰi	host (inf.)	
nteu-he	ǹtʰʉ́	compensation	

Orthography	IPA	Gloss	Ultrasound?
ntou-he	ńtʰú	insult (inf.)	
ndie	ǹdȉ	lord	yes
ndeuh	ǹdʉ̏	raffia string	yes
ndouh	ǹdȕ	river	yes
ndi-he	ǹdʰȉ	descendant	yes
ndeu-he	ǹdʰʉ̏	boundary	yes
ndou-he	ǹdʰȕ	distant relative	yes
keuh	kʉ̀ꜜʉ́	run! (imp.)	
kouh	kùꜜú	snore! (imp.)	
le keu-he	lə̀kʰʉ̏	trap! (imp.)	
kou-he	àkʰȕ	leg	
nkeuh	ńꜜkʉ́	run (inf.)	
nkouh	ńꜜkú	snore (inf.)	
nkeu-he	ǹkʰʉ̀	rope	
nkou-he	ńꜜkʰú	purge	

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Chapter 3

A phonetic and phonological analysis of the Rere vowel height system

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Previous research on Rere has documented an eight-vowel system /i e ɛ ɐ a u o ɔ/ with strict vowel harmony rules (Quint 2009). The present study provides an acoustic analysis of the Rere vowel system to capture the phonetic characteristics of vowel quality in phonological distributions and phonetic processes. Using elicited data with instrumental suffixation and valence-changing structures (including causatives and passives), we largely confirm the previous account of vowel height agreement in Rere. However, considerable variation in vowel height and vowel quality was also observed. To account for the exceptions, we propose that the mid front vowel /e/ is shifting to a higher vowel [ɪ], which better explains words with disharmonic combinations, mismatches between root and suffix vowels in the instrumental construction, and the lack of alternation in derived verbs in causatives.

1 Introduction

The way in which vowel height contrasts interact with ATR contrasts can be varied and imply different typologies deriving from harmony patterns (Pulleyblank 2011, Casali 2003, 2008). Kordofanian languages of the Niger-Congo family have been documented to have a generally pervasive vowel harmony system based on height features (Moro: Ritchart & Rose 2017), or ATR features (Laru: Abdalla Kuku 2012; Lumun: Smits 2017; Tocho: Alaki & Norton 2013; Acheron: Norton 2013; Dagik: Vanderelst 2016; Tima: Bashir 2013) based on their vowel inventories and trigger factors.

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Rere, or Koalib, belongs to the Heiban group of Kordofanian languages spoken in the Nuba Mountains of southern Sudan by an estimated population of 100,000 (Quint 2009). Rere has been documented as having an eight-vowel system containing no contrast between high front vowels, and previous work reports a pervasive vowel height system rather than ATR (Quint 2009). However, besides the phonological descriptions, an acoustic analysis of the Rere vowel system is lacking. Thus, the current study provides a phonetic analysis of the vowels in Rere to investigate its vowel distributions and vowel height agreement in morphophonological processes. Interestingly, the data reported here show a not-so-robust vowel harmony system with sizable variation and exceptions. In particular, this paper proposes that the mid front vowel [e] is shifting to a higher vowel [ɪ] with its shifting phonological properties, as will be shown in two grammatical processes, instrumental suffixation and causative constructions. This proposal provides a better account for the exceptions of disharmonic suffixed words and non-conformity of vowel harmony patterns. The fact that the present analysis does not completely agree with a previous phonological description by Quint (2009) is likely due to speakers' variation or language contact with Arabic (cf. Tabaq; Hellwig & Schneider-Blum 2014).

This paper presents a phonological as well as acoustic analysis of the elicited data from one male native speaker of Rere, Taitas Kanda, who was born and raised in the town of Kwandaŋ in the Abri area in Sudan. We elicited weekly sessions with Taitas from January to May 2019 and annotated the data using ELAN (all the examples can be accessed in the Kwaras Rere corpus at rere.ucsd.edu). For the acoustic analysis, I segmented words and phonemes in Praat (Boersma & Weenink 2019), and processed the acoustic measures in VoiceSauce (Shue et al. 2011). In Section §2, I demonstrate the vowel inventories as well as common phonetic processes such as vowel centralization and cross-word assimilation, in comparison to what has been discussed previously in Quint (2009). In Section §3, I investigate the within-word vowel harmony and raising alternations, which appear in a few grammatical processes including instrumental suffixation and valence-changing constructions. Sections §4 and §5 revisit the vowel inventory with regard to the alternation patterns observed in Rere, the typological patterns with neighboring languages, and conclude.

2 Rere vowel inventory

2.1 Vowels

Quint 2009 described the eight vowel phonemes /i e ɛ ɐ a u o ɔ/ in Rere, as shown in Table 1.

Table 1: Inventory of the vowel phonemes of the Rere dialect (adapted from Quint 2009: P31, Table 5)

	Front	Central	Back
High	i		u
Mid	e	ɐ	o
Low	ɛ	a	ɔ

In addition, Quint had noted that the phoneme /e/ had a higher point of articulation than the cardinal [e] and slightly lower than the high vowel /i/, which was also found in our data (the majority of [e] attested has an average F1 of 350 Hz).

We confirm Quint's (2009) findings that vowel length is contrastive and perceptible whereas nasalization is not. The long counterparts of the eight vowel phonemes were attested, as shown in Table 2. Note that in many of these examples, the long vowels are in the penultimate position of the word. Thus, there seems to be a tendency for penultimate vowels to be long, which could be an acoustic correlate of lexical prominence. We also found an additional degree of vowel length such that an extra-long vowel (i.e., notated by V::) is used to express an object at a fair distance, e.g., [kʊ̋ɭâw ŋgwá::ɭà] 'that cat (over there)', as compared to [kʊ̋ɭâw ŋgwàɭà] 'that cat', whereas the word with a long vowel [kʊ̋ɭâw ŋgwà:ɭà] was not attested. Based on the acoustic measurements, the regular vowels usually have a duration of 60-70 ms while contrastive long vowels typically exceed 100 ms and the super long vowel [a::] has a duration of 300 ms.

2.2 Vowel minimal pairs

Based on our research with Taitas, the eight phonemic vowels were attested in his speech. The following minimal pairs and near-minimal pairs illustrate the contrastive status of the eight vowel phonemes.

Table 2: Examples of long vowels. All the examples can be searched and accessed at http://rere.ucsd.edu.

iː	[îː]	'drink'	TK01162019-6:07:22.4
eː	[ʈèːɾà]	'girl'	TK02012019-6:02:00.9
ɛː	[ɭɛ̀ːɖɛ̀r]	'bowl'	TK02202019-5:12:31.3
ɐː	[ɐ́ːmù]	'rat'	TK02222019-1:12:42.7
aː	[jáːɾì]	'ash'	TK01162019-3:11:50.7
aːː	[kʊ̋ɭâw ŋgwáːːɭà]	'that cat (over there)'	TK02062019-4:04:17.7
uː	[kúːɭù]	'smoke'	TK01162019-3:02:44.5
oː	[ôːɾì]	'red'	TK01162019-4:11:08.0
ɔː	[ʈɔ́ːɲò]	'gourd'	TK02202019-5:18:04.7

(1) a. a versus ɐ versus e
kâɭ 'stone' TK01112019-7:01:47.9
kɐ̂ɭ 'sheath' TK04122019YHSC-2:08:01.6
kêɭ 'seed-hole' TK04192019YHSC-2:04:27.2

b. o versus ɔ
ʈôr 'child' TK02012019-5:13:02.0
ʈɔ̂r 'hammer' TK05172019-2:02:46.9
ɗòŋ 'group' TK04122019YHSC-2:13:58.0
ɗɔ̀ŋ 'back of skull' TK04122019YHSC-2:12:57.9
kwórtò 'rich person' TK04122019YHSC-2:11:34.0
kwɔ́rtɔ̀ 'blacksmith' TK04122019YHSC-2:11:16.8

c. o versus u
ɭùbòŋ 'hole in tree' TK04102019-7
ɭùbùŋ 'hole on ground' TK04102019-79
ʈ̪òːròm 'star' TK01112019-5:07:56.0
ʈ̪úrùm 'government' TK04122019YHSC-2:10:33.69

d. e versus ɛ
ɭèːɾè 'seed of gourd' TK04192019YHSC-2:01:32.1
ɭɛ́ːɾɛ̀ 'sky' TK04122019YHSC-2:05:01.3

e. i versus e
ɭîː 'they will drink' TK04262019-YH2
ɭêː 'they will wash' TK04262019-YH2

The distribution of F1 and F2 of the eight vowel phonemes is plotted in Figure 1 based on the mean formant values over the entire duration of each of the eight vowels in the representative words (see Appendix §6). Ten to twenty monosyllabic or disyllabic words which contain clear articulations were selected for each vowel.

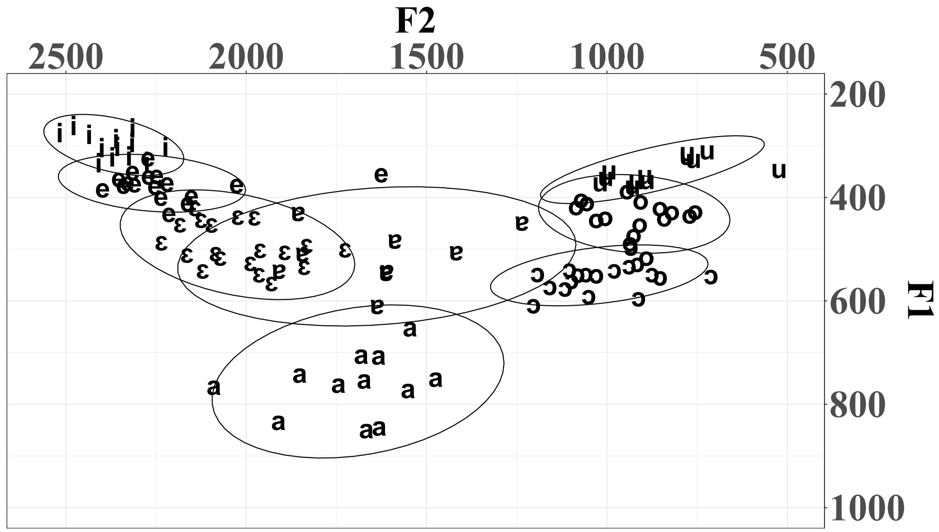

Figure 1: Mean F1 and F2 (Hz) of the eight Rere vowel phonemes

In particular, the cluster of mid central vowel [ɐ] shows much variation with some fronting, though not as front as the low front vowel [ɛ]. Also, several instances of [u] have relatively higher F2, which are closer to [ʊ]. The tokens of [e] are clustered closer in the vowel space to the high vowel [i].

Figure 2 shows the current vowel space based on the average F1 and F2 across the same vowel phonemes.

2.3 Vowel allophones and variations

Next, I show three allophones [ʊ e ə] as the variants of the phonemic vowels in different contexts with a discussion of changes in vowel including centralization and cross-word assimilation such as rounding, and raising. Overall, these allophones are more likely phonetic variants found in the realization of certain phonemes, or even in free variation, rather than caused by phonologically conditioning. For example, the schwa is typically a phonetic intrusive vowel occurring between consonants, or is an allophone of centralized vowels, and [e ʊ] are seen after certain consonants and/or at the word-final positions, to be detailed below.

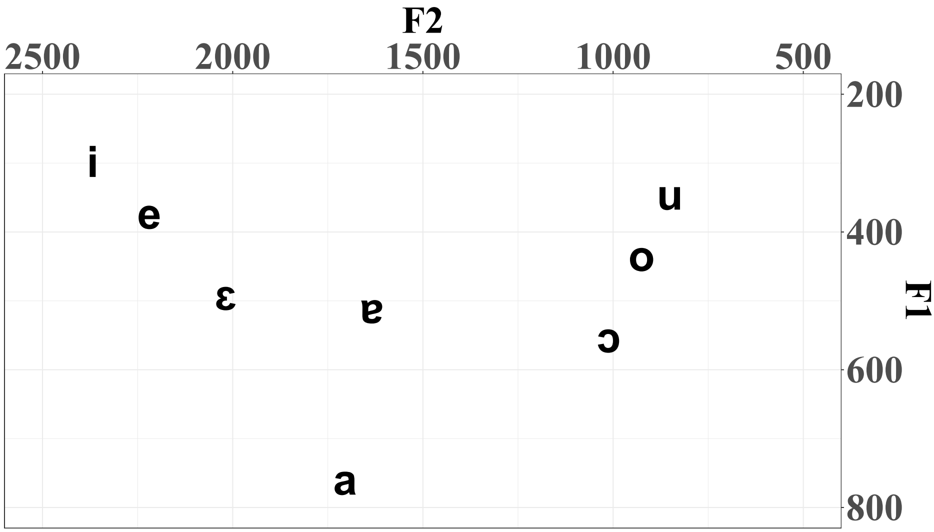

Figure 2: Representative Rere vowel space (in Hz)

The vowel [ʊ] is possibly an allophone of [o], which usually occurs after the palatal fricative [ç], for example, in [çʊ́nɖàŋ] < /çónɖàŋ/ 'lion'. There is also free variation between [o] and [ʊ], as seen in [ɕʊ́ːɾì] and [ɕóːɾè] 'be clean', from different elicitation sessions. However, in the current data, [ʊ] was not found to alternate with [o] in word-final positions.

In other circumstances, [ʊ] is a centralized version of [u], which has a similar F1 to the high vowel [u] but with a much higher F2. For example, it often appears in a closed syllable, as seen in [t̪ʊ́ɭ] < /t̪úɭ/ 'giraffe' and [t̪ʊ̂ɭ] < /t̪ûɭ/ 'porridge', or it becomes short in [kʊ́ɭàw] 'cat' (26 ms; Quint 2009 had it as a centralized [u]), and [ɕʊ̀kúɭè] 'edible gourd' (28 ms). These instances of [ʊ] have an F2 near 1200-1400 Hz, compared to a typical [u] in [kûːɭù] 'smoke', [ɭùbùŋ] 'hole on ground', and [kwúrì] 'he will cut' with an F2 of 650-800 Hz.

(2) [ʊ] < /o, u/:

çʊ́nɖàŋ 'lion'	TK02062019-9:08:45.7
ɕʊ́ːɾì 'be clean'	TK06072019YH
ɕóːɾì 'be clean'	TK03082019SCARYH-3
t̪ìɕʊ́ːɾì 'to clean'	TK03082019SCARYH-3
t̪ʊ́ɭ 'giraffe' TK02152019-8	
t̪ʊ̂ɭ 'porridge'	TK02152019-8
kʊ́làw 'cat'	TK02062019-1
ɕʊ̀kúɭì 'edible gourd'	TK04122019YHSC-2:06:50.8

Though /e/ is a phonemic vowel, [e] also appears as surface realizations of other underlying vowels /ɛ, ɐ/, which results in neutralization. The allophonic [e] occurs when the underlying vowels are colored by palatal consonants. For example, in [ɭèʝ] < /ɭɛ̀ʝ/ 'eye', the underlying /ɛ/ is higher because of the influence of the following palatal fricative. Similarly, /ɐ/ becomes [e] in [éjjɐ́] < /ɐ́jjɐ̀/ 'who' due to the adjacent palatal glide. In other cases, the vowel status is not particularly stable in that the word may be articulated with vowels of variable quality on one occasion versus another occasion, for example, [t̠ê] 'be cold' varies with [t̠ɛ̂] in casual versus careful speech.

(3) [e] < /ɛ, ɐ/:

lèʝ 'eye'	TK02082019-1:07:40.0
éjjɐ́ 'who'	TK03152019-4:01:04.8
t̠ê 'be cold'	TK04192019YHSC-2:26:26.5
t̠ɛ̂ 'be cold'	TK05102019-YH3

The reduced vowel [ə] never occurs in monosyllabic words. Consistent with the centralization process described in Quint (2009), the schwa is typically derived from any vowels that are too short to reach their target formant values, especially when they are adjacent to liquids or rhotics, or preceded by velars, as in [ʈít̠ərà] < /ʈít̠érà/ 'cup', and [kəɽèɭɭè] < /kèɽèɭɭè/ 'nail' and [ŋərpò] < /ŋòrpò/ 'tomorrow'. Sometimes, the schwa can also be an intrusive vowel without a tonal association occurring between two consonants, or according to Quint, the liquid becomes syllabic, for example, [kɛ́ɾəgɛ̀] 'hand'.

(4) [ə]:

ʈít̠ərà 'cup'	TK02202019-5:08:10.3
kɛ́ɾəgɛ̀ 'hand'	TK04192019YHSC-2:26:26.5
kəɽèɭɭè 'nail'	TK02082019-4:05:28.8
ŋərpò 'tomorrow'	TK05012019-3:02:46.4

To add to the centralization process, word-final vowels and vowels in closed syllables are often centralized and reduced in duration. For example, [ɪ] as a centralized variant of /i/ in [ʈáːmìn] < /ʈáːmìn/ 'finger' has an F2 of around 1800 Hz, compared to the reference F2 value above 2000 Hz in Figure 2. Likewise, in [nánáɭò] 'sit', the final vowel [o] reduced to 27 ms with an F2 of around 1200 Hz and in [t̠ìɗàŋàɭò] 'surface', [o] becomes centralized with a relaxed quality and an F2 of 1500 Hz. And in the sentence 'A dog is sleeping', the word-final vowel [o] becomes its centralized version [ɵ] in the two words, with an F2 of around 1600 Hz.

(5) ʈá:mɪ̀n ‘finger’ TK03012019NK-4:00:41.0
nánáɭ**ò** ‘sit’ TK03152019-YH1:10:06.9
pɪ̀rt̪ɪ̀r t̪ɪ̀ɗàŋàɭ**ò** ‘Wipe the surface! (to PL)’ TK04242019-9
ʈíɲɛ́n kə́r**ɵ́** ʈɪ̀nd̪ər**ɵ̀** ‘A dog is sleeping’ TK02202019-1:07:09.1

Further, vowel assimilation is seen in labial spreading across boundaries, particularly in connected speech. This phenomenon is referred to as velarization in Quint (2009). The following example in (6) provides a case of regressive assimilation: occasionally when the verb is followed by a word that contains a rounded vowel [o], the final vowel [ɛ] in the verb /ɛ́ɟɛ̀/ ‘see’ is labio-velarized to be [ɛ́ɟó]. However, this process seems to be subject to free variation and speech rate because the vowel [ɛ] in word [ɛ́ɟɛ̀] is retained in some other utterances of the same sentence.

(6) a. [ɲí-gw-ɛ̂:ɟ**ó** kókò-ŋò]
/ɲí-gw-ɛ̂:ɟ**ɛ́** kókò-ŋò/
1sg-cl$_{kw}$-see.ipfv koko-acc
‘I will see Koko.’ (TK02152019-1)

b. [ɭ-ɛ̂:ɟ**ó** kókò-ŋó ŋòrpò]
/ɭ-ɛ̂:ɟ**ɛ́** kókò-ŋó ŋòrpò/
3pl-see.ipfv koko-acc tomorrow
‘They will see Koko tomorrow.’ (TK02152019-3)

c. [ŋéŋé ɭɛ̂:ɟ**ó** kókò-ŋó ŋòrpò]
/ŋéŋé ɭɛ̂:ɟ**ɛ́** kókò-ŋó ŋòrpò/
2pl see.ipfv koko-acc tomorrow
‘You all will see Koko tomorrow.’ (TK02152019-3)

Another similar case is that the vowel height of final centralized vowels can be conditioned by the height of the following vowel in the following word. For example, /mà:ní/ ‘cook’ is realized as [mà:nɨ́] (7a) when preceding a high vowel such as in [t̪ʉ̀ɭì] ‘porridge (accusative)’, and as [má:nə́] (7b) when preceding a non-high vowel as in [kàɣròŋé] ‘chicken (accusative)’.

(7) a. ɲí-gw-má:n**ɨ́** t̪ʉ̀ɭ-ì nâ kàɣrò
1sg-cl$_{kw}$-cook.pfv porridge-acc and chicken
‘I cooked porridge and chicken.’ (TK02222019-5:05:56.9)

b. ɲí-gw-má:n**ə́** kàɣrò-ŋé nâ t̪ûɭ
1sg-cl$_{kw}$-cook.pfv chicken-acc and porridge
‘I cooked chicken and porridge.’ (TK02222019-5:07:26.9)

The cross-word vowel height assimilation also targets the progressive marker, *ŋgó/ ŋgú*. The vowel in *ŋgó/ ŋgú* alternates between [o] and [u] depending on the vowel in the preceding word. When the subject is the first person singular, *ɲí* 'I', which contains a high vowel [i], *ŋgú* is produced (8a); when the subject is the second person singular, *ŋá* 'you', or a name such as Koko that includes [o] as a non-high vowel, *ŋgó* occurs (8b).

(8) a. ɲí **ŋgú** gw-àβrə̀-ŋà
1SG CL_{kw}.PROG CL_{kw}-run.away-2SG
'I am running away from you.' (TK03062019-8:04:15.6)

b. kókò **ŋgó** gw-àβrə̀-ŋà
koko CL_{kw}.PROG CL_{kw}-run.away-2SG
'Koko is running away from you.' (TK03062019-6:02:59.6)

3 Vowel height change/agreement in grammatical processes

Vowel harmony was described in Quint (2009) as being a pervasive phonological phenomenon such that within words vowels must belong to the same height class, which even applies to non-Koalib origin words. He further described the role of vowel harmony in morphophonology and derived verbs that change valence. Specifically, affixes alternate for vowel height according to the height class of the root, and vowels raise to indicate increased valency in derivational processes. Thus, in this section, I first show harmonic words that are consistent with the previously found pattern, and then present counterexamples of words containing vowels disagreeing in height. Moreover, I present data on multiple grammatical processes, including noun suffixation in instrumental constructions "with X", verbal conjugation in valency changing structures including causatives and passives, and possessives, to investigate the within-word vowel harmony patterns.

3.1 Root-internal harmonic and disharmonic vowel combinations

According to Quint, vowels can be divided into two sets: high vowels /i ɐ u/, and low vowels /e ɛ a ɔ o/, as shown in Table 3 (reproduced).

Supposedly, words should contain vowels of harmonic combinations such that high vowels and non-high vowels do not appear within the root of a word. Table 4

Table 3: Distribution of Koalib vowels by vowel harmony set (reproduced from Quint 2009: P34, Table 6)

	Front	Central	Back
High	i	ɐ	u
Low	e	a	o
	ɛ		ɔ

Table 4: Example words containing vowels of the same height class

ɐ́ːmù	‘rat’	kwɔ́rtɔ̀	‘blacksmith’
íːgɐ̀	‘fire’	kwàɾàɭɭè	‘cough’
ʈɔ́ːɲò	‘gourd’	kìmɐ̀u	‘doctor’
kúnɐ̀d̪ùrì	‘number 9’	kwɐ̀ɭùŋ	‘liar’
úːmì	‘sick’	kwɔ́àj	‘slave’
ɲéːɽò	‘goat’	t̪òɣwɔ̀r	‘heart’

contains examples of harmonic words in which vowels belong to the same height class.

However, exceptions or counterexamples to the vowel height agreement rule are abundant in our elicitation with the speaker. Table 5 shows examples of root-internal disharmonic words.

Out of the 200 multisyllabic words including those containing identical vowels in our corpus, there are around 56 words that contain disharmonic vowel combinations (~28%). In the following section, I discuss variations in vowel harmony, using a case study of the instrumental suffix, showing that the harmony pattern is not shown as clearly as in previous work by Quint.

Table 5: Words containing vowels not agreeing in vowel height

jáːrì	‘ash’	frìjàr	‘flash of light’
kɽít͡ɕâ	‘wine’	ʈíɲèn	‘dog’
ôːɾì	‘red’	ʈít̪ə́rà	‘cup’
ɗùkka	‘stick’	fóɾì	‘light’
kòkòɽɐ̀ɲ	‘few’	jɛ́ːnì	‘ear’
ɭùbòŋ	‘tree-hole’	kímòw	‘snake’

3.2 Suffix of the instrumental case: 'with X' construction

The morpheme that indicates the instrumental case in 'with X' constructions alternates between *-ki* and *-ke*, conditioned by the corresponding vowel height set of the root vowels. For example, in Quint's transcriptions, we can compare the suffix vowel agreeing with the low vowels in [kwáːráɭ-gè] 'with the antelope' with that agreeing with the high vowels in [kwɐ̀ɭùŋ-gì] 'with the liar' (here /k/ is realized as [g] after sonorants).

We elicited words containing vowels of different heights under suffixation, and Table 6 shows the alternating patterns in the instrumental case for the two sets of words with either high /i ɐ u/ or low vowels /o ɔ ɛ e a/ in the root. These are found to be largely consistent with previous findings in Quint (2009). The transcription was based on both perception and acoustic measures of their respective F1 and F2 values. Note that the consonant in the suffix /-ki, -ke/ is conditioned by noun class, thus we denote the instrumental case to be /-Ci, -Ce/.

Indeed, we see /u i ɐ/ form one group while /o ɔ ɛ e a/ form another group in conditioning distinct vowels in the instrumental suffix. However, counterexamples exist such that 1) words with low vowels can take the higher suffix /-Ci/; and 2) words take both suffixes in free variation, regardless of supposed vowel harmonic sets. Table 7 and Table 8 show the two scenarios respectively.

In Quint's classification, /e/ is grouped with other low vowels, as is supported by its use in alternation with /i/ in the instrumental suffix. However, we found that a few words containing /e/ select the higher suffix *-Ci*, instead of the suffix *-Ce*. This mismatch of vowel heights between root and suffix, along with cases with other low vowels /o a/, adds to the variation of the vowel harmony patterns in Rere. Interestingly, almost all disharmonic cases show a combination of a low root and a high suffix, rather than a high root and a low suffix, except when double forms exist, as in Table 8. Out of the 84 suffixed nouns, we found 19 words that are disharmonic (~23%), and 13 of them contain the vowel /e/. To some extent, the low vowels pattern with high vowels in terms of vowel harmony. In particular, it is possible that the vowel /e/ shifts to a higher vowel, which is consistent with its higher point of articulation (Quint 2009).

Moreover, the phonetic realizations of the suffixed forms are not stable in that the same suffix in the same word can be produced with different vowel qualities (see Table 8). Relatedly, even in words without a suffix, the status of [e] is not steady in that it freely varies with the higher vowel [i], for example, [t̪ê] 'arm' is sometimes produced as [t̪î].

Table 6: Two vowel sets with the instrumental case /-Ci, -Ce/

(a) High V

	With + X		With + X		With + X
wùɾúṯ-ṯì	‘larger antelope’	kû:ɭú-ɣî	‘smoke’	kúːɾí-ɣî	‘mouse’
ŋèɭúŋ-ŋì	‘lie’	ṯúrùm-ðî	‘government’	ɘ́ːmù-wî	‘rat’
kɘ́ɳɖɘ̀ŋ-ɣî	‘knife’	gúɾùɟí-ɣî	‘money’	kíːɾíɲ-ɣì	‘warthog’
kímìɟi-kî	‘kitchen knife’	ɟíːðì-ɟì	‘meat’	ɕùkúɭì-ɣî	‘edible gourd’
ɲúr-ɲì	‘fruit’	ʈíɲì-rî	‘rabbit’	ɭùbùŋ-ɭî	‘ground-hole’
ɭùr-ɭì	‘manure’	ì:gɘ́-wì	‘fire’	ṯúɭ-ðì	‘giraffe’
kîːɾù-kì	‘small antelope’				
TK04262019-YH1,2		TK05102019-YH			

(b) Low V

	With + X		With + X		With + X
ṯóŋór-ðè	‘elephant’	ʈɔ́ŋɔ̀r-rè	‘boy’	lɛ̀blɛ́ṯ-ɭè	‘cloud’
ṯòːròm-ðê	‘star’	kwɔ́rtɔ̀-gè	‘blacksmith’	ɭɛ́ːɾɛ́-ɭè	‘sky’
ɭóm-ɭè	‘fish’	ʈɔ́r-rê	‘hammer’	ɭɛ̀ːɖɛ̀r-ɭê	‘bowl’
kwór-ɣê	‘man’	ɭɔ̀rɭɔ̀ɭɔ́-ɭè	‘beetle’	kéɭ-kè	‘seed-hole’
ɗòŋ-ɭê	‘group’	kâɭ-ɣè	‘stone’	ɭèːðè-ɭê	‘pine tree’
ʈór-rê	‘child’				
‘with elephant’ in TK04262019-YH1,2; others in TK05102019-YH					

Table 7: Words containing low vowels with /-Ci/

ŋwéɛ̀ŋ-ŋî	‘with soot’	TK04262019-YH1
ŋèà-ŋî	‘with poison’	TK04262019-YH2
ɭè-ɭì	‘eye’	TK05102019-YH
ŋéːɽè-ŋî	‘goat’	TK05102019-YH
kwórtò-ɣì	‘with rich person’	TK05102019-YH
kwáːráɭ-ɣì	‘with antelope (biggest)’	TK05102019-YH

Table 8: Words with both forms of suffix

kwɔ́àj-ɣê	kwɔ́àj-ɣî	'with slave'	TK04262019-YH1
kwá:ráɭ-ɣè	kwá:ráɭ-ɣì	'with biggest antelope'	TK04262019-YH1
t̪ùɭ-kè	t̪ùɭ-kì	'with porridge'	TK05102019-YH
t̪úɭùŋ-rê	t̪úɭùŋ-rî	'with silo'	TK05102019-YH
ʈè:ɾà-ɽê	ʈè:ɾà-ɽî	'with girl'	TK05102019-YH
t̪é-ðè	t̪é-ðì	'with arm'	TK05102019-YH
ɭè:ɭè-ɭê	ɭè:ɭè-ɭî	'with termite'	TK04262019-YH1
ámɭà-wê	ámɭà-wî	'with trap'	TK05102019-YH

So far, we have seen counterexamples showing that not only words allow root-internal disharmonic vowel combinations, but also words with low vowels /e o a/ can be followed by the suffix containing the high vowel *-Ci*, and words can freely vary between the phonetic realizations of the suffix. This is at odds with Quint's description that all words only allow vowels of the same height group. To further probe the distinction between the vowel qualities in the two alternants of the instrumental case, I plotted the distribution of the mean F1 and F2 values for each [i e] in the suffix based on the transcriptions of the words from above (see Figure 3).

Table 9: Mean vowel formants of [i e] in /Ci, Ce/ based on transcription

	mean F1 (Hz)	mean F2 (Hz)	mean F3 (Hz)	mean F2-F1 (Hz)
i	322.17	2276.07	2828.24	1953.90
ɪ	374.35	2136.40	2725.71	1762.05

The vowel labels based on human perception (by the author and colleagues in the fieldwork class) clearly show that /i/ is a higher and fronter vowel than /e/ in that its tokens are more concentrated in the top left corner of the vowel space with a lower F1 (with a difference > 50 Hz) and slightly higher F2. However, to preclude subjective biases from the transcription, I then used an alternative unsupervised machine classification approach (Stehr 2018) to separate two clusters of the two vowels [i e] by automatically specifying two centers in the K-means algorithm. The corresponding plot is shown in Figure 4.

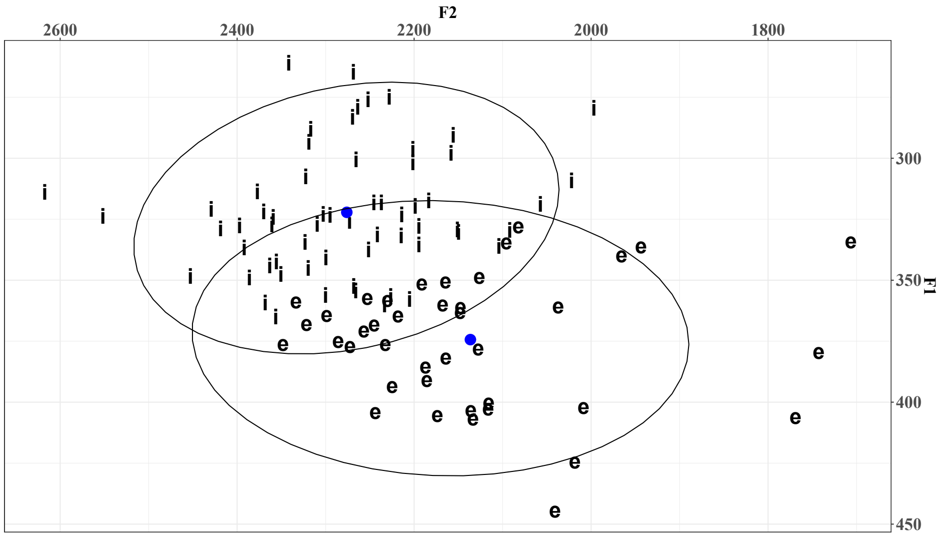

Figure 3: Mean F1 and F2 of [i e] in /Ci, Ce/ based on transcription. The blue dots show the center mean F1 and F2 of [i e] across all tokens. The values are shown in the following table.

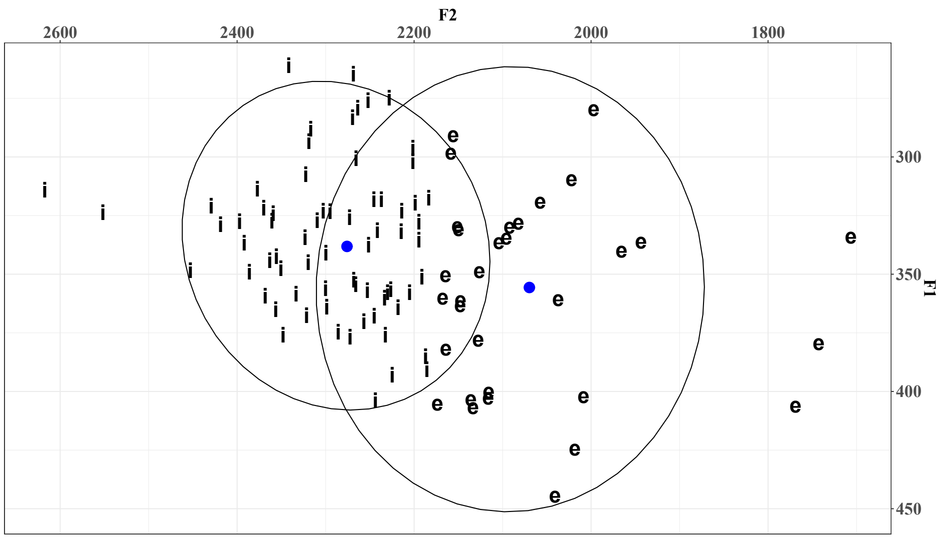

Figure 4: Mean F1 and F2 of [i e] in /ki, ke/ based on k-means clustering at two centers. The blue dots show the center mean F1 and F2 of [i e] across all tokens. The values are shown in the following table.

Table 10: Mean vowel formants of [i e] in /Ci, Ce/ based on k-means clustering

	mean F1 (Hz)	mean F2 (Hz)	mean F3 (Hz)	mean F2-F1 (Hz)
i	338.15	2275.85	2869.08	1937.70
ɪ	355.67	2069.75	2564.42	1714.08

The biggest difference between human perception and the computational analysis lies in the driving factor. We relied more on the difference of F1, or the height between the two vowels while the machine weighed more the linear difference of F2 (> 200 Hz) between the two vowels. Nonetheless, the regular [i] is more concentrated with a lower F1 and higher F2 whereas [e] is more variable with an overall higher F1 and lower F2.

Furthermore, inspired by (Hellwig & Schneider-Blum 2014), I adopted a third supplemental approach to sort out the vowel quality in the suffix *-Ci/ -Ce* by a priori labeling them into three groups: words that contain clearly high vowels /i u ɐ/, words that contain clearly low vowels /ɛ a ɔ o/, and words that contain the supposedly low vowel /e/. Figure 5 shows the distribution of the different suffixes by the three groups.

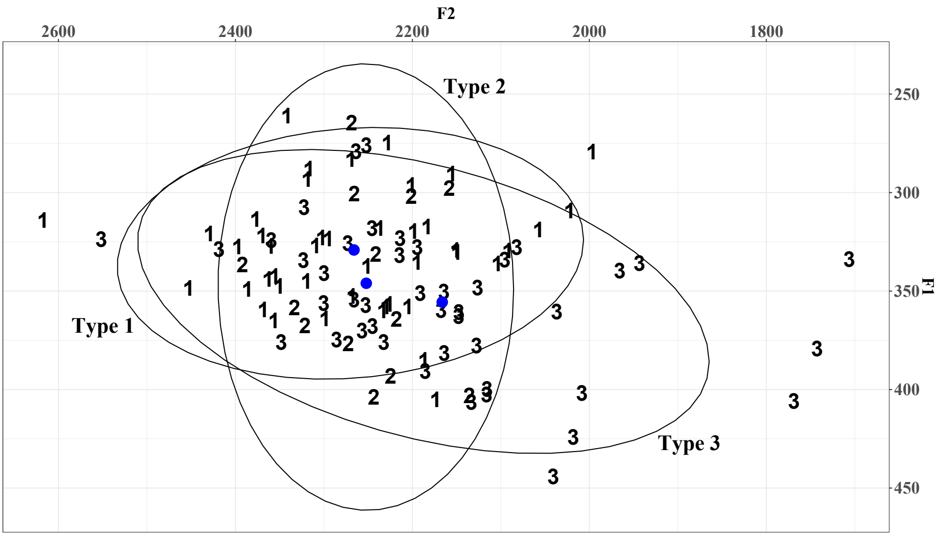

Figure 5: Mean F1 and F2 of [i e] in /Ci, Ce/ divided into three types based on the vowel classes in the root. Type 1: /i u ɐ/; Type 2: /e/; Type 3: /ɛ a ɔ o/. The blue dots show the respective center means of the three types.

Comparing to Figure 3, the circle of Type 1 suffixes resembles the vowel space of [i] with similar formant values with lower F1 and higher F2, which is consistent with our observations that words with higher vowels select *-Ci*. The suffixes in Type 3, the group of words with low vowels, show the opposite pattern of Type 1 by having higher F1 and considerably more variation in both formants, reflected in the few vowel-height mismatching cases discussed above. The suffixes in Type 2, the group of words with [e], however, are more variable along the F1 dimension and more constrained across F2 values, suggesting the unstable status of the height of this vowel, consistent with the above findings on disharmonic suffixation and free variation.

3.3 Valence-changing structures: causatives, passives

Verbal morphology is rich in Rere as it is involved in various derivational constructions. In contrast to the instrumental suffixation where the suffix is the target of harmony and the root is the trigger, in derived verbs in causative and passive constructions, the suffix triggers vowel harmony in the stem, sometimes even without the presence of the suffix. In particular, low vowels in the verb stem raise to become high vowels in the presence of a causative or passive suffix *-in* or *-ən* (a similar pattern occurs in the related language Moro with the causative suffix *-i*; (Strabone & Rose 2012). Here, I present data that show the vowel harmony process where the four low vowels /a o ɔ ɛ/ raise to [ɐ u ʊ i (ɪ)].

The examples (9) and (10) show raising of the central low vowel /a/ to the central high vowel [ɐ] in verbs /áŋgɽí/ 'draw water' and /mà:ní/ 'cook' under causative constructions, triggered by the causative suffix *-in*.

(9) a raises to ɐ:

a. ɲí-gw-t̪-ɐ́mɟ-í ɲì:ɾà t̪ə̀-r-**àŋgɽì**
1SG-CL$_{\text{kw}}$-HAB-make-TAM CL$_{\text{ɲ}}$.girl HAB-3PL-draw.water
(TK03012019-3:05:38.2)
'I make the girls draw water.'

b. ɲí-gw-t̪-**ɐ́ŋgɽ**-*ín*-í ɲì:ɾà
1SG-CL$_{\text{kw}}$-HAB-draw.water-CAUS-TAM CL$_{\text{ɲ}}$.girl
(TK03012019-3:07:22.2)
'I make the girls draw water.'

(10) a. ɲí-gw-t̪-ɐ́mɟ-í ɲìːrà t̪ə̀-r-**màːnì**
1SG-CL$_{kw}$-HAB-make-TAM CL$_{ɲ}$.girl HAB-3PL-cook
(TK03012019-3:00:36.2)
'I make the girls cook.'

b. ɲí-gw-t̪í-**mɐ́ːn**-*ín*-í ɲìːrà
1SG-CL$_{kw}$-HAB-cook-CAUS-TAM CL$_{ɲ}$.girl
(TK03012019-3:09:45.6)
'I make the girls cook.'

The two sets of sentences in (11) and (12) show that /o/ in the adjectives 'be clean' and 'be dry' changes to [u] in the verbs 'be cleaned' and 'be dried' under passive constructions, triggered by the passive suffix *-ən*.

(11) o raises to u:

a. jìɽáðí jí-**ɟòɾ-ò**
CL$_{j}$.clothes CL$_{j}$-be.clean-TAM
'Clothes are clean.' (TK06072019-YH)

b. jìɽáð jì-t̪ì-**ɟùɾ**-*ə̀n*-ì
CL$_{j}$.clothes CL$_{j}$-HAB-clean-PASS-TAM
'Clothes are cleaned.' (TK06072019-YH)

(12) a. jíɽɛ̀t gíjó j-**ònd̪-ò**
CL$_{j}$.clothes CL$_{j}$.DEM CL$_{j}$-be.dry-TAM
'These clothes are dry.' (TK03082019SCARYH-3)

b. jìɽɛ́ð jì-t̪-**ùnd̪**-*ə̀n*-ì
CL$_{j}$.clothes CL$_{j}$-HAB-dry-PASS-TAM
'Clothes are dried.' (TK06072019-YH)

Also note that the instances of [u] in *jì-t̪ì-jùɾ-ə̀n-ì* (11b) and *jì-t̪-ùnd̪-ə̀n-ì* (12b) have a centralized quality as the F2 reaches 1200-1300 Hz.

The examples in (13) and (14) show the low vowel /ɔ/ raises to [ʊ] or [u] in the two verbs /ɔ́ːɭɔ̀/ 'insult' and /ɔ́rɔ́/ 'become' in causative sentences with the presence of the causative suffix *-in*.

(13) ɔ raises to u/ʊ:

a. kw-**ɔ̂ːɭ-ɔ̀**
CL$_{kw}$-insult.IPFV-TAM
'He will insult.' (TK05102019-YH)

b. ɲú-gw-**û**ː**ɭʊ̀**-ð[1]-*ən*-í ʈɔ̀ːŋɔ́r-ɔ́ gwɔ̀ːr-ɔ̀
1SG-CL$_{kw}$-insult.IPFV-SUF-CAUS-TAM CL$_{ʈ}$.boy-ACC CL$_{kw}$.man-ACC
'I will make the boy insult the man.' (TK05312019-YH)

(14) a. ɲí-gw-ɔ́mɟ-ɛ́ ʈɔ̀ːŋɔ́r-ɔ́ àð-**ɔ́rɔ́** gw-ɔ́mnɛ̀
1SG-CL$_{kw}$-make.PFV-TAM CL$_{ʈ}$.boy-ACC INF-become CL$_{kw}$-something
'I made the boy become something.' (TK05292019-6)

b. ɲú-gw-**ùrù**-ð-*in*-á ʈɔ̀ːŋɔ́r-á kɨ́mɔ̀w
1SG-CL$_{kw}$-become.PFV-SUF-CAUS-TAM CL$_{ʈ}$.boy-ACC CL$_{k}$.snake
'I made the boy become a snake.' (TK05312019-YH)

In particular, in (13b), the second [u] in the verb *ɲú-gw-ùːɭʊ̀ð-ən-í* has a lax quality with an F2 around 1450 Hz. Thus, the low vowel [ɔ] raises to both the high vowel [u] and a phonetic [ʊ], especially in a closed syllable.

The low front vowel /ɛ/ also provides substantial evidence for the vowel harmony process, as seen in the verbs 'go', 'wipe', 'dance', 'hit lightly', and 'finish' with causative suffixation. Note that, besides the regular causative suffix conjugation, causatives can also be formed solely by vowel raising without a segmental suffix, such is the case of /ɛ/ in *kʷ́-t̪-ɛ́ɭ-ɛ̀* 'He goes' raising to [i] in *gw-t̪-íɭ-ì* (15b). In the following examples, the vowel /ɛ/ raises to [i] or [ɪ] depending on whether the syllable is open or closed, as examples (16) - (19) show that [ɪ] occurs in closed syllables while [i] occurs in an open syllable in (15).

(15) ɛ raises to i/ɪ:

a. kʷ́-t̪-**ɛ́**ɭ-**ɛ̀**
CL$_{kw}$-HAB-go-TAM
'He goes.' (TK02152019SCYHAR-2)

b. ɲú-gw-t̪-**í**ɭ-**ì**
1SG-CL$_{kw}$-HAB-go.CAUS-TAM
'I make him (somebody) go.' (TK05102019-YH)

(16) a. kwʊ̀-m-**pɛ̀rt̪-á** t̪ìɗà-ŋ-àɭɔ̀
CL$_{kw}$-REC-wipe-TAM CL$_{t̪}$.surface-ACC-O
'He has just wiped the surface.' (TK04242019-9)

[1]We observed that certain verbs have an optional [-ð] or [-Vð] suffix in conjugation. For example, 'insult', 'become', and 'milk (verb)' have it in causatives. The role of the additional suffix is yet to be determined.

b. kẁ-t̪ɪ-**βírt̪**-*ín*-í ʈɔ̀ːŋɔ́r-ɔ́ t̪ìɗà-ŋ-àɭò
CL$_{kw}$-HAB-wipe-CAUS-TAM CL$_{ʈ}$.boy-ACC CL$_{t̪}$.surface-ACC-on
'He makes the boy wipe the surface.' (TK05312019-3)

(17) a. kw-**ɛ̀rt̪-è**
CL$_{kw}$-dance.IPFV-TAM
'He will dance.' (TK05102019-YH)

b. ɲí-gw-t̪-**írt̪**-*ín*-í ɲɔ̀ŋɔ́r-à
1SG-CL$_{kw}$-HAB-dance-CAUS-TAM CL$_{ʈ}$.boy-ACC
'I make boys dance.' (TK05312019-YH)

(18) a. kw-**ɛ̀rt̪-ɛ̀**
CL$_{kw}$-hit.lightly.IPFV-TAM
'He will hit lightly.' (TK05102019-YH)

b. kẁ-t̪-**írt̪**-*ín*-í ʈɔ̀ːŋɔ́r-á gwòːr-ò
CL$_{kw}$-HAB-hit.lightly-CAUS-TAM CL$_{ʈ}$.boy-ACC CL$_{kw}$.man-ACC
'He makes the boy hit the man lightly.' (TK06072019-YH)

(19) a. kw-**ɛ́rn-ɛ́** t̪ùɭ-ì ŋərpò
CL$_{kw}$-finish.IPFV-TAM CL$_{t̪}$.porridge-ACC tomorrow
'He will finish the porridge tomorrow.' (TK05242019-6:14:37.5)

b. kwù-t̪-**írn**-*ín*-í ʈɔ̀ːŋɔ́r-á t̪ùɭ-ì
CL$_{kw}$-HAB-finish-CAUS-TAM CL$_{ʈ}$.boy-ACC CL$_{t̪}$.porridge-ACC
'He makes the boy finish the porridge.' (TK05312019-3)

Next, I show examples that indicate no change in vowel quality for [e] and [ɐ] under causative constructions.

(20) e does not raise to a higher vowel like [i]:

a. ɲí-gw-t̪-ɐ́mɟ-í ʈòr-ó t̪-ùŋ-**èndèrè**
1SG-CL$_{kw}$-HAB-make-TAM CL$_{ʈ}$.child-ACC HAB-SUBJ-sleep
(TK03082019SCARYH-3)
'I make the child sleep.'

b. ɲí-gw-t̪-**éndér-é** ʈòr-ò
1SG-CL$_{kw}$-HAB-sleep.CAUS-TAM CL$_{ʈ}$.child-ACC
(TK03082019-6)
'I make the child sleep.'

Contrary to what Quint (2009: p. 37) has documented, that the vowel /e/ in verb [èntèré] 'sleep' changes to [i] in [ìndìrí] 'to put to sleep' in causatives, we did not observe a vowel change comparing the sentences in (20). That is, [e] does not raise to a higher vowel. This again implies that [e] can pattern as a high vowel instead of being a pure non-high vowel, as we already saw in the instrumental suffixation, so that it does not change in causatives. While a possible explanation could resort to the absence of the causative suffix -in to trigger raising of [e], we have seen cases in (15) where the low vowel /ɛ/ raises to /i/ without the causative suffix.

Likewise, [ɐ] does not exhibit height changes because it already patterns as a high vowel in the corresponding vowel harmony set.

(21) ɐ does not raise to higher vowels such as the phonetic vowel [ə]:

a. kẃ-**wɐ́** ŋìɖà ŋərpò
CL$_{kw}$-milk cow tomorrow
'He will milk the cow tomorrow.' (TK06052019-YC:10:39.3)

b. ɲí-gw-**wɐ̀**ð*ìn*-í t̪ɔ̀:ŋɔ́r-à ŋìɖà
1SG-CL$_{kw}$-milk.IPFV-CAUS-TAM boy-ACC cow
'I will make the boy milk the cow.' (TK05312019-YH)

In sum, we confirm the vowel harmony patterns in Quint (2009) with the exception of /e/ raising to [i]. Table 11 in my analysis summarizes the attested raising patterns compared to Quint's analysis (Table 8; 2009, p.37).

Table 11: Attested vowel harmony in valence-changing verbs

Simple verb	èndèrè 'sleep'	ɛ́l̪ɛ̀ 'go'	má:ní 'cook'	ɔ́rɔ̀ 'become'	òn̪dò 'be dry'
Derived verb	èndèrè 'make sleep'	íl̪ì 'make go'	mɐ̀:nì 'make cook'	úrù 'make become'	ùn̪dù 'be dried'

3.4 Possessives

Another potential case for vowel harmony processes is the possessive construction. Several kinship terms with possessive suffixes show variation in vowels depending on the person marker where the vowels in the roots are conditioned by the vowels in the suffix marker.

Table 12: Vowel harmony shown in kinship terms with possessive suffixes

t̪ɐ́ɾɪɲ-ɐ́ɾ**í**	‘my father’	TK02012019-6:07:20.9
t̪áɾəɲ-âɭ**ò**	‘your.SG father’	TK03152019NDYC-1:05:38.4
m**ɐ́**ðiɣ-ɐ́ɾ**í**	‘my close friend’	TK05172019-3:14:32.0
m**á**ðɪɣ-áɭ**ò**	‘your.SG close friend’	TK05172019-4
ɐ́ŋg-ɐ́ɾ**í**	‘my sibling’	TK05242019-YH
áŋg-áɭ**ò**	‘your.SG sibling’	TK05242019-YH

Most of the alternations happen among [ɐ] and [a], which corroborates the raising correspondence in example (21) from the above section §3.3 on vowel height raising triggered by the causative marker. For example, in [t̪ɐ́ɾɪɲ-ɐ́ɾí] ‘my father’, [ɐ] and [i] belong to the same height group and in [t̪áɾəɲ-âɭò] ‘your.SG father’, [a] and [o] are of the same height.

4 Current Rere vowel system and vowel harmony

Based on the present analysis of the Rere vowel behaviors in grammatical processes that involve vowel agreement and alternations, we observe that, despite the largely consistent vowel harmony patterns, considerable variation is found. In particular, the mid front vowel /e/, might be shifting its phonological properties towards a higher vowel [ɪ] in that it can pattern as a high vowel, as seen in the disharmonic words, instrumental suffixation, and causative constructions. The shifting process should be under way, such that the mid front vowel still retains the low vowel characteristics: it would co-occur with low vowels root-internally or during instrumental suffixation. Here, I propose two variants of /e/, such that the higher variant gradually moves towards the mid-high vowel /ɪ/, forming a contrast with the high vowel /i/ only in rare minimal pairs (e.g., [kwîː] ‘he will drink’ vs. [kwɪ̂ː] ‘he will wash’ with a difference of 80 Hz in F1), and the lower variant patterns with other low vowels with a clearly higher F1 (400 Hz). The two harmony sets are hypothesized as high vowels /i ɪ ɐ u/, and low vowels /e ɛ a ɔ o/, as shown in Table 13.

A possible explanation of the apparent lack of harmony is that /e/ is shifting to a high vowel. In instrumental suffixation, under the current analysis, it is expected that *-Ci* will appear after words that contain [ɪ] (the higher variant of /e/) and that [ɪ] can co-occur with other high vowels /i ɐ u/ within a word. In

Table 13: Proposed vowel height classification in Rere

	Front	Central	Back
High	i	(ə)	u
	[ɪ]	ɐ	(ʊ)
	↑		
	/e/		
Non-high	/e/ → [e]		o
	ɛ	a	ɔ

causatives, if /e/ has shifted to [ɪ], it does not need to raise to a higher vowel. These could explain some of the counterexamples in Sections §3.1 - §3.3. However, in the previous analysis by Quint (2009), /e/ is a low vowel and so it would only occur after low vowels.

Table 6 shows selected examples where /e/ behaves like a high vowel [ɪ] and where it behaves like a low vowel [e]. Among the words that contain /e/ in the stem, suffix, or derived forms, the relative frequency of the higher form is about the same as the lower form with the constant variation being the most prominent observation. This may be extended to the entire vowel system, or limited to idiosyncratic characteristics of a sole speaker, but it is clear that vowel harmony is not as robust as it appears to be in previous work.

	/e/ → [ɪ]	/e/ → [e]
(Dis)harmonic word	kéːnì 'ear'	ɲéːɽɵ 'goat'
	ûɽèjì 'earth'	éɟè 'see'
	ʈíɲèn 'dog'	pɛ́ɾt̪è 'wipe'
	íjè 'eat'	éɽɭâɭâ 'stand'
		rèɭò 'wait'
Instrumental suffix	ŋéːɽè-ŋî 'with goat'	kéɭ-kè 'with seed-hole'
	ɭè-ɭì 'with eye'	ɭèːðè-ɭê 'with pine tree'
	t̪é-ðì 'with arm'	t̪é-ðè 'with arm'
	ɭèːɭè-ɭî 'with termite'	ɭèːɭè-ɭê 'with termite'
Causatives	èndèrè 'make sleep'	

Figure 6: Examples illustrating variants of /e/ in different constructions

Figure 7 further illustrates the current vowel system with raising patterns found in the valence-changing structures discussed in the above section on vowel harmony.

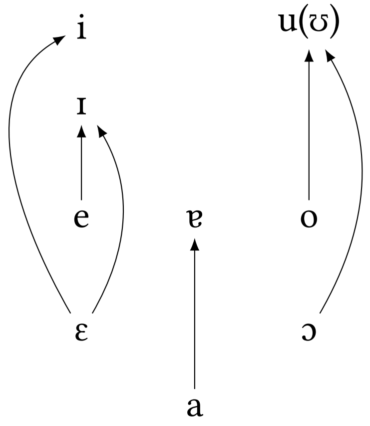

Figure 7: Vowel raising patterns in Rere

We see height raising patterns happening in four low vowels /ɛ a o ɔ/. In particular, the raising schemes shown in (22) suggest that, in accordance with Quint (2009), Rere displays more of a height harmony rather than ATR harmony (also see Moro, a related Kordofanian language, for a height harmony system; Ritchart & Rose 2017). For example, in related languages [ɛ ɔ ɪ ʊ] are [-ATR] vowels, if there is ATR harmony involved in Rere, one would expect alternations between [-ATR] and [+ATR] vowels (e.g., /ɔ/ → [o]) whereas height should not be the conditioning factor. However, in Rere, those supposedly [-ATR] vowels do not always raise to [+ATR] but are allowed to raise to higher [-ATR] vowels (e.g., /ɔ/ → [ʊ]). Moreover, in the causative constructions at least, in closed syllables, /ɛ/ and /ɔ/ become /ɪ/ and /ʊ/ whereas in open syllables, they become /i/ and /u/, respectively, and /o/ goes to /u/ regardless of syllable type.

(22) a. o → u / __ i ə
b. ɛ → i(ɪ) / __ i ə
c. ɔ → u(ʊ) / __ i ə
d. a → ɐ / __ i

Specifically, the vowel raising patterns are derived from the conjugated verbal constructions under valence-changing structures. The trigger of the harmony could be the high vowels or schwa in the causative/passive suffix *-in/ən*; however, we have examined the cases where vowels are raised without the presence of this suffix. Because the trigger of the height harmony can be optional, the vowel raising may be a morphophonological alternation process, rather than an agreement one.

So far, we have seen the vowel height agreement or alternation processes targeted instrumental suffixation, were triggered by causatives, passives, and possessives, as well as some cross-word harmony patterns. Though vowel harmony languages usually restrict vowels of the same harmony set to appear within the same root or word (with few exceptions), Rere does not conform strongly to the vowel height agreement rule. In general, there does not seem to be a pervasive vowel agreement pattern in terms of height or ATR throughout Rere, in that it exhibits substantial root-internal and word-internal disharmonic vowel combinations and free variation of realization of suffix vowels, unlike some other Kordofanian languages studied so far (e.g., Tima, Moro, Laru, Dagik, Acheron, Tocho, Lumun, with more details below).

To summarize, the present paper proposes that, the mid front vowel /e/ is shifting to a higher vowel /ɪ/, resulting in an asymmetric vowel system between front and back vowels, drawing evidence from the patterns of vowel alternations seen in the vowel agreement and raising processes. Still, the nature of the raising patterns needs to be further investigated with more speakers and data. For example, /o/ ⟶ [u] would be height harmony, but /a/ ⟶ [ɐ] could be height or ATR or both. /ɛ ɔ/ ⟶ [i u] agrees on both height and ATR, but /ɛ ɔ/ ⟶ [ɪ ʊ] seems to agree on height only, except that the exact realization of /ɛ ɔ/ after raising is conditioned by syllable structure.

5 Typological implications

In this section, the vowel system of Rere is compared to other systems in neighboring languages. First, the eight-vowel system in Rere resembles but does not completely accord with the 1IU vowel system discussed in Casali (2017). 1IU systems, often seen in West African languages, have seven vowels /i u e o ɛ ɔ a/, which typically refers to vowel systems that do not have contrast among high front vowels. Even with the proposed Rere vowel height system where high vowels are forming contrasts, it is unclear if there is evidence for ATR vowel harmony in Rere, as the main factor accounting for harmony is still height.

Second, neighboring languages such as Laru (Abdalla Kuku 2012), another Heiban language, and Talodi languages including Dagik (Vanderelst 2016), Acheron (Norton 2013), Tocho (Alaki & Norton 2013), and Lumun (Smits 2017) also have an eight-vowel inventory. In terms of vowel harmony patterns, Laru has the same raising pattern as Rere: /ɛ ɔ/ ⟶ [i u] respectively, but in a [+ATR] plus height harmony system with a vowel inventory lacking /e o/. The Talodi languages would raise /ɛ ɔ/ to their mid allophones [e o], but also differ from Rere in that they have a symmetric 2IU vowel system /i ɪ u ʊ ɛ ɔ ə a/, with contrasts among high front vowels, and exhibit a dominant [+ATR] harmony. Also, for Lumun, Smits (2017) noted that the ATR contrasts in the high vowels were weak or even absent, only remaining clear in minimal pairs, suggesting vowel harmony may be weakening. Rere is similar in this sense, for example, the high vowel contrasts were most obvious when articulating the minimal pair [kwîː] 'he will drink' versus [kwɪ̂ː] 'he will wash'.

Finally, the state of Rere vowel quality is not always steady, especially in high front vowels, for example, [t̪ê] 'arm' is sometimes pronounced as [t̪î], [kîːɾù] 'small antelope' as [kêːɾù], to name a few. All languages have variation to some extent; however, the variable production of /e/ and /i/ in Rere leads to a disrupted vowel height harmony system. The distinction between the high and low vowels becomes blurred. This calls attention to the status of language sustainability and preservation, as brought up for Tabaq (Hellwig & Schneider-Blum 2014). Tabaq, another Nuba Mountains language, has substantial language contact with Arabic. The vowel system in that language was particularly hard to capture. For instance, the short vowel phonemes are subject to centralization, and the same word produced by the same speaker at different occasions could induce differences in acoustics and perception. In addition, Tabaq shows an inconclusive vowel harmony for a short unstressed suffix *-d̪u/ -d̪ʊ*, which is comparable to the instrumental suffix *-ki/ -ke* in Rere. Hellwig and Schneider-Blum assumed that the assimilations in vowel height were ad-hoc or local phenomena instead of remnants of an earlier vowel harmony system in Tabaq; however, the vowel raising process seems to be stronger in Rere, which I would treat more as a disrupted vowel harmony system.

The data so far might suggest that Rere is exhibiting signs of disintegration of its vowel harmony system, perhaps rooted in language contact with Arabic. However, Arabic also lacks a height contrast for back vowels. It is possible that during the language contact process, the front vowels in the "original" Rere vowel system are more unstable and subject to change than the back vowels. However, the underlying reason remains to be probed. Furthermore, the current vowel harmony system for this speaker is not as categorical as Quint suggested, since Quint insisted that the harmony pattern is pervasive even in loanwords Quint 2018. Yet, the speakers come from the same dialect and geographical area.

6 Conclusion

In this paper, I depict the current eight-vowel inventory in Rere with acoustic analysis on vowel distributions and characteristics. I show that the vowel height agreement patterns in Rere are not as robust as previous work has described due to variation seen in root-internal and word-internal disharmonic vowel combinations and noun suffixation with different realizations of the instrumental case. Moreover, I investigate the verbal conjugation under valence-changing constructions, discussed with regard to the vowel raising pattern: /ɛ a o ɔ/ raise to [i (ɪ) ɐ u ʊ], which has been shown to be more consistent with the features of height harmony. I further propose that the mid front vowel /e/ is likely shifting to a higher vowel [ɪ] in its phonological properties which explains its patterning with other high vowels. Future work could look closely into the impact of the syllable structure on the production of raised mid vowels and the implications of an alternative transcription ([ɪ] as [e], or [o] as [ʊ]). In addition, we should examine articulatory differences, in reference to the acoustic differences, such as the tongue root retraction, tongue height grooving, and/or constriction of the glottis for voice quality correlates (Starwalt 2008) for the potential ATR contrasts in high vowels (/i ɪ/). Lastly, although the current study did not make use of data from loanwords, it would be interesting to investigate in the future the vowel harmony patterns in a phonetic and phonological study on Rere loanwords.

Abbreviations

1, 2, 3	first, second, third person	HAB	habitual
IPFV	imperfective	TAM	tense/aspect marker
ACC	accusative	PASS	passive
SBJV	subjunctive	DEM	demonstrative
PFV	perfective	SUF	suffix
PROG	progressive	ATR	advanced tongue root
CAUS	causative	F1	first formant
CL	classifier	F2	second formant
		F3	third formant

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Appendix

Representative word list for vowel acoustics
(All the examples used in the paper can be searched and accessed at rere.ucsd.edu)

File	Word	V	F1	F2	F3	IPA
TK01112019-2	place of gathering	ɐ	542.50	1612.63	2885.87	ɐ̀ḿərɐ̀
TK01112019-2	place of gathering	ɐ	539.22	1610.52	2640.64	ɐ̀ḿərɐ̀
TK04262019-YH1	knife	ɐ	538.33	1909.28	2559.49	kɐ́ɳɖɐ̀ŋ
TK04262019-YH1	sheath	ɐ	505.47	1844.08	2356.40	kɐ̂ɭ
TK04262019-YH1	with the lie	ɐ	426.78	1856.35	2154.33	ŋɐ̀ɭúŋè
TK04192019YHSC-2	liar	ɐ	445.29	1235.86	2594.94	kwɐ̀ɭùŋ
TK02082019-1	body	ɐ	502.66	1418.02	2557.57	áŋgnà
TK02082019-1	body	ɐ	606.60	1637.08	2506.46	áŋgnà
TK02082019-1	body	ɐ	480.10	1588.05	2389.88	áŋgnà
TK04262019-YH1	seed-hole	e	397.19	2236.46	2862.12	kêɭ
TK04262019-YH1	seed of gourd	e	368.48	2329.55	3016.24	ɭèːɾè

TK04262019-YH1	seed of gourd	e	321.09	2272.09	2910.68	ɭèːɾè
TK02012019-6	girl	e	360.84	2353.52	3047.55	t̪èːɭà
TK02012019-6	girls	e	356.30	2270.92	3178.12	ɲèːɾà
TK05102019-YH	girl	e	355.14	2248.38	2853.53	t̪èːɭà
TK02082019-1	arm	e	373.95	2340.49	3220.97	t̪ê
TK05102019-YH	arm	e	332.69	2409.21	3080.12	t̪ê
TK04262019-YH1	termite	e	371.42	2309.61	3268.79	ɭèːɭè
TK02082019-7	to come	e	351.94	1625.58	2751.31	êːlà
TK05102019-YH	to come	e	347.52	2315.09	3102.45	t̪èːɭà
TK05012019-1	to dance	e	394.68	2151.90	2811.66	t̪èrt̪è
TK04192019YHSC-2	lower back	e	381.21	2397.92	2983.28	kèːɾèɲ
TK04192019YHSC-2	lower back	e	408.26	2162.81	2881.44	kèːɾèɲ
TK04192019YHSC-2	lower back	e	375.59	2253.44	2932.54	kèːɾèɲ
TK04192019YHSC-2	lower back	e	428.58	2214.14	2735.20	kèːɾèɲ
TK02062019-7	kill	e	369.73	2219.16	2980.48	ɽɛ́ɲè
TK05102019-YH	be cold	ɛ	440.08	2125.77	2705.47	ðɛ̂
TK04122019YHSC-2	sky	ɛ	498.17	1962.04	2854.94	ɭɛ́ːɾɛ̀
TK04122019YHSC-2	sky	ɛ	489.10	1833.28	2696.22	ɭɛ́ːɾɛ̀
TK02082019NKJGQX-3	one	ɛ	497.09	1726.61	2535.54	kwɛ́ʈɛ̀
TK02082019NKJGQX-3	one	ɛ	448.60	2184.04	2949.30	kwɛ́ʈɛ̀
TK05102019-YH	go	ɛ	507.30	2164.75	3172.16	ɛ̂lɛ̀
TK04172019-5	be strong	ɛ	545.42	1965.04	2664.64	pɛ́rɭɛ̀
TK04172019-5	feel better	ɛ	530.82	1839.98	2684.26	pɛ́rɭɛ̀
TK20190308SCARYH-3	wipe	ɛ	433.89	2023.76	2812.16	pɛ́ɾt̪ɛ̀
TK05312019-YH	finish!	ɛ	504.58	2085.14	2563.16	ɛ̀rnà
TK05312019-YH	hit lightly	ɛ	523.34	1989.15	2732.68	ɛ́rt̪ɛ̀
TK05312019-YH	hit lightly	ɛ	449.09	2096.63	2825.83	ɛ́rt̪ɛ̀
TK02202019-5	bowl	ɛ	513.01	2072.46	3016.89	ɭɛ̀ːɖɛ̀r
TK02202019-5	bowl	ɛ	562.24	1930.61	2660.06	ɭɛ̀ːɖɛ̀r
TK02202019-5	bowls	ɛ	502.01	1894.03	2559.93	ŋwɛ̀ːɖɛ̀r
TK01162019-2	clouds	ɛ	538.04	2121.05	2835.88	ŋwʌ̀blɛ̀t̪˺
TK02062019-7	kill	ɛ	483.49	2235.63	3005.37	ɽɛ́ɲè
TK05312019-YH	dance	ɛ	435.24	1977.83	2663.80	ɛ̀rt̪è
TK05312019-YH	dance	ɛ	417.25	2142.24	2758.48	ɛ̀rt̪è
TK20190308SCARYH-3	be clean	o	384.62	944.84	2542.55	ɕóːɾè
TK20190308SCARYH-3	be dry	o	401.43	1071.92	2608.28	ónd̪ì
TK02012019-6	star	o	404.41	906.87	2236.87	t̪òːròm
TK02012019-6	star	o	424.12	755.85	2137.84	t̪òːròm
TK02152019-8	child	o	449.19	909.62	2472.54	ʈôr
TK01252019-11	man	o	431.73	770.98	2422.21	kwôr
TK01252019-11	men	o	470.06	926.53	2268.17	lôr
TK01252019-12	fish	o	440.33	1029.93	2586.43	ɭóm

TK04102019-7	hole in the tree	o	513.27	891.07	2692.80	ɭùbòŋ
TK02152019NDYC-1	elephant	o	485.54	936.31	2715.77	t̪óŋôr
TK02152019NDYC-1	elephant	o	417.42	853.46	2320.26	t̪óŋôr
TK04122019YHSC-2	rich person	o	437.32	841.36	2249.44	kwórtò
TK04122019YHSC-2	rich person	o	407.61	1056.22	2642.01	kwórtò
TK04122019YHSC-2	rich person	o	425.07	820.59	2331.18	kwórtò
TK04122019YHSC-2	rich person	o	436.16	1005.20	2642.41	kwórtò
TK04122019YHSC-2	group	o	415.50	1085.75	2498.19	ɗòŋ
TK04122019YHSC-2	government	u	359.01	1003.71	2596.89	t̪úrùm
TK04122019YHSC-2	government	u	355.22	895.20	2476.52	t̪úrùm
TK04192019YHSC-2	manure	u	346.35	994.66	2700.18	ɭùr
TK02152019-8	silo	u	375.62	929.26	2507.29	t̪úɭùŋ
TK02152019-8	silo	u	369.47	1018.80	2538.95	t̪úɭùŋ
TK04102019-7	hole in ground	u	324.14	760.42	2615.82	ɭùbùŋ
TK01162019-2	smoke	u	307.55	722.39	2622.59	kû:ɭù
TK01162019-2	smoke	u	365.36	919.43	2197.12	kû:ɭù
TK01162019-2	much smoke	u	317.93	777.60	2242.40	kú:ɭù kûːɾù
TK01162019-2	much smoke	u	310.80	777.53	2305.24	kú:ɭù kûːɾù
TK01162019-2	much smoke	u	343.56	523.20	2215.43	kú:ɭù kûːɾù
TK04172019-6	money	u	364.96	888.94	2442.86	gúɾùʃ
TK02152019-8	hammer	ɔ	572.95	1115.55	2465.84	ʈɔ̂r
TK04262019-YH1	with cup	ɔ	536.51	1103.56	2272.18	ʈɔ̀ːɲɛ́rì
TK02012019-6	boy	ɔ	546.30	1080.35	2212.47	ʈɔ́ːŋɔ̀r
TK02012019-6	boy	ɔ	525.31	915.05	2121.98	ʈɔ́ːŋɔ̀r
TK04122019YHSC-2	beetle 1	ɔ	569.86	1157.85	2366.67	ɭɔ́rɭɔ́ɭɔ̀
TK04122019YHSC-2	beetle 1	ɔ	558.15	1097.63	2868.95	ɭɔ́rɭɔ́ɭɔ̀
TK04122019YHSC-2	beetle 1	ɔ	544.99	1192.23	2631.05	ɭɔ́rɭɔ́ɭɔ̀
TK04122019YHSC-2	beetle 1	ɔ	605.38	1203.23	2891.92	ɭɔ́rɭɔ́ɭɔ̀
TK04122019YHSC-2	beetle 1	ɔ	587.87	1050.26	2467.03	ɭɔ́rɭɔ́ɭɔ̀
TK04122019YHSC-2	blacksmith	ɔ	537.80	979.22	2359.84	kwɔ́rtɔ̀
TK02082019NKJGQX-3	three	ɔ	529.81	938.08	2391.32	t̪ɔ́:ɽɔ̂ɭ
TK04192019YHSC-2	vocal tract	ɔ	551.44	851.72	2279.99	kwɔ́ːrɔ̀
TK04172019-5	become	ɔ	545.20	874.59	2292.89	ɔ́ɾɔ̀
TK04172019-5	become	ɔ	591.90	912.17	2640.50	ɔ́ɾɔ̀
TK04122019YHSC-2	back of skull	ɔ	547.39	1028.42	2488.97	ɗɔ̀ŋ
TK04122019YHSC-2	beetle 2	ɔ	545.13	1057.77	2553.14	ɭɔ̀mnɔ́kɔ̀
TK04122019YHSC-2	beetle 2	ɔ	493.73	932.88	2542.14	ɭɔ̀mnɔ́kɔ̀
TK02202019-5	gourd	ɔ	548.86	711.41	2520.81	ʈɔ́ːɲò

TK02082019-7	to come	a	830.90	1910.62	2566.47	ê:là
TK02082019-1	body	a	747.37	1474.69	2473.66	áŋgnà
TK02082019-1	head	a	750.88	1673	2366.24	ɳɖà
TK02012019-6	girl	a	762.99	2089.55	2598.32	t̪è:ɾà
TK02082019-2	foot	a	769.30	1551.40	2092.08	ká:ɤà
TK02082019-2	leg	a	841.88	1631.32	2598.63	l̪à:ɾà
TK02082019-2	leg	a	739.51	1851.85	2569.85	l̪à:ɾà
TK02082019-2	finger	a	704.49	1633.13	2185.43	l̪á:mìn
TK02082019-2	finger	a	846.85	1667.03	2461.74	l̪á:mìn
TK02082019-2	finger	a	702.88	1681.21	2725.73	l̪á:mìn
TK02082019-2	day (short)	a	759.03	1744.38	2527.67	t̪á:mìn
TK02222019-4	cook	a	538.26	1451.32	2550.30	má:nì
TK03062019-1	meat	i	321.37	2371.55	2999.95	jí:ðì
TK03062019-1	meat	i	265.46	2315.29	2897.44	jí:ðì
TK04192019YHSC-2	warthog	i	301.06	2357.34	2462.10	kì:ɾìɲ
TK04192019YHSC-2	warthog	i	301.57	2224.04	2925.84	kì:ɾìɲ
TK01162019-6	drink	i	277.85	2435.63	3267.88	î:
TK05032019-4	rabbit	i	303.53	2400.55	3209.52	t̪íɲì
TK05032019-4	rabbits	i	319.56	2325.07	3062.60	ɲíɲì
TK03152019-YH1	hit	i	293.68	2316.45	2990.98	pî
TK03152019-YH1	fly	i	274.44	2517.08	3160.95	ɗí:ɽî
TK03152019-YH1	fly	i	286.15	2361.03	3103.54	ɗí:ɽî
TK05032019-4	catch	i	260.72	2478.75	3189.06	í:ðì
TK02082019-2	thumb (ox)	i	330.12	2275.51	2657.18	ɲíðɾì

Chapter 4

Vowel hiatus resolution in Kikuyu

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This paper describes and analyzes vowel hiatus resolution in Kikuyu, filling empirical gaps in previous descriptions and addressing differences between our data and earlier published data that may reflect dialectal and/or generational differences. We demonstrate that Kikuyu's superficially very complex system of vowel hiatus resolution can be analyzed straightforwardly using ordered autosegmental rules, most notably *ATR shift*, which captures the observation that, with limited systematic exceptions, when two vowels come together with underlying features [−ATR][+ATR] or [−ATR][−ATR] they surface as [+ATR][−ATR], while underlying sequences [+ATR][−ATR] and [+ATR][+ATR] surface unchanged (in other words, if either vowel is [−ATR] underlyingly, the surface form will be [+ATR][−ATR]). Other rules include fusion, assimilation, diphthongization, and shortening.

1 Introduction

This paper describes vowel hiatus resolution (VHR) in Kikuyu (E.51, Kenya). There exists a significant earlier description (Armstrong 1940; see also Mugane 1997), so one goal of this paper will be to fill gaps in that description and address differences between our data and earlier published data that may reflect dialectal and/or generational differences. We will also present a rule-based phonological analysis of Kikuyu VHR; for an OT analysis of some aspects of this system, see Kuzmik (2020). The vowel inventory of Kikuyu is presented in Table 1 with the feature specifications we assume. Each of the seven short vowels also has a long counterpart.

A variety of factors determine the surface form when vowels come together across a word or morpheme boundary. The factors that we have determined to

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Table 1: Kikuyu vowel features

	/i/	/e/	/ɛ/	/a/	/ɔ/	/o/	/u/
[±high]	+	-	-	-	-	-	+
[±low]	-	-	-	+	-	-	-
[±ATR]	+	+	-	-	-	+	+
[±back]	-	-	-	+	+	+	+
[±round]	-	-	-	-	+	+	+

be relevant in Kikuyu are listed in (1) (see Casali 2011 for discussion of these and other factors that influence VHR outcomes across languages).

(1) **Factors in Kikuyu VHR outcomes**
- V_1 quality & length; V_2 quality & length
- presence/quality/length of V preceding V_1
- presence/type of C (velar vs. non-velar) preceding V_1 segment following V_2
- presence/quality/length of V following V_2
- presence/type of C (nasal vs. oral) following V_2
- boundary type between V_1 and V_2 (morpheme vs. word)

This paper focuses on Kikuyu VHR in a subset of possible contexts: V_1+V_2 across a word boundary, where V_1 is preceded by a consonant (non-velar, where possible) and V_2 is followed by an oral consonant.

2 Data

All data in the paper, except where noted, reflect auditory-impressionistic transcriptions produced by the authors. Some vowel quality distinctions are especially challenging to transcribe in the connected-speech context since asking the speaker to slow down the pronunciation for ease of transcription will in many cases categorically alter the vowels (because hiatus resolution rules do not apply in careful speech). Our speaker therefore patiently repeated the more difficult connected-speech forms for us many times. A large portion of our elicitation time has been spent comparing forms and marking surface vowel sequences as ‘same’ vs. ‘different’ as a check on consistency external to individual transcriptions. For example, we transcribed the connected-speech form of ‘Mũgo, answer!’

as *móɣóɛ́tékà* and noted that the [oɛ] sequence (derived from underlying ɔ+e) sounded 'the same' as the [oɛ] sequence in *gɛ̀ʃóɛ́hɛ́rà* 'Ngecũ, stand aside!' (from underlying o+ɛ) whereas both were explicitly marked as 'different' from the sequence we transcribed as [oe] in *gèʃòròètékà* 'Gĩcũrũ, answer!'. Although minimal pairs that control for surrounding segments are hard to find in this domain, pairwise comparisons isolating the vowel sequences of interest have increased our confidence in the auditory transcriptions.

Note that the tonal transcriptions have not been cross-checked comprehensively for consistency with a phonological analysis of Kikuyu tone. Especially in the connected speech context, downstep is difficult to identify (both the perceived tonal contour and its representation in a pitch track using Praat differs minimally and unreliably in HH vs. H!H and HLH vs. H!HH sequences). The phonology of downstep is notoriously complex in Kikuyu (see, e.g., Clements & Ford 1981a), and we are not aware of an existing description of tone patterns in the specific syntactic context that represents the bulk of the examples presented in this paper (i.e., a person's name or other nominal used as a vocative followed by a singular imperative form) that might help us to confirm and refine our transcriptions. Existing descriptions also do not address speech rate effects in surface phrase-level tone/intonation. Therefore, we regretfully acknowledge that future research may reveal errors in our tonal transcriptions, particularly with respect to the presence/absence and placement of downsteps. We have opted to tone-mark our data regardless for completeness, but we do not advise using our tonal transcriptions as the sole basis for future analyses of the tone system.

3 Description of the core vowel hiatus resolution pattern

Table 2 summarizes the surface forms corresponding to input V_1+V_2 (short vowel) combinations.[1]

The boxed cells in Table 2 indicate surface vowel combinations produced by our consultant that differ from those reported by Armstrong, which we discuss further below. Some generalizations that can be noted regarding the patterns in Table 2 are: (a) no changes apply when V_1 and V_2 are identical (except we assume they merge into a single long vowel); (b) no changes apply when V_1 is [+ATR]; (c) no changes apply when V_2 is i; (d) *u* as V_2 diphthongizes after a [−ATR] V_1 with

[1]We transcribe and present sequences of identical vowels here as, e.g., ii, ee for ease of identifying correspondences between underlying and surface vowels. We do not intend these to be interpreted as sequences; as will be discussed, our analysis includes a rule that fuses identical adjacent short vowels into a single long vowel.

Table 2: Short V_1 + Short V_2

	V_2						
V_1	i	e	ɛ	a	ɔ	o	u
i	ii	ie	iɛ	ia	iɔ	io	iu
e	ei	ee	eɛ	ea	eɔ	eo	$\boxed{\text{eu}}$
ɛ	ɛi	ɛɛ	ɛɛ	ea	eɔ	$\boxed{\text{eo}}$	eɔi
a	ai	ɛɛ	ɛɛ	aa	ɔɔ	ɔɔ	ɔi
ɔ	ɔi	oɛ	oɛ	$\boxed{\text{ɔa}}$	ɔɔ	ɔɔ	ɔi
o	oi	oe	oɛ	oa	$\boxed{\text{oɔ}}$	oo	$\boxed{\text{ou}}$
u	ui	ue	uɛ	ua	uɔ	uo	uu

additional changes applying to V_1; (e) the /e/ vs. /ɛ/ and /o/ vs. /ɔ/ contrasts are neutralized before mid vowels of the opposite value for backness; (f) surface mid vowel sequences can be [+ATR][−ATR] but not the reverse.

Below are examples of all combinations of short vowels that undergo a quality change in the context of interest here. In each example, the careful speech form is given on the left, and the connected speech form is on the right. We assume that careful speech reflects the underlying form in terms of vowel quality, but not in all details (e.g., tone). Therefore, the forms to the left of the arrow should not be taken as underlying forms.

(2) V_1+V_2 combinations that undergo quality change (careful speech → connected speech)

a.	ɛ+e → ɛɛ	ŋɔ́ɔ́bɛ́ èɣɛ́ðìɛ̀	→ ŋɔ́ɔ́bɛ́ɛ́ɣɛ̀ðìɛ̀	'The cow went.'
		jɔ̀rɔ̀gɛ́ étékà	→ jɔ̀rɔ̀gɛ́ɛ́tékà	'Njoroge, answer!'
b.	ɛ+a → ea	dɔ̀ɔ̀nìrɛ́ áðùùrì	→ dɔ̀ɔ̀nìréáðúúrì	'I saw the elders.'
		dòkààrɛ̀kɛ̀ áhóótɛ̀	→ dòkààrɛ̀kèàhóótɛ̀	'Don't let her get hungry.'
		dɛ̀ɛ̀tìrɛ́ átùmíà	→ dɛ̀ɛ̀tìréátùmíà	'I called the women.' (rem. past)
		rɛ̀kɛ̀ áðìè	→ rɛ̀kéáðìè	'Let him go.'
c.	ɛ+ɔ → eɔ	kàmààdɛ́ ɔ́hà	→ kàmààdéɔ́hà	'Kamande, tie!'
		kàmààdɛ́ ɔ́yà	→ kàmààdéɔ́yà	'Kamande, lift!'

d.	ɛ+o → eo	ɔ̀ʃɔ́ɔ́kɛ́ ótòɛ̀jɛ̀	→ ɔ̀ʃɔ́ɔ́kèòtòɛ̀jɛ̀	‘Then shave us.’
		nààwɛ́ óɣékúúdɛ́káɣɛ́	→ nààwéóɣékúúdɛ́káɣɛ́	‘and you continue tying…’
e.	ɛ+u → eɔi	jɔ̀rɔ̀gɛ́ úɣà	→ jɔ̀rɔ̀géɔ́ìɣà	‘Njoroge, say something!’
		kàmààdɛ́ úɣà	→ kàmààdéɔ́íɣà	‘Kamande, say something!’
f.	a+e → ɛɛ	nyààbùrá étékà	→ nyààbùrɛ́ɛ́tékà	‘Nyambura, answer!’
		wáʃíírá ètékà	→ wáʃíírɛ̀ɛ̀tékà	‘Waciira, answer!’
g.	a+ɛ → ɛɛ	nyààbùrá ɛ̀hɛ́rà	→ nyààbùrɛ́ɛ́ꜜhɛ́rà	‘Nyambura, stand aside!’
		wáʃíírá ɛ̀hɛ́rà	→ wáʃíírɛ́ɛ́ꜜhɛ́rà	‘Waciira, stand aside!’
h.	a+ɔ → ɔɔ	tààtà ɔ́yà	→ tààtɔ́ɔ́yà	‘Aunt, lift!’
		nyààbùrá ɔ́hà	→ nyààbùrɔ́ɔ́hà	‘Nyambura, tie!’
i.	a+o → ɔɔ	tààtà óyó	→ tààtɔ̀ɔ̀yó	‘this aunt’
		nyòògò yá òʃòrò	→ nyòògò yɔ́ɔ́ʃòrò	‘porridge pot’
		mòðɛ́nyà óʃìɔ̀	→ mòðɛ́nyɔ̀ɔ̀ʃíɔ́	‘that day’
		nà òrɛ́ɛ́hɛ̀	→ nɔ̀ɔ̀rɛ́ɛ́hɛ̀	‘and bring…’
j.	a+u → ɔi	tààtà úɣà	→ tààtɔ́ìɣà	‘Aunt, say something!’
		bùrá úrà	→ bùrɔ́ìrà	‘Rain, come down!’
k.	ɔ+e → oɛ	móɣɔ́ étékà	→ móɣóɛ́tékà	‘Mũgo, answer!’
		gèkɔ̀nyɔ́ étékà	→ gèkɔ̀nyóɛ́tékà	‘Gĩkonyo, answer!’
l.	ɔ+ɛ → oɛ	gèkɔ̀nyɔ́ ɛ́hɛ́rà	→ gèkɔ̀nyóɛ́hɛ́rà	‘Gĩkonyo, stand aside!’
		bɔ̀ɣɔ̀ ɛ́hɛ́rà	→ bɔ̀ɣòɛ́hɛ́rà	‘Mbogo, stand aside!’
m.	ɔ+o → ɔɔ	mòtàrɔ́ óʃíɔ̀	→ mòtàrɔ́ɔ́ʃíɔ́	‘that drain’
		gèkɔ̀nyɔ́ óhèɣà	→ gèkɔ̀nyɔ́ɔ́hèɣà	‘Gĩkonyo, be smart!’

n.	ɔ+u → ɔi	gèkɔ̀nyɔ́ úɣà	→ gèkɔ̀nyɔ́ꜜíɣà	‘Gĩkonyo, say something!’
		bɔ̀ɣɔ̀ úɣà	→ bɔ̀ɣɔ́íɣà	‘Mbogo, say something!’

As mentioned earlier, there are some differences between our data and Armstrong’s. First, Armstrong (1940: 23) states that *ɔ+a* yields *oa*, though the example she provides is actually an *ɔ+aa* input sequence with a long V_2: *aɣeeta waðiɔmɔ* ***aa****ke* → *aɣeeta waðiɔm****oaa****ke* ‘and he invited his greatest friends…’. Our speaker replicated this example with *ɔ+aa* → *ɔa* (*àɣèètá wáðíɔ̀m****ɔ̀ áá****ke* → *àɣèètá wáðíɔ̀m****ɔ̀à****ke*; see §5.4 below for more on V+V: sequences). For our speaker, *ɔ+a* yields *ɔa*, as shown in (3).

(3)	ɔ+a → ɔa	mòɣɔ̀ áyá	→ mòɣɔ̀àyá	‘these Mũgos’
		mòɣɔ̀ àrìà	→ móɣɔ́árìà	‘Mũgo, speak!’

A second difference from Armstrong is that for our consultant, *ɛ+o* surfaces as *eo*, while Armstrong reports *eɔ*. Some forms from our consultant (replicated from (2d)) are given in (4).

(4)	ɛ+o → eo		
	ɔ̀ʃɔ́ɔ́kɛ́ ótòɛ̀jɛ̀	→ ɔ̀ʃɔ́ɔ́kèòtòɛ̀jɛ̀	‘Then shave us.’
	nààwɛ́ óɣékúúdɛ́káɣɛ́	→ nààwéóɣékúúdɛ́káɣɛ́	‘and you continue tying…’

Compare the forms in (4) with Armstrong’s examples (1940: 20), shown in (5a). Our speaker’s replications of those forms are shown in (5b).

(5)	a.	Armstrong’s examples with ɛ+o → eɔ		
		ndaaɣorirɛ ota omwɛ	→ ndaaɣorireɔtɔɔmwɛ	‘I bought one bow.’
		moceɛrɛ oyo	→ moceɛreɔyo	‘this rice’
		rɛɛhɛ moɣatɛ omwɛ	→ rɛɛhɛ moɣateɔmwɛ	‘Bring one loaf.’
		tohɛ ohɔɔrɛri na ðaayo	→ toheɔhɔɔrɛri na ðaayo	‘Grant us tranquility and peace.’
	b.	Forms replicated by our speaker with ɛ+o → eo		
		ndààɣòrìrɛ́ ótà ómwɛ́	→ ndààɣòrìrèótɔ̀ɔ̀mwɛ́	‘I bought one bow.’
		mòʃɛ́ɛ́rɛ̀ óyó	→ mòʃɛ́ɛ́rèòyó	‘this rice’
		rɛ̀ɛ̀hɛ́ mòɣàtɛ̀ ómwɛ́	→ rɛ̀ɛ̀hɛ́ mòɣàtèòmwɛ́	‘Bring one loaf.’
		tóhɛ́ òhɔ́ɔ́rɛ́rí nà ðààyò	→ tóhéóhɔ́ɔ́rɛ́rí nà ðààyò	‘Grant us tranquility and peace.’

Another difference is that Armstrong states (1940: 24) that [oɔ] is "in most cases impossible" (occurring only in forms where [o] is the passive suffix), so o+ɔ surfaces as [uɔ]. While this is also true for our speaker for sequences arising across a morpheme boundary within words (infinitive prefix + stem), it is not true for sequences occurring across a word boundary, where our speaker produces [oɔ]. Armstrong does not provide any *o+ɔ* sequences crossing word boundaries, so we do not know whether this discrepancy reflects an actual difference between our consultants' grammars. It may simply reflect a gap in Armstrong's description. The examples in (6) are our transcriptions of forms replicated from Armstrong by our speaker, where both have *o+ɔ → uɔ*.

(6) o+ɔ → uɔ

/ko-ɔya/	→ kùɔ̀yá	'to lift'
(within words)		
/ko-ɔha/	→ kùɔ̀há	'to tie up'

Across word boundaries, for our consultant, *o+ɔ* surfaces unchanged, as shown in (7) (though as we indicate in these examples, it optionally undergoes glide formation, as will be discussed further in §5.1).

(7) o+ɔ → oɔ

gèʃòrò ɔ́hà	→ gèʃòròɔ́hà	'Gĩcũrũ, tie!'
~gèʃòrwɔ́ɔ́hà		
wàjíkó ɔ́yà	→ wàjìkóɔ́yà	'Wanjikũ, lift!'
~wàjìkwɔ́ɔ́yà		

A final discrepancy between our findings and Armstrong's here is that in combinations of short vowels, for our speaker, *o+u* and *e+u* sequences surface as *ou, eu* rather than undergoing mid vowel raising as reported by Armstrong. Some examples are given in (8).

(8) a. o+u → ou

wàjìkó úɣà	→ wàjíkóúɣà	'Wanjikũ, say something!'
kèmààrò úɣà	→ kèmààròúɣà	'Kĩmarũ, say something!'

b. e+u → eu

gèʃóhè úɣà	→ gèʃóhèúɣà	'Gĩcũhĩ, say something!'
kèvàkè úmà	→ kèvàkèúmà	'Kĩbakĩ, come out!'

As with o+ɔ, for *o+u* Armstrong provides examples (1940: 24) where the sequence does change (to *uu*) within words, as it also does for our speaker within words (examples in (9a) are replicated from Armstrong with tone marking added).

Additionally, though Armstrong provides examples of *e+u* changing to *iu* both within and across words, we only find evidence for this change within words (9b).

(9) a. o+u → uu

/to-uɣ-ir-ɛ/	→ tùùɣírɛ́	‘we said (today)’
/ko-uɣ-a/	→ kùùɣá	‘to say something’

b. e+u → iu

/n-ge-um-a/	→ gíúmà	‘I came out.’
/n-ge-uɣ-a/	→ gíúɣà	‘I said something.’

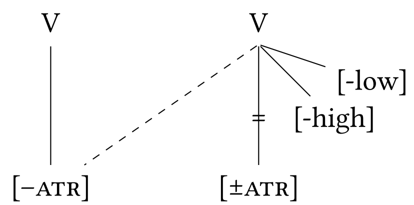
Armstrong cites the example *njok**e** **u**ma* → *njok**iu**ma* ‘Njũkĩ, come out!’ (1940: 24) with *e+u* surfacing as *iu* across a word boundary, but our speaker produces this form with *eu* (*jòk**é** ꜜ**ú**mà* → *jòk**é**ꜜ**ú**mà*).

4 Generalizations and rules accounting for core vowel hiatus resolution patterns

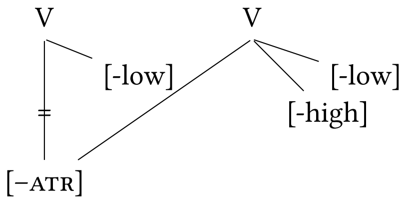
In this section, we state generalizations and rules to account for all of the observed VHR patterns in the context that we focused on in §3 (combinations of short vowels across word boundaries). We assume autosegmental theory, but we present SPE-style rules as a shorthand in instances where autosegmental representations are not crucial to understanding a pattern.

An overarching generalization characterizing the patterns represented by Table 2 concerns the behavior of mid vowels – the only group of vowels for which [±ATR] is contrastive. When a sequence of mid vowels contrasts underlyingly in [±ATR], with two classes of exceptions to be discussed, the underlying sequences [−ATR][+ATR] and [−ATR][−ATR] change to [+ATR][−ATR]. On the other hand, the underlying sequences [+ATR][−ATR] and [+ATR][+ATR] are unchanged. In other words, if either vowel is [−ATR] underlyingly, the surface form will be [+ATR][−ATR]. This state of affairs can be captured via *ATR shift*, shown in (10a-b).[2]

(10) a.



[2]We are thankful to an anonymous reviewer who suggested the *ATR shift* idea, greatly improving the generality of our analysis.

b. 

(10a) spreads [−ATR] from a [−ATR] vowel onto an adjacent [-low, -high] vowel to its right, and [±ATR] is delinked from V_2. Subsequently, the rule in (10b) delinks the shared [−ATR] feature from V_1 when V_1 is [-low] (since /a/ does not lose its [−ATR] feature; this restriction on V_1 is one reason why (10a) and (10b) must be considered separate rules, while a second reason based on rule ordering will become apparent momentarily).

The result of (10a-b) is that, in any sequence of two mid vowels where V_1 is [−ATR], V_1 will have no [±ATR] feature while the [−ATR] feature underlyingly associated to V_1 will surface on V_2. The context-free rule in (11) later fills in the default value [+ATR] on V_1 (this rule should be interpreted as *feature-filling* only, so it does not apply to a vowel that already has a [±ATR] value).

(11) V → [+ATR]

The combined effect of (10a-b) and (11) is that the underlying sequences [−ATR][+ATR], [−ATR][−ATR], and [+ATR][−ATR] surface as [+ATR][−ATR], while underlying [+ATR][+ATR] surfaces unchanged as [+ATR][+ATR]. These rules predict that (1) no sequence of mid vowels should surface as [−ATR][+ATR]; (2) no underlying sequence of mid vowels should surface as [−ATR][−ATR]; and (3) in any sequence of two mid vowels that contains a [−ATR] mid vowel in the input, [−ATR] should surface on V_2.

We believe it is the case that there is no sequence of mid vowels which surfaces as [−ATR][+ATR]; therefore prediction #1 is correct as far as we are aware. However, as mentioned above, there are two principled exceptions to the ATR shift generalization. Prediction #2 is seemingly violated in cases of total vowel quality assimilation, and prediction #3 is violated by the specific pattern *ɛ + o* → *eo*. Dealing first with this latter complication, we propose the specific rule in (12) that applies to */ɛ+o/*.

(12) $$\begin{bmatrix} \text{V} \\ -\textsc{high} \\ -\textsc{low} \\ -\textsc{atr} \\ -\textsc{back} \end{bmatrix} \rightarrow [+\textsc{atr}] \ / \ \_ \begin{bmatrix} \text{V} \\ -\textsc{high} \\ -\textsc{low} \\ +\textsc{atr} \\ +\textsc{back} \end{bmatrix}$$

The rule in (12) precedes (10a), bleeding the ATR shift rule by removing the [−ATR] feature from V_1. This accounts for one set of apparent exceptions to ATR shift.

The other exception involves sequences that appear to surface as identical [−ATR] vowels: *ɛ+e, ɛ+ɛ* → *ɛɛ*; and *ɔ+o, ɔ+ɔ* → *ɔɔ*. According to (10a-b) and (11), these should surface as **eɛ, *oɔ*. We propose that what prevents these sequences from undergoing ATR shift is that they are not 'sequences' at the stage in the derivation where (10b) applies, delinking [−ATR] from V_2. Prior to (10b), these sequences will have fused into a single long vowel and therefore do not meet the structural description for (10b) to apply, since (10b) requires two adjacent vowels. The fusion rule applies to all sequences of adjacent identical vowels (not only to the mid vowels of interest here) and is given in (13).

(13) $V_i + V_i \rightarrow V_i\!:$

The fusion rule in (13) must be ordered between (10a) and (10b) to produce the correct surface forms (which is one argument for why (10a) and (10b) cannot be combined into a single rule). Sample derivations are given in Table 3 to illustrate:

Table 3: Sample derivations

Correct ordering		Fusion too early		Fusion too late	
Underlying form	/ɛe/	Underlying form	/ɛe/	Underlying form	/ɛe/
ATR shift (10a)	ɛɛ	Fusion (13)	N/A	ATR shift (10a)	ɛɛ
Fusion (13)	ɛː	ATR shift (10a)	ɛɛ	Delinking (10b)	*eɛ
Delinking (10b)	N/A	Delinking (10b)	*eɛ	Fusion (13)	N/A

Another generalization regarding Table 2, similar to but arguably distinct from ATR shift, is that in *ɛ+a* sequences, *ɛ* raises to *e*, yielding *ea*. We account for this with the rule in (14).

(14) $\begin{bmatrix} \text{V} \\ -\text{HIGH} \\ -\text{LOW} \\ -\text{ATR} \\ -\text{BACK} \end{bmatrix} \rightarrow [+\text{ATR}] \;/\; \_\begin{bmatrix} \text{V} \\ +\text{LOW} \end{bmatrix}$

The target must be limited to [−back] vowels, as it is formulated here, since *ɔ+a* does not change to *oa.* [3]

[3]A reviewer suggested that *ɛ+a* → *ea* can be subsumed under ATR shift, but we believe it must be

Also regarding /a/, recall from Table 2 that when a precedes any mid vowel, it assimilates to [-low] and to the backness/roundness of the triggering vowel while retaining its [−ATR] feature (so *a+o* and *a+ɔ* surface as *ɔɔ*, while *a+e* and *a+ɛ* surface as *ɛɛ*). If this rule is ordered after ATR shift, it can be formulated as total vowel feature assimilation, as in (15).

(15) $$\begin{bmatrix} \text{V} \\ \text{+LOW} \end{bmatrix} \rightarrow \text{V}_\text{i} \ / \ \_ \begin{bmatrix} \text{V}_\text{I} \\ -\text{HIGH} \\ -\text{LOW} \end{bmatrix}$$

The rule in (15) is equivalent to spreading all vowel quality features from V_2 (when V_2 is mid) onto V_1 when V_1 is /a/. As long as the [−ATR] feature has already spread from /a/ onto V_2 via the earlier application of ATR shift, the [−ATR] feature will correctly be retained when /a/ totally assimilates to V_2 via (15). We are thus accounting for *a+o, a+e → ɔː , ɛː* in three steps: (1) *ao, ae → aɔ, aɛ* via ATR shift; (2) *aɔ, aɛ → ɔɔ, ɛɛ* via a-assimilation (15); and (3) *ɔɔ, ɛɛ → ɔː , ɛː* via fusion.

Some complex changes apply to input V_1+u sequences where V_1 is [-high, -ATR]: *ɛu* changes to *eɔi*, *au* changes to *ɔi*, and *ɔu* changes to *ɔi*. One generalization we can make is that in all of these cases, *u* undergoes diphthongization, changing to *ɔi*. We account for this via the rule in (16) [4] , where dashes indicate inserted items. We are expressing this rule using an autosegmental representation to illustrate how the diphthongization manipulates feature values already present in the underlying vowels, but this is not intended as a departure from the rest of

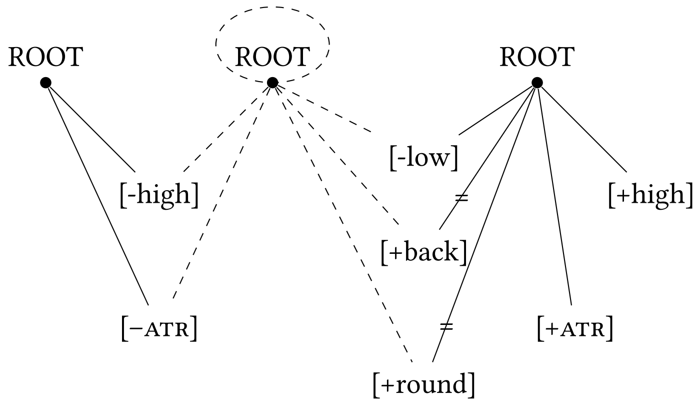
a separate rule. Recall that (10b) was limited such that /a/ does not trigger or undergo delinking. If delinking were formulated such that V_2 could be any [-high] vowel (i.e., if V_2 could be /a/), this would incorrectly predict that /ɔ+a/ should surface as **oa* rather than *ɔa*. This is why we have excluded /a/ from triggering delinking, necessitating the additional rule in (14) to account for /ɛ+a/ → *ea*. Accounting for this pattern via delinking would make incorrect predictions (i.e., delinking cannot be allowed to change /ɔ+a/ → oa with the derived oa later changing back to [ɔa], since underlying /o+a/ does not change to [ɔa]; ATR shift also cannot be restricted to applying only when V_1 is [-back], since ATR shift does apply in other cases where V_1 is /ɔ/, e.g., /ɔ+e/ → *oɛ*).

This rule could be seen as a shorthand for multiple rules, one inserting the root node and one or more others filling in its features. Nothing within the analysis hinges on the question of whether one or multiple rules are represented here. In these derivations, for ATR shift we give intermediate output forms rather than stating "N/A" even though ATR shift makes no change to the segments listed as outputs of the previous rule. This is because ATR shift does apply in each case, spreading [−ATR] from V_1 to V_2. The identity of the segments does not change, but the [−ATR] feature crucially takes on the doubly-linked representation that feeds delinking.

[4]This rule could be seen as a shorthand for multiple rules, one inserting the root node and one or more others filling in its features. Nothing within the analysis hinges on the question of whether one or multiple rules are represented here.

our analysis since, as mentioned above, we have assumed autosegmental theory throughout and have used SPE notation for simplicity elsewhere.

(16)



In effect, this rule inserts a new root node between V_1 and *u*, then fills in the [-high] and [−ATR] values of the new vowel via spreading of these features from V_1 and the [-low], [+back], and [+round] features from *u* (with the latter two delinking from *u*). We assume the features [-back] and [-round] are later inserted by default and associated to the root node that formerly represented *u*. The output is a sequence of (V_1+*ɔi*), where V_1 surfaces unchanged while *u* has changed to *ɔi* via (16) followed by default insertion of [-back] and [-round].

Following the change of *u* to *ɔi*, further rules apply to the triggering V_1. When V_1 is *ɛ*, the *ɛ* changes to *e* via ATR shift and delinking, yielding the sequence *eɔi*. When V_1 is *ɔ* or *a*, V_1 appears to be deleted (*au* and *ɔu* both surface as *ɔi* rather than **aɔi*, **ɔɔi*). These sequences can all be accounted for with an ordering in which diphthongization (16) applies, followed by *a*-assimilation (15), ATR shift (10a), fusion (13), delinking (10b), and finally a rule to be introduced in §5.4 that shortens a long vowel before another vowel. The effects of these rules are shown in Table 4.[5]

[5] In these derivations, for ATR shift we give intermediate output forms rather than stating "N/A" even though ATR shift makes no change to the segments listed as outputs of the previous rule. This is because ATR shift does apply in each case, spreading [−ATR] from V_1 to V_2. The identity of the segments does not change, but the [−ATR] feature crucially takes on the doubly-linked representation that feeds delinking.

Table 4: Effects of the rules

Underlying form	/ɛ+u/	Underlying form	/a+u/	Underlying form	/ɔ+u/
Diphthongization (16)	ɛɔi	Diphthongization (16)	aɔi	Diphthongization (16)	ɔɔi
ATR shift (10a)	ɛɔi	ATR shift (10a)	aɔi	ATR shift (10a)	ɔɔi
a-assimilation	N/A	a-assimilation	ɔɔi	a-assimilation	N/A
Fusion (13)	N/A	Fusion (13)	ɔːi	Fusion (13)	ɔːi
Delinking (10b)	eɔi	Delinking (10b)	N/A	Delinking (10b)	N/A
Shortening (§5.4)	N/A	Shortening (§5.4)	ɔi	Shortening (§5.4)	ɔi

The rules presented in this section are sufficient to account for all VHR patterns presented in Table 2. In the next section, we will discuss some complications to this core pattern that arise due to the additional factors and contexts that were listed in §1.

5 Other factors/contexts affecting vowel hiatus resolution

5.1 Segment preceding V_1

The segment preceding a V+V sequence can affect the outcome of VHR. For example, Armstrong reports (1940: 22) that input *iɛ+a* surfaces as *ia* with the *ɛ* elided. Normally *ɛ+a* surfaces as *ea* (as discussed above), so deletion of *ɛ* from *iɛ+a* is conditioned by the preceding *i*. We have not investigated 3-vowel sequences systematically, so it is unclear how general this deletion rule is (in terms of which specific vowels undergo or trigger it). This is a matter for future research. [6]

A consonant preceding the V_1+V_2 sequence also affects VHR, specifically in terms of whether glide formation (GF) applies to V_1 or not. We will demonstrate this by first establishing the general GF pattern (see also Kuzmik 2020 for discussion and an OT analysis of glide formation).

Generally, GF can apply to *o*, changing it to *w* when it precedes any vowel except *o* or *u*. GF is sometimes optional but is obligatory for some forms (we have not yet determined when it is obligatory vs. optional; this may be a lexical property). Examples of *o*+V combinations that undergo GF are shown in (17a); (17b) shows *o*+V combinations where GF does not apply.

[6] Note, however, that the number of combinations makes it impractical to study all three-vowel sequences systematically. If any of the 14 long/short vowels can hypothetically precede all 49 combinations of short vowels across a word boundary, this yields 686 V_1+V_2V_3 combinations; doubling this number to include utterances where the boundary occurs instead after V_2 (V_1V_2+V_3) yields 1372 combinations. Doubling this number to add the within-word context produces a total of 2744 unique combinations.

(17)

a.	o+i → wii ~oi	wàjìkó íkòmí	→ wàjìkwííkòmí ~ wàjìkòíkòmí	'ten Wanjikũs'
	o+e → wee ~oe	wàjìkó étékà	→ wàjìkwéétékà ~ wàjìkóétékà	'Wanjikũ, answer!'
	o+ɛ → wɛɛ ~oɛ	wàjìkó ɛ́hɛ́rà	→ wàjìkwɛ́ɛ́hɛ́rà ~ wàjìkóɛ́hɛ́rà	'Wanjikũ, stand aside!'
	o+a → waa ~oa	wàjìkó áyá	→ wàjìkwááyá ~ wàjìkóáyá	'these Wanjikũs'
	o+ɔ → wɔɔ ~oɔ	wàjíkó ɔ́hà	→ wàjíkwɔ́ɔ́hà ~ wàjíkóɔ́hà	'Wanjikũ, tie!'
b.	o+o → oo *woo	wàjìkó òyò	→ wàjìkóóyó *wajikwooyo	'this Wanjikũ'
	o+u → ou *wuu	wàjìkó úɣà	→ wàjíkóúɣà *wajikwuuɣa	'Wanjikũ, say something!'

As shown in (18), GF can also apply to an *o* that is not underlying but is derived via the raising of *ɔ* before *ɛ* via ATR shift (so GF is ordered after ATR shift).

(18) ɔ+ɛ → oɛ
(→ wɛɛ)

húkɔ́ ɛ́hɛ́rà	→ húkwɛ́ɛ́hɛ́rà ~húkóɛ́hɛ́rà	'mole, stand aside!'
mèhèèdɔ́ èná	→ mèhèèdwɛ̀ɛ̀nà ~mèhèèdòɛ̀nà	'four ropes'
jɔ̀mɔ̀ ɛ́hɛ́rà	→ jɔ̀mwɛ́ɛ́ꜜhɛ́rà ~jɔ̀mɔ́ɛ́ꜜhɛ́rà	'Njomo, stand aside!'

Some vowels other than *o* also undergo GF, but less robustly. In contrast to Mugane's report (1997: 9) that *i* and *u* do not undergo GF, *i* does undergo GF in some cases, but apparently only before *u*, as can be seen by comparing (19a) vs. (19b).

(19)

a.	mwààgì úmà	→ mwààgyúúmà *mwaagiuma	'Mwangi, come out!'
	mwààgì úɣà	→ mwààgyúúɣà *mwaagiuɣa	'Mwangi, say something!'
	wààbìtí úɣà	→ wààbìtyúúɣà ~wààbìtíúɣà	'Wambiti, say something!'
	gèðèèjí úɣà	→ gèðèèjyúúɣà ~gèðèèjíúɣà	'Gĩthĩnji, say something!'

		kàríòkí úɣà	→ kàríòkyúúɣà ~kàríòkìúɣà	‘Kariũki, say something!’
		kèmání úmà	→ kèmányúúmà ~kèmáníꜜúmà	‘Kĩmani, come out!’
		kàɣɔ̀ʃí úɣà	→ kàɣɔ̀ʃꜜyúúɣà ~kàɣɔ̀ʃíꜜúɣà	‘Kagoci, say something!’
		kàrémí úɣà	→ kàrémꜜyúúɣà ~kàrémìúɣà	‘Karĩmi, say something!’
	b.	mwààgì íkòmí	→ mwààgííkòmí *mwaagyiikomi	‘ten Mwangis’
		mwààgì étékà	→ mwààgìètékà *mwààgyèètékà	‘Mwangi, answer!’
		mwààgì ɛ́hɛ́rà	→ mwààgíɛ́hɛ́rà *mwaagyɛɛhɛra	‘Mwangi, stand aside!’
		mwààgì áyá	→ mwààgìàyá *mwaagyaaya	‘these Mwangis’
		mwààgì ɔ́hà	→ mwààgíɔ́hà *mwaagyɔɔha	‘Mwangi, tie!’
		mwààgì òyò	→ mwààgìòyó *mwaagyooyo	‘this Mwangi’

Similarly, *u* seems to undergo glide formation most readily before *i* (20a), though it also applies before non-round vowels (20b). We do not have examples of it applying before *ɔ*, *o*, or *u* (20c).

(20)	a.	kàrúúgú íkòmí	→ kàrùùgwììkòmí *karuuguikomi	‘ten Karungus’
		màfùkù ìkòmí	→ màfùkwììkòmí *mafukuikomi	‘ten books’
		kààbútú íkòmí	→ kààbútwííkòmí *kààbútúíkòmí	‘ten Kambutus’
	b.	kàrúúgú étékà	→ kàrúúgwèètékà ~kàrúúgùètékà	‘Karungu, answer!’
		kàrúúgú ɛ́hɛ́rà	→ kàrúúgwɛ́ɛ́hɛ̀rà ~kàrúúgúɛ́ꜜhɛ́rà	‘Karungu, stand aside!’
		kàrúúgú àtáánó	→ kàrùùgwààtáánó ~kàrùùgùàtáánó	‘five Karungus’
	c.	kàrúúgú ɔ́hà	→ kàrúúgùɔ́hà *karuugwɔɔha	‘Karungu, tie!’

		kàrúúgú óyó	→ kàrùùgùòyó *karuugwooyo	'this Karungu'
		kàrúúgú úɣà	→ kàrúúgùúɣà *karuugwuuɣa	'Karungu, say something!'

We have observed a small number of instances of *e* undergoing GF, as shown in (21a); (21b) shows that GF does not apply to *e* before *e* or *i.*

(21)	a.	kèvàkè ɛ̀hɛ́rà	→ kèvàkyɛ́ɛ́ꜜhɛ́rà ~kèvàkèɛ́ꜜhɛ̀rà	'Kĩbakĩ, stand aside!'
		kèvàkè áyá	→ kèvàkyààyá ~kèvàkèàyá	'these Kĩbakĩs'
		gèʃòké áyá	→ gèʃòkyááyá ~gèʃòkéáyá	'these Gĩcũkĩs'
		kèvàkè ɔ́hà	→ kèvàkyɔ́ɔ́hà ~kèvàkèɔ́hà	'Kĩbakĩ, tie!'
		kèvàkè óyó	→ kèvàkyòòyó ~kèvàkèòyó	'this Kĩbakĩ'
		gèʃòké òyò	→ gèʃòkyóóyó ~gèʃòkéóyó	'this Gĩcũkĩ'
		kèvàkè úɣà	→ kèvàkyúúɣà ~kèvàkèúɣà	'Kĩbakĩ, say something!'
	b.	kèvàkè étékà	→ kèvàkèètékà *kevakyeeteka	'Kĩbakĩ, answer!'
		kèvàkè íkòmí	→ kèvàkéíkòmí *kevakyiikomi	'ten Kĩbakĩs'

Other forms with *e* as V_1 fail to undergo GF, as shown in (22).

(22)	gèʃóhè úɣà	→ gèʃóhèúɣà *geʃohyuuɣa	'Gĩcũhĩ, say something!'
	gàré úɣà	→ gàréꜜúɣà *garyuuɣa	'Ngarĩ, say something!'
	mòtè óʃíɔ́	→ mòtèòʃíɔ́ *motyooʃiɔ	'that tree'
	gèʃòké ɛ́ꜜhɛrà	→ gèʃòkéɛ́ꜜhɛ́rà *geʃokyɛɛhɛra	'Gĩcũkĩ, stand aside!'
	gèʃòké ɔ́hà	→ gèʃòkéꜜɔ́hà *geʃokyɔɔha	'Gĩcũkĩ, tie!'
	gèʃòké úɣà	→ gèʃòkéꜜúɣà *geʃokyuuɣa	'Gĩcũkĩ, say something!'

Mugane (1997: 10) reports *mũtyũcio* for '[that] tree' (an orthographic form corresponding to [motyoʃiɔ], although presumably the *o* after the glide is lengthened; the orthography does not indicate vowel length). Our speaker rejects the form with GF for the same phrase, as seen in (22). Note also in comparing (21) with (22) that the final V of the name Gĩcũkĩ variably undergoes GF, seemingly depending on the following vowel but with no clear phonological generalization.

As mentioned earlier, the preceding consonant (if any) affects the likelihood of GF application. In particular, although GF can apply after other consonants, a preceding *k* seems to make GF most likely. (23) shows some representative examples where GF is obligatory (for these particular forms only) after *k* and *g* (23a) but optional after the consonants shown in (23b).

(23)	a.	/k/	màfùkù ìkòmí	→ màfùkwììkòmí (*mafukuikomi)	'ten books'
		/g/	kàrúúgú íkòmí	→ kàrùùgwììkòmí (*karuuguikomi)	'ten Karungus'
	b.	/t/	wààbìtí úɣà	→ wààbìtyúúɣà ~wààbìtíúɣà	'Wambiti, say something!'
		/d/	mòhéédɔ̀ étékà	→ mòhéédòɛ̀tékà ~mòhéédwɛ̀ɛ̀tékà	'rope, answer!
		/dʒ/	gèðèèjí úɣà	→ gèðèèjyúúɣà ~gèðèèjíúɣà	'Gĩthĩnji, say something!'
		/ʃ/	kàɣɔ̀ʃí úɣà	→ kàɣɔ̀ʃꜜyúúɣà ~kàɣɔ̀ʃíꜜúɣà	
		/r/	gèʃòrò ɔ́nà	→ gèʃòròɔ́nà ~gèʃòrwɔ́ɔ́nà	'Gĩcũrũ, see!'
		/m/	wàìrìmó áyá	→ wàìrìmwááyá ~wàìrìmóáyá	'these Wairimũs'
		/n/	kèmání úmà	→ kèmányúúmà ~kèmáníꜜúmà	'Kĩmani, come out!'
		/ŋ/	dòòŋó íkòmí	→ dòòŋwííkòmí ~dòòŋòíkòmí	'ten Ndũng'ũs'

In contrast to the consonants in (23), other consonants when preceding the target vowel appear to inhibit or block GF. Some representative examples are given in (24).

(24)	/ɣ/	bɔ̀ɣɔ̀ ɛ́hɛ́rà	→ bɔ̀ɣòɛ́hɛ́rà (*bɔɣwɛɛhɛra)	‘Mbogo, stand aside!’
	/ʃ/	gɛ̀ʃó étèkà	→ gɛ̀ʃóététékà (*gɛʃweeteka)	‘Ngecũ, answer!’
	/ð/	kèmɔ̀ðɔ̀ ɛ́hɛ́rà	→ kèmɔ̀ðòɛ́hɛ́rà (*kemɔðwɛɛhɛra)	‘Kĩmotho, stand aside!’
	/h/	mòhóhò ɛ́ꜜhɛ́rà	→ mòhóhòɛ̀hɛ́rà (*mohohwɛɛhɛra)	‘Mũhoho, stand aside!’[7]
	/r/	mòðúúrí úɣà	→ mòðúúrìúɣà (*moðuuryuuɣa)	‘elder, say something!’
	/ny/	gèkɔ̀nyɔ́ ɛ́hɛ́rà	→ gèkɔ̀nyóɛ́hɛ́rà (*gekɔnywɛɛhɛra)	‘Gĩkonyo, stand aside!’
	/y/	wàmóyò étèkà	→ wàmóyòétèkà (*wamoyweeteka)	‘Wamũyũ, answer!’

Notice that some consonants (*r*, *ʃ*) appear on the lists in both (23) and (24), as licensing/triggering GF but also inhibiting/blocking it. This is due to an interaction between the consonant and the specific target vowel. While a preceding *r* does not inhibit GF applying to *o*, it does apparently inhibit GF applying to *i* (our consultant attributed this to the fact that the sequence *rw* sounds natural to him but *ry* does not). Conversely, while GF does apply to *i* after *ʃ*, it seems to be inhibited from applying to *o* after *ʃ*. GF is deserving of further study to obtain a clearer picture of the interaction of the various factors that determine when it applies optionally or obligatorily vs. not at all. The purpose of this section has been to give some insight into the phenomenon and some data that complicate or contradict previous descriptions, and to show that the preceding consonant plays a role.

[7] Note that this name is pronounced *mòhóhò* despite its spelling, which implies **mohɔhɔ*.

5.2 Segment following V_2

The segment following V_2 can affect VHR in ways we have not systematically studied. One instance where we can see this is in the difference in the behavior of *a* and *ɔ* when followed by *ɔ*C vs. when followed by *ɔ*V. Recall that *a*+*ɔ* and *ɔ*+*ɔ* both surface as *ɔɔ* when followed by a consonant, as shown in (25).

(25)	a + ɔ → ɔɔ	tààtà ɔ́yà	→ tààtɔ́ɔ́yà	'Aunt, lift!'
		nyààbùrá ɔ́hà	→ nyààbùrɔ́ɔ́hà	'Nyambura, tie!'
	ɔ + ɔ → ɔɔ	gèkɔ̀nyɔ́ ɔ́hà	→ gèkɔ̀nyɔ́ɔ́hà	'Gĩkonyo, tie!'
		mòɣɔ̀ ɔ́yà	→ mó^ꜜɣɔ́ɔ́yà	'Mũgo, lift!'

On the other hand, as noted earlier in §4 in the discussion of *u*-diphthongization, *a* and *ɔ* are deleted when followed by *ɔi* (derived from /u/), as shown in (26).

(26)	a → Ø / __ ɔi	tààtà úɣà	→ tààtɔ́ìɣà	'Aunt, say something!'
	(from /u/)	bùrá úrà	→ bùrɔ́ìrà	'rain, come down!'
	ɔ → Ø / __ ɔi	gèkɔ̀nyɔ́ úɣà	→ gèkɔ̀nyɔ́ꜜíɣà	'Gĩkonyo, say something!'
	(from /u/)	bɔ̀ɣɔ̀ úɣà	→ bɔ̀ɣɔ́íɣà	'Mbogo, say something!'

Hence, *a*+*ɔ*, *ɔ*+*ɔ* behave differently when followed by a consonant vs. when followed by *i*. In this paper we do not attempt a full account of V+V+V sequences, as noted earlier. However, as was spelled out in the derivations in Table 4, our analysis does account for (26). The key observation is that diphthongization of *u* applies first, feeding total assimilation of *a* to the derived *ɔ* of *ɔi*. The adjacent *ɔ* vowels then fuse into a single long *ɔ*: vowel. The remaining step is that, as will be discussed further in §5.4, the long vowel shortens before another vowel (in this case, *i*).

A consonant following V_2 can also affect VHR, by obscuring its effect. In particular, a nasal consonant following a [+ATR] mid vowel causes the vowel to sound very similar to its [-ATR] counterpart (i.e., *o* and *e* sound like *ɔ* and *ɛ*, respectively, before a nasal). The ATR contrast is still preserved but becomes very subtle and difficult to hear. Due to the confusability of vowels in this context, we have avoided forms with nasals following the V+V sequence where possible in this study.

5.3 Boundary type between V_1 and V_2 (morpheme vs. word)

Earlier we saw examples where the type of boundary (morpheme vs. word) between the two vowels results in different hiatus resolution effects (see examples

(6) and (9) in §3). In the case of word boundaries, the type of syntactic boundary has not proved significant; the VHR effects that occur across word boundaries seem to apply anywhere within the clause (though not across different clauses within an utterance).

In the earlier discussion of the differences between our description and Armstrong's, we showed that while *o+ɔ* surfaces as *oɔ* across a word boundary, it changes to *uɔ* within words across a (within-word) morpheme boundary. Similarly, we saw that while *o+u* surfaces as *ou* across a word boundary, it changes to *uu* across a morpheme boundary, and *e+u* surfaces as *eu* across a word boundary but as *iu* across a morpheme boundary.

In addition to these patterns (which were discussed in §3 in reference to differences from Armstrong's description), there is another combination that behaves differently within words vs. across words, namely *e+o*, which surfaces as *eo* across a word boundary but as *io* across a morpheme boundary (this was not discussed in §3, which focused on behavior across word boundaries, since our data agrees with Armstrong's in that specific context). Examples are given in (27).

(27)	a. e+o → eo	mòtè óyó	→ mòtèòyó	'this tree'
	(across words)	mòtè òʃíɔ́	→ mòtèòʃíɔ́	'that tree'
		né ótà	→ néótà	'it's a bow'
		né ótùkò	→ néótùkò	'it's night'
	b. e+o → io	/n-ke-ok-a/	→ gíókà	'I came'
	(within words)	/n-ke-or-a/	→ gíórà	'I got lost'

Interestingly, Armstrong (1940: 24) reports no change to *e+o* even within words (cf. *ŋgeoka* 'I came').

The differences between the across-word vs. within-word contexts show that there are some hiatus resolution rules that apply at the lexical level but not post-lexically:

(28) Additional VHR rules that apply only lexically

a. o → u / __ ɔ

b. o → u / __ u

c. e → i / __ u

d. e → i / __ o

Rules (28b-c) can be collapsed into a single rule, shown in (29).

(29) $\begin{bmatrix} \text{-HIGH} \\ \text{-LOW} \\ \text{+ATR} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+HIGH} \end{bmatrix} / \_ \begin{bmatrix} \text{+HIGH} \\ \text{+BACK} \end{bmatrix}$

Note that this rule has to be limited to applying before a [+back] vowel since *i* does not trigger raising (*o+i*, *e+i* do not change to *ui*, *ii* within words; cf. /ko-ìkár-à/ ⟶ *ɣòíkàrà* 'to stay', /n-ke-ikar-a/ ⟶ *gèìkárá* 'I stayed'). It is also not possible to write rules raising *o*, *e* before all [+back, +round] vowels because *o* does not raise before *o* (though this could be explained via the fusion of *o+o* ⟶ *o:* applying before raising) and *e* does not raise before *ɔ* (*eɔ* ⟶ *eɔ* both within and across word boundaries; cf. /n-ke-ɔh-a/ ⟶ *géɔ́hà* 'I tied').

5.4 Vowel length

Armstrong provides few examples of combinations involving long vowels, tending to lump them in with combinations of short vowels despite the fact that they behave somewhat differently, as we show below. Table 5 shows combinations of a short V_1 with a long V_2 across a word boundary (as before, boxed cells indicates differences from Armstrong; question marks indicate combinations we have been unable to elicit).

Table 5: Short V_1 with long V_2 across word boundary

	V_2						
V_1	ii	ee	ɛɛ	aa	ɔɔ	oo	uu
i	$\boxed{\text{ii}}$	ie	iɛ	ia	iɔ	io	iuu
e	eii	$\boxed{\text{ee}}$	eɛ	ea	eɔ	$\boxed{\text{eo}}$	euu
ɛ	ɛii	ɛɛ	ɛɛ	ea	eɔ	$\boxed{\text{eo}}$	ɛuu
a	aii	ɛɛ	ɛɛ	$\boxed{\text{aa}}$	ɔɔ	ɔɔ	auu
ɔ	?	$\boxed{\text{oɛ}}$	oɛ	$\boxed{\text{ɔa}}$	ɔɔ	ɔɔ	?
o	?	$\boxed{\text{oe}}$	$\boxed{\text{oɛ}}$	$\boxed{\text{oa}}$	$\boxed{\text{oɔ}}$	$\boxed{\text{oo}}$	?
u	?	?	uɛ	ua	uɔ	uo	?

One systematic difference between our description and Armstrong's concerns the behavior of V+V: sequences where the vowels have identical quality. Armstrong reports (1940: 12) that these surface as "very long" (e.g., *meteeerea* 'those trees') but we consistently find long vowels in this context that sound the same as other long vowels, not "very long" (e.g., *mèt**è** **é**éréá* ⟶ *mèt**èè**réá* 'those trees').

Additionally, in Armstrong's data *ɔ+aa* surfaces as *oaa* (this was discussed earlier in §3 in the context of V+V combinations since Armstrong incorrectly cited the example as an instance of *ɔ+a*). For our speaker, *ɔ+aa* yields *ɔa*.

Another difference concerns long vowels following *o*. Armstrong suggests (1940: 23-24) that all vowels except short *ɔ* and *u* surface unchanged after *o*, implying that long vowels are not shortened in this context, specifically stating (1940: 24, footnote 1) that "*oɔɔ* (*wɔɔ*) and *ouu* (*wuu*) occur," though no examples are cited. We hypothesize that the forms in question are [wɔɔ] and [wuu] (we cannot confirm this since Armstrong cites no examples) and that these may result from a two-step process of shortening and GF (which re-lengthens the V), e.g., *o+ɔɔ* ⟶ *oɔ* ⟶ *wɔɔ*. Otherwise, we have no explanation for why vowels would systematically fail to shorten after *o*, which happens to be the only V that consistently undergoes GF.

A final discrepancy involves whether long *ee* and *oo* undergo shortening. In our data, *ee* and *oo* shorten after another V. According to Armstrong, however, *ɔ+ee* fails to undergo shortening, surfacing as *ɔee* or *oɛɛ* (1940: 21) (e.g., *meheend***ɔ** ***ee****rea* ⟶ *meheend***oɛɛ***rea* 'those ropes'), *e+oo* surfaces as *eoo* (1940: 20) (e.g., *maɣua m***e** ***oo****ke* ⟶ *maɣua m***eoo***ke* 'honeycombs contain honey'), and *ɛ+oo* surfaces as *ɛoo* or *eɔɔ* (1940: 20) (e.g., *mocɛɛr***ɛ** ***oo****rea* ⟶ *mocɛɛr***eɔɔ***ea* 'that rice'). As seen in (30), our speaker produces these sequences as *oɛ*, *eo*, and *eo*, respectively. (30) shows that in most cases a long V_2 undergoes shortening, and most V+Vː combinations have surface forms identical to the corresponding V+V combinations that were presented in §3.

(30) Sequences with long V_2 where the surface form is identical to sequence with short V_2

i + ii → ii	tí ííjí émòɛ̀	→ tííjí émòɛ̀	'this is not one inch'
i + ee → ie	mèìrí èèréá	→ mèìríéréá	'those P. africana trees'
	gààrí èèréá	→ gààríéréá	'that car'
i + ɛɛ → iɛ	kèmàní ɛ́ɛ́tìrɛ́	→ kèmàníɛ́tìrɛ́	'Kimani called'
	tí ɛ́ɛ́ɣà	→ tíɛ̀ɣà	'they (people) are not good'
i + aa → ia	kèmàní áányɔ̀nírɛ́	→ kèmàníányɔ̀nírɛ́	'Kĩmani saw me'
i + ɔɔ → iɔ	kèmàní ɔ́ɔ́nìrɛ́	→ kèmàníɔ́nìrɛ́	'Kĩmani saw (something)'
i + oo → io	mòðùùrì òòréá	→ mòðùùrìòréá	'that elder'
e + ee → ee	mètè ééréá	→ mètèèréá	'those trees'
	gàré èèréá	→ gàrééréá	'that leopard'
e + ɛɛ → eɛ	gèʃóhè ɛ́ɛ́tìrɛ́	→ gèʃóhèɛ́tìrɛ́	'Gĩcũhĩ called'

	né ɛ̀ɛ̀ɣà	→ néɛ̀ɣà	'they (people) are good'
e + aa → ea	gèʃóhè áányɔ̀nírɛ̀	→ gèʃóhèányɔ̀nírɛ̀	'Gĩcũhĩ saw me'
	gèʃóhè áárèɔ̀nírɛ̀	→ gèʃóhèárèɔ̀nírɛ̀	'Gĩcũhĩ saw it (cl. 5)'
e + ɔɔ → eɔ	gèʃóhè ɔ́ɔ́nìrɛ́	→ gèʃóhèɔ́nìrɛ́	'Gĩcũhĩ saw (something)'
e + oo → eo	gèʃóhè òòréá	→ gèʃóhèòréá	'that Gĩcũhĩ'
	mòtè óóréá	→ mòtèòréá	'that tree'
ɛ + ee → ɛɛ	ŋɔ̀ɔ̀bɛ̀ èèréá	→ ŋɔ̀ɔ̀bɛ̀ɛ̀réá	'that cow'
ɛ + ɛɛ → ɛɛ	ɔ́ɔ́nɛ̀ɛ̀tɛ́ ɛ̀ɛ̀kí	→ ɔ́ɔ́nɛ̀ɛ̀tɛ́ɛ́kì	's/he saw doers'
ɛ + aa → ea	mònɛ̀nɛ́ áányɔ̀nírɛ̀	→ mònɛ̀néányɔ̀nírɛ̀	'the boss saw me'
	jɔ̀rɔ̀gɛ́ áányɔ̀nírɛ̀	→ jɔ̀rɔ̀géányɔ̀nírɛ̀	'Njoroge saw me'
ɛ + ɔɔ → eɔ	mwèèrɛ́ ɔ́ɔ́kɛ̀	→ mwèèréɔ́kɛ̀	'tell him to come'
	ɔ́ɔ́nɛ̀ɛ̀tɛ́ ɔ̀ɔ̀tí	→ ɔ́ɔ́nɛ̀ɛ̀téɔ́tì	's/he saw baskers'
ɛ + oo → eo	mɔ̀ʃɛ́ɛ́rɛ̀ òòréá	→ mɔ̀ʃɛ́ɛ́rèòréá	'that rice'
	né déétɛ̀ óòké	→ né déétèòkè	'I have eaten honey'
a + ee → ɛɛ	mèkààdá èèréá	→ mèkààdɛ́ɛ́réá	'those ropes'
a + ɛɛ → ɛɛ	ná ɛ́ɛ́kì	→ nɛ́ɛ́kì	'... and doers'
	nà ɛ̀ɛ̀jánì	→ nɛ̀ɛ̀jánì	'... and hairdressers'
a + aa → aa	nyààbùrá áányɔ̀nírɛ̀	→ nyààbùrááányɔ̀nírɛ̀	'Nyambura saw me'
a + ɔɔ → ɔɔ	ná ɔ́ɔ́tì	→ nɔ́ɔ́tì	'... and baskers'
	nà ɔ̀ɔ̀bí	→ nɔ̀ɔ̀bí	'... and potters'
a + oo → ɔɔ	mòrààtá òòréá	→ mòrààtɔ́ɔ́réá	'that friend'
	márééáɣà òòké	→ márééáɣɔ̀ɔ̀ké	'they eat honey'
ɔ + ee → oɛ	mèhèèdɔ̀ èèréá	→ mèhèèdòɛ̀réá	'those ropes'
ɔ + ɛɛ → oɛ	gèkɔ̀nyɔ́ ɛ́ɛ́tìrɛ́	→ gèkɔ̀nyóɛ́tìrɛ́	'Gĩkonyo called'
ɔ + aa → ɔa	gèkɔ̀nyɔ́ áányɔ̀nírɛ̀	→ gèkɔ̀nyɔ́ányɔ̀nírɛ̀	'Gĩkonyo saw me'
ɔ + ɔɔ → ɔɔ	gèkɔ̀nyɔ́ ɔ́ɔ́nìrɛ̀	→ gèkɔ̀nyɔ́ɔ́nìrɛ̀	'Gĩkonyo saw (something)'
ɔ + oo → ɔɔ	gèkɔ̀nyɔ́ òòréá	→ gèkɔ̀nyɔ́ɔ́réá	'that Gĩkonyo'
o + ee → oe	mèðààdókò èèréá	→ mèðààdókòèréá	'those wattle trees'
	mètìtó èèréá	→ mètìtóéréá	'those forests'
o + ɛɛ → oɛ	gèʃòrò ɛ́ɛ́tìrɛ́	→ gèʃòròɛ́tìrɛ́	'Gĩcũrũ called'
	gɛ̀ʃó ɛ́ɛ́tìrɛ́	→ gɛ̀ʃóɛ́tìrɛ́	'Ngecũ called'
o + aa → oa	gèʃòrò áányɔ̀nírɛ̀	→ gèʃòròányɔ̀nírɛ̀	'Gĩcũrũ saw me'
o + ɔɔ → oɔ	gèʃòrò ɔ́ɔ́nìrɛ́	→ gèʃòròɔ́nìrɛ́	'Gĩcũrũ saw (something)'
o + oo → oo	gèʃòrò óóréá	→ gèʃòròòréá	'that Gĩcũrũ'
u + ɛɛ → uɛ	mátú ɛ́ɛ́tìrɛ́	→ mátúɛ́tìrɛ́	'Matu called'
u + aa → ua	mátú áányɔ̀nírɛ̀	→ mátúányɔ̀nírɛ̀	'Matu saw me'
u + ɔɔ → uɔ	mátú ɔ́ɔ́nìrɛ̀	→ mátúɔ́nìrɛ̀	'Matu saw (something)'
u + oo → uo	màtù óóréá	→ màtùòréá	'that Matu'

In contrast, other V+V: sequences yield a different surface form from their V+V counterparts. These are listed in Table 6 along with a characterization of the type of difference(s); representative examples are given in (31).

(31) Combinations where long V_2 yields a different surface form from short V_2

i + uu → iuu	tí úúbúðé	→ tíúúbúðé	‘those are not dregs’
	tí úúmèrò	→ tíúúꜜmérò	‘this is not an exit’
e + ii → eii	né ííjì	→ néííjì	‘this is an inch’
	né ííjìní	→ néííjìní	‘this is an engine’
e + uu → euu	né úúbùðè	→ néúúbùðè	‘those are dregs’
ɛ + ii → ɛii	ɔ́ɔ́nìrɛ́ ííjìní	→ ɔ̀ɔ̀nìrɛ́ííjìní	‘s/he saw an engine’
ɛ + uu → ɛuu	ɔ́ɔ́nɛ̀ɛ̀tɛ́ úúgùmáníá	→ ɔ́ɔ́nɛ̀tɛ́úúgùmáníá	‘he saw corruption’
a + ii → aii	dɔ̀ɔ̀ná ííjìnì	→ dɔ̀ɔ̀náííjìnì	‘I saw an engine’
	ná ꜜííjìnì	→ náꜜííjìnì	‘... and an engine’
a + uu → auu	ná úúbùðè	→ náùùbùðè	‘... and dregs’
	nà ùùðí	→ nàùùðí	‘... and thread’

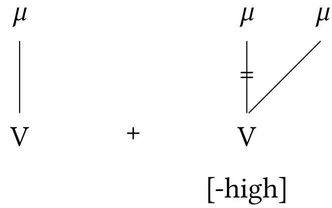
Table 6: Type of difference between V+V: and V+V surface forms

V1+ V2 quality	Output w/ long V2	Output w/ short V2	Type of difference
ɛ+i	ɛii	ɛi	mora count
a+i	aii	ai	mora count
i+u	iuu	iu	mora count
e+u	euu	eu	mora count
a+u	auu	ɔi	mora count; application of quality change
ɛ+u	ɛuu	eɔi	application of quality change

All *ii*-initial words we have found are borrowed, and the long *ii* may derive from pre-nasal lengthening. This probably does not account for the failure of shortening, however, since, as we will show below, high vowels also do not undergo shortening in V_1 position, as non-high vowels do. Also, the long *uu* in words like *ùùðí* results from combining the cl. 14 prefix *u-* with an *u*-initial stem and still does not shorten (cf. forms in (30) with initial non-high long vowels containing the cl. 14 prefix that do shorten, such as *ooke* 'honey').

Clements and Ford's account of downstep in Kikuyu contains some discussion of long vowel shortening (1981b: 202-205). In their analysis, shortening is driven by the fusion of adjacent vowels into a single syllable, combined with a restriction that long vowels generally do not share a syllabic nucleus with other vowels. In terms of moraic theory and constraint-based phonology, we might attribute this generalization to a restriction where syllables are maximally bimoraic. Our analysis is not incompatible with a syllable-based approach, but for simplicity we account for shortening via the rule in (32), which does not refer to syllables.

(32)



The failure of *ii* and *uu* to shorten is captured by the fact that the rule in (32) applies only to [-high] vowels. The change of *i* + *ii* ⟶ *ii* must therefore be handled separately. In general, for our speaker, sequences of V+V: where the quality of the vowels is identical surface as V: and there are not instances of an extra-long V: : (contrary to Armstrong's description). A syllable-based approach, which we do not attempt here, might subsume all of these facts under a set of generalizations regarding which combinations of vowels (based on their quality) are eligible to fuse into a single syllable, and this in turn could be used to restrict shortening (because shortening would only apply when the vowel sequence occurs within a single syllable). The identification of the vowel pairs that can fuse into a single syllable would be based on which vowels shorten, so the reasoning would be circular, but this might enable a coherent and unified analysis of syllable-driven shortening that does not treat *i* + *ii* ⟶ *ii* separately from the shortening of non-high long vowels after another vowel. We leave this for future work (and note that Clements & Ford 1981b also did not propose a predictive generalization regarding which vowel sequences fuse vs. which sequences remain in separate syllables).

An important fact to note is that while V length can be difficult to distinguish auditorily, it is clearly the V+V: context and not simply the connected speech context that induces shortening in word-initial long vowels, since the vowels still surface as long in isolation when elicited in connected speech, as demonstrated in (33).

(33) Words with initial long vowels pronounced in isolation in connected speech

ííjí	'inch'	*iji
ééréá	'those (cl. 4)'	*erea
ɛ́ɛ́tìrɛ́	'he called'	*ɛtirɛ
áányɔ̀nírɛ̀	'he saw me'	*anyɔnirɛ
ɔ̀ɔ̀tí	'baskers'	*ɔti
òòké	'honey'	*oke
úúbúðé	'dregs'	*ubuðe

The forms in (34) with *ɛuu*, *auu* combinations show that diphthongization to *ɔi* applies only to short *u*, not to long *uu*. These forms cannot surface with **eɔi*, **ɔi*.

(34)

ɔ́ɔ́nɛ̀ɛ̀tɛ́ úúgùmáníá	→ ɔ́ɔ́nɛ̀tɛ́úúgùmáníá *ɔɔnɛteɔigumania	'he saw corruption'
ná úúbùðè	→ náùùbùðè *nɔibuðe	'… and dregs'

V: +V combinations show significantly different behavior from V+V and V+V: combinations. Table 7 shows the VHR outcomes for all combinations with a long V_1. Note that Armstrong does not comment on these combinations, so no comparison is possible between our description and Armstrong's here.[8,9]

Since shortening applies to non-high vowels before any vowel, we propose the rule in (35), which is the mirror image of the rule in (32).

(35)

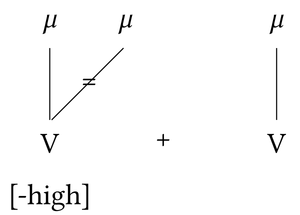


Table 8 gives a summary of differences in VHR outcomes when V_1 is long vs. when it is short.

[8]The *aa*-final nouns we have identified (*báá* 'dew' and *dàà* 'louse') exceptionally resist shortening before *u*, for reasons we have not established. Due to the otherwise general shortening pattern and the small number of lexical items involved, we suspect this cell should be filled with *au* but do not have examples to confirm this.

[9]Our one *oo*-final noun, *móó* '*M. hildebrandtii* tree', does not undergo shortening in any context. We hypothesize that there is something special about this noun, perhaps having to do with its CV: shape (see also footnote 12), and that if we are able to identify other nouns with final *oo*, they will undergo shortening.

Table 7: Long V_1 + Short V_2

V_1↓ V_2→	i	e	ɛ	a	ɔ	o	u
ii	ii	iie	iiɛ	iia	iiɔ	iio	iiu
ee	ei	ee	eɛ	ea	eɔ	eo	eu
ɛɛ	ɛi	ɛɛ	ɛɛ	ɛa	eɔ	eo	ɛu
aa	ai	aɛɛ	aɛɛ	aa	aɔɔ	aɔɔ	?
ɔɔ	ɔi	oɛ	oɛ	ɔa	ɔɔ	ɔɔ	ɔu
oo	?	?	?	?	?	?	?
uu	uui	uue	uuɛ	uua	uuɔ	uuo	uu

Table 8: Difference of VHR outcomes when V_1 is long vs. short

V1+ V2 quality	Output w/ long V2	Output w/ short V2	Type of difference
i+V	iiV (except ii)	iV	mora count
u+V	uuV (except uu)	uV	mora count
ɛ+a	ɛa	ea	application of quality change
ɛ+u	ɛu	eɔi	mora count; application of quality change
a+e, a+ɛ	aɛɛ	ɛɛ	mora count; application of quality change
a+o, a+ɔ	aɔɔ	ɔɔ	mora count; application of quality change
a+u	a(a?)u (see above)	ɔi	mora count (?); application of quality change
ɔ+u	ɔu	ɔi	mora count; application of quality change

Some of these differences can be explained by the shortening rule in (35) applying late in the derivation, counterfeeding some of the quality changes described and analyzed in §3, §4, if we analyze those rules as applying only to short vowels. For example, ordering the *ɛa* ⟶ *ea* raising rule before (35) explains the failure of raising in (36).

(36)	ɛɛ + a → ɛa	mòðɛ́ɛ̀ áyá	→ mòðɛ́àyá	‘these Mũthees’
		mòðɛ́ɛ̀ áɣérà	→ mòðɛ́ꜜáɣérà	‘Mũthee, be nice!’

The mirror image shortening rule in (32), in contrast, applies earlier and feeds most of the quality changes, as in the examples below where the shortened vowel is the trigger (37a) or the target (37b).

(37)	a.	ɛ + aa → ea	jɔ̀rɔ̀gɛ́ áányɔ̀nírɛ̀	→ jɔ̀rɔ̀géányɔ̀nírɛ̀	‘Njoroge saw me’
		ɔ + ɛɛ → oɛ	gèkɔ̀nyɔ́ ɛ́ɛ́tìrɛ́	→ gèkɔ̀nyóɛ́tìrɛ́	‘Gĩkonyo called’
	b.	ɛ + ee → ɛɛ	ŋɔ̀ɔ̀bɛ̀ èèréá	→ ŋɔ̀ɔ̀bɛ̀ɛ̀réá	‘that cow’
		ɔ + oo → ɔɔ	gèkɔ̀nyɔ́ òòréá	→ gèkɔ̀nyɔ́ɔ́réá	‘that Gĩkonyo’
		ɔ + ee → oɛ	mèhèèdɔ̀ èèréá	→ mèhèèdòɛ̀réá	‘those ropes’

The relative ordering of the two shortening rules also allows us to make sense of some perhaps unexpected surface forms when *aa* is followed by a mid vowel, shown in (38).

(38)	aa + e → aɛɛ	dàà étékà	→ dàɛ́ɛ́tèkà	‘louse, answer!’
			*daeteka, *dɛɛteka, *daɛteka	
		báà étékà	→ báꜜɛ́ɛ́tèkà	‘dew, answer!’
			*baeteka, *bɛɛteka, *baɛteka	
	aa + ɛ → aɛɛ	báà ɛ́hɛ́rà	→ báɛ̀ɛ̀hérà	‘dew, stand aside!’
			*baɛhɛra, *bɛɛhɛra	
	aa + ɔ → aɔɔ	báà ɔ́hà	→ báꜜɔ́ɔ́hà	‘dew, tie!’
			*baɔha, *bɔɔha	
	aa + o → aɔɔ	báà ókà	→ bá ꜜɔ́ɔ́kà	‘dew, come!’
			*baoka, *bɔɔka, *baɔka	

Recall that the corresponding sequences behave as follows when both vowels are short (39a) and when V_2 is long (39b).

(39)	a.	a+e → ɛɛ	b.	a+ee → ɛɛ
		a+ɛ → ɛɛ		a+ɛɛ → ɛɛ
		a+ɔ → ɔɔ		a+ɔɔ → ɔɔ
		a+o → ɔɔ		a+oo → ɔɔ

Our explanation for this difference is that in *aa*+V, the second half of the long *aa* interacts with the following mid V, fusing into *ɛɛ* or *ɔɔ* while the initial mora of the *aa* remains associated to the features of *a*. The resulting *a*+V: sequence does not undergo the rule that normally shortens non-high long vowels after another V because that rule already applied earlier in the derivation, as shown in (40).

(40) Derivation of /baa oka/ → baɔɔka

Underlying form	baa oka
Shortening of V+VV	N/A
a+o → ɔɔ	baɔɔka
Shortening of VV+V	N/A
Surface form	baɔɔka

We can identify which of the VHR rules apply before vs. after V:+V ⟶ VV based on the quality changes that do vs. do not apply in V:+V sequences. The changes in (41) affecting V_1 do apply to V:+V sequences, suggesting that ATR shift and delinking should be ordered after the rule that shortens a long vowel before a short vowel.

(41)	a.	ɛ+ɔ → eɔ	mòðɛ́ɛ̀ ɔ́hà	→ mòðéꜜɔ́hà	'Mũthee, tie!'
	b.	ɛ+o → eo	mòðɛ́ɛ̀ óyó	→ mòðéòyó	'this Mũthee'
			mòðɛ́ɛ̀ ókà	→ mòðéꜜókà	'Mũthee, come!'
	c.	ɔ+e → oɛ	kàŋɔ́ɔ̀ étékà	→ kàŋóꜜɛ́tékà	'Kang'oo, answer!'
	d.	ɔ+ɛ → oɛ	kàŋɔ́ɔ̀ ɛ́tɛ̀rɛ́rà	→ kàŋóꜜɛ́tɛ́rɛ́rà	'Kang'oo, wait!'

A final discrepancy between V:+V and V+V that needs to be accounted for is that we do not find examples of *u*-diphthongization following a long *ɛɛ*, *aa*, or *ɔɔ* (even if the long vowel is later shortened). As shown in (42), in this context the long V_1 shortens but the *u* surfaces unchanged.

(42)	ɛɛ + u → ɛu	mòðɛ́ɛ̀ úɣà	→ mòðɛ́ꜜúɣà	'Mũthee, say (something)!'
			*moðeɔiɣa, *moðɛɔiɣa	
	aa + u → aau	báà úɣà	→ báꜜáúɣà	'dew, say something!'
			*baɔiɣa, *baaɔiɣa	
	ɔɔ + u → ɔu	kàŋɔ́ɔ̀ úɣà	→ kàŋɔ́ꜜúɣà	'Kang'oo, say something!'
			*kaŋɔiɣa, *kaŋɔɔiɣa	

This suggests that the diphthongization rule is triggered specifically by a preceding *short* vowel, and that diphthongization must apply prior to the rule that shortens a long vowel before another vowel.

One last type of combination to consider is V:+V:. These forms are difficult to elicit due to the relative scarcity of long vowels both initially and finally and the syntactic category of words ending and beginning with long vowels. The combinations we have found are consistent with our observations about other combinations involving long vowels, including that non-high vowels undergo shortening when they precede or follow a vowel while high vowels do not, as shown in (43).

(43)	ii + ɛɛ → iiɛ	kèfíì ɛ́ɛ́tìrɛ́	→ kèfííꜜɛ́tìrɛ́	'fog called'
	ii + aa → iia	kèfíì áányɔ̀nírɛ́	→ kèfííꜜányɔ̀nírɛ́	'fog saw me'
	ii + ɔɔ → iiɔ	kèfíì ɔ́ɔ́nìrɛ́	→ kèfííꜜɔ́nìrɛ́	'fog saw (something)'
	uu + ɛɛ → uuɛ	wààbúù ɛ́ɛ́tìrɛ́	→ wààbúúꜜɛ́tìrɛ́	'Wambuu called'
	uu + aa → uua	wààbúù áányɔ̀nírɛ̀	→ wààbúúꜜányɔ̀nírɛ̀	'Wambuu saw me'
	uu + ɔɔ → uuɔ	wààbúù ɔ́ɔ́nìrɛ̀	→ wààbúúꜜɔ́nìrɛ̀	'Wambuu saw (something)'
	uu + oo → uuo	wààbúù óóréá	→ wààbúúòréá	'that Wambuu'

As shown in (44), the one combination we have found involving long *aa* with another V: is consistent with our analysis of the *aa*+V examples provided earlier in (38) (where *aa*+*e* ⟶ *aɛɛ*).

(44)	aa + ee → aɛɛ	báà ééréá → báɛ̀ɛ̀réá	'that dew'
		dàà ééréá → dáɛ̀ɛ̀réá	'that louse'

The derivation of *aa* + *ee* ⟶ *aɛɛ* is explained as in (45).

(45) Derivation of /baa eerea/ → baɛɛrea

Underlying form	baa eerea
Shortening of V+VV	baaerea
a+e → ɛɛ	baɛɛrea
Shortening of VV+V	N/A
Surface form	baɛɛrea

We have elicited two combinations of $V{:}_i$+$V{:}_i$ (identical long vowels) and in both cases the surface form is $V{:}_i$ (a single long vowel that does not sound 'overlong'), as in (46).

(46)	ɛɛ + ɛɛ → ɛɛ	mòðɛ́ɛ̀ ɛ́ɛ́tìrɛ́	→ mòðɛ́ꜜɛ́tìrɛ́	‘Mũthee called’
	oo + oo → oo	mòò óóréá	→ móòréá	‘that M. hildebrandtii tree’

This is as expected since we have rules that shorten a long vowel both before and after another vowel, so $V{:}_i$+$V{:}_i$ first changes to $V{:}_i$+V_i and then to V_i+V_i.

The only other V:+V: combinations we have found involve *ɛɛ* followed by another long vowel, shown in (47).

(47)	a.	ɛɛ + ɔɔ → eɔ	mòðɛ́ɛ̀ ɔ́ɔ́nìrɛ̀	→ mòðéꜜɔ́nìrɛ̀	‘Mũthee saw (something)’
	b.	ɛɛ + oo → eo	mòðɛ́ɛ̀ óóréá	→ mòðéòréá	‘that Mũthee’
	c.	ɛɛ + aa → ɛa	mòðɛ́ɛ̀ áányɔ̀nírɛ̀	→ mòðɛ́ꜜányɔ̀nírɛ̀	‘Mũthee saw me’

(47a) and (47b) are consistent with the behavior of all other types of combinations (V+V, V+V:, V:+V). The combination *ɛɛ+aa* (47c) behaves like *ɛɛ+a* in failing to undergo the raising (*ɛ+a* ⟶ *ea*) that applies when *ɛ* is underlyingly short (*ɛ+a*, *ɛ+aa*).

6 Conclusion

In this paper we have attempted to provide as comprehensive an analysis as possible of VHR effects in Kikuyu. A number of outstanding issues remain for future research.

First, we have not distinguished diphthongs from vowel sequences that cross a syllable boundary. We perceive that some VV sequences sound shorter than others, suggesting they may be tautosyllabic while others are in separate syllables. However, this is difficult to distinguish, and we have not identified a diagnostic for syllable membership.

Relatedly, we have not addressed the relationship of tone to VHR. Our transcriptions reflect some tone differences between careful and connected speech, but we have not made any claims here about underlying tones. Clements & Ford (1981a: 317-318) show how a rule of tonal absorption can be used to distinguish between lexical items ending in a diphthong vs. heterosyllabic V.V sequences when they have a final LH tone pattern, but we have not yet been able to adapt this or any other tonal diagnostic for use in derived VV sequences originating across a word or morpheme boundary.

One interesting aspect of our findings is the failure of long high vowels to undergo shortening, which may suggest that Kikuyu VHR is not motivated in general by a pressure to produce "optimal" diphthongs. In theory, a high front or back vowel, being "peripheral" in the vowel space, is an ideal start or end point for a diphthong since the accurate perception of a diphthong relies on there being sufficient distance between the two portions of the vowel. Therefore, it is perhaps unexpected that high vowels fail to shorten in order to form diphthongs when combined with other vowels.

Another matter of potential theoretical interest concerns the difference in outputs comparing V:+V sequences with V+V. In an OT account, the change of *εa* to *ea* cannot be straightforwardly driven by a markedness constraint like **εa* since [εa] is the correct output for *εε+a*. There would need to be a faithfulness constraint that preferentially protects the features of *εε* over those of *ε*. The analytical challenge is that this preferential faithfulness is not manifested across the board but only relative to certain VHR rules (e.g., *εε* does raise to *e* when it precedes *o* or *ɔ*). It is partly for this reason that we have opted to analyze the system in terms of ordered rules rather than giving a markedness-driven analysis.

Abbreviations

ATR	Advanced tongue root
C	Consonant
cl.	Noun class
GF	Glide formation
H	High tone
L	Low tone
μ	Mora
OT	Optimality Theory
rem.	Remote
SPE	Sound pattern of English
V	Vowel
V:	Long vowel
VHR	Vowel hiatus resolution

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Chapter 5

Town Nyanja verbal tonology

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This paper describes and analyzes the verbal tonology of Town Nyanja, spoken in Lusaka, Zambia. While closely related to Malawian Chichewa and Eastern Province Nyanja, Town Nyanja is shown to be critically different in several respects. First, unlike Chichewa, which still exhibits a tone contrast in verb roots, Town Nyanja has lost that underlying contrast. Second, while Chichewa is one of the Bantu languages which has some High-toned verbal extensions, Town Nyanja does not. Finally, it is shown that tonologically all verbs fall into three patterns, dictated by two factors: 1) the tense/aspect/mood/polarity (tamP), and 2) the presence (or absence) of an object marker. Depending on those two factors, a verb ends up with either one or two High tones in the macrostem. A melodic High tone is present in each verb, and all object markers have a floating H. It is shown that there are only 3 possible docking sites for these floating Hs: 1) the macrostem-initial tbu, 2) the stem-initial tbu, and 3) the penult. The tamP determines whether there is one or two docking sites for the floating tone(s) present. Where two sites are designated, it is shown that these need to be ranked or prioritized to account for the complex array of surface tones.

1 Introduction

Nyanja is one of Zambia's seven national languages. It has a very close historical and typological relationship with Chichewa. Guthrie (1967–1971) classified both Nyanja and Chichewa as N.31. Maho (2003) lists Chichewa as N.31a and Nyanja as N.31b. Ethnologue lists Chewa-Nyanja (ISO:nya) as a single entry. While excellent research, both tonal and non-tonal, has been published on some of the varieties of Malawian Chichewa/Nyanja, unfortunately such is not the case with

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Figure 1: Linguistic Map of Zambia (Ethnologue)

either the Nyanja spoken in Zambia's Eastern Province (area 23 on the map below, which borders Malawi), nor the variety of Nyanja spoken in Zambia's capital, Lusaka, often referred to as "Town Nyanja," the subject of this paper.[1] With regard to its status as an independent linguistic variety, we note that while certainly serving as a lingua franca (as do a number of other regional languages in Zambia), a large number of people in Lusaka speak Town Nyanja as a first language.

The goal of this paper is to provide an overview of the verbal tonology of Town Nyanja (TN), contrasting it at different points with its better-known cousin,

[1]The only paper I am aware of on this subject, as yet unpublished, is James (in preparation) which describes and analyzes the tone patterns of a number of TAMs in Town Nyanja.

Chichewa. The data I'll be presenting were elicited in Albany, NY from Ms. Mwaka Mauro-Nachilongo, a 43 year old native speaker of Town Nyanja. All data were recorded and transcribed by the author.

The language has five contrastive vowels as seen below.

Table 1: Town Nyanja Vowels

i		u
e		o
	a	

There is no underlying vowel length contrast (as is also true for Chichewa). Rather we find penultimate vowel lengthening at the right edges of phrases.

(1) a. mùù-ntù
Cl-person
'person'

b. mù-ntù mù-kúùlù
c1-person c1-big
'big person'

The consonant system is as given in the table below:

Table 2: Town Nyanja Consonants

	Bilabial	Labio-dental	Alveolar	Alveo-palatal	Velar	Glottal
Stops	p b		t d		k g	
Affricates				ch j		
Fricatives		v f	z s	sh		h
Nasals	m		n	ny	ng'	
Laterals			l			
Rhotics			r			
Glides	w			y		

We follow TN orthographic conventions in the presentation of the data where <ch> = [tʃ], <j> = [dʒ], <sh> = [ʃ], <ny> = [ɲ], <y> = [j], <ng'> = [ŋ], <r> = [ɾ].

We note here that Town Nyanja does not have some of the consonants found in Chichewa, viz. contrastive aspirated voiceless plosives, as well as alveolar affricates.

Attested tone/syllable types are given in (2).

(2) Tone Syllable Types

a.	Short-Low	Cà
b.	Short-High	Cá
c.	Long-Low	Càà
d.	Long-Falling	Cáà

High tones (including Long-Falling) can also be downstepped, indicated by a raised exclamation point.

With regard to the verbal morphology, we assume the structure below, common to many Bantu languages, and discussed in more detail in §5. The INFL position contains negative prefixes, subject markers (SM) and Tense/Aspect/Mood (TAM) prefixes. The macrostem contains the stem plus any object markers, while the stem contains the root, any derivational extensions and the final vowel.

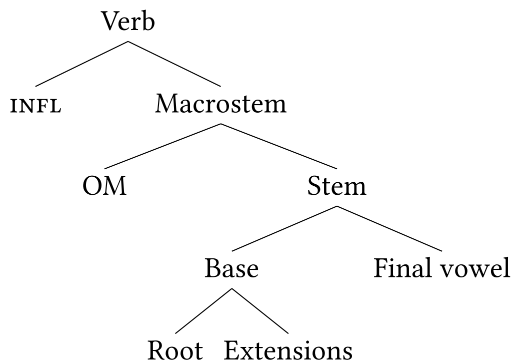


Figure 2: Morphological Structure of the Verb

2 Underlying tonal contrasts: comparison with Chichewa

Tone is underlyingly contrastive in Town Nyanja noun roots, as seen in the nominal minimal pairs in (3), where in each case one root has an underlying H on the initial Tone Bearing Unit (TBU) and the other is completely toneless.

(3) a. mù-tééngò ’tree’ /téngo/
b. mù-tèèngò ‘price’ /tengo/
c. kà-léèzà ‘razor’ /léza/
d. kà-lèèzà ‘lightning’ /leza/

With regard to verb roots, while Chichewa has an underlying tonal contrast, Town Nyanja does not. This can be seen in the examples below (all Chichewa data are drawn from Downing & Mtenje 2017).

(4) Chichewa Infinitives
a. kù-témbénùùz-à
INF-turn.over-FV
‘to turn over’ Cf. Town Nyanja kù-témbénùùz-à
b. kù-támbálààl-á
INF-stretch.legs-FV
‘to stretch legs’ Cf. Town Nyanja kù-támbálààl-à

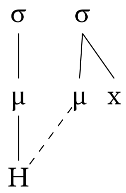
In the Chichewa infinitival forms above, a High tone sponsored by the /ku-/ prefix shifts onto the root-initial TBU and then undergoes a process of High tone Doubling. This is the only H in forms with toneless roots (4a). In forms with H-toned roots (4b), the root H ends up associating to the final syllable and retracting onto the penult (when the form is phrase-final). In Town Nyanja, however, there is but a single tone pattern in verbal infinitives, not two, and that pattern matches the one exhibited by verbs with toneless roots in Chichewa (4a). This is shown in the comparative forms in which the cognate roots of the Chichewa forms are found.

Tone Doubling, evident in the forms in (4) is a very productive process in Town Nyanja (as it is in Chichewa). Further evidence of this process can be seen in nouns when non-phrase final. While the underlying H on the penult will not undergo Tone Doubling in (3a,c) in phrase-final forms where the penult is long, it will double, as seen below in non-phrase-final forms where the target is a short vowel.

(5) a. mù-téngó ù-kúùlù ‘big tree’ /mu-téngo u-kúlu/
b. kà-lézá kà-kúùlù ‘price’ /ka-léza ka-kúlu/

A High tone doubles onto the following TBU when that following TBU is: 1) heteroyllabic, and the sole mora in its syllable. I.e. It fails to apply within a long vowel (accounting for the lack of Doubling in (3a,c) or onto a long vowel (to be illustrated further below)). This is formalized in (6).

(6) Tone Doubling



Let us now turn to verbal extensions. Chichewa is among those Bantu languages that have a tonal contrast in verbal extensions (Hyman & Mtenje 1999, Downing & Mtenje 2017). While most extensions are toneless, three are underlyingly High: intensive /-íts/, stative/passive /-ík/, reversive intransitive /-úk/.

All the Chichewa imperatives in (7) have toneless roots. The form in (7a) has a causative extension and the one in (7b) has a transitive extension, and each surfaces as all-Low. The forms in (7c) and (7d) with the same toneless roots contain the stative and reversive extensions respectively, which sponsor a High tone, ultimately being realized on the second TBU of the penult. In the infinitival forms in (8), one can see that the presence of the Intensive extension adds a second H tone to the form, also realized on the second mora of the penult.

(7)
a. thàndìz-ììts-à
help-CAUS-FV
'cause to help'

b. kàn-ùùl-à
separate-TRS-FV
'separate'

c. thàndìz-ìík-à
help-STAT-FV
'be able to be helped'

d. kàn-ùúk-à
separate-REV-FV
'be separated'

(8)
a. kù-fótókòòz-à
INF-explain-FV
'to explain'

b. kù-fótókòz-èéts-à
INF-explain-INT-FV
'to explain (intensive)'

A range of Town Nyanja infinitival forms with extensions are given below in (9)-(11).

(9)
a. kù-ségúl-ììl-à 'to open for'
b. kù-ségúl-ààn-à 'to open e.o.'
c. kù-ségúl-ììs-à 'to be opened'
d. kù-ségúl-ììs-à 'to open (intensive), to cause to open'

(10)
a. kù-chétékèl-ààn-à 'to trust e.o.'
b. kù-chétékèl-èèk-à 'to be trusted'
c. kù-chétékèl-èès-à 'to trust (intensive), to cause to trust'

(11)
a. kù-kán-ùùl-à 'to separate'
b. kù-kán-ùùk-à 'to be separated'
c. kù-nyám-ùùl-à 'to carry'
d. kù-nyám-ùùk-à 'to stand up, lift'
e. kù-pánd-ùùl-à 'to crack open'
f. kù-pánd-ùùk-à 'to be cracked open'

As noted above, all roots in the language are toneless. As is the case in Chichewa a High in the infinitive always appears on the stem-initial TBU and undergoes Doubling (cf. (8)). This is the only High tone that appears in all of the Town Nyanja infinitival forms, including those containing stative (9c), (10d), reversive (11b,d,f) or intensive (9d), (10c) extensions, the three extensions which contribute an additional High tone in Chichewa. In Chichewa, there are a number of tonal minimal pairs where one member contains the toneless Causative /-its/ extension and the other contains the H-toned Intensive /-íts/ extension, which surface as tonally distinct. In Town Nyanja, these pairs neutralize, surfacing as homophonous as all extensions are toneless (9c,d).

3 Tone in the TAM system

We now turn to describing and accounting for the attested tone patterns found in Town Nyanja verbs. Downing & Mtenje (2017) document 8 distinct tonal patterns in Chichewa main clause affirmative verbs. Main clause negative forms exhibit 4 patterns, and relatives exhibit 3 patterns. While the surface tone patterns are ultimately the result of a number of different factors, including the presence or absence of object markers and H-toned extensions, as well as multiple productive tonal rules, the main parameters which distinguish these 8 tonal patterns in Chichewa include the following:[2]

a. whether Subject Marker is H-toned or not

b. whether TAM prefix is: 1) toneless, 2) High, or 3) places a H on following TBU

c. Melodic High status: none, penult, fina

We will argue that Town Nyanja has 3 different patterns in main clause affirmative verbs. We define the patterns as being distinguished by where H tones are found within the macrostem, where the positions are confined to three locations (see Figure 2).[3]

(12) a. the macrostem-initial TBU
b. the stem-initial TBU
c. the penult

Given that all roots and extensions are toneless, we will argue below that there are only two sources of Hs within the TN macrostem: a) an Object Marker, and b) a Melodic High tone. While the H from an Object Marker is only present in forms with an Object Marker, we propose that a Melodic High is present in all verb forms. Thus, each verb will have either one or two Hs in the macrostem. We will see that the three Town Nyanja patterns differ according to where the tone or tones within the macrostem are realized, where again, possible docking sites are limited to the three positions listed in (12). We now exemplify each pattern.

3.1 Pattern 1

To illustrate the first pattern, we carefully examine verbal infinitives (a few of which were introduced above (9)-(11)). We consider verbs both with and without object markers. In (13), we present verbal infinitives without object markers, where the number of syllables in the stem varies from one to four. The left-hand column contains the phrase-final forms, exhibiting phrase-final lengthening (cf.

[2]The definition of and justification for the "Melodic High" is detailed immediately below in §3.1.

[3]We note that the domain on which the "patterns" are distinguished is the full verb in Downing & Mtenje's (2017) analysis of Chichewa, as a different tone in SMs and/or TAM prefixes can establish a new pattern. We have chosen to base "patterns" in TN on the tone sequences exhibited within the macrostem—the domain in Bantu which includes the stem and any preceding object (Figure 2). This will be explored and defended below in §5.

(1)), while the right-hand column presents the verbs in non-phrase-final form, each followed by the adverb *bwììnò* 'well'.

(13) Verbal infinitives (no object) ku-Base-a

a.	kúù-dy-à	e.	kú-dy-á bwììnò	'to eat (well)'
b.	kù-máàng-à	f.	kù-máng-á bwììnò	'to tie (well)'
c.	kù-máng-ììl-à	g.	kù-máng-íl-à bwììnò	'to tie for (well)'
d.	kù-chétékèèl-à	h.	kù-chétékèl-à bwììnò	'to trust (well)'

The verbs all have a High tone which generally surfaces on the first TBU of the stem, and undergoes Doubling, given the constraints on this process, as formalized in (6), which prevent it from applying within (13a,b) or onto (13c) a long vowel. When the stem is monosyllabic, the H is realized on the prefix /ku-/. This can be accounted for by assuming that the H docks on the initial TBU of the prosodic stem, which is minimally bisyllabic, forcing the infinitive prefix to be part of the prosodic stem just in case it's followed by a monosyllabic morphological stem (for more on the prosodic stem within Bantu, see, inter alia, Downing 1998, Downing 2006, Mkochi & Bickmore 2021).

The next question is to identify the underlying source of this H, which surfaces on the (macro-)stem-initial TBU (and undergoes Doubling). We propose this is a grammatical rather than a lexical High tone. As surveyed recently in Odden & Bickmore (2014) and Bickmore (forthcoming) Bantu tone languages show evidence of a grammatical tone, often referred to within Bantu as a "melodic" tone, whose presence and docking pattern is conditioned by various combinations of inflectional features in the verb (e.g. TAM, polarity, clause type, to name a few). While in many Bantu languages, certain bundles of inflectional features trigger the presence of a Melodic High, while others do not, in some it is argued to be present in every verb form (cf. Ebarb et al. 2014 analysis of Nyala West, and Bickmore & Mkochi 2018 analysis of Malawian CiTonga, the latter of which is fairly closely related to Chichewa/Nyanja). Thus, for the forms in (13) with no OM, we propose the sole H in the macrostem is the Melodic High, which docks onto the first TBU of the (macro-)stem, and then undergoes Doubling.

Below in (14), we consider the same 8 infinitival forms with an object marker.

(14) Verbal infinitives (with object) ku-Base-a

a. kù-chíì-dy-à

b. kù-bá-mààng-à

c. kù-bá-má!ng-íìl-à

d. kù-bá-chétèkéèl-à

e. kù-chí-dy-á bwììnò ‘to eat it (C7) (well)’
f. kù-bá-máng-à bwììnò ‘to tie them (well)’
g. kù-bá-má!ng-íl-á bwììnò ‘to tie for them (well)’
h. kù-bá-chétèkél-á bwììnò ‘to trust them (well)’

In (14c,d,g,h), we see the presence of a second High tone, realized on the penult. We propose that the additional High tone present in these forms is due to the presence of the OM, which always sponsors a H, which we suggest is floating. Given that, we propose that the URs for the non-phrase-final forms in (13h) and (13h) are as in (15a,b). The exact linear placement of the MH is not crucial to our analysis. It could be a segmentless tonal suffix, or even sponsored by the FV.

(15) a. ku-chetekel-a bwiino   b. ku-ba-chetekel-a bwiino   UR
H   H H

To account for the surface forms, we propose that there are two docking sites in the infinitive (and all Pattern 1 verbs): the macrostem-initial TBU and the penultimate TBU. To account for the forms in (13) without an OM (=(15a)), where the lone H surfaces on the macrostem-initial TBU, we propose that of the two docking sites in this pattern, the Macrostem is prioritized (ranked above) the Penult. I.e. if only one of the two docking sites can attract the H, it will be the macrostem-initial TBU. (Theoretical issues stemming from this analysis are taken up in §5.)

Turning to the forms with object markers in (14) (=(15b)), there are two High tones and two docking sites. Each docking site attracts a tone, after which Doubling occurs. This is illustrated derivationally below for (15a,b).

(16) a. ku-chetekel-a bwiino   b. ku-ba-chetekel-a bwiino   Float H Docking
| | |
H   H H

ku-chetekel-a bwiino   ku-ba-chetekel-a bwiino   Doubling
|/ |/ |/
H   H H

In (16a) the there is a single underlying floating H—the melodic H. While there are two docking sites associated with this TAM, the macrostem-initial one is prioritized over the penult and hence the H in this form docks onto the macrostem-initial TBU (and subsequently undergoes Doubling). Forms like this show that “extra” Hs are never added to a form just to ensure every docking site ends up being linked to a H.

In (14a,e) the two docking sites (macrostem-initial and penult) are one and the same tbu (/chi-/). We could assume that both dock onto this tbu or that once one does, the other cannot. For (14b,f), assuming the two Hs dock onto the OM (the macrostem-initial tbu) and the immediately following penultimate tbu, we propose that the rightmost of these two adject Highs delete (a fairly common process known as Meeussen's Rule in Bantu linguistics). The surviving H (on the OM) will then double in (14a/e). In (14f), we see that the rightmost H undergoes Doubling even though the syllable following the target is linked to a High tone, violating the ocp, ultimately resulting in a phonetic downstep. Here, I follow Odden (1982) proposal for Kishambaa in accounting for downsteps in languages such as Town Nyanja where the underlying distinction is H vs. Ø instead of H vs. L. In such cases a phonetic downstep results when two adjacent tbus are linked to different H autosegments. Other studies also employing this representation of downstep in Bantu languages include, inter alia, Bickmore & Kula (2013) for Bemba, and Bickmore & Mkochi (2018) for Malawian CiTonga.

There are a number of other tams (some affirmative, some negative) in Town Nyanja which exhibit macrostem tonal patterns identical to those presented above for the infinitives in (13) and (14). Below we show the non-phrase-final forms, with and without OMs, of verbs with four syllable stems to illustrate this. The morphological structure of the tam is given to the right of the tam name. An underlined sm indicates it is prelinked to a High tone (an issue pursued at greater length in §5).

(17) Potential sm-nga-(OM)-Base-a
a. tì-ngà-chétékèl-è 'we can trust'
b. tì-ngà-bá-chétèkél-é 'we can trust them'

(18) Subjunctive Itive sm-ka-(OM)-Base-e
a. tì-kà-chétékèl-è 'we should go and trust'
b. tì-kà-bá-chétèkél-é 'we should go and trust them'

(19) Progressive Habitual sm-ngo-(OM)-Base-a
a. tí-ngò-chétékèl-à 'we keep trusting'
b. tí-ngò-bá-chétèkél-á 'we keep trusting them'

(20) Present Continuous sm-ku-ngo-(OM)-Base-a
a. tí-kú-ngò-chétékèl-à 'we are continually trusting'
b. tí-kú-ngò-bá-chétèkél-á 'we are continually trusting them'

(21) Future Progressive sm-za-mbo-(OM)-Base-a
a. tí-zá-mbò-chétékèl-à 'we will be trusting'
b. tí-zá-mbò-bá-chétèkél-á 'we will be trusting them'

(22) Negative Prog Habitual sí-sm-ngo-(OM)-Base-a
a. sí-tí-ngò-chétékèl-è 'we don't keep trusting'
b. sí-tí-ngò-bá-chétèkél-é 'we don't keep trusting them'

(23) Negative Potential sí-sm-nga-(OM)-Base-a
a. sí-tí-ngà-chétékèl-è 'we can't trust'
b. sí-tí-ngà-bá-chétèkél-é 'we can't trust them'

(24) Negative Present Contin sí-sm-ku-ngo-(OM)-Base-a
a. sí-tí-kù-ngò-chétékèl-à 'we're not continually trusting'
b. sí-tí-kù-ngò-bá-chétèkél-á 'we're not continually trusting them'

(25) Neg Future Progressive sí-sm-za-mbo-(OM)-Base-a
a. sí-tí-zà-mbò-chétékèl-à 'we will not be trusting'
b. sí-tí-zà-mbò-bá-chétèkél-á 'we will not be trusting them'

One Pattern 1 tam that merits special discussion, as first documented in James (ms), is the Recent Past. The phrase-final and non-phrase-final forms are given below.

(26) Recent Past sm-a-(OM)-Base-a

a. t-áà-dy-à
b. t-à-máàng-à
c. t-à-máng-ììl-à
d. t-à-chétékèèl-à
e. t-à-dy-à chìì-ntù 'we just ate the things'
f. t-à-màng-à mùù-ntù 'we just tied the person'
g. t-à-màng-ìl-à mùù-ntù 'we just tied for the person'
h. t-à-chètèkèl-à mùù-ntù 'we just trusted the person'

(27) Cont.

a. t-à-chíì-dy-à
b. t-à-bá-mààng-à
c. t-à-bá-má!ng-íìl-à
d. t-à-bá-chétèkéèl-à

e.	t-à-chí-dy-á bwììnò	'we just ate it (c7) (well)'
f.	t-à-bá-máng-à bwììnò	'we just tied them (well)'
g.	t-à-bá-má!ng-íl-á bwììnò	'we just tied for them (well)'
h.	t-à-bá-chétèkél-á bwììnò	'we just trusted them (well)'

While the Recent Past forms with an OM (27), and those without an OM in phrase-final position (26a-d) have identical patterns to other Pattern 1 TAMS, forms without an OM in non-phrase-final position (26e-h) surface as all Low, in contrast to other Pattern 1 verbs where a High surfaces on the first two TBUs of the macrostem (cf. 13). This TAM, then, is simply exceptional in not generating (or docking) a MH in non-phrase-final forms with no OM. (See fn. 4 for a second exceptional case of this type.)

There are 3 additional TAMS, which I argue are also part of Pattern 1, even though their surface stem tone patterns are not identical to those of the infinitive and the TAMS in (17)-(25). To evaluate this claim, let us consider the tonology of the Remote Past, indicated by the H-toned prefix /ná-/. Below are phrase-final and non-phrase-final forms of Remote Past verbs with and without an OM, of varying stem lengths.

(28) Remote Past (no OM) SM-ná-Base-a

a.	tì-náà-dy-à	
b.	tì-ná-mààng-à	
c.	tì-ná-máng-ììl-à	
d.	tì-ná-chétèkèèl-à	
e.	tì-ná-dy-á bwììnò	'we ate (well)'
f.	tì-ná-máng-à bwììnò	'we tied (well)'
g.	tì-ná-máng-ìl-à bwììnò	'we tied for (well)'
h.	tì-ná-chétèkèl-à bwììnò	'we trusted (well)'

(29) Remote Past (w/ OM) SM-ná-OM-Base-a

a.	tì-ná-chìì-dy-à	
b.	tì-ná-bá-mààng-à	
c.	tì-ná-bá-màng-îìl-à	
d.	tì-ná-bá-chètèkéèl-à	
e.	tì-ná-chí-dy-à bwììnò	'we ate it (well)'
f.	tì-ná-bá-màng-à bwììnò	'we tied them (well)'
g.	tì-ná-bá-màng-íl-á bwììnò	'we tied for them (well)'
h.	tì-ná-bá-chètèkél-á bwììnò	'we trusted them (well)'

In the forms without an OM , there is a single surface H—the one on the tam prefix /ná-/, which undergoes Doubling. In (29) there are two surface Hs—one on the tam prefix and a second one, which docks onto the penult. One possible analysis of these forms would be to posit a new and separate pattern, where no MH is present, and the docking target is just the penult. But it's also possible to consider these to fall squarely within Pattern 1. Recall that Pattern 1 is characterized by two docking sites: the macrostem-initial tbu and the penult. Employing that analysis here, in forms without an OM (28), the Melodic High would dock onto the macrostem-initial tbu, which immediately follows the H-tone tam prefix. We have already noted evidence for Meeussen's Rule (motivated by (14b,f)) which deletes the second of two adjacent Hs. If we assume this rule applies both within the macrostem as well as across it, it will delete the H docked onto the macrostem, after which the H on the tam prefix will undergo Doubling, accounting for the surface patterns.

The forms in (29) can be straightforwardly analyzed as being part of Pattern 1 in the same way. In those forms there are two floating Hs in the macrostem, one from the OM and the other the MH. The one which docks onto the macrostem initial tbu will undergo Meeussen's Rule and the other will dock onto the penult.

Derivations for (28h) and (29h) are given below.

```
(30) a. ti-na-chetekel-a bwiino    b. ti-na-ba-chetekel-a  bwiino          UR
           |                            |
           H          H                 H  H          H
        ti-na-chetekel-a bwiino       ti-na-ba-chetekel-a bwiino     Docking
           |    |                       |  |          |
           H    H                       H  H          H
        ti-na-chetekel-a bwiino       ti-na-ba-chetekel-a bwiino     M's Rule
           |    |                       |  |          |
           H    H→ø                     H  H→ø        H
        ti-na-chetekel-a bwiino       ti-na-ba-chetekel-a bwiino     Doubling
           |/                           |/          |/
           H                            H           H
```

There are two other tams that have identical surface tone patterns as the Remote Past, which we propose are also part of Pattern 1. Like the Remote Past, each of these has a H linked to the tbu immediately preceding the macrostem, which induces Meeussen's Rule: the General Future where that pre-macrostem tbu is also a tam prefix (/zá-/), and the Present, which has a null tam prefix, but where the SM is High-toned. These are shown in (31) and (32). We adopt the pattern 1 analysis for these 3 TAMs as it is more parsimonious than setting up a new, distinct pattern.

(31) General Future sm-zá-(OM)-Base-a
a. tì-zá-chétèkèl-à 'we will trust'
b. tì-zá-bá-chètèkél-á 'we will trust them'

(32) Present sm-(OM)-Base-a
a. tí-chétèkèl-à 'we trust/are trusting'
b. tí-bá-chètèkél-á 'we trust/are trusting them'

3.2 Pattern 2

We now turn to Pattern 2. This pattern in exemplified by the Habitual, indicated by the toneless TAM prefix /ma-/. Below are phrase-final and non-phrase-final forms of Habitual verbs with no OM, of varying stem lengths.

(33) Habitual (no OM) sm-ma-Base-a
a. tí-máà-dy-à
b. tí-má-!máàng-à
c. tí-má-màng-íìl-à
d. tí-má-chètèkéèl-à
e. tí-má-dy-á bwììnò 'we eat (well)'
f. tí-má-!máng-á bwììnò 'we tie (well)'
g. tí-má-màng-íl-á bwììnò 'we tie for (well)'
h. tí-má-chètèkél-á bwììnò 'we trust (well)'

We see evidence of two Hs in these verbs. The first is linked to the SM, which is underlyingly H in this TAM. There is a second H which surfaces on the penult, which we ascribe to the Melodic High. Both Highs are subject to Doubling.

Below we present the same set of Habitual verbs containing an OM.

(34) Habitual (with object) sm-ma-OM-Base-a
a. tí-má-!chíì-dy-à
b. tí-má-bà-máàng-à
c. tí-má-bà-màng-íìl-à
d. tí-má-bà-chètèkéèl-à
e. tí-má-!chí-dy-á bwììnò 'we eat it (well)'
f. tí-má-bà-máng-á bwììnò 'we tie them (well)'
g. tí-má-bà-màng-íl-á bwììnò 'we tie for them (well)'
h. tí-má-bà-chètèkél-á bwììnò 'we trust them (well)'

In these forms with an OM, we find the same generalization: there is a H on the SM and a second one which docks onto the penult, after which both undergo Doubling. The URs of (33h) and (34h) are given in (40).

```
(35)  a. ti-ma-chetekel-a bwiino     b. ti-ma-ba-chetekel-a bwiino        UR
         |                              |
         H            H                 H    H        H
```

There is a MH in both forms, shown below the FV. In (40b) there is a second floating H, contributed by the OM. Unlike Pattern 1, which had two docking sites, we propose that this pattern has a single docking site: the penult. In each case the penult will attract a floating H, which then doubles. This is illustrated below.

```
(36)     ti-ma-chetekel-a bwiino        ti-ma-ba-chetekel-a bwiino   DOCKING
         |            |                 |              |
         H            H                 H    H         H
         ti-ma-chetekel-a bwiino        ti-ma-ba-chetekel-a bwiino   DOUBLING
         |/           |/                |/             |/
         H            H                 H    H         H
```

We note here for (36) that, just as noted for (14a,e), when there are two floating tones and a single docking site it is not in fact clear which of the two floating Hs will dock. Assuming a single H docks onto the penult, it is not clear if the other H remains floating or deletes. What is clear is that any remaining floating H has no tonal effect on the form.

The one form in this TAM which necessitates a bit of further discussion is (33e). The MH on our analysis docks onto the penult, which in this case is the TAM prefix /ma-/. Even though this docked H is immediately preceded by a H on the SM, it appears that the docked H in this case does not delete, as it undergoes Doubling onto the FV. We know from many studies that in a single language the Obligatory Contour Principle (OCP) can have demonstrably different effects in different morphological and prosodic domains (see, inter alia, Shona (Myers 1987) and Malawian CiTonga (Bickmore & Mkochi 2018)). For Town Nyanja, we propose that while Meeussen's Rule, as claimed above, operates within the macrostem (14b,f), and across the macrostem (28)-(29), it does not apply within the INFL domain (Figure 2). (The relevance of morphological domains in TN will be discussed in greater detail below in §5.)

Other TAMs which exhibit identical surface tone patterns as the Habitual are given below. We note here that while Pattern 2 contains the majority negative forms, it does not contain all of them (cf. (22)-(25)).[4,5]

(37) Temporal — SM-ka-(OM)-Base-a
a. tì-kà-chètèkél-á ‘when we trust’
b. tì-kà-bà-chètèkél-á ‘when we trust them’

(38) Remote Future — SM-zá-ka-(OM)-Base-a
a. tì-zá-ká-chètèkél-á ‘we will trust’
b. tì-zá-ká-bà-chètèkél-á ‘we will trust them’

(39) Imperative (no OM) — Root-a
chètèkél-á ‘trust!’

(40) Neg. Imperative — ó-sa-(OM)-Base-a
a. ó-sá-chètèkél-á ‘don’t trust’
b. ó-sá-bà-chètèkél-á ‘don’t trust them’

(41) Neg. Imperative Itive — ó-sa-ka-(OM)-Base-e
a. ó-sá-kà-chètèkél-é ‘don’t go and trust’
b. ó-sá-kà-bà-chètèkél-é ‘don’t go and trust them’

(42) Negative Infinitive — kú-sa-(OM)-Base-a
a. kú-sá-chètèkél-á ‘to not trust’
b. kú-sá-bà-chètèkél-á ‘to not trust them’

(43) Negative Remote Past — sí-SM-na-(OM)-Base-a
a. sí-tí-nà-chètèkél-é ‘we didn’t trust’
b. sí-tí-nà-bà-chètèkél-é ‘we didn’t trust them’

(44) Negative General Future — sí-SM-za-(OM)-Base-a
a. sí-tí-zà-chètèkél-á ‘we won’t trust’
b. sí-tí-zà-bà-chètèkél-á ‘we won’t trust them’

[4] There is one irregularity in the Imperative. Non-phrase-final bisyllabic imperatives surface as all-Low, instead of the expected High-High. E.g. máàng-à ‘tie!’, but màng-à bá-ànà ‘tie the children!’ (cf. chètèkél-á bá-ànà ‘trust the children’) See (26) for the other case in TN where the MH unexpectedly fails to link in a non-phrase-final verb.

[5] My consultant notes there is some speaker variation here, where the FV /-e/ is also acceptable.

(45) Negative Habitual sí-SM-ma-(OM)-Base-a
a. sí-tí-mà-chètèkél-á ‘we don’t trust’
b. sí-tí-mà-bà-chètèkél-á ‘we don’t trust them’

(46) Negative Remote Future sí-SM-za-ka-(OM)-Base-a
a. sí-tí-zà-kà-chètèkél-á ‘we won’t trust’
b. sí-tí-zà-kà-bà-chètèkél- ‘we won’t trust them’

(47) Negative Present sí-SM-(OM)-Base-a
a. sí-tí-chètèkél-á ‘we don’t trust’
b. sí-tí-bà-chètèkél-á- ‘we don’t trust them’

(48) Negative Subjunctive SM-sa-(OM)-Base-e
a. tí-sá-chètèkél-é ’you should not trust’
b. tí-sá-bà-chètèkél-é ‘you should not trust them’

(49) Neg. Subjunctive Itive SM-sa-ka-(OM)-Base-e
a. tí-sá-kà-chètèkél-é ‘you should not go and trust’
b.tí-sá-kà-bà-chètèkél-é ‘you should not go and trust them’

(50) Negative Temporal sí-SM-ka-(OM)-Base-e
a. sí-tí-kà-chètèkél-é ‘when we didn’t trust’
b. sí-tí-kà-bà-chètèkél-é ‘when we didn’t trust them’

3.3 Pattern 3

Finally, we turn to Pattern 3. This pattern in exemplified by the Subjunctive, which has a null prefix, and triggers the FV /-e/. Below are phrase-final and non-phrase-final forms of Subjunctive verbs with no OM, of varying stem lengths.

(51) Subjunctive (no OM) SM-Base-e

a.	tíì-dy-è	e.	tì-dy-é bwìinò	‘we eat (well)’
b.	tì-máàng-è	f.	tì-máng-é bwìinò	‘we tie (well)’
c.	tì-màng-íìl-è	g.	tì-màng-íl-é bwìinò	‘we tie for (well)’
d.	tì-chètèkéèl-è	h.	tì-chètèkél-é bwìinò	‘we trust (well)’

In these forms, we see a single H on the penult, which undergoes Doubling. The same verb forms with an OM are presented below. (Forms with five syllable stems are also given here to further illustrate the claims being made.)

(52) Subjunctive (w/ OM) SM-OM-Base-e

a.	tì-chíì-dy-è	
b.	tì-bà-máàng-è	
c.	tì-bà-máng-ììl-è	
d.	tì-bà-chété!kéèl-è	
e.	tì-bà-chétékèl-éès-è	
f.	tì-chí-dy-é bwììnò	'we eat it (well)'
g.	tì-bà-máng-é bwììnò	'we tie them (well)'
h.	tì-bà-máng-íl-è bwììnò	'we tie for them (well)'
i.	tì-bà-chété!kél-é bwììnò	'we trust them (well)'
j.	tì-bà-chétékèl-és-é bwììnò	'we trust them intens. (well)'

In the forms with an OM, we see evidence of two H tones in (52d,e,i,j): one on the stem-initial TBU (as contrasted with the macrostem-initial TBU seen in Pattern 1), and one on the penult, both of which undergo Doubling. We propose that the TAMs exhibiting pattern 3 have two docking sites—the penult and the stem-initial TBU—with the former being prioritized over the latter. Derivations of (51h) and (52i) are given below.

(53) a. ti-chetekel-e bwiino b. ti-ba-chetekel-e bwiino UR

H H H

ti-chetekel-e bwiino ti-ba-chetekel-e bwiino DOCKING

| | |

H H H

ti-chetekel-e bwiino ti-ba-chetekel-e bwiino DOUBLING

H H H

In (53a) there is a single underlying floating H—the melodic H. Parallel to our analysis of (16a), while there are two docking sites associated with this TAM, one (in this case the penult) is prioritized over the other (in this case the stem-initial one) and hence the H in this form docks onto the penult (and subsequently undergoes Doubling). In (53b) there are two underlying Hs and two docking sites. The two Hs dock and then undergo Doubling. In form (52c,h) we see another example where the second of two adjacent Hs (the one on the penult) will delete within a macrostem via Meeussen's Rule (cf. (14b,f)).

Two other TAMs exhibit the same tonology as the Subjunctive forms, and are shown below.

(54) Imperative Itive ka-(OM)-Base-e
a. kà-chètèkéèl-è ‘go and trust’
b. kà-bà-chété!kél-é ‘go and trust them’

(55) Imperative w/ OM OM-Base-e
bà-chété!kél-é ‘trust them’

4 Relative verb forms

Downing & Mtenje (2017) note that relative forms in Chichewa are sometimes, though not always, tonally different from their matrix clause counterparts. This is also true in Town Nyanja. We first illustrate the syntax of relative clauses. Consider the TN Habitual forms below.

(56) Bàà-ntù bá-má-chètèkél-á bá-ànà
c2-person c2.sm-tam-trust-fv c2-child
‘The people trust the children’

(57) Bà-ntù bà-méné bá-má-chètèkél-á bá-ànà
c2-person c2-rel c2.sm-tam-trust-fv c2-child
‘the people who trust the children’

(58) Bà-ntù b-éè bá-má-chètèkél-á bá-ànà
c2-person c2-rel c2.sm-tam-trust-fv c2-child
‘the people who trust the children’

(59) Bà-ntù bá-má-chètèkél-á bá-ànà
c2-person c2.sm-tam-trust-fv c2-child
‘the people who trust the children’

The form in (56) shows the verb in a matrix clause. The Habitual falls into Pattern 2, assigning a MH to the penult. The forms in (57)-(59) show three ways the relative can be expressed in TN. The phrase in (57) contains the relative root /-méne/ immediately preceding the verb, which agrees in class with the head of the phrase. The phrase in (58) contains the relative root /-e/, which also agrees with the phrasal head. In (59) we see that it is possible in TN to omit the relative word entirely (as is true in Chichewa). In all cases the relative verb itself (57)-(59) has the same morphological composition as the matrix form (56). In the particular example shown above, it turns out that the relative verb form seen in (57)-(59) is identical to the verb in the matrix phrase (56) (something true of many

Chichewa verbs). However, it should be noted that the entire relative phrase in (59) is not in fact homophonous with the matrix phrase. This is due to the fact that, as demonstrated above in (1), there is a productive process of penultimate lengthening that applies to phrase-final words. In Town Nyanja there is a phonological phrase break between a subject Determiner Phrase (DP) and a following matrix verb, but not between the head DP of a subject relative and the immediately following word (see Clemens & Bickmore 2021 for parallel behavior of prosodic phrase construction in Rutooro, a Ugandan Bantu language).

As we consider the broad range of Town Nyanja forms discussed above, the vast majority are similar to the affirmative Habitual forms presented above in (56)- (59) in that the tonal pattern of the matrix and relative forms are identical. Below we note those cases where there is some change in the tonology. These fall into two main groups. The first group consists of the Potential, a Pattern 1 verbs which has a subject marker which is underlyingly toneless in the matrix form, which becomes High in the corresponding relative forms.

(60) Potential
a. Bàà-ntù bà-ngà-chétékèl-è. ‘The people can trust.’
b. bà-ntù bá-ngà-chétékèl-è ‘the people who can trust’

The second group also contains Pattern 1 verbs with underlyingly toneless SMs. But in the relative counterparts of these verbs, the subject has a High tone, and there is a High on the penult. Thus these relatives are realized as Pattern 2.[6]

(61) Recent Past
a. Bàà-ntù b-à-chétékèl-à. ‘The people just trusted.’
b. bà-ntù b-á-chétèkél-á. ‘the people who just trusted’

(62) General Future
a. Bàà-ntù bà-zá-chétèkèl-à ‘The people will trust.’
b. bà-ntù bá-zá-chètèkél-á ‘the people who will trust’

(63) Past
a. Bàà-ntù bà-ná-chétèkèl-à ‘The people trusted.’
b. bà-ntù bá-ná-chètèkél-á ‘the people who trusted’

[6]Downing & Mtenje (2017) note that Chichewa has the same three possible outcomes for relative verbs: 1) no tone change, 2) changing the SM from Low to High, and 3) changing the SM from Low to High and adding a High to the penult.

In (61b) the High on the subject marker will be immediately followed by the MH assigned to the stem-initial TBU. Meeussen's Rule applies, deleting the second H, after which the H on the SM will undergo Doubling. In (62b) and (63b) there will be 3 consecutive adjacent Hs, on: the SM, the TAM Prefix and the stem-initial TBU. In these two cases both the second and third Hs delete via Meeussen's Rule, after which the H on the SM undergoes Doubling.

No Pattern 2 or 3 verbs change their tonology in relatives.

5 Summary and discussion

We have proposed that all Town Nyanja (matrix clause) verbs fall into one of three patterns, as outlined above. A central question for any analysis is: what are the sources of High tones within the verb. We propose that some High tones within the verb are pre-linked, while others are floating. In order to expound on this, as an aid to the reader we repeat here the morphological structure of the TN verb, first given in Figure 2.

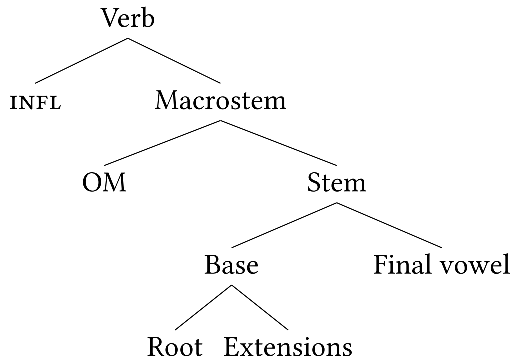


Figure 3: Morphological Structure of the Verb

We propose that within the INFL portion of the verb, i.e. the prefixes preceding the macrostem, morphemes contrast in terms of whether they are pre-linked to a High tone or are toneless.[7] Some TAMs are underlyingly High-toned (e.g. Remote past /ná-/ (28), (29); General Future /zá-/ (31)) while most others are toneless. In one case, the infinitive prefix exhibits lexical allomorphy, as it is toneless (/ku-/) in the affirmative ((13)-(14)), and High-toned (/kú-/) in the negative (42). The

[7] One possible exception here is the TAM prefixes /ngo-/ (19) which resists the tone Doubling of the H on the immediately preceding SM. One way to account for this would be to posit that this TAM prefixe is (exceptionally) linked to a L underlyingly.

negative prefix /sí-/ (always word-initial and followed by a SM) is High-toned (e.g. (43)-(47)), while the negative prefix /sa-/ (never word-initial) is toneless (e.g. (40)-(42)). As is the case in a number of Bantu languages, Subject Markers vary in their underlying tonality, depending on inflectional factors such as TAM and polarity (this is true in other N languages, such as Malawian CiTonga (Mkochi & Bickmore 2021), as well as Chichewa (Downing & Mtenje 2017)). In Town Nyanja, Subject Markers are generally toneless, but in a number of cases are underlyingly High (e.g. Progressive Habitual (19), Present Continuous (20), Future Progressive (21), Present (32), and the Habitual (33)), something which cannot be predicted on phonological grounds. We suggest this is accounted for via lexical allomorphy.

Let us now turn to the tonology within the macrostem. We presented three different patterns, summarized in Table 3. In the second column we note where H appears in forms without an OM. In the third column we note where the H or Hs appear in forms with on OM, where in one case there is a single docking site (Pattern 2), while in two cases (1,3) there are two docking sites. In the third column we summarize the analysis, where there is a ranking in the event of multiple docking sites.

Table 3: Summary of Town Nyanja verbal tone Patterns

Pattern	Hs in MS: No OM	Hs in MS: w/OM	Analysis
1	MS-init	MS-Init, Penult	MS-Init > Penult
2	Penult	Penult	Penult
3	Penult	Stem-Init, Penult	Penult > Stem-Init

Factors determining the surface tonology within the pattern depend on the TAM, the polarity, and the presence (or absence) of an object marker. We propose that unlike the INFL domain where the contrast is between TBUs linked to a H or being toneless, within the macrostem, High tones are underlyingly floating. They have only two sources. First, we propose that a Melodic High tone is present in all verb forms. (As noted above, formally this could be a tonal suffix or part of the final vowel.) Second, we propose that all object markers sponsor a floating High tone underlyingly.

The realization of melodic tones can be conceived as a two-part process, each of which is triggered by inflectional properties such as TAM, polarity, clause type, presence of OMs, just to name a few: 1) triggering the insertion/presence of one or more melodic tones into the verb, and 2) determining exactly how these melodic tones dock onto the TBUs comprising the verb (e.g. establishing one or more docking sites). Specifically for Town Nyanja, we propose that all verb forms have a Melodic High tone, but the particular combination of inflectional properties of the form determines the docking site (or sites). In Town Nyanja there are three such attested sites, where either one or two are specified for a particular verb: 1) the macrostem-initial TBU, 2) the stem-initial TBU and 3) the penult. Thus, for any verb form there are either one or two underlying floating Hs in the macrostem, and either one or two docking sites.

While it is not unusual to have some constellation of inflectional properties trigger multiple melodic tones in a language, in such cases each tone is generally assigned a distinct docking target. For example, in Kikuria some verbs trigger two MHs where one docks onto the first mora of the macrostem and the second docks onto the 4th mora (Marlo et al. 2014). In Emakhuwa, some verbs trigger two MHs where one docks onto the first mora of the macrostem and the second docks onto the third mora of the stem, while in other verbs the first of two MHs docks onto the second mora of the macrostem and the second docks onto the penult (Kisseberth & Guérois 2014). What we are positing for Town Nyanja is somewhat innovative, as we propose that when the inflectional properties trigger two docking sites, that they are ranked or prioritized.[8] Doing this allows positing just three patterns. An alternative, eschewing the prioritization/ranking of docking sites, would be to admit 6 different patterns. Under this scenario, e.g., an infinitive without any OM would be one pattern (specifying the macrostem-initial TBU as the docking site) and an infinitive with an OM would be a separate pattern (specifying both the macrostem-initial as well as the penult as docking targets). But under that alternative, it would be possible to have one set of TAMs with no OM target say the macrostem-initial TBU, and that same set of TAMs with an OM target just the penult, or the stem-initial TBU and the penult. The analysis proposed here predicts that within a given TAM/polarity, an attested target in forms without any OM is also always attested in forms with an OM.[9]

We conclude by noting two things. First, we do not claim that the TAM/Polarity combinations are equally distributed among the four patterns. As seen above

[8]In a co-phonology OT analysis of TN, e.g., there would be two constraints each demanding that some TBU be linked to a High, and those two constraints would be ranked. Kuria and Emakhuwa would presumably have similar constraints under a co-phonology OT approach, but there would just be no justification for ranking them as the number of targets always match the number of MHs present in the verb.

[9]The determination of the docking sites in TN is made in almost every case by just the TAM and polarity. The sole exception is the (affirmative) Imperative, where it falls into Pattern 2 when there is no OM (39), and Pattern 3 when there is an OM (55). We note that across Bantu the Imperative and Subjunctive often behave exceptionally vis-a-vis other TAMs with regard to melodic tone assignment. See, e.g. Meeussen (1962)

Patterns 1 and 2 are much more common than Pattern 3. Second, while affirmative forms can be found in all 3 patterns, negative forms are only found in patterns 1 and 2. Future research might shed light on how the TN patterns compare to other closely related languages and what set of diachronic changes could have produced this synchronic state of affairs.

Abbreviations

c	class number	om	object marker
cauS	causative	rel	relative
dp	determiner phrase	rvs	reversive
fv	final vowel	sm	subject marker
inf	infinitive	staT	stative
mh	melodic high	tbu	tone bearing unit
ocp	Obligatory Contour Principle	trs	transitive

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Chapter 6

Labial-velar to labial sound changes in Luto

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Proto-Sara-Bongo-Bagirmi labial plosives became labial fricatives (*P > F) in both the Nduga and Luto dialects of the Luto language. Subsequently, labial-velar plosives became labial plosives (*KP > P) in the Luto dialect, but were retained in the Nduga dialect.

This study adds to the growing literature on the labial-velar to labial change *KP > P (Cahill 2024 [this volume]). In addition, the occurrence of *P > F and the nonoccurrence of *KP > P in the Nduga dialect provides evidence that the chain shift was a pull chain rather than a push chain.

1 Introduction

In this paper I describe sound changes in Luto (ISO 639–3 code [ndy]), a language spoken in northern Central African Republic and southern Chad by approximately 19,000 speakers. *Ethnologue* (Eberhard et al. 2022) lists the language name and one dialect name as "Lutos." This spelling may have been the result of a misreading of Nougayrol (1990: 76). The standard autoglossonym is "Luto."

The Luto language is classified as part of the Sara-Bongo-Bagirmi (SBB) subgroup of Central Sudanic. *Ethnologue* lists five dialects: Luto (which is called Rito or Ruto in Chad), Nduga, Nduka, Wada, and Konga. In this paper, I'll examine the first two dialects: Luto and Nduga.

My research was conducted in Bangui, Central African Republic, during three visits from 2012 to 2017, for a total of about four weeks. I worked with a team of three speakers, who are fluent in both the Luto and Nduga dialects. Part of

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the research was done in collaboration with SIL members Paul Murrell and Brad Festen. Unless otherwise noted, the data in the paper are from our consulting sessions.

There is a modest amount of previous research on the Luto language. This includes *mémoires* by Moundo (1975) and Ndoko (1991), demographic information found in Nougayrol (1990), and a phonology sketch and wordlist by Olson (2013) and Olson & Ndocko-N'Doukoua (2013), respectively. A large amount of data on Luto is found in the comparative lexicon of the SBB languages by Boyeldieu et al. (2006) (and its accompanying article Boyeldieu (2006)). The lexicon provides extensive wordlist data for "Luto", "Nduga", "Ndoka", and "Wad". "Ndoka" and "Wad" are likely the same as what *Ethnologue* calls the Nduka and Wada dialects, respectively.

In § 2, I review the consonant systems of the Nduga and Luto dialects. In § 3, I discuss the recent set of labial-velar to labial sound changes in the Luto dialect. In § 4, I discuss an earlier process that changed Proto-SBB labial plosives to fricatives in both Nduga and Luto. In § 5, I discuss the two sets of sound changes and show that the interplay between them is likely a chain shift – specifically a pull chain – in which fricativization created a gap in the consonant system, which was consequently filled by the labial-velar to labial change, in order to maintain symmetry.

2 Consonants

The Nduga and Luto consonant systems are shown in Tables 1 and 2.[1] For the purposes of this paper, there are three key things to note. First, a set of three labial-velar plosives exists in Nduga, but they are absent in Luto. Second, the set of labial plosives is robust in Luto, but they are rare in Nduga. (Rarity is represented by parentheses.) Third, there is a robust set of labial fricatives in both dialects.

3 *KP > P (labial-velar to labial change)

The first set of sound changes examined here is the recent change of labial-velar plosives to corresponding labial plosives in the Luto dialect, as shown in Table 3. That is, *kp became /p/, *gb became /b/, and *ŋgb became /mb/. I call

[1] I use IPA transcriptions in this paper. Whether a narrow phonetic transcription of /ŋgb/ should be [ŋg͡b] or [ŋ͡mg͡b] is left for further research.

Table 1: Nduga consonant system

ɓ		ɗ					
(p)		t			k	kp	
(b)		d			g	gb	
(mb)		nd			ŋg	ŋgb	
	f	s					(h)
	v	z					
	mv	nz					
m		n	ɲ				
		r		ɽ			
		l					
w			j				

Table 2: Luto consonant system

ɓ		ɗ				
p		t			k	
b		d			g	
mb		nd			ŋg	
	f	s				(h)
	v	z				
	mv	nz				
m		n	ɲ			
		r		ɽ		
		l				
w			j			

these changes "recent," because the language consultants recognize that they have occurred within their lifetimes. The changes occurred with the entire series of labial-velar plosives: voiceless, voiced, and prenasalized. I capture this set by employing capital letters as an abbreviation. Hence, *KP > P includes the three changes.

The sound change set *KP > P is not found in general surveys of sound changes, such as Campbell (2004: 33–46). However, Cahill (2024 [this volume]) shows that these changes are common in Sub-Saharan Africa. These changes could perhaps be construed as lenitions, a category which includes among other things the change of two consonants to one (Campbell 2004: 44). However, the labial-velar plosives in Luto – as well as throughout Africa – are considered unitary

Table 3: Labial-velar to labial changes in the Luto dialect (*KP > P)

voicing	sound change
voiceless	*kp > p
voiced	*gb > b
prenasalized	*ŋgb > mb

phonemes. As a result, we are not dealing with the change of two consonants into one, but rather the change of a single consonant with two primary places of articulation (labial and velar) into another consonant with a single place of articulation (labial). As a result, the label "lenition" is not ideal in this case.

Labial-velar plosives still exist in Nduga. These labial-velars correspond to labial plosives in the Luto dialect. So, Nduga /kp/ corresponds with Luto /p/, Nduga /gb/ corresponds with Luto /b/, and Nduga /ŋgb/ corresponds with Luto /mb/, as shown in Table 4.

Table 4: Labial-velar : labial correspondences

Nduga		Luto
kp	:	p
gb	:	b
ŋgb	:	mb

Sample cognates that exemplify these three correspondences are given in Table 5.

The first row in Table 5 shows the correspondence kp : p in word-initial position. The word for 'poison' is [kpā.ɾù] (with a kp) in Nduga and [pā.ɾù] (with a p) in Luto. The fourth row shows the same correspondence in word-medial position: Nduga [tì.kpì] corresponds to Luto [tì.pì] 'intestines'.[2]

The second row shows the correspondence gb : b in word-initial position. Nduga [gbā.gū] corresponds with Luto [bā.gā] 'wing'. Note that there is also an unexplained difference of vowel quality in word-final position for this particular word. The fifth row shows the same correspondence word-medially: Nduga [nzì.gbò] corresponds with Luto [nzì.bò] 'to wash'.

[2]Word medial labial-velar plosives in monomorphemic words are common in SBB (Boyeldieu et al. 2006).

Table 5: Sample cognates that exemplify labial-velar : labial correspondences

posn.	corresp.	Nduga	Luto	gloss	< Proto SBB	
init.						
	kp : p	[kpā.ɾù]	[pā.ɾù]	‘poison’	—	
	gb : b	[gbā.gū]	[bā.gā]	‘wing’	*gb-G-, *a-ɔ	N/303
	ŋgb : mb	[ŋgbā.ɽā]	[mbā.ɽā]	‘assegai’	*ngb-ɭ-, *a-a	N/300
med.						
	kp : p	[tì.kpì]	[tì.pì]	‘intestines’	*t-kp-, *i-i	N/058
	gb : b	[nzì.gbò]	[nzì.bò]	‘to wash’	*?-gb-, *i-o	V/068
	ŋgb : mb	—	—	—	—	

Finally, the third row shows the correspondence ŋgb : mb word-initially: Nduga [ŋgbā.ɽā] corresponds with Luto [mbā.ɽā] ‘assegai’. I did not find this correspondence in word-medial position.

The SBB crosslinguistic lexicon (Boyeldieu et al. 2006) provides additional support for *KP > P. That resource posits Proto-SBB forms for four of the glosses in Table 5, as shown in the rightmost column. Of particular interest is the fact that all of the reconstructed forms include the labial-velar plosives instead of the labial plosives.

Boyeldieu et al. (2006) separate out the consonants and vowels in their reconstructed forms, and I’ve followed this practice for the forms I provide from their source. Sometimes they posit more than one set of reconstructed consonants or vowels for a given gloss. In those cases, I include the proto forms that most likely correspond to the data in Table 5. I also provide the reference number for each gloss.

Since we’re looking at labial-velar plosives, it would be appropriate to examine more closely both labial and velar plosives in the language.

As far as velar plosives are concerned, there is a robust number of them in both dialects. As a result, the correspondence sets k : k, g : g, and ŋg : ŋg are well-established. These are exemplified in Table 6.

The cognates in Table 6 are identical except for the tone in the first row: A high-low [ˊ ˋ] tonal pattern in Nduga corresponds to a high-superhigh [ˊ ˝] pattern in Luto. The correspondence between these two tonal patterns is regular.

As seen in the rightmost column, Boyeldieu et al. (2006) posit Proto-SBB forms for all of these words. This provides support that we are dealing with true cognates here, and that the velar plosives can be traced back to Proto-SBB.

Table 6: Velar plosive correspondences and sample cognates

posn.	corresp.	Nduga	Luto	gloss	< Proto SBB	
init.						
	k : k	[kú.lù]	[kú.lű]	‘charcoal’	*K-l-, *u-u	N/115
	g : g	[gā.zù]	[gā.zù]	‘horn’	*g-j-, *a-u	N/052
	ŋg : ŋg	[ŋgā.lā]	[ŋgā.lā]	‘heart’	*ng-l-, *a-ɔ ?	N/245
med.						
	k : k	[nzà.kà]	[nzà.kà]	‘cultivate’	*nɖ-k-, *a-a	V/354
	g : g	[kā.gā]	[kā.gā]	‘tree’	*k-g-, *a-a	N/199
	ŋg : ŋg	[kó.ŋgō]	[kó.ŋgō]	‘hill’	*k-Rng-, *O-O ?	N/166

In Table 7, we look at correspondences between labial plosives in the two dialects. It turns out that these sounds are quite rare in Nduga. As a result, I found only a very few cases of the correspondence sets p : p, b : b, and mb : mb in our data.

Table 7: Labial plosive correspondences

posn.	corresp.	Nduga	Luto	gloss	< Proto SBB	
init.						
	p : p	[pì.píī]	[pì.píī]	‘hot pepper’	—	
	b : b	[bá.ndà]	[bá.nda̋]	‘net’	*gb-nd-, *a-a	N/318
	mb : mb	[mbà.mbò]	[mbà.mbò]	‘hundred’	—	
med.						
	p : p	[pì.píī]	[pì.píī]	‘hot pepper’	—	
	b : b	—	—	—		
	mb : mb	[mbà.mbò]	[mbà.mbò]	‘hundred’	—	

Once again, the corresponding forms in Nduga and Luto are identical except for the same tone difference that we saw in Table 6 ([´ `] vs. [´ ˝]), which we see in the second row of Table 7.

Contrary to what we saw for velar plosives, however, only one of the words in Table 7 has a reconstructed form in Boyeldieu et al. (2006), and its form is unexpected: The reconstructed form of the word for ‘net’ has a labial-velar *gb instead of the expected labial *b. This suggests that the Nduga form of the word (which contains /b/) could be construed as an exception to the general gb : b correspondence seen in Tables 4 and 5 above.

The other words in Table 7 have not been traced back to Proto-SBB. This leads me to consider these to be likely the result of recent borrowing or innovation rather than being cognates.

4 *P > F (fricativization)

If labial-velar plosives have become labial in the Luto dialect, while labial plosives are rare in Nduga, what explains this state of affairs?

The SBB crosslinguistic lexicon (Boyeldieu et al. 2006) provides some clues to this. Looking at the data in that source, I was able to identify the set of sound changes shown in Table 8. Specifically, the three labial plosives found in Proto-SBB have become the corresponding labial fricatives in both Nduga and Luto. That is, Proto-SBB *p became /f/, *b became /v/, and *mb became /mv/.

Table 8: Proto-SBB to Nduga/Luto fricativization (*P > F)

voicing	sound change
voiceless	*p > f
voiced	*b > v
prenasalized	*mb > mv

Here we are dealing with fricativization (also called spirantization), which among other things can involve the change of a plosive to a fricative. This is a common change crosslinguistically (Campbell 2004: 45), although a prenasalized version is perhaps less well-known. Also, Proto-SBB lacked labial fricatives (Boyeldieu 2006), so the sound system was well-situated to accept this change.

Table 9 provides some sample data, taken from Boyeldieu et al. (2006). The transcriptions are from the original source, including y = IPA [j]. We see that fricativization has occurred in both Nduga and Luto. In addition, the changes are attested in both word-initial position and word-medial position.

The examples in Table 9 that concern the prenasalized stops provide perhaps the clearest cases. There, the cognates between Nduga and Luto are identical (except for one tone difference), and the sound change is regular.

Table 9: Sample forms that exemplify *P > F (Boyeldieu et al. 2006)

posn.	sd. chg.	Nduga	Luto	gloss	< Proto SBB	
init.						
	*p > f	fítī	fítī, fītī	'flower'	*p-t-, *i-i	N/767
	*b > v	vèlé	vɛ̀lɛ̄	'feather'	*b-l-, *E-E	N/148
	*mb > mv	mvīyá	mvíyà	'beard'	*mb-y-, *i-a	N/144
med.						
	*p > f	ūfà	—	'cut up'	*-p-, *u-a	V/131
	*b > v	ɗóvò	ɗóvò	'path, road'	*ɗ-b-, *O-O	N/255
	*mb > mv	kámvà	kámvà	'foliage'	*k-mb-, *a-a	N/129

5 Discussion

So, to review, we've seen that Proto-SBB labial plosives became labial fricatives (*P > F) in both the Nduga and Luto dialects. In addition, labial-velar plosives became labial plosives (*KP > P) in the Luto dialect, but labial-velar plosives were retained in the Nduga dialect.

These two sets of sound changes can account for the fact that labial plosives are rare in Nduga, as well as the fact that labial-velar plosives are absent in the Luto dialect.

Fricativization (*P > F) is well-established as a sound change crosslinguistically, and the labial-velar to labial change (*KP > P) is common in Sub-Saharan Africa, as mentioned in § 3. One question that arises then is this: What motivates the interplay of these processes in this particular case?

One common view would be to consider that these two changes make up a *chain shift* (Campbell 2004: 47–52). I suggest that we are dealing with a *pull chain*: *P > F created a gap in the consonant system that paved the way for *KP > P to fill in the gap.

In this view, the absence of labial plosives in the consonant inventory after the application of *P > F resulted in a somewhat asymmetric sound system, containing coronal and velar plosives but no labial ones. Pike (1947: 59) has noted that sound systems tend toward phonetic symmetry, so one could argue that the system began to look for a way to repair this asymmetry.

The second sound change, *KP > P, served to repair this gap, at the expense of the labial-velar plosives – three sounds that are less common crosslinguistically than the labial plosives. Hence, this produced a more symmetric and typologically common sound system – at least for the Luto dialect.

One of the implications of this analysis is that the extant Nduga consonant system is perhaps unstable, suggesting that it may be subject to readjustment in the future. We already see that a handful of words containing labial plosives has emerged in the language, probably from borrowing or innovation.

Instead of a pull chain, one could entertain the idea that the chain shift consisted of a *push chain*. In this view, *KP > P came first, encroaching on the labial plosives. In order to maintain semantic distinctions, the labial plosives then became fricatives, i.e. *P > F.

However, this interpretation does not account for the Nduga data. In that dialect the labial-velar plosives have been retained, and *P > F has occurred without pressure from a *KP > P change.

Table 10 exemplifies the ordering of the two sound changes in the Luto dialect for the words for 'feather' and 'intestine' (tones omitted). The ordering relationship between the two sound changes is one of *counterfeeding*. In the actual order, *P > F does not apply to Proto-SBB **tikpi* 'intestine'. However, if the two changes had occurred in the opposite order, *KP > P would have applied to **tikpi* resulting in *tipi*. This form meets the structural description of *P > F, which would have resulted in *tifi*. That is, *KP > P would have fed *P > F. But given the actual ordering of the sound changes, feeding does not occur.

Table 10: Counterfeeding ordering in the Luto dialect

	sound changes	'feather'	'intestine'
Proto-SBB		*bElE	*tikpi
*P > F	fricativization	vele	—
*KP > P	LV-to-L change	—	tipi
Extant forms		vele	tipi

Cahill (2024 [this volume]) notes that there are some languages that have a velar reflex of *KP, i.e. *KP > K. These are rare in comparison to *KP > P. Cahill presents an argument from speech perception for explaining the preponderance of *KP > P. As pointed out by Ladefoged & Maddieson (1996: 334–339, and references therein), in the production of labial-velar consonants, the labial articulation slightly lags the velar one. At the moment when the velar articulation is released, the labial articulation still holds, damping the acoustic energy of the velar release. Then, at the moment when the labial articulation is released, the rest of the oral cavity is already open, allowing for undamped acoustic energy. As a result, the labial release is the more prominent of the two. The moment of release is the most perceptually prominent part of the articulation of a plosive, so KP is more likely to be perceived as P than K. This could perhaps provide an additional motivation for why the change *KP > P occurred in Luto instead of *KP > K.

6 Conclusion

To conclude, we have seen that Proto-SBB labial plosives became labial fricatives (*P > F) in both the Nduga and Luto dialects of the Luto language. Subsequently, labial-velar plosives became labial plosives (*KP > P) exclusively in the Luto dialect of the language.

This study adds to the emerging evidence for the sound change set *KP > P (Cahill 2024 [this volume]). In addition, the presence of *P > F and the absence of *KP > P in the Nduga dialect provides evidence that the chain shift involved is a pull chain rather than a push chain.

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Chapter 7

Where do labial-velars go?

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The historical development of labial-velars, not being Indo-European, has not been addressed except for individual language families; larger cross-linguistic tendencies have gone largely unnoted. A survey of a larger sample reveals two common and clear tendencies of historical change. First is the "decay" into simple labials /p, b, m/, symbolically *KP > P. I propose this is due to the fact that the two articulations of KP are not precisely simultaneous; KP has a labial release. Second is the merger of voiceless /kp/ and voiced /gb/ into the voiced /gb/. Even the voiceless /kp/ often has phonetic characteristics commonly associated with voiced obstruents. These processes are thus both shown to have clear phonetic motivations.

1 Introduction

The term "labial-velars," as used in this paper, refers to the near-simultaneously doubly articulated sounds k͡p, g͡b, ŋ͡m and their modifications (often abbreviated KP here, with no tie-bars). In discussing the diachronic development of labial-velars, two major topics are the *origins* of labial-velars and the *changes* that labial-velars undergo. Here I focus on the latter – if a *KP undergoes regular sound change, what are the most common reflexes? Since labial-velars are only known in non-Indo-European languages, their development is not discussed in most historical linguistics books, with the notable exception of Dimmendaal 2011. So rather than discussions of labial-velars as a general type of sound, the attention to labial-velars in the literature is largely restricted to specific individual language families (e.g. Edoid in Elugbe 1989, Guang in Snider 1990, Northern Mande in Long 1971, Mande in Dwyer 1989, Lower Cross in Connell 1995), and

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larger cross-linguistic tendencies have gone largely unnoted, with the exception of some of Connell's work (e.g. Connell 1994), and more recently, areal considerations (Clements & Rialland 2008, Güldemann 2008, Idiatov & Van de Velde 2021).

Labial-velars exhibit two common and clear tendencies when they undergo regular sound change. First, / k͡p, g͡b, ŋ͡m/ simplify to the simple labials /p, b, m/, losing their velar component. Second, an independent tendency is that /kp/ and /gb/ not infrequently merge into the voiced counterpart /gb/. These are the most common sound changes that *KP undergoes, and will be discussed below. For each of these, relevant data will be presented from a number of languages and language families, and phonetic motivations for these patterns will be discussed. Most of the studies have been on African languages, where indeed the bulk of KP's are found, but we will show a similar case from the Pacific. Other less frequent cases will be mentioned briefly as well.

2 Labial-velars tend to have labial reflexes (*KP > P)

2.1 Data

Here are sample cases of reconstructed labial-velars yielding reflexes of plain labials.

Snider (1990: 50) notes the "clear innovation" of *kp > p in Coastal Guang. (For both Guang and the Lower Cross languages discussed below, /kp/ is the only labial-velar; there is no voiced or nasal counterpart.)

Connell (1991, 1994, 1995) notes that Proto-Lower-Cross (PLC) *kp has evolved most commonly into [p]. In a list of PLC languages in the table below, we see that only Ebughu, Enwang, and Okobo below don't have [kp]; in each of these it has been replaced by [p] (Connell 1991: 161) (Table 1).

The Kwa languages of Cote d'Ivoire and Ghana also illustrate the tendency to lose the velar portion, as Abron (a close kin of Akan) did in Table 2.

Reinforcing this, Dolphyne & Dakubu (1988: 62) note one sign of a split in central Volta-Comoé languages is that "Nzema-Anyi-Baule and Chakosi have /kp/ where Akan has /p/."

Williamson (2004), in a publication which has since been criticized, asserts Proto-Igboid had *kp, *gb, and the velar gesture eroded, leaving implosives in most Igboid languages, which correspond to plain labials in Bantu. "It thus appears likely that an earlier common proto-language had *gb, retained in PI but simplified to *b in Bantu and Akan." (2004: 436)

Table 1: Connell 1991: 200 (abbreviated list) Lower Cross languages

Gloss	bag	bone	leopard	die
Anaang	ɛ̀-kpàt	á-kpɔ́	ɛ́-kpè	kpá
Ebughu	è-pè	ɔ́-pɔ́	é-píè	pé
Efai	è-kpè	ɔ́-kpɔ́	ɛ́-kpǐ	kpá
Efik	è-kpàt	ɔ́-kpɔ́	ɛ́-kpè	kpá
Enwang	è-pè	ɔ́-pɔ́	é-pè	pá
Ibibio	è kpàt	á-kpɔ́	ɛ́-kpê	kpá
Iko	ɛ̀-kpà	´ ú-kúp	ɛ́-kpɛ̀	kpá
Obolo	à-kpà	ú-kúp	ɛ́-gbè	k^{w}ù / g^{w}ù
Okobo	è-pà	ɔ́-pɔ́	é-pǐ	pá
PLC	*e-kpàt	*ɔ́-kpɔ́	*é-kpè / i-	*kpá

Table 2: Kwa correspondences (Mensah 1983)

Abron	Agni (Anyi)	Baoulé	Nzema	
pám	kpá	kpá	kpá	coudre ‘stitch’
àpàràá	kpààlɛ́	kpàlɛ̄	–	pangolin
pɔ̀rɔ̀	kpɔ̀lɔ́	kplɔ̀	kpɔ̀lɔ̀	pourrir ‘rot’
pùsù	kpùsú	—	kpùsù	secouer ‘shake’

Table 3: Bantu b=PPAB *ɓ = PI *gb

	CB		Akan	PPAB	PI		Ekpeye	Owere	Onicha
64.	*=bʊ̋d-	‘break’, ‘smash’, ‘hit’, ‘kill’	-bʊrʊ	*-ɓʊlʊ	*-gbú	‘cut’, ‘hit’, ‘kill’	-gbú	-ɓú	-ɓú
	*-báb-	‘sting’			*-gbá		-gbá	-ɓá	-ɓá
	*-báŋgá	‘jaw’			*-gbȁ		à-gbà	à-g^{wh}ȁ, à-b^{h}ȁ	à-ɓà
	*-báŋg-	‘open up’			*-gbá̋á	‘open’	–	-ɓá	-ɓá

Ohiri-Aniche (2004) reconstructs *kp, *gb, *’kp, *’gb for “Pre-Lower Cross Igboid Yoruboid-Edoid.” Her *kp and *gb as well as the lenis *kp’ and *gb’ have labial-velar reflexes and labial ones in the daughter families, but no velars (2004: 412), with the single exception of a few g^{wh} cases in Igboid.

In Ikwere (Clements & Osu 2002), what is now written as <kp, gb>, in some dialects, including that of the second author, have no velar contact at all, but have a purely labial closure. They say “These sounds are reflexes of older labial-velar stops, and may still have labial-velar realizations in some varieties of Ikwere. However, in the variety described here, they are realized as bilabial sounds with no velar contact at any point in their production. We transcribe them as [b̟] and [’b̟], respectively.” (2002: 314)

Nasal as well as stop labial-velars can undergo this sound change. In his reconstruction and study of Proto-Yoruba-Igala, Silverstein (1973) reconstructs */ŋm/as a proto-segment which changed to /m/ not only in Yoruba, but also in several dialects of Igala.

Olson (2024 [this volume]) demonstrates a recent set of sound changes where the Luto dialect of Lutos has changed all its labial-velars to plain labials Table 4.

Table 4: Sample cognates

Nduga dialect	Luto dialect	gloss
[kpā.ɾù]	[pā.ɾù]	‘poison’
[gbā.gū]	[bā.gā]	‘wing’
[ŋgbā.ɽā]	[mbā.ɽā]	‘assegai (spear)’

Turner (1974) notes several cases of KP in African languages having labial reflexes in the North America Creole Gullah. For example, Mende *gbalɛma* > Gullah *balɛma* ‘a sore, ulcer’, Yoruba *gbewa* > Gullah *bewa* ‘to put on,’ Yoruba *akparo* > Gullah *aparo* ‘bush fowl, quail,’ Yoruba *arukpɛ* > Gullah *arupɛ* ‘dwarf’, and Yoruba *ikpete* > Gullah *ipete* ‘intention.’

A few of these, such as Williamson’s proposal, have been noted as somewhat controversial, but the prevailing crosslinguistic tendency is clear. Some languages have been reported to have K or other sounds as a reflex of KP (e.g. Boyeldieu 2006 posits Central Sudanic *KP having reflexes of kp, k, p, etc., depending on the language); these are distinctly in the minority. In some cases, this reflex could be due to sociolinguistic pressures. Sometimes the direction of a putative *KP > K change is open to alternate interpretations: which is actually the proto-segment?

For the languages considered in this section, the question also naturally arises as to the direction of the sound change. Is it *KP > P or *P > KP? Though there are proposals of labials giving rise to labial-velars (e.g. Demolin 1995 noting the development of /gb/ from /ɓ/), these are a minority. For the languages considered here, which are by far the more prevalent pattern, a general change of *P > KP would require a specific environment for some, but not all, cases of *P to change, since /p/ does occur in these languages, and such conditioning is absent. By contrast, conditions for the change *KP > P are present and we turn now to these.

2.2 Motivation for change – why a labial reflex, not velar?

/k͡p/ is usually written in the linear order [kp] and not [pk]. This is no accident; the labial component slightly trails the velar one, producing a distinctively labial release. A labial release is supported by spectrograms from a multiplicity of languages, including Dedua (PNG) and Efik (Ladefoged & Maddieson 1996) as well as Ibibio in Figure 1.

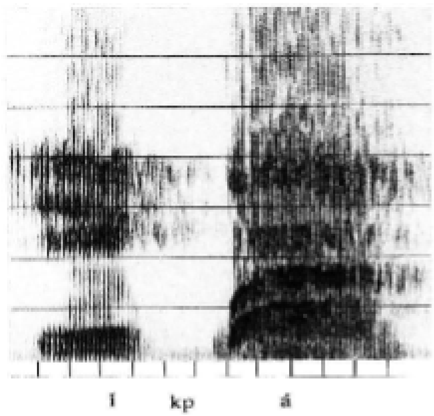

Figure 1: Ibibio – Connell 1994. Note the “velar pinch” of F2 & F3 going into the [kp], and steep F1 & F2 transition out of the [kp].

This is also supported by electromagnetic articulography from Ewe (Maddieson 1993) (Figure 2).

The *release* of a consonant is more salient to the hearer than the onset; so a KP is more likely to be perceived as P than K (noted as far back as Westermann & Ward 1933). What is perceived is what is pronounced, and so *KP > P.

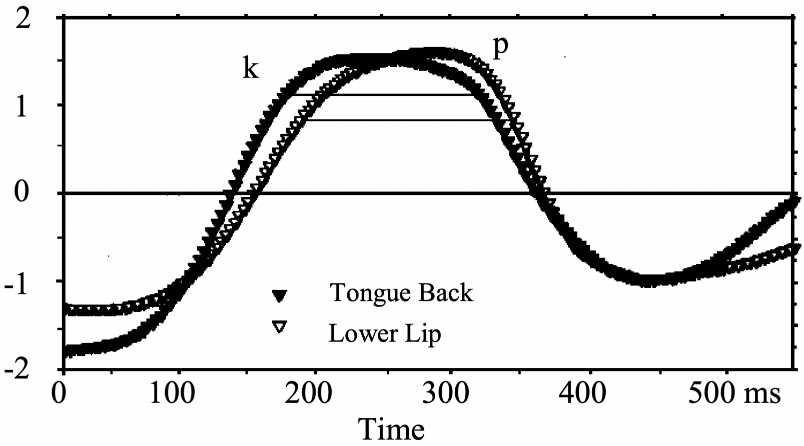

Figure 2: Coordination of lower lip and tongue back moveements in the Ewe word *akpa*. Y-axis is vertical displacement; horizontal lines indicate the likely duration of actual contact of the articulator.

3 Labial-velars /kp/ and /gb/ often merge to the voiced /gb/

3.1 Data

In the clear majority of cases, when *kp and *gb merge into one reflex, the result is synchronic /gb/, not /kp/ (Cahill 2008). This is somewhat surprising, since typologically, a language is more likely to have a voiceless series of stops than a voiced series (Maddieson 2013). Cahill 2008 lists 29 languages which have /gb/ but not /kp/. The mere absence of /kp/ in current languages, of course, does not guarantee that it was in the proto-language. However, the families of the languages below have either been specifically reconstructed with both *kp and *gb, or the bulk of the languages in the family have both /kp/ and /gb/, rendering reconstruction with *kp and *gb quite plausible. A sample is shown in (1), including one language from outside Africa:

(1)	Jiru (Jukunoid [jrr])	p/b, t/d, k/g, -/gb	(Shimizu 1971)
	Kar (Senufo [xrb])	p/b, t/d, k/g, -/gb	(Wichser 1994)
	Manya (W. Mande [mzj])	p/b, t/ᶑ, k/g, -/gb	(Manessy 1964)
	W. Sisaala (S. Gur [ssl])	p/b, t/d, k/g, -/gb	(Moran 2006)
	Tepo (W. Kru [ted])	p/b, t/d, k/g, -/gb	(Thalmann 1980)
	Ono (W. Huon, PNG [ons])	p/b, t/d, k/g, -/gb	(Phinnemore 1985)

Languages with only /k͡p/ but no /gb/ do exist, but thus far in my investigations, such languages always have other related gaps in the segmental inventory. This suggests strongly that the reason for the lack of /g͡b/ is because it never developed, or that there was a simultaneous historical devoicing of all stops having a velar component (Cahill 2008).

3.2 Motivation for change – why voicing?

Several phonetic details of the pronunciation of a typical /kp/ are also those which are more typically characteristic of voiced rather than voiceless stops. Here I list three; further research may uncover more, but these are well-established.

The first similarity of a /kp/ to a /gb/ is that typically, /kp/ is either unaspirated or has a distinctively shorter VOT than the other voiceless stops in the language. Some particular examples:

- Smith (1967) reports aspiration on all voiceless stops in Nupe [nup] except labial-velars, which he specifically states are unaspirated.
- In Konkomba [xon] (Steele & Weed 1966), Vagala [vag] (Crouch & Smiles 1966), Tampulma [tpm] (Bergman et al. 1969), Kusaal [kus] (Spratt & Spratt 1968), Nafaara [nfr] (Jordan 1980), Dilo [ntr] (Jones 1987) and Sisaala-Pasaale [sig] (Toupin 1995), /kp/ alone among voiceless stops is not aspirated.
- Phwien [pug] has a phonemic contrast between aspirated and unaspirated voiceless stops (p, t, c, k), with the exception of the labial-velar stop (K. Warfel, pc).
- Gangam [gng] (Dye) has aspiration on all voiceless stops except for labial-velars (Reimer 2020).
- The Lɔɔma [lom] /kp/ is specifically noted as unaspirated, while other stops are labeled aspirated (Sadler 2006: 12-14).
- In Kɔnni [kma], "voiceless stops are generally lightly aspirated, except for the labial-velar [kp], which is unaspirated." This is illustrated by wave forms (Cahill 2007).
- Westermann & Ward (1933: 58) in talking about African labial-velars, state flatly that "There is no aspiration in kp."

The second similarity of /kp/ to voiced stops is that /kp/ often has an ingressive air mechanism (implosion), which typologically is much more common with voiced stops.

- Ladefoged (1968) notes three mechanisms for producing labial-velars, two of which involve ingression (31 of 33 languages).
- Labial-velars in the Tyebaara dialect of Senufo [sef] are pronounced “with noticeable suction in the oral cavity, and with a pop upon release.” (Mills 1984).
- Dan (Santa) [dnj] is described as having “bilabial implosion” for /gb/ and “strong bilabial implosion for /kp/ (Bearth & Zemp 1967).
- Engenni [enn] /kp/ and /gb/ are specifically listed as “ingressive,” in contrast to the other “egressive” stops (Thomas 1978).
- Wilhoit (1999) labels /kp/ and /gb/ as “implosive” in Loma [lom].
- Labial-velars are not implosive in all languages, however. Besides Ladefoged’s notes above, Painter (1970) specifically notes that Gonja [gjn] has a simple pulmonic airstream. Kɔnni also has a simple pulmonic airstream for labial-velars (Cahill 2007).
- Ega [ega] evidently has both; it is, quite unusually, reported as having a contrast between implosive and non-implosive voiced labial-velars, symbolized as /g͡b/ and /g͡ɓ/ (Connell et al. 2002).

The third similarity of /kp/ to /gb/ is that there is often partial voicing even of the “voiceless” /kp/. This is similar to the lack of aspiration (both relate to VOT), but with some crucial differences. First, the languages noted here have an actual *negative* value of VOT, not just a zero VOT. Next, some of the world’s languages, such as Thai and some Indian languages, contrast voiceless aspirated stops, unaspirated stops, and voiced stops; in these, there is a *categorical difference* between an essentially zero VOT and a negative VOT. So these can be regarded as distinct phenomena. Finally, partial voicing can also occur at the *left* edge of the stop, a continuation of voicing from a preceding vowel into the stop (“voicing tail”) – which simple stops generally lack (Connell 1994 and references therein, Shryock, Ladefoged & Williamson 1996). Some specific cases of partial voicing of /kp include the following.

- Connell (1994) reports on specific voice onset times for phonemically voiceless stops in Ibibio, with average VOTs of +6 ms for /p/, +21 ms for /k/, but −26 ms for /k͡p/.

- Olson (2005: 141) measured VOTs for Mono [mnh] as +10.2 ms for /p/, +27.6 ms for /k/, but −10.0 ms for /k͡p/.
- Rolle (2013) measured VOT for Urhobo [urh] voiceless stops. /p/ was slightly aspirated (13–36 ms), as were /t/ (60–100 ms) and /k/ (45–66 ms), but /kp/ actually had negative VOT (-18 to -109 ms).
- Shryock et al. (1996) note that /kp/ in Defaka [afn] has the onset of voicing prior to its release, similar to that of /b/ in English.
- Innes (1964) notes specifically that in Loko [lok], the voiceless counterpart of /gb/ is "initially voiceless, but with slight voicing finally," and even transcribes this as /kb/.

In summary, these three phonetic tendencies – lack of aspiration, ingression, and negative VOT – are characteristics which would nudge a proto-sound *kp toward a reflex that is categorically voiced.

4 Both labial and voiced reflexes

These two tendencies are both concretely illustrated in the development of Supyire (Gur, Senufo subgroup). Supyire has no labial-velar stops, unlike most Senufo languages (Carlson 1994). The labial-velar stops in northern Senufo languages (Cebaara in the table in (2)) first merged *kp and *gb into /gb/ (e.g. Sucite and Shenara in Garber 1987), then Supyire changed this /gb/ to /b/.

(2)	Cebaara	Shenara	Sucite	Supyire	gloss
	kpāʔā	gbaʔa	gbāxā	bāgā	'house'
	gbāʔālāgà	gbaʔalaga	—	bàhàgà	'bedbug'

Correspondingly, the Supyire /b/ is disproportionately common, the results of combining the frequencies of words with *b, *gb, and *kp.

Mande languages offer another possible example of both patterns. In Table 5, we see the correspondence k͡p ~ g͡b in the left five columns, and the correspondence g͡b ~ b in the right two columns.[1]

In Table 5, Vai and Ligbi alone have k͡p, and most of the other languages have corresponding g͡b. (Kurankɔ, Kɔnɔ, and Wasulunka also have other correspondences with 'skin.')

[1]A reviewer has noted that some of the cognates here may be false correspondences, e.g. Vai *kpala* and Ligbi *gbarɛ* because of the l/r disconnect, and some or all of the gb/b matches for 'all.'

Table 5: Northern Mande (Long 1971, re-ordered)

Language	'skin'	'hit'	'white'	'hot'	'big'	'all'	'cry'
Ligbi	-kpolo-	—	kpiɛ	—	gbon-	gbo	gbarɛ
Vai	kpolo	kpasi	kpɛi	kpandile	—	gbi	kpala
Kɔnɔ	boo	gbasi	gbɛ	gban	—	gbɛ	gbai
Kurankɔ	bole	gbɛsi	gbɛ	—	—	—	gba-
Maninka	gbolo	gbasi	gbɛ	—	bon	bɛɛ	—
Wasulunka	golo	gbɛsɛ	gbɛ	—	bo	bɛ	—
Konyanka	gbolo	gbasi	gbɛ	gban	—	bɛ	—
Marka	gboo	gbasi	gba-ni	gban	bo	ba	—

Connell (1995: 60) also discusses Proto-Lower Cross *kp > Usaghade [usk] /b/.

Most KPs are found in Africa, but there appear to be similar historical processes at work in the Pacific. On first glance, both of the main processes discussed here could have happened in the Solomon Islands language of Owa and the related languages of Malaita Province. Owa [stn] has a /gb/ where cognate words in the Malaita languages have /p/ (Greg Mellow, pc). For example, we see /gb/ and /p/ in cognate words in Owa and the Are'are [alu] language of South Malaita (data from Ron Gebauer, pc):

(3)	Owa'	Are'are	gloss
	gbotagia	potaria	'break'
	gbore	pore	'stare'
	gboo	poo	'pig'
	gbiu	piu	'dumb/stupid'
	gbauna	pauna	'head'
	gbahegbahe	pahe	'walk' (Owa form means 'play-walk')

At first glance, a proto-form of *kp could account for these, invoking both the processes previously discussed. If so, then in Owa, *kp > gb, and in the Malaita languages, *kp > p. However, a fuller picture emerges when we note that 'Are'are has no voiced stops in its consonantal inventory (Roxanne Gebauer, pc, also Naitoro 2013); all voiced stops became voiceless at some point in its history. This raises the probability of only *gb being present even in the proto-inventory (no *kp), with 'Are'are undergoing the sound changes *gb > b > p (or possibly *gb > kp > p), and Owa remaining unchanged. More research is needed into the comparative phonologies of languages of the area.

5 Other

The patterns highlighted here are not universal. Dimmendaal (2019: 150), for example, briefly states that labial-velars, present in Katla [kcr], have become labialized velar stops in the closely related Tima [tms] (*gb > *g(w) > k(w)). /g/ is very rare (http://tima-dictionary.mine.nu) even though /b, d/ are common.

(4)

Katla	Tima	gloss
gb-ɘlana	kɘ̀-lááné̤	‘elder’
gb-àjàŋ	k-àràŋ	‘leopard’
g-û	k-úù	‘dog’
g-ʊ́nʊ̂	k-ɔ́nɔ̀	‘ear’

Patterns like these, though they exist and should be accounted for in a more detailed look at historical reconstructions, are again, definitely in the minority.

6 Summary

These patterns (*KP > P and *kp > gb) are not the only reflexes of *KP, but they are by far the most common, and are perhaps the most amenable to systematic explanations. Both patterns connect to phonetic explanations, especially to perceptual ones:

- *KP > P because the labial gesture lags and is more perceptible than the velar gesture.
- *kp > gb because even a “voiceless” /kp/ often has characteristics commonly found in voiced stops.

It’s helpful when researchers note the phonetic details that I’ve alluded to above. But many do not. There is usually a chart of phonemes, which is valuable, but it would be even more valuable if phonetic details like aspiration and implosion were noted, even measured. For example, if the airstream mechanism were more commonly noted, its effect on historical development could be clarified, even quantified.

This paper has focused on the basic three labial-velars: /kp, gb, ŋm/. However, other variants exist, such as prenasalized labial-velars, and fortis and lenis labial-velars. As usual, there is more to investigate.

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Chapter 8

On the syntax-prosody interface in Wushi (Babessi): Tone pattern, dissimilation and spreading

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The interaction between syntax and prosody has been widely studied for Narrow Bantu languages, but quite less for Bantoid languages. Yet, the syntax-prosody interface informs us on significant principles underlying the organisation of language systems. In the light of Match Theory (Selkirk 2011), in this paper we analyze the syntax-prosody interface of Wushi, an under-documented Ring Grassfields Bantu language. We identify and discuss two major processes characterizing it: tone dissimilation and tone spreading.

1 Introduction

One of the essential arguments of the prosodic structure theory is the independence of phonological domain structure from the syntactic structure (Selkirk 2011: 440). In other words, there is no inherent relation between prosodic category types found in phonological representation and the category types of syntactic representation (ibid. 436), which each have distinct properties. However, Match Theory (Selkirk 2011), claims that "in the ideal case, the grammar allows the fundamental syntactic distinctions between clause, phrase, and word to be reflected in, and retrieved from, the phonological representation". This means that prosodic domains mirror syntactic constituents, at least *ideally*, although several cases of mismatches are attested in languages. This non-isomorphism between prosodic domains and syntactic constituents are generally due to the high

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ranking of phonological markedness constraints on prosodic structure which are peculiar to each language.

The study of the syntax-prosody interface has attracted increasing interest among linguists and bantuists in particular. We can mention Cheng & Downing (2007) on Zulu, Hyman & Katamba (2010) on Luganda, Selkirk (2011) on Xitsonga, and Kula & Bickmore (2015) on Bemba, to name a few works on Narrow Bantu languages. On the other hand, as for Bantoid and Grassfields Bantu in particular, studies of the syntax-prosody interface are still rudimentary. This paper provides a description and an analysis of the interaction between syntax and prosody in Wushi, a Ring Grassfields Bantu language of Cameroon. Based on Match Theory, we will focus on simple indicative sentences and modal constructions expressing possibility, which seem to be most significant for this study. We begin by presenting lexical tones in Wushi in §2. Then, in §3 we examine indicative and subjunctive clauses, and more specifically, how prosodic domains interact with syntactic constituents, how well Match constraints are met and which language-specific constraints violate them. The question is also raised as to whether it is not rather the prosodic structure that determines the syntactic constituency in Wushi.

2 The lexical tone system

First of all, it should be noted that we distinguish between (individual) tones and tone patterns. Tone patterns are those associated with morphemes, nominal or verbal, in their underlying representation (UR), and they may vary on the surface.

Underlyingly, Wushi has four tones: two level tones H (high) and L (low) inherited from the proto language – they were reconstructed for Proto-Grassfields (Watters 2003: 236) – and two contour tones that were phonologized in the language, LH (rising) and HL (falling). Surface tones are H, L, M (mid), HL (falling), LH (rising), and HM, plus downstepped ꜜH, ꜜM and ꜜHM. As for tone patterns, I identify two categories: simple tone patterns and complex tone patterns.

2.1 Simple tone patterns

Simple tone patterns consist of only associated tones, i.e., they do not contain any floating tone. They are H, L, HL, and LH. Table 1 provides some examples.

The nouns in the table belong to classes with a zero affix (class 1 for 'chief' and 'man', class 3 for 'wood' and 'potato'). But even with nouns taking an affix, the tone patterns do not change; this is because tone patterns concern noun roots,

Table 1: Simple tone patterns

Tone	UR	SR	Gloss
H	ŋká	ŋká	wood
L	fùà	fùà	chief
HL	mbɔ̂	mbɔ̂	man
LH	ntǎ	ntǎ	potato

not including affixes which are underlyingly toneless and copy their tone from the noun root. Assuming toneless noun class affixes differs from the analysis generally adopted for other Grassfields languages which is that tone on noun class affixes is high (Hyman 1980a, Akumbu & Chibaka 2012). Also, the realization of tone patterns may vary on the surface, depending on the tonal environment. The sentences in (1) and (2) illustrate this with the nouns *fùà* 'chief' and *ŋká* 'wood'.

(1) fùá wɔ́ dʒʉ̀ː
fùà wɔ́ dʒʉ̀
chief POT come
'Will the chief come?'

(2) mbɔ̀ mɛ̂ ndǒ ŋkâʔ mɛ̂
mbɔ̂ mɛ̂ ndò ŋká mɛ̂
man DET bite wood DET
'The rat bit the wood.'

In sentence (1), the second mora of the diphthong in *fùà* 'chief' assimilates the high tone of the potential marker and becomes high. This is a general rule in the language, that the closest mora to the potential marker assimilates its tone. The mora is the tone bearing unit in the language. Concerning interrogative sentences, they always end in a L tone. As a matter of fact, when the syntax remains SVO, what indicates the interrogative 'force' of the sentence in the absence of an interrogative word like 'what' is the final L coupled with a lengthening of the vowel bearing it. Declarative sentences on the other hand are not restricted in this regard as they can end in any tone pitch.

In sentence (2), the noun *ŋká* 'wood' is underlyingly H, yet surfaces as HL. We also see that the glottal stop is inserted on the surface to emphasize syllable demarcation. This glottal stop may be responsible for the fall of the tone, but more investigation is needed to confirm it.

In Wushi like in all the other Ring languages, the mid tone is phonetic. In Wushi particularly, it has several sources which are: either a L̥[1] tone raised to M by a preceding H tone in a HL̥ pattern or a L raised to M by a following H̥ in a LH̥ pattern. M in these two contexts – illustrated in Table 2 – could also be interpreted as the fusion of L and H. And, as shown in (3) below, M can also be the realization of the underlying pattern LL̥, but this is much rarer.

Another important phenomenon in Wushi and the whole Grassfields is downstep, the lowering of a H triggered by an adjacent L (or L̥) tone. In Wushi downstep is much more frequent in the context of L̥ than with a phonetically realized L. Moreover, downdrift, the gradual declination of H tones in a sequence so that the last H has a lower pitch than the first H, is also recurrent. For example:

(3) ŋə́ tíꜜ twɔ́ꜜ dʒʉ̀
ŋə́ tí twɔ́ dʒʉ̀
3SG NEG yet come
'He has not yet come.'

The first H, the one on the third person singular pronoun, is a "canonical" H. Then the second H is realized on a lower pitch and the third one a little lower again than the second H. We will see in the rest of the discussion that downdrift is in fact conditioned by a fundamental principle of the language system. But before looking at that, we present complex tone patterns in §2.2.

2.2 Complex tone patterns

Complex tone patterns are those that comprise an associated or non-floating tone and a floating tone. The floating tone is always at the final position and so follows the associated tone. The reason for this is historical: Grassfields Bantu languages have lost the final syllable of Proto-Bantu nouns, leading to the change *CVCV > CV. While disappearing, the second syllable left its tone behind, unassociated. This unassociated or floating tone generally manifests itself on the surface as a mid tone, or causes the preceding tone to surface as mid. I identified three complex tone patterns in Wushi: HL̥, LH̥, and LL̥. Their behaviour is portrayed in the following examples.

We can see from Table 2 that the realisation of the floating tone varies. The floating L̥ in *ndō* 'husband' joins the preceding H which raises it to M and both eventually form a contour tone surfacing as HM. So, HL HM. In the LL̥ pattern, the floating L̥ causes the preceding L to manifest as M in *ʃī* 'grave' but does not

[1]The diacritic (circle) under the tone means the tone is floating.

Table 2: Complex tone patterns

Tone pattern	HL̥	LH̥	LL̥
SR	ndṓ	ntɔ̄ːkə̄	ʃī
UR	ndó L̥	ntɔ̀ː H̥ -kə	ʃì L̥
Gloss	'husband'	'elephant'	'grave'

associate. Thus, the change from LL̥ may be a way to ascertain the presence of a floating tone, here L̥. This is the only instance of such a type we encountered in our data.[2] Concerning the word for 'elephant', the floating H̥ raises the preceding L to M and does not associate. The noun class suffix which, as said earlier, is underlyingly toneless, then copies the mid tone of the noun root. The UR forms of the nouns in Table 2 correspond to their citation forms. Their tonal underlying representation (or tone pattern) was identified following Snider (2018) methodology, based on a major principle which is that tones are more about patterns instead of individual TBUs. In this method, Snider proposes that we begin by analyzing tone patterns in simple CV words (nouns and verbs) having different tones; then we place them in identical environments such as plural form and associative construction where we examine their tonal behaviour. Words that display identical tones in all of these contexts, even if their tones may differ in isolation, have the same tone pattern underlyingly. Then we can proceed with more complex (disyllabic and polysyllabic) words.

3 Prosodic domains vs. syntactic constituents: do they really match?

Two fundamental properties distinguish prosodic from syntactic structure representation: they are the prosodic hierarchy and strict layering (Selkirk 2011: 437).

The prosodic hierarchy is a set of prosodic categories (prosodic domains above the word, influenced by syntactic structure as well as rhythm (Elfner 2018: 3)) which are, from the largest to the smallest:

[2] I have been collecting the data from a 24-year-old native speaker of Wushi since 2018. The civil war going on in the Anglophone region of Cameroon (where Wushi and all Ring languages are spoken) has made the field inaccessible since 2016 and forced thousands of people to leave the region and be dispersed to safer places of the country and also in Nigeria. Therefore, it literally takes a miracle to find native speakers.

- Intonational Phrase (IP, ι)
- Phonological Phrase (PP, φ)
- Prosodic Word (PW, ω)

In Match Theory, prosodic structure is derived from a set of MATCH constraints, "which call for correspondence between syntactic constituents (word, phrase, clause) and prosodic domains (ω, φ, ι)" (Elfner 2018: 5). The mapping constraints can be represented as follows:

(4) MATCH constraints (Ibid.)
MATCH-CLAUSE: syntactic clause ⟶ intonational phrase (ι)
MATCH-PHRASE: syntactic phrase ⟶ phonological phrase (φ)
MATCH-WORD: syntactic word ⟶ prosodic word (ω)

Thus, this theory predicts that every syntactic constituent corresponds to a prosodic domain. More specifically, following the indirect reference theory which underlies Match Theory, syntactic structure is first mapped to the prosodic structure, a separate representation to which phonological processes apply, which produce or determine phonological phrases. However, the high ranking of language-particular phonological markedness constraints on prosodic structure may result in mismatches between syntactic and prosodic structures. Our purpose in this paper is first, to identify the phonological processes that define phonological phrases in Wushi, and second, to analyze the relationship between syntactic constituents and prosodic domains, as well as potential misalignments.

Before tackling those issues, we should briefly discuss Wushi syntax. Grassfields Bantu languages are known to be quite isolating, compared to Narrow Bantu languages which are rather agglutinating. This is particularly evident in the verb morphology. Indeed, in Bantu languages the verb consists of a root to which prefixes and suffixes are attached, which represent tense, aspect, mood, negation, evidentiality, indexes of agreement with the subject and object, etc. Many of these morphemes have a V (vocalic) shape and for some others, CV. Nurse (2008: 40) represents the structure of the Bantu verb as follows:

(5) Pre-SM + SM + NEG2 + TA + OM + root + extension + FV + post-FV

In Grassfields Bantu languages, the situation is quite different. Almost all verbal morphemes are independent morphemes with a CV shape. So that the structure of the verb phrase or the sentence exhibits the syntax as in Narrow Bantu, the main difference being that constituents agglutinate on the verb root in one case, whereas they are separate elements in the other. The following sentences taken from Aghem (Hyman 1979: 71), Babanki (Akumbu & Chibaka 2012: 144) and Wushi (personal notes) illustrate the isolating tendency of (Ring) Grassfields languages. Note that for Aghem, the author does not provide the UR of sentences. The numbers indicate the noun class.

(6) bvʉ́ ʻtɨ́ mâa zɨ́ bɛ́-kɔ́ à lɨ́m-ghɔ́
bvʉ́ ʻtɨ́ mâa zɨ́ bɛ́-kɔ́ à lɨ́m-ghɔ́
dog SM P1/FOC eat fufu and yams
'The dogs *did* eat fufu and yams.'

(7) nyámsə́ pfɨ́ʼə́ ágə́ŋ
nyàm.sə́ sə́ pfé' ə à.gə́ŋ
animal.10 10.SM chew PROG 06.grass
'Cattle eat/are eating grass.'

(8) vī ŋɔ̄ nɔ̌ nâ tʃá
vì́ ŋ.ɔ́ nɔ̌ nâ tʃá
wife 1.POSS.1SG PROG cook fish
'My wife is cooking fish.'

As we can see, tense-aspect markers and subject/object-verb agreement[3] markers are not affixes attached to the verb root but they are rather independent morphemes. Another notable point is the absence of subject/object-verb agreement in Wushi, which makes the order or position of the constituents of the sentence the only indicator of syntactic relationships in the language. The scarcity of concord marking is a general feature of Wushi, not only in the verbal system but also in the nominal system. With noun phrases, concord is evident, at least in a shape similar to what obtains in Narrow Bantu languages, only in possessive and demonstrative phrases. In the other types of modification (especially adjective and genitive) something quite unusual happens: the noun class suffixes – among the nine noun classes six are suffixes – display an exceptional mobility, in most cases, leaving the head noun to appear on the modifier or at the right end of the phrase, after the determiner which is invariable, i.e., it does not strictly speaking agree with the noun it modifies. In some instances of genitive phrase, the two nouns even exchange their suffix. For lack of space, and because this is not the focus of our discussion here, we will simply mention two examples in order to give a glimpse of the phenomenon. The first example is an adjectival phrase and the second is a genitive phrase.

[3] I use "agreement" and "concord" interchangeably.

(9) ntsə́ fə́-mə́ mɛ̂
ntsə́-mə́ fə́ mɛ̂
blood-6a black DET
'the black blood'

(10) núà wùfúá mɛ̂ -fə̀
núá-fə̀ wù-fúá mɛ̂
bird-19 2-chief DET
'the bird of the chiefs'

In (9), the suffix of the head noun *ntsə́-mə́* 'blood' (class 6a and sometimes class 19) attaches to the adjective *fə́* 'black' which is followed by the determiner. In the genitive phrase, the head noun suffix moves right to the end of the phrase, after the determiner. These two examples could be interpreted as two instances of the different "stops" made by the head noun suffix. All things being equal, however, it is quite patent that the preferred direction of noun class suffixes in noun phrases is rightward and probably this very movement actually indicates concord.

3.1 Indicative sentences

Concerning the actual syntactic structure of sentences in the indicative mood, they are made up of the subject (S), followed by the negative marker (NEG), aspect marker (A) – unlike the other Ring languages some of which have up to seven tense markers, tense is not morphologically marked in Wushi: it is an aspect-prominent language, probably the only one of this type in the group, at least from the data on Ring languages available so far (the aspectual system of Wushi is described in Hodieb 2021) – the verb root (V) that may itself be followed by the object(s) (O). Schematically:

(11) S + NEG + A + V + O

The majority of sentences we will be using for the argumentation have either the first person (*mə̀*) or the third person (*ŋə́*) singular pronoun as subject. The latter bears a L tone in the object position, whereas the former does not change from subject to object position.

3.1.1 Sentences involving one aspectual-modal marker

To begin with, the perfective marker is the only non-segmental aspect marker: it consists of a LH tone ascribed to the verb root, as seen in the following examples.

Table 3: Sentences with perfective

UR	SR	Gloss
ŋə́ jɔ̀ʔ	ŋə́ jɔ̌ʔ	'He sings.'
ŋə́ tʃɔ̀ʔ	ŋə́ tʃɔ̌ʔ	'He speaks.'
ŋə́ tàʔ ŋgɔ̀ːkə	ŋə́ tǎʔ ŋgɔ̀ːkə̀	'He wants the banana.'
ŋə́ zə́ ŋgɔ̀ːkə	ŋə́ zə̌ ŋgɔ̀ːkə̀	'He eats the banana.'
ŋə́ jɛ́ ŋgɔ̀ːkə	ŋə́ jɛ̌ ŋgɔ̀ːkə̀	'He sees the banana.'
ŋə́ bé	ŋə́ bě	'He sleeps.'
H H/L (L)	H LH (L)	

The first three verb roots are underlyingly L, while the others are underlyingly H. Nevertheless, they all surface with LH in the perfective. This shows us that the perfective marker is very steady. Also, it does not fluctuate, whatever the tonal or morphosyntax environment.

Let us now consider the negative forms of these sentences.

Table 4: Sentences with perfective and negation

UR	SR	Gloss
ŋə́ tí jɔ̀ʔ	ŋə́ tī jɔ̀ʔ	'He does not sing.'
ŋə́ tí tʃɔ̀ʔ	ŋə́ tī tʃɔ̀ʔ	'He does not speak.'
ŋə́ tí tàʔ ŋgɔ̀ːkə	ŋə́ tī tàʔ ŋgɔ̀ːkə̀	'He does not want the banana.'
ŋə́ tí zə́ ŋgɔ̀ːkə	ŋə́ tī zə̄ꜜ ŋgɔ̀ːkə̀	'He does not eat the banana.'
ŋə́ tí jɛ́ ŋgɔ̀ːkə	ŋə́ tī jɛ̄ˊ ŋgɔ̀ːkə̀	'He does not see the banana.'
ŋə́ tí bé	ŋə́ tī bēꜜ	'He does not sleep.'
H H L/H (L)	H M L/Mꜜ (L)	

In Table 4, we go from H H H to H M Mꜜ on one hand and from H H L to H M L on the other hand – we are omitting the object here. The subject pronoun being always the same, *ŋə́* with H, what differentiates the two patterns is actually the tone of the verb. First, the H of the negative marker has to distinguish from the H of the subject by becoming M, and second, the verb which was initially H just like the negative marker, in its turn distinguishes from the preceding negative marker now bearing M, by becoming Mꜜ. So, we see that the tonal interaction from the subject to the verb is one where each element adjusts itself according to what precedes. More precisely, the tone of the negative marker turns from H to M because of the H of the preceding subject pronoun from which it must differ. Indeed, in the presence of a L tone pronoun instead, the negative marker keeps its H tone and does not change to M as seen in (12):

(12) wà tí nɔ̌ jʉ̂ fá
wà tí nɔ̌ jʉ́ fá-kə
1pl neg prog do thing-7
'We are doing nothing.'

With the distal marker which is *kə̀* bearing a L tone underlyingly, the verbs in the affirmative in (4) behave as in Table 5.

Table 5: Sentences with distal

UR	SR	Gloss
ŋə́ kə̀ jɔ̀ʔ	ŋə́ kə̀ jɔ̌ʔ	'He sang.'
ŋə́ kə̀ tʃɔ̀ʔ	ŋə́ kə̀ tʃɔ̌ʔ	'He spoke.'
ŋə́ kə̀ tàʔ ŋgɔ̀:kə	ŋə́ kə̀ tǎʔ ŋgɔ̀:kə̀	'He wanted the banana.'
ŋə́ kə̀ zə́ ŋgɔ̀:kə	ŋə́ kə̀ zə́ꜜ ŋgɔ̀:kə̀	'He ate the banana.'
ŋə́ kə̀ jɛ́ ŋgɔ̀:kə	ŋə́ kə̀ jɛ́ꜜ ŋgɔ̀:kə̀	'He saw the banana.'
ŋə́ kə̀ bé	ŋə́ kə̀ béꜜ	'He slept.'
H L L/H (L)	H L LH/Hꜜ (L)	

When a L verb follows the L distal marker it changes to LH, whereas a H verb is produced on a lower pitch than the initial subject pronoun H. This could suggest that L verbs differ from H verbs in the way they dissimilate: while the former insert a final H to become contour LH tone at sentence final position, H tone verbs either lower their pitch to Hꜜ (when preceded by L), or become Mꜜ (when preceded by M).

3.1.2 Sentences involving two aspectual-modal markers

In the following sentences, the distal marker is accompanied by the negative marker which it follows, so, two TAM markers are involved. Note that the negative marker *tí* is considered to occupy the modal position of the sentence as part of TAM, right after the subject as shown in Table 6.

Table 6: Sentences with distal and negation

	UR	SR	Gloss
a.	ŋə́ tí kə̀ jɔ̀ʔ	ŋə́ tī kə̄ jɔ̀ʔ	'He did not sing.'
b.	ŋə́ tí kə̀ tʃɔ̀ʔ	ŋə́ tī kə̄ tʃɔ̀ʔ	'He did not speak.'
c.	ŋə́ tí kə̀ tàʔ ŋgɔ̀ːkə	ŋə́ tī kə̄ tàʔ ŋgɔ̀ːkə̀	'He did not want the banana.'
d.	ŋə́ tí kə̀ zə́ ŋgɔ̀ːkə	ŋə́ tī kə̄ zə́ꜜ ŋgɔ̀ːkə̀	'He did not eat the banana.'
e.	ŋə́ tí kə̀ jɛ́ ŋgɔ̀ːkə	ŋə́ tī kə̄ jɛ́ꜜ ŋgɔ̀ːkə̀	'He did not see the banana.'
f.	ŋə́ tí kə̀ bé	ŋə́ tī kə̄ béꜜ	'He did not sleep.'
	H H L L/H (L)	H M M L/Mꜜ (L)	

Interestingly, the negative marker and the distal marker which are respectively H and L in the UR both appear on the surface as M. Thus, in this case, the two morphemes do not have to differentiate. Immediately after the M distal marker, L verbs remain L, whereas H verbs lower their pitch, just like in the preceding instances in Table 5. Our assumption, which we will discuss in detail in §4, is that tone dissimilation demarcates prosodic domains and within a prosodic domain, each element carries the same tone, through tone spreading. In other words, whenever tone dissimilates, it signals the frontier of a prosodic domain or rather the beginning or edge of a prosodic domain.

Tone dissimilation between prosodic domains is further exemplified in the sentences in Table 7.

Table 7: Sentences with distal and potential

	UR	SR	Gloss
a.	ŋə́ wɔ́ʔ kə̀ dʒʉ̀	ŋə́ wɔ̀ʔ kə̀ dʒʉ́	'He will be coming.'
b.	ŋə́ wɔ́ʔ kə̀ zə́	ŋə́ wɔ̀ʔ kə̀ zə́	'He will be eating.'
	H H L L/H	H L L H/L	

Because *wɔ́ʔ* (potential marker) and *kə̀* (distal marker) belong to the same prosodic group, they have to bear the same tone. First, they have to dissimilate with the preceding group which is the subject pronoun group having a H tone. This dissimilation is achieved though the change of *wɔ́ʔ*, the first element of the second group (the aspectual group) from H to L. Then, since *kə̀* already bears a similar tone, no tone spreading is needed. Next, the verb group also dissimilates with the preceding which is L, and turns from L to H in sentence (a) in Table 7, whereas in sentence (b) in Table 7, dissimilation does not occur as the verb group already carries a different tone.

There are a few exceptions to this rule as shown in Table 8.

Table 8: Exceptions

	UR	SR	Gloss
a.	ŋə́ tí kə̀ fè ŋgɔ̀:kə	ŋə́ tī kə̀ fě ŋgɔ̀:kə̀	'He did not sell the banana.'
b.	ŋə́ tí kə̀ tʃěʔ ŋgɔ̀:kə	ŋə́ tī kə̀ tʃěʔ ŋgɔ̀:kə̀	'He did not cut the banana.'
c.	ŋwɛ̂ wɔ́ʔ kə̀ tʃɔ̀ʔ	ŋə́ wɔ̀ʔ kə̀ tʃɔ̀ʔ	'They will be talking.'

With the verbs in (a, b) from Table 8, the distal marker does not change from L to M after the M negative marker. Consequently, the verbs themselves display unexpected tonal patterns: *fè* 'sell' becomes LH – instead of remaining L, and, recalling that each tone changes according to the preceding tone, this change is due to the preceding distal marker which also keeps its L and does not change to M as expected. However, the second verb, *tʃěʔ* 'cut' keeps its underlying LH tone. The reason why *kə̀* does not change to M in these two contexts is still to be clarified. Likewise, the tone verb group consisting of the verb *tʃɔ̀ʔ* in sentence (c) from Table 8 is expected to become H, dissimilating with the preceding L aspectual group consisting of *wɔ̀ʔ* and *kə̀*. Probably the tone of the subject pronoun HM has a certain influence on the pattern of the sentence, but again, we do not have enough arguments for now to confirm or reject this hypothesis.

Another exceptional case concerns the progressive (or imperfective) marker *nɔ̌*. Like the perfective which is always LH – recall that the perfective is marked only tonally and not segmentally – the tone on this morpheme is also unchanging, whatever the tonal, segmental or syntactic environment. This clearly appears in Table 9 and Table 10.

Interestingly, the unchanging form of the progressive is also attested in Babanki (Akumbu, Hyman & Kießling 2020), a Central Ring language. There should be a historical explanation for this phenomenon, probably dating back to Proto-Ring. Besides that, the tone on the verb following *nɔ̌* deserves our attention. Indeed, it is never LH like the progressive marker, but always carries a different tone. This is another evidence of the dissimilation process at work in the construction of indicative sentences.

Table 9: Tone dissimilation with progressive

	UR	SR	Gloss
a.	mə̀ nɔ̌ nâ	mə̀ nɔ̌ nâ	'I am cooking.'
b.	ŋə́ nɔ̌ dʒʉ̀	ŋə́ nɔ̌ dʒʉ̂	'He is coming.'
c.	wə̀ nɔ̌ tàʔ ŋə́	wə̀ nɔ̌ tàʔ ŋə́	'You want it.'

Table 10: Tone dissimilation with progressive and distal

	UR	SR	Gloss
a.	ŋə́ kə̀ nɔ̌ dʒʉ̀	ŋə́ kə̀ nɔ̌ dʒʉ́	'He was coming.'
b.	ŋə́ kə̀ nɔ̌ zə́	ŋə́ kə̀ nɔ̌ zə́	'He was eating.'
c.	wà tí nɔ̌ jʉ̀ fákə	wà tí nɔ̌ jʉ̂ fá	'We are doing nothing.'

3.1.3 Sentences involving three aspectual-modal markers

So far, we have been looking at prosodic groups consisting of one or two morphemes. It is worth mentioning the case where more than two morphemes are found in a group. As a matter of fact, the maximum number is three, and we will see that this case stands out from the findings we have hitherto been discussing, namely, the occurrence of tone dissimilation between prosodic groups and tone spreading inside a group.

When there are three elements in a group, particularly in the aspectual group, they never assimilate, contrary to what was observed when they are two in the group.

Table 11: Prosodic groups with three morphemes

	UR	SR	Gloss
a.	ŋə́ tí wɔ́ʔ kə̀ dʒʉ̀	ŋə́ tī wɔ̀ʔ kə́ dʒʉ̄	'He will not be coming.'
b.	ŋə́ tí wɔ́ʔ kə̀ zə́	ŋə́ tī wɔ̀ʔ kə̀ zə́	'He will not be eating.'
c.	ŋə́ tí kə̀ nɔ̌ dʒʉ̀	ŋə́ tī kə̀ nɔ̌ dʒʉ́	'He was not coming.'
d.	ŋə́ tí kə̀ nɔ̌ zə́	ŋə́ tī kə̀ nɔ̌ zə́	'He was not eating.'

The aspectual prosodic group is made up of *tí wɔ́ʔ* and *kə̀* (respectively, the negative marker, potential marker and distal marker) in the first two sentences, and in sentences (c) and (d) from Table 11 it is made up of *tí* and *kə̀*. In sentence (a) from Table 11, the distal marker (*kə̀*) is H, but L in (b); the only difference between these two sentences is the verb, which is underlying L Table 11a and H in Table 11b. We could straightaway assume the process of anticipatory dissimilation to be responsible for this discrepancy: the distal marker turns from L to H dissimilating in anticipation from the following L verb which subsequently becomes M. In Table 11b, since the verb is already H, i.e., underlyingly, and thus different from the L distal marker, nothing changes. In sentences (c) and (d) from Table 11, each element in the aspectual group surfaces with its underlying tone, except the negative marker which in all four cases – in fact in all cases in general – lowers from H to M because of the preceding H of the subject pronoun. In other words, even though assimilation does not always take place within the aspectual group when three morphemes are involved, two dissimilatory changes seem to be inescapable: 1) between the subject pronoun and the negative marker, and 2) between the last aspectual marker (i.e., the last element of the aspectual group) and the verb. This is confirmed when we compare for instance the sentence in Table 11a with the one in (12), where the subject pronoun is L (*wà* 'we') and for this very reason, i.e., because they already differ, the underlying H of the negative marker *tí* following it does not change, contrary to Table 11a where this same negative has to dissimilate from the preceding H subject pronoun which belongs to a different prosodic group, hence its realization as M.

Before closing this section on indicative sentences, one last context we could examine and that corroborates our assumption is the potential aspect, marked by *wɔ̀(ʔ)*. The final glottal stop is optional, and one of its functions in Wushi is syllable demarcation.

Table 12: Prosodic groups with three morphemes

	UR	SR	Gloss
a.	ŋə́ tí wɔ́ʔ jɔ̀ʔ	ŋə́ tī wɔ̄ʔ jɔ̀ʔ	'He will not sing.'
b.	ŋə́ tí wɔ́ʔ tʃɔ̀ʔ	ŋə́ tī wɔ̄ʔ tʃɔ̀ʔ	'He will not speak.'
c.	ŋə́ tí wɔ́ʔ tàʔ ŋgɔ̀:kə	ŋə́ tī wɔ̄ʔ tàʔ ŋgɔ̀:kə̀	'He will not want the banana.'
d.	ŋə́ tí wɔ́ʔ zə́ ŋgɔ̀:kə	ŋə́ tī wɔ̄ʔ zə́ꜜ ŋgɔ̀:kə̀	'He will not eat the banana.'
e.	ŋə́ tí wɔ́ʔ jɛ́ ŋgɔ̀:kə	ŋə́ tī wɔ̄ʔ jɛ́ꜜ ŋgɔ̀:kə̀	'He will not see the banana.'
f.	ŋə́ tí wɔ́ʔ bé	ŋə́ tī wɔ̄ʔ béꜜ	'He will not sleep.'
	H H H L/H (L)	H M M L/Hꜜ (L)	

Tonal dissimilation and tone spreading manifestly organize the prosodic structure of sentences at least in the indicative mood: tone dissimilation demarcates what we refer to here as prosodic groups, and tone spreading occurs within a group. Hence the M tone shared between *tī* and *wɔ̄ʔ*, respectively the negative marker and the potential marker, constituting what we will call the *aspectual group*. The M tone produced on the two successive morphemes could be seen as an instance of tone spreading applying within the group and not across. This aspectual group is preceded by the *subject group* which is H in the above examples, and is followed by the *verb group* which is L or H↓ depending on the underlying tone of the verb. The verb group in its turn may be followed by the object which we consider extrametrical; in other words, it is invisible to the tone processes occurring in the rest of the sentence. What justifies this choice is the fact that the tone of the object does not dissimilate with the preceding tone, that of the verb. This is seen in the above examples with the L object *ngɔ̀:kə̀* 'banana' and is equally observed when the object is H.

Table 13: Extrametricality of the object

	UR	SR	Gloss
a.	ŋə́ tí wɔ́ʔ tàʔ tʃá	ŋə́ tī wɔ̄ʔ tàʔ tʃá	'He will not want the fish.'
b.	ŋə́ tí wɔ́ʔ zə́ tʃá	ŋə́ tī wɔ̄ʔ zə́↓ tʃá↓	'He will not eat the fish.'
c.	ŋə́ tí wɔ́ʔ jɛ́ tʃá	ŋə́ tī wɔ̄ʔ jɛ́↓ tʃá↓	'He will not see the fish.'
	H H H L/H H	H M M L/H↓ H/H↓	

The tone on the object *tʃá* 'fish' remains H except when preceded by a downstepped H; this is the result of downdrift, whereby the pitch level of a H in a sequence of Hs is dependent on a preceding H tone. This shows us that the object is out of the scope of dissimilation. Put differently, tone dissimilation concerns only the subject pronoun group, the aspectual group, and the verb group, as far as indicative sentences are concerned. Note that these are prosodic groups, i.e. they make up the prosodic constituency of indicative sentences, and do not necessarily match with syntactic constituents, as assumed in the theory of prosodic structure as well as theories of the syntax-prosody interface. We will come back to this discussion later.

3.2 Modal constructions: possibility

In this section we will focus on modality, specifically the expression of possibility. Grassfields Bantu languages are well-known for their highly analytic morphology and this is particularly evident in modal constructions. Indeed, while in Narrow Bantu languages modality is mostly expressed through affixes, this is achieved in most Ring Grassfields languages through independent particles generally preceding the verb. Modal constructions expressing possibility in Wushi are particularly interesting for our present study as they show a tonal pattern very close to what we have described for simple indicative sentences although their syntax is quite different. The modal marker *làkə̀* comes first, and then the rest of the sentence displays the canonical order, i.e. SVO as schematized in (13).

(13) làkə̀ + S + V + O

It should be noted that *làkə̀* is not limited to possibility but is used for other types of modality including necessity, permission, and certainty. I explain in my dissertation its initial position as signalling its scope, which goes from the next element, i.e., the subject, to the end of the sentence. In other words, the entire sentence is its scope, meaning that the modality expressed affects the meaning of the clause as a whole. Thus, the representation in (13) could otherwise be as follows:

(14) làkə̀ {S V O}

The brackets here mean the whole clause, i.e., SVO, is the scope of the modality *làkə̀*, rather than the verb only.

Let us now consider some examples.

Table 14: Tone dissimilation and modality

	UR	SR	Gloss
a.	làkə̀ wə́ gɛ̀	làkə̀ wə́ gɛ̀	‘You can go/You are free to go.’
b.	làkə̀ ŋə́ tí dʒʉ̀	làkə̀ ŋə́ tì dʒʉ̂	‘He cannot come.’
c.	làkə̀ mə̀ dʒʉ̀ mbó:kə́	làkə̀ mə́ dʒʉ̀ mbó:kə́	‘Can I come and play?’
d.	làkə̀ ŋə́ tí tʃɔ̀ʔ	làkə̀ ŋə́ tì tʃɔ̂ʔ	‘He cannot speak.’
c.	làkə̀ mə̀ tʃàʔsə́ ŋwàʔnə̀ jə	làkə̀ mə́ tʃàʔsə́ ŋwàʔnə́ jə̄	‘Can I borrow your book?’
	L L/H (H) L	L H L H L	

Here again, the dissimilation process taking place is striking. We go from patterns like L H H L (sentences b and d in Table 14) and L L L H (sentence c in

Table 14) in the UR with consecutive identical tones, to a L H L H pattern on the surface, obviously forbidding successive identical tones – we count *làkə̀* as a single L since this is a unique marker,[4] that of modality. The (H) corresponds to the negative marker, present only in sentences (b) and (c) in Table 14. We assume that the L H L H pattern actually underlies modal constructions, so that every one of them aligns with it. Sentence (c) in Table 14 is another significant illustration. It reveals that the tone pattern on the noun *ŋwàʔnə̀* 'book' changes from LL to LH, so as to fit in the pattern of the whole sentence, although the two L in the L L pattern belong to the same morpheme. In addition, evidence also comes from the first person singular pronoun *mə̀* which is underlyingly L and always changes to H when following *làkə̀*. Since *làkə̀* carries a L tone, the L tone on *mə̀* must dissimilate. This is not the case for the third person singular pronoun *ŋə́* which is H in the UR, and given that its tone is already different from that of the preceding modal marker, nothing changes. In other words, the pattern L H L H is a fixed pattern for modal constructions with *làkə̀*, unlike indicative sentences where the nature of each tone constituting the tonal pattern depends on the preceding tone, and therefore in this case the pattern is built up as the sentence unfolds. Nevertheless, there is an invariant tonal process governing the construction of these patterns, be they fixed or "context-dependent", and that is dissimilation. How could the Match Theory account for these phenomena? The next section is dedicated to this question.

4 Discussion

Prosodic domains in Bantu languages – also referred to as tone groups in other studies, for example in Chen (1987), and Hyman & Katamba (2010) – are characterized by a variety of tonal processes including tone spreading at the phrasal level for example in Copperbelt Bemba M40 (Kula & Bickmore 2015), L deletion and H plateauing in Luganda JE15 (Hyman & Katamba 2010), penultimate lengthening in Xitsonga S53 (Selkirk 2011), to give but a few examples. What is common to these processes is that they occur within a prosodic domain and only within that domain, and therefore characterize it as a prosodic domain. Some of these processes occur specifically at the left or right edge of a constituent. For instance, Truckenbrodt (1999: 237) explains that in Kimatuumbi, shortening applies on long stem vowels, except in the prosodic word immediately preceding the right edge of a p-phrase. Thus, shortening applies on *mpúunga* 'rice' in the

[4]Although not a unique morpheme. Indeed, *làkə̀* is made up of two morphemes: *là* the hypothetic marker, and *kə̀* the distal marker.

phrase *mpunga wá baándu* 'rice of people' as the word for 'rice' in this context is the prosodic word immediately preceding the right edge of the phonological phrase (φ).

(15) (mpunga wá baándu) φ 'rice of people'

Such phonological processes are equally attested in Wushi. When analyzing indicative sentences, we saw that tone spreads within a group; this concerns particularly what we referred to as the aspectual group, when consisting of two elements: generally the first element is the negative marker *tí*, followed by either the distal marker *kə̀* and/or the potential marker *wɔ́ʔ*, but we can also have, in the absence of the negative marker, the potential marker followed by the distal marker. We observed that tone spreading in this group is quite regular when two morphemes are involved, but less consistent when all the three morphemes appear. However, in all cases, one process necessarily obtains, and this is tone dissimilation between prosodic groups or domains. In fact, the Obligatory Contour Principle (OCP) underpins the construction of (indicative) sentences, so that identical consecutive tones are avoided on the surface.

To represent these requirements and constraints in the syntax-prosody framework, we consider three major prosodic domains (four including the object group) which are phonological phrases, as far as indicative sentences without modality are concerned.

(16) a. (ŋə́) φ (tī kə̄) φ (zə́ꜜ) φ (ŋgɔ̀ːkə̀) φ 'He did not eat the banana.'
b. (ŋə́) φ (wɔ̀ʔ kə̀) φ (dʒʉ́) φ 'He will be coming.'
c. (ŋə́) φ (tī wɔ̄ʔ) φ (jɔ̀ʔ) φ 'He will not sing.'

The peculiarity of the organization of prosodic constituency in Wushi is that each phonological phrase is determined by the preceding one instead of by what happens within, in other words the indicator of the frontier of a phonological phrase is not within the phrase in question but outside: it is tone dissimilation. More specifically, as the sentence unfolds, tone dissimilates whenever we are crossing a phrase boundary, and until the frontier is crossed, every element receives the same tone (hence tone spreading postulated earlier). Accordingly, tone dissimilation indicates that we have accessed the next phonological phrase. Thus, as the utterance is produced, tone is assigned to each prosodic group based on this fundamental principle. For example, the phonological phrase (*tī kə̄*) exhibits a M because of the H of the preceding group. *tí*, which is the first element to dissimilate to *tī* thereby signalling the left edge of a new phrase, changes to M because of the preceding H. Then, this M spreads until the next occurrence of dissimilation, indicating the next boundary. It is in this sense we are claiming that each phonological phrase is dependent on what precedes. This is why when the subject pronoun is L, the negative marker does not need to change to M, and thus, it remains H as in the sentence in (12).

One crucial question would be, given the rigid tone on the progressive marker which is always LH, where do we put the next boundary? We could answer that since *nǒ* is never subject to change, it should be considered as an exceptional morpheme, and therefore it would be inappropriate to base our hypothesis on it. The most regular pattern prevailing is rather one where the negative marker and the aspectual markers share the same tone, hence their grouping together into one prosodic group. Consequently, although in sentence (12) there is no clear indication of a phonological phrase consisting of *tí* and *nǒ*, the general and most consistent observation allows us to group them together in the prosodic constituency.

Another central question pertains to the correspondence between prosodic structure and syntactic structure and Match Theory. If we consider both structures in the sentences in (16), we will have the following:

(17) a. $_{S}$[(ŋə́)$_{\varphi}$] $_{VP}$[(tī kə̄)$_{\varphi}$ (zə́ꜜ)$_{\varphi}$] $_{O}$[(ŋgɔ̀ːkə̀)$_{\varphi}$] 'He did not eat the banana.'
b. $_{S}$[(ŋə́)$_{\varphi}$] $_{VP}$[(wɔ̀ʔ kə̀)$_{\varphi}$ (dʒʉ́)$_{\varphi}$] 'He will be coming.'
c. $_{S}$[(ŋə́)$_{\varphi}$] $_{VP}$[(tī wɔ̄ʔ)$_{\varphi}$ (jɔ̀ʔ)$_{\varphi}$] 'He will not sing.'

Following Dixon (2009), we consider the syntactic verb phrase to consist of the verb and the grammatical morphemes associated to it, such as tense, aspect, mood, and modality. Here, misalignment between the syntactic verb phrase and prosodic structure requires specifying constraints on the prosodic constituency that will repair the violation of MATCH(Phrase, φ). Two constraints will be posited here: ALIGN-L(φ, PrW) followed by SPREAD(φ). T in the representation below stands for tone.

(18)
$$\begin{array}{ccc} T_1 & & {}^*T_2 \\ | & & | \\ {}_{\varphi}(\omega & & \omega)_{\varphi} \end{array}$$

ALIGN-L(φ, PrW): align a tone with the left-most prosodic word of a phonological phrase.
SPREAD(φ): spread the tone to the entire phonological phrase.

This constraint stipulates that the tone of the prosodic word on the left edge determines the tone of the phonological phrase and is followed by spreading which is restrained to the elements of the phonological phrase, so that two different tones (here T_1 and T_2) cannot co-occur within the same phonological phrase. A different tone will therefore have to be associated to a different (following) phonological phrase.

Concerning modal constructions, since the L H L H pattern is fixed for all the constructions, we are claiming here that it actually constitutes the intonational phrase. Thus:

(19) a. $_\iota$ {làkə̀ wə́ gɛ̀} $_\iota$
b. $_\iota$ {làkə̀ ŋə́ tí dʒʉ̀} $_\iota$
c. $_\iota$ {làkə̀ ŋə́ tì tʃɔ̂ʔ} $_\iota$

Indeed, contrary to the "context-dependent" application of dissimilation in indicative sentences without modality, which consequently may yield several different tonal patterns on the surface, the rigid L H L H pattern associated to modal constructions indicates that the whole clause is the target. And the corresponding prosodic domain is the intonational phrase. Therefore, MATCH(Clause, ι) constraint is met.

Before concluding this paper, a crucial question already raised by Elfner (2012: 11) is whether prosodic structure plays a role in determining the surface structure "traditionally syntactic domains such as word order…" We could even go further and ask ourselves if syntactic constituency is not, at least in certain languages, and in particular contexts, the reflection of prosodic structure. In other words, what if it was rather the syntactic structure that matches the prosodic structure, which therefore, would be the one deriving the syntactic structure? A necessary implication of such an analysis would be that prosody pre-exists syntax, as argued by Martin (2013).

5 Conclusion

The aim of this paper was to analyze the syntax-prosody interface in Wushi, an under-documented Ring Grassfields Bantu language. Our focus was on indicative sentences with and without modality, and we established the analysis in the framework of Match Theory (Selkirk 2011). It followed that tone dissimilation governs the prosodic structure of sentences, and, more generally, OCP (Obligatory Contour Principle). This forbids consecutive phonological phrases to display the same tone. On the other hand, tone spreading obtains within each phonological phrase, except in a few special cases. We found out that MATCH(Phrase, φ) is overriden by ALIGN-L(φ, PrW) and SPREAD(φ), while MATCH(Clause, ι) is met especially in modal constructions expressing possibility. More descriptions of the prosody-syntax interface in Grassfields languages, as well as the study of intonation would help us have a wider understanding of the interaction between tone and syntax not only in this language group, but in African languages at large.

Abbreviations

POT	potential	P1	today past
DET	determiner	POSS.1SG	1st person singular possessive
SM	subject marker	SR	surface representation
NEG	negation	UR	underlying representation
TA	tense aspect		
OM	object marker		
FV	final vowel		

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Chapter 9

A unified account of grammatical tone and length in Gã

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In Gã [Kwa: Ghana], several aspectual and modal distinctions are exponed through changes in tone. These grammatical tones may be realized on a subject proclitic, or on a verbal prefix when the subject is not pronominal. Previous analyses of this phenomenon have differed in the representation of the underlying forms: in particular, whether the alternations are suppletive or the result of predictable phonological processes has been a point of discussion. In this paper, I present novel data which sheds light on these processes and propose that the emergence of portmanteau STAMP (Subject, Tense, Aspect, Mood, Polarity) morphs in Gã is fully predictable from regular phonological processes present in the language, including independently motivated vowel hiatus resolution strategies, syllable structure restrictions, and tone association rules. I argue that the STAMP morphs in Gã are best analyzed as derived phonologically from combinations of individual underlying items, where each morphosyntactic feature contributes a distinct phonological component. This analysis is able to account for grammatical distinctions which involve changes in vowel length as well as tone.

1 Introduction

STAMP morphs — portmanteau morphemes which simultaneously expone subject, tense, aspect, mood, and/or polarity features — are common across the Macro-Sudan Belt (Anderson 2016, Garvin et al. 2021). For example, in Degema [ISO:deg, Nigeria] (Kari 2004), the sole difference between affirmative and negative polarity lies in the surface form of the proclitic (1).

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(1) STAMP in Degema (Kari 2004: p. 130)

a. **me**=tá mú éki
1sg=go to market
'I am going to the market.'

b. **mî**=tá mú éki
1sg.neg=go to market
'I am not going to the market.'

These morphemes, which exhibit properties of both pronominals and auxiliaries, present an opportunity to examine the interface between phonology and morphology. As an areal property and a vector for furthering understanding of this interface, the properties of STAMP morphs have become a topic of growing interest in the literature (Anderson 2011, 2015, 2016, Konoshenko 2020, Rolle 2022, Felice 2021, Garvin et al. 2021). In many languages with STAMP morphs, the fused pronoun-auxiliary complexes have been grammaticalized and are not synchronically separable. In this paper, however, I present novel data from Gã which sheds light on the formation and synchronic morphophonology of STAMP morphs. This data supports an analysis in which STAMP morphs are derived phonologically from the combination of two individual underlying items: a subject proclitic and the tone, or tones, associated with a particular grammatical specification. The surface form of each combination is predictable from independently motivated phonological phenomena in the language, including vowel hiatus resolution strategies and syllable structure constraints.

The goal of this paper is to present a case of a language in which surface portmanteau STAMP morphs can be decomposed into distinct underlying morphemes and derived using regular language-internal phonological processes. In doing so, two different kinds of suprasegmentals — tone and length — can be analyzed within a single unified account across the language. I begin in Section 2 with background on Gã and information concerning tone and pronominal marking. I turn in Section 3 to discussion of each relevant grammatical specification, focusing particularly on important differences between clauses involving pronominal and non-pronominal subjects. I also introduce new data relating to constructions in which a constituent may intervene between subject and verb, which offer insight into the compositionality of STAMP morphs in the language. In Section 4 I briefly discuss prior analyses of the phenomena I have described in Gã, and assess how their conclusions may accommodate novel data. I then present my analysis in Section 5, in which I demonstrate that the surface forms I have described are fully predictable from regular phonotactics and phonological processes. I note several exceptional forms and point to potential avenues for future research in Section 6. Finally, I conclude in Section 7, arguing that pronominal and aspect morphemes are synchronically decomposable in Gã, and undergo a process involving deletion and tone reassociation in specific phonological environments.

2 Language background

Gã [ISO:gaa] is a Kwa language spoken by approximately 800,000 people in and around Accra, Ghana (Eberhard et al. 2022). The data presented in this paper comes from a corpus of 5299 sentences collected with native speakers, comprised of data from elicitations and oral narratives. The language makes use of both lexical and grammatical tone (Kropp Dakubu 2002). There is a two-way surface contrast between L and H (Table 1). The tone-bearing unit (TBU) is the mora.[1]

Table 1: L vs. H in Gã

	L	H
Noun	là 'fire'	lá 'blood'
	wù 'husband'	wú 'bone'
Verb	là 'dream'	lá 'sing'
	bɛ̀ 'beckon'	bɛ́ COP.NEG

This two-way surface contrast reflects an underlying three-way distinction between toneless (∅), L and H. This three-way contrast is made clear with verbs once grammatical tone is involved, as toneless verbs pattern with L verbs in some contexts but with H verbs in others (Table 2). In the perfective, which is marked by a floating L tone prefix, toneless verbs pattern with L verbs. However, in the imperative, marked by a floating H tone suffix, toneless verbs pattern with H verbs.

There is evidence for leftward tone association in Gã from the behavior of toneless verbs in imperative contexts. For instance, the verb 'swim' is toneless, and surfaces as L in the perfective (2a). As previously mentioned, the imperative

[1]Generally, more than one tone cannot surface on a single mora in Gã. There are a few lexical exceptions to this generalization, though, and one morpheme-specific exception. Some verbs of the shape CVV surface with a HL contour on the final mora when they appear at the end of an intonational phrase (Kropp Dakubu 2002). In other contexts, they surface simply as H, and there is no evidence of a following floating L tone. Additionally, a H tone directly preceding the progressive marker *Ǹ-* surfaces with a HL contour on a single mora: see (15d).

Table 2: Three-way underlying tonal contrast in Gã

	∅	L	H
Gloss	‘come’	‘dream’	‘ask’
Underlying	/ba/	/là/	/bí/
Perfective	bà	là	bí
Imperative	bá	làá	bí

is marked by a H tone suffix.[2] The H tone of the imperative spreads from right to left, originating from the suffix *-mɔ́* (2b). This tone spreading affects only TBUs which are not underlyingly associated with a particular tone (Kropp Dakubu 2002).

(2) a. kòfí sèlè
Kofi swim
‘Kofi swam.’

b. sélé-mɔ́
swim-IMP
‘Swim!’

Subject proclitics, below in Table (3), are unspecified for tone, and instead receive their surface tone from elsewhere (Kropp Dakubu 2002).

Table 3: Subject proclitics

	SG	PL
1	ĩ=	wɔ=
2	o=	ɲɛ=
3	e=	amɛ=

These subject morphemes are not agreement markers, but rather proclitics (3) (Campbell 2017). The sentence in (3c), in which the nominal subject is followed by a pronominal prefix on the verb, is ungrammatical for this meaning: instead, it would be interpreted as topicalization of the subject.

[2]The imperative has two allomorphs: following monosyllabic verbs, its exponent is simply a floating H tone, but following disyllabic verbs, its exponent is a segmental suffix *-mɔ́*.

(3) a. è=jò
3sg=dance
'She danced.'[3]

b. yòó=ꜜɛ́ jò
woman=def dance
'The woman danced.'

c. *yòó=ꜜɛ́ è=jò
woman=def 3sg=dance
intended: 'The woman danced.'

3 Distinctions made with STAMP morphs

Dakubu (2008) meticulously describes an elaborate set of hierarchical aspect and modality features which comprise Gã verbal morphology, including [+/-realis], [+/-volitional], and many more. In doing so, she makes reference to cases of what she terms 'segmental deletions and contractions', in which a grammatical prefix to the verb sometimes surfaces as a segmental syllable and sometimes only as the tone of the preceding syllable — in other words, as STAMP morphs. In this paper, I discuss only those grammatical specifications which make up this subset of Gã verbal morphology. Several grammatical contrasts in Gã are made through the use of STAMP morphs, including the perfective, perfect, subjunctive and progressive. The corresponding portmanteau forms of each subject proclitic are provided below in Table (4). Only singular pronouns show alternations in the progressive, so the cells for the plural are left blank.

Perfective forms differ from their perfect counterparts only in tone; all segments are identical. Perfect and subjunctive forms are identical, with the sole exception of the first person singular.

3.1 Perfective

The perfective, used to indicate the completion of an action, takes the form of a floating L tone verbal prefix. The L of the perfective associates to the toneless subject proclitic (4). I use the three verbs 'come', 'dream', and 'ask' throughout to represent toneless, L, and H verbs, respectively.

[3] The third person singular in Gã is not differentiated on the basis of gender. Translations into English reflect the context in which each sentence was elicited.

Table 4: STAMP portmanteau morphs in Gã

	Perfective	Perfect	Subjunctive	Progressive
1SG	ĩ̀=	ĩ́=	má=	mĩ́ĩ́=
2SG	ò=	ó=	ó=	òò=
3SG	è=	é=	é=	èè=
1PL	wɔ̀=	wɔ́=	wɔ́=	
2PL	ɲɛ̀=	ɲɛ́=	ɲɛ́=	
3PL	àmɛ̀=	àmɛ́=	àmɛ́=	

(4) a. è=bà
3SG=come
'He came.'

b. è=là
3SG=dream
'He dreamed.'

c. è=bí
3SG=ask
'He asked.'

When the subject is non-pronominal, the effects of the floating L tone are visible. Following a subject with a final H tone, a verb-initial H is realized as downstepped (5b). This downstep results from the floating L of the perfective wedged between the final H of 'Kofi' and the initial H of the verb.

(5) a. è=bí lɛ̀
3SG=ask 3SG.ACC
'He asked her.'

b. kòfí ꜜ**bí** lɛ̀
Kofi ask 3SG.ACC
'Kofi asked her.'

In summary, the exponent of the perfective aspect is a floating L tone prefix on the verb, with no segmental component. When the subject is pronominal, that floating tone associates to the toneless proclitic. When the subject is non-pronominal, the presence of the floating L tone is visible only in between H tones, as it causes downstep.

3.2 Perfect

In perfect contexts, tonal alternations occur on both subject proclitics and verbs. The subject proclitic is always realized as H in the perfect (6). The tone of the verb, on the other hand, is affected by the presence of a floating L tone prefix: as such, the exponent of the perfect can be analyzed as a HL contour tone. The effects of the floating L part of the contour are notable on verbs in which the initial TBU is toneless or H. A toneless verb is realized as L. A H verb-initial TBU is downstepped in the perfect, as an effect of the floating L wedged in between the H pronoun and initial H of the verb (6c).

(6) a. é=bà
3SG.PRF=come
'He has come.'[4]

b. é=là
3SG.PRF=dream
'He has dreamt.'

c. é=ꜜbí
3SG.PRF=ask
'He has asked.'

When the subject is non-pronominal, a verb-initial prefix *é-* appears, and realizes the H tone of the perfect (7b). The L tone component of the perfect is still realized on the verb.

(7) a. é=bà
3SG.PRF=come
'He has come.'

b. kòfì é-bà
Kofi PRF-come
'Kofi has come.'

In 7, this PRF prefix looks just like the 3SG subject proclitic, as they are both pronounced *é*. Although they may be identical on the surface, new data provides

[4]Here, and throughout, I gloss the subject proclitic as exponing a grammatical meaning to indicate that it is realizing the only exponent of that morpheme. For instance, I gloss the proclitic here as 3SG.PRF since the exponent of the perfect morpheme is tone, which is realized on the pronoun. I do not make any claims about the composition of these morphemes at this point.

evidence that they are in fact entirely distinct morphemes. In comitative, instrumental and some locative constructions in Gã, a constituent can intervene between a pronoun and the inflected verb (8).[5] The pronoun, which here is free, surfaces as L. The same prefix exponing the perfect shows up with subjects of all person and number specifications. This affix exponing the perfect is clearly not the subject proclitic itself, as it is invariably *é*.

(8) a. ì̃ kɛ̀ lɛ̀ **é**-bà
1sg with 3sg.acc prf-come
'I have come with her.'

b. ò kɛ̀ lɛ̀ **é**-bà
2sg with 3sg.acc prf-come
'You have come with her.'

c. è kɛ̀ lɛ̀ **é**-bà
3sg with 3sg.acc prf-come
'He has come with her.'

d. wɔ̀ kɛ̀ lɛ̀ **é**-bà
1pl with 3sg.acc prf-come
'We have come with her.'

Attempts at using portmanteau forms exponing both subject and aspect features, or with an inflected pronoun separated from the verb, are judged as wholly ungrammatical (9).

(9) a. *ì̃ kɛ̀ lɛ̀ í̃-bà
1sg with 3sg.acc **1sg.prf**-come
intended: 'I have come with her.'

b. *í̃ kɛ̀ lɛ̀ bà
1sg.prf with 3sg.acc come
intended: 'I have come with her.'

Instrumental phrases may appear either pre-verbally (10a) or post-verbally (10b), with no difference in meaning. When subject features are exponed by the

[5] There are various analyses of these constructions: Campbell 2017 analyzes them as serial verb constructions that may be in the process of grammaticalization, while Felice (this volume) argues that there is morphosyntactic evidence indicating that they should be analyzed as adjuncts to the verb. Regardless of their syntactic status, there are a small number of constructions that behave this way: comitatives with *kɛ̀*, instrumentals with *kɛ̀*, and some locatives with *jɛ̀*.

proclitic, that proclitic surfaces with the H tone component of the perfect. When the pronoun is free, however, the H of the perfect is realized on the perfect prefix.

(10) a. ȉ kɛ̀ pɛ́ŋ é-ŋmà
1sg with pen prf-write
'I have written with a pen.'

b. í̋=ŋmà kɛ̀ pɛ́ŋ
1sg.prf=write with pen
'I have written with a pen.'

In summary, the perfect is multiply marked, with both a tonal component and a segmental component. A segmental verbal prefix *é-* expones the perfect. The perfect is also associated with a floating L tone, which affects the tone of the verb. When the subject of a clause is pronominal, however, the segmental component of the perfect does not appear on the surface, and instead, the proclitic realizes its H tone.

3.3 Subjunctive

In subjunctive contexts, tonal alternations take place on both subject proclitics and verbs. Just like the perfect, when the subject is pronominal, the proclitic is always realized as H (11).[6]

(11) a. é=ꜜbá
3sg.sbjv=come
'He should come.'

b. é=ꜜlá
3sg.sbjv=dream
'He should dream.'

c. é=bí
3sg.sbjv=ask
'He should ask.'

While both the perfect and subjunctive involve realizations of a H tone on the proclitic, the two clearly differ in non-pronominal contexts: the subjunctive appears with a verbal prefix *á-* (12).

[6]The tone of the verb in the subjunctive is attributable to the effects of a systematic rule in the language, the HL Rule (Paster 2003), in which a sequence of a H tone followed by an utterance-final L raises to HꜜH. As such, the verbs 'come' and 'dream' in (11), which are underlyingly toneless and L respectively, appear as downstepped H on the surface.

(12) a. kòfì é-bà
Kofi PRF-come
'Kofi has come.'

b. kòfì á-ꜜbá
Kofi SBJV-come
'Kofi should come.'

Similarly, when a constituent intervenes between the pronoun and verb, this same *á-* prefix appears on the verb (13a). When the subject is cliticized to the verb, however, the prefix does not appear and the proclitic is instead H-toned (13b).

(13) a. ò kɛ̀ blɔ́ á-tsúꜜmɔ́
2SG with broom SBJV-clean
'You should clean with a broom.'

b. ó=tsúmɔ̀ kɛ̀ blɔ́
2SG.SBJV=clean with broom
'You should clean with a broom.'

To summarize, the subjunctive is marked by a segmental prefix *á-*. All surface tonal alternations are fully predictable from rules that apply throughout the language. The segmental prefix exponing the subjunctive does not appear on the surface when a proclitic is present: instead, the proclitic realizes its H tone.

3.4 Progressive

The progressive is realized in two distinct ways: as an alternation in the vowel length of the pronoun, or as a prefix of a L-toned nasal consonant on the verb. This allomorphy is conditioned by pronoun shape, which corresponds to number: the vowel length allomorph attaches to singular pronouns, which all consist of a single vowel (14).

(14) a. mĩ̋ĩ́=ꜜbá
1SG.PROG=come
'I am coming.'[7]

b. òò=bà
2SG.PROG=come
'You are coming.'

[7]This 1SG.PROG form is exceptional: see section 6 for further discussion.

c. èè=bà
3SG.PROG=come
'He is coming.'

Elsewhere, the nasal consonant allomorph appears. The progressive in these contexts is exponed by a L-toned nasal which receives its place of articulation from the following consonant (15). When the TBU immediately preceding the verb has an underlying H tone, it surfaces with a HL contour tone, as is visible from the form of 'Kojo' in (15d).

(15) a. wɔ̀=m̀-bà
1PL=PROG-come
'We are coming.'

b. ɲɛ̀=ǹ-jò
2PL=PROG-dance
'You (pl.) are dancing.'

c. àmɛ̀=ɲ̀-ɲɛ́
3PL=PROG-walk
'They are walking.'

d. kòjô ŋ̀-kánè wòlú=ꜜɛ́
Kojo PROG-read book=DEF
'Kojo is reading the book.'

Similarly, clauses with free pronominal subjects show an identical pattern (16a).

(16) a. ȉ yɛ̀ skû ŋ̀-kánè nı̋ȉ
1SG at school PROG-read thing
'I am reading at school.'

b. mı̋ı̋=kánè nı̋ȉ yɛ̀ skú
1SG.PROG=read thing at school
'I am reading at school.'

To summarize, the progressive aspect has two distinct allomorphs: the lengthening of the vowel of singular proclitics, and a segmental prefix *Ǹ*-, in which N represents a nasal homorganic to the following consonant. The progressive does not affect the tone of the verb, but does have an impact on the surface realization of a preceding tone, as evidenced by the behavior of 'Kojo' in (15)d and 'school' in (16)a. I consider this evidence that the progressive has both a segmental and tonal component: the verbal prefix *Ǹ*- as well as a floating L tone prefix.

3.5 Interim summary

The tonal and segmental exponents of various grammatical specifications in Gã are presented below in Tables 5 and 6. The segmental components of certain morphemes are visible as transcribed only when a subject proclitic is not present.

Table 5: Exponents of grammatical specifications in the absence of a subject proclitic

	Perfective	Perfect	Subjunctive	Progressive
Tonal	L	L		L
Segmental		*é-*	*á-*	*Ǹ-*

When a proclitic is present, any segmental component is not realized on the surface; instead, the proclitic realizes its tone. As such, the exponence of these four morphemes is solely suprasegmental in the presence of a subject proclitic.

Table 6: Exponents of grammatical specifications in the presence of a subject proclitic

	Perfective	Perfect	Subjunctive	Progressive
Tonal	L	HL	H	LL (+ lengthening for SG proclitics)

4 Prior analyses

Several prior analyses of Gã verbal morphology address the phenomena I have described here, in which a verbal prefix alternates with the tone of the pronoun in various grammatical contexts (Kropp Dakubu 2002, Dakubu 2008, Paster 2003). However, these prior works differ in their analyses about representation of the underlying forms. Dakubu considers these alternations to result from the deletion of the prefix before a pronoun, in which the tone of the prefix delinks and reassociates to the pronoun. Paster, on the other hand, argues that the process of prefix deletion before pronouns is not part of the synchronic phonology. She claims that there is no independent motivation in Gã for such deletion rules, as she argues that it would not pattern with vowel hiatus resolution strategies elsewhere in Gã. Paster therefore proposes that these pronouns should be analyzed as suppletive portmanteaux. The realization of the segmental prefixes exponing aspect and mood, then, is morphologically blocked when the subject is a prefix.

Neither author makes any reference to the constructions in which a constituent intervenes between the pronoun and the verb (as in (16), for instance). These constructions raise some issues for Paster's analysis of portmanteau morphs: if the process of prefix deletion before pronouns is not part of the synchronic phonology, as Paster argues, how can we account for these constructions? In addition, Paster claims that the prefixes exponing aspect and mood are subject pronouns in all contexts: this analysis cannot account for the constructions in which both subject pronouns and aspect prefixes are realized within a single sentence.

Following Kropp Dakubu 2002, I argue that the novel data I have presented from comitative, instrumental and locative constructions supports the conclusion that STAMP morphs result from the deletion of the segmental component of a verbal prefix in the presence of a subject proclitic. I now proceed to lay out the specifics of this analysis in a constraint-based model.

5 Constraint-based analysis of surface realizations

I have presented the realizations of several grammatical specifications in various contexts, including clauses involving pronominal subjects (both as free pronouns and proclitics) as well as those involving non-pronominal subjects. Prior analyses of these phenomena have differed in their representations of the underlying forms: specifically, whether they should be considered to be suppletive portmanteaux, or the result of predictable phonological processes. I have shown that an analysis involving suppletion is not the most appropriate for the data, and as such, in this section I demonstrate that the described surface realizations of STAMP morphs in Gã can be straightforwardly derived from regular phonological processes present in the language.

5.1 Vowel hiatus resolution

Despite claims to the contrary, the process of prefix deletion after a subject proclitic is in fact completely in line with vowel hiatus resolution in Gã.[8] This phenomenon is clear in the possessive construction (17): when a proclitic of the shape

[8] Paster's specific claim is that 'there is no independently motivated rule in Gã that deletes an /a/ after another vowel, nor is there a rule that deletes /i/ before /a/' (Paster 2003: 29). While this is true, there is no reason why rules targeting specific vowel qualities would be necessary, rather than referring to the vowel hiatus resolution strategy I describe which applies to a specific position within the word.

V attaches to a V-initial noun, the first vowel of the noun deletes. When a VV onset would be created, as in (17)c, the second vowel deletes in order to prevent that onset from surfacing.[9]

(17) a. òmɔ́
rice
'rice'

b. è=mɔ́
3SG=rice
'his rice'

c. *è=òmɔ́
3SG=rice
intended: 'his rice'

This process exactly parallels what we find with the alternations between proclitics and verbal prefixes, such as the subjunctive *á-* (18).

(18) a. kòfí á-ꜜbá
Kofi SBJV-come
'Kofi should come.'

b. é=ꜜbá
3SG.SBJV=come
'He should come.'

c. *è=á-ꜜbá
3SG=SBJV-come
intended: 'He should come.'

I make use of three constraints: *#VV, which penalizes an initial syllable consisting of a sequence of two vowels; MAX-TONE, which penalizes the deletion of a tone present in the underlying representation; and MAX, which penalizes the deletion of a segment present in the underlying representation. When ranked such that *#VV and MAX-TONE outrank MAX, we are able to correctly derive the surface form found in (19). I assume, following Kropp Dakubu 2002, that the underlying form of the word includes both the prefix (here, *é-*) and the proclitic

[9] A reviewer has suggested that the initial consonant of 'rice' could be analyzed as a prefix, in which case the possessive morpheme would simply take the place of the prefix. However, there is no independent evidence in the language to suggest that the initial /o/ here should be analyzed as prefixal, and all vowel-initial nouns in Gã (regardless of which vowel) pattern as shown in (17).

(here, *ĩ=*). In the underlying representation, both the proclitic and verb are toneless. The underlying representation of the perfect includes the segmental prefix *é-*, which itself carries a H tone, as well as a floating L tone, represented as a superscript L.

(19) ĩ́=bà
1SG.PRF=come
'I have come.'

ĩ=é-^{L}-ba	*#VV	MAX-TONE	MAX
a. ĩ̀ébà	*!		
☞ b. ĩ́bà			*
c. ĩ̀bà		*!	

Candidate (a), in which the floating L of the perfect associates to the verb and the toneless proclitic is assigned a default L tone, is penalized for having a dispreferred VV initial syllable. In candidate (b), the segmental component of the perfect prefix is deleted, resulting in the reassociation of its H tone to the toneless proclitic to its left. This contrasts with candidate (c), in which deletion of the prefix occurs, but its tone does not reassociate with the subject proclitic. Since the H tone associated with the perfect does not appear in the output, this candidate violates MAX-TONE. Therefore, candidate (b) is the winner. This constraint ranking is able to account for the surface realization of specifications in which the segmental exponent is a single vowel. Therefore, this ranking can also take care of the perfect and subjunctive forms. However, correctly accounting for the surface forms of the progressive involves delving further into language-internal phonotactic rules.

5.2 Syllable structure constraints

The progressive looks slightly different on the surface from the other grammatical constructions I have presented: while the others are clearly exponed tonally, the STAMP forms of the progressive involve vowel length. However, I argue that these forms are still attributable to tone, thereby unifying the analyses of grammatical tone and length in Gã. Recall that STAMP morphs in the progressive are limited only to singular pronouns: lengthening results only with pronouns of the shape V. I propose that the segmental component of the progressive, a nasal consonant unspecified for place of articulation, is always present in the underlying structure. However, a restriction on the phonological shape of words in Gã comes into play: a syllable cannot have a coda with no onset. As such, VN is not a possible syllable in Gã. A possible way to get around this constraint on syllable structure while maintaining features of both segments could be to nasalize the vowel of the proclitic: however, the mid +ATR vowels /o/ and /e/ have no nasal counterparts in the Gã inventory.[10]

These observations can be rewritten in constraint form: *VN assigns a violation for a syllable of the shape VN; *ẽ assigns a violation for any nasal mid +ATR vowel in the output, and Ident[cons] assigns a violation for an output segment which differs from the input in the feature [consonantal]. Additionally, the faithfulness constraint Max-Nas penalizes a change between input and output in the feature [nasal].[11] When ranked alongside the previously introduced constraints Max-Tone and *#VV, we can correctly derive the surface form we see in (20). The progressive is represented in the underlying form by its segmental component, the verbal prefix *Ǹ*, as well as a floating L tone to its left.

(20) èè=bà
3sg.prog=come
'He is coming.'

e=^{L}-Ǹ-ba	*VN	*ẽ	Max-Tone	*#VV	Ident[cons]	Max-Nas
a. èm̀bà	*!					
b. ẽ̀ẽ̀bà		*!			*	
☞ c. èèbà				*	*	*
d. ẽ̀bà		*!	*			
e. èbà			*!			*

Candidate (a), in which the unspecified nasal of the progressive morpheme receives its place of articulation from the following consonant, violates the markedness constraint *VN and is thereby eliminated. In candidate (b), the mora of the progressive morpheme is retained but is realized as a lengthening of the vowel of the proclitic, maintaining the nasalization associated with the mora of the progressive. The floating low tone associated with the progressive associates to the

[10]These two vowels specifically are relevant since the 1sg proclitic is already a nasal vowel, and therefore is not affected by nasalization; the 2sg proclitic is *o=*, and the 3sg *e=*, precisely those vowels which may not nasalize.

[11]An anonymous reviewer additionally suggested the inclusion of the constraint Max-Mora. I agree that this constraint correctly captures the pattern in the data; however, in this particular tableau, it is superfluous since each tone is associated with exactly one mora, so the relevant effects are captured by the violations of Max-Tone. In the rare contexts in Gã involving multiple tones surfacing on one mora, however, Max-Mora would certainly be a necessary addition to the list of constraints.

proclitic to its left. The presence of the surface form [ẽ] violates a highly ranked markedness constraint in the language. Candidate (c) shows the same process as (b), but does not maintain nasalization. In candidate (d), deletion of the mora associated with the progressive morpheme occurs; however, doing so incurs a violation of the constraint Max-Tone, as there is one more tone present in the input than in the output. Candidate (e) differs only in that it does not maintain input nasalization. Ultimately, candidate (c) is the winner, as it does not violate any of the highly ranked constraints in the tableau.

6 Exceptional forms

The surface forms of several portmanteau morphs, listed below in Table (7), cannot be predicted from the regular phonology. All three involve the first person singular, and all involve the unexpected appearance of an initial bilabial nasal consonant.[12] The first person singular pronoun in Gã was in fact historically pronounced as *mĩ*, and is still written as such in the orthography (Campbell 2017).

Table 7: Exceptional portmanteau forms

	predicted	observed
1sg.prog	ì̃ì̃=	mí̃í̃=
1sg.sbjv	í̃=	má=
1sg.irr	ì̃=bàá	má=

A possible analysis of these exceptional forms could involve morpheme-specific suppletive allomorphy. The 1sg.sbjv and 1sg.irr forms could potentially result from the segmental fusion of adjacent morphemes. As the segmental form of the subjunctive is *á*, a potential analysis could cite the phonological fusion of the nasality of the first person singular proclitic with the vowel of the subjunctive. While all other attested STAMP morphs can be straightforwardly derived from the regular phonological processes I have described, these three forms remain unpredictable. I acknowledge that these three forms of the first person singular proclitic are exceptional, but leave the specific implementation of a solution to this piece of the paradigm for future work.

[12] I have not discussed the formation of the irrealis in Gã here: in all cases except for the first person singular, the irrealis simply involves the cliticization of a proclitic to the auxiliary *bàá*.

7 Conclusions

I have presented new data collected with native speakers of Gã that sheds light on STAMP processes in the language. I have shown that this data supports an analysis in which surface STAMP morphs are fully predictable from the combination of decomposable subject proclitics and verbal prefixes. The emergence of STAMP morphs in Gã can be accounted for through phonotactic restrictions and regular phonological phenomena present in the language for which there is ample independent evidence. This approach greatly simplifies underlying representations of exponents of grammatical specifications in that it does not need to resort to suppletive allomorphy in order to account for portmanteau morphs. Additionally, the difference in exponence between grammatical tone and length (namely, that tone is marked on all pronouns but only singular pronouns undergo lengthening) is attributable to the phonological shape of pronouns. This analysis thereby is able to present a single unified account of both grammatical tone and length in Gã. This data provides support for an account in which pronominals and aspect prefixes are synchronically decomposable, but undergo a process of deletion and tone reassociation in specific phonological environments. This work contributes to the theoretical literature on STAMP morphs, particularly by highlighting a language in which pronominals and aspect prefixes are separable, and offers insight into how now-grammaticalized STAMP morphs may have functioned and developed in the past.

Abbreviations

1	first person	DEF	definite
2	second person	NEG	negative
3	third person	PRF	perfect
SG	singular	SBJV	subjunctive
PL	plural	PROG	progressive
ACC	accusative	IRR	irrealis

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Chapter 10

Grammaticalisation of the Kimakunduchi demonstrative: Insights into the emergence of post-stem object markers in Bantu

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This study examines contracted forms of the demonstrative in the Kimakunduchi dialect of Swahili. Unlike uncontracted demonstratives, the contracted demonstrative always refers to a topic, which can be expressed by preverbal noun phrases. After describing this feature, the study proposes that the Kimakunduchi contracted demonstrative is at an early stage of the development of a pronominal suffix, and provides insights into the hypothesis related to the emergence of post-stem object markers widely observed in Bantu languages.

1 Introduction

In the Kimakunduchi dialect of Swahili,[1] there are contracted forms of the demonstrative in addition to uncontracted basic forms. The contracted and basic forms

[1]In the coastal areas of Eastern Africa, there are several language varieties regarded as local dialects of Swahili (Nurse & Hinnebusch 1993). Kimakunduchi, also known as Kihadimu and Kikae, is one such dialect spoken in the southeastern part of Unguja (where Makunduchi District is located), the largest island of the Zanzibar archipelago in Tanzania. In Guthrie's referential classification, Kimakunduchi has been assigned the code G43c (Guthrie 1948, 1967–1971, Maho 2009).

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can occur in different contexts. For example, the basic form *yuno* in (1a), but not the corresponding contracted form *=yu* in (1b), can modify nouns.[2]

(1) a. m̩-m-ono mwalimu yuno
sm1sg-om1-see:pfv 1.teacher dem.prox.1
'I saw this teacher.'

b. *m̩-m-ono mwalimu=yu
sm1sg-om1-see:pfv 1.teacher=dem.prox.1
Intended: 'I saw this teacher.'

Furthermore, contracted forms differ from basic forms in that they can be co-referential with preverbal noun phrases (see also Racine-Issa 2002: 59). This can be seen in (2).[3]

(2) a. mwalimu yuno ka-ja=yu
1.teacher dem.prox.1 sm1-come:pfv=dem.prox.1
'This teacher came.'

b. #mwalimu yuno ka-ja yuno
1.teacher dem.prox.1 sm1-come:pfv dem.prox.1
Intended: 'This teacher came.'

The above-mentioned two features suggest that contracted forms of the demonstrative are in the process of diverging from basic forms in terms of its function. The present study focuses on this point, which has previously received little attention. More specifically, I propose that the contracted demonstrative has grammaticalised into a bound pronoun, which only refers to a topic, and is at a very early stage of the development of post-stem object markers, which are widely observed in Bantu languages.

[2]Unless otherwise noted, the examples in this article are provided by the Kimakunduchi native speakers, Sigombe Haji Choko and Zainabu Khatibu Bonde, who are listed in the acknowledgements. Examples are transcribed using the orthography of Standard Swahili with the following modifications: aspiration and nasal syllabicity are marked with the respective IPA symbols, the first characters of sentences and proper nouns are written in lower case, periods are not added at the end of sentences, Ø is used for a prefix without phonological form, and morpheme boundaries are shown with hyphens (for affixes) and equal signs (for clitics). Numbers in the gloss primarily demonstrate noun class information. While the first and second persons are also represented by numbers 1 and 2 in the same way as classes 1 and 2, they, unlike the class numbers, are shown together with sg or pl. Other abbreviations glossed to functional morphemes are listed at the end of this article.

[3]When the same basic forms occur both in the preverbal and postverbal positions, they are construed as having different referents.

Following the introduction, §2 describes basic formal features of the contracted demonstrative, while §3 deals with its topic-marking. §4 provides an analysis from a diachronic perspective and summarises new insights which the Kimakunduchi contracted demonstrative provides for the hypothesis regarding the development of post-stem object markers in Bantu. §5 concludes the article with a summary.

2 Basic formal features of the contracted demonstrative

2.1 The form of the demonstrative

Kimakunduchi has a three-term system of the demonstrative; more precisely, there are proximal, medial, and distal forms. In addition to the location of the referent, the noun class information of the corresponding noun also controls the form of the demonstrative. Assuming that Kimakunduchi nouns can be categorised into noun classes numbered from 1 to 18 (minus 12–14) in the same way as Standard Swahili (Meinhof 1932: 128; Racine-Issa 2002: 30ff.), forms of the demonstrative can be summarised as in Table 1.[4] Note that for class 15, there seem to be no forms of the demonstrative (see also Racine-Issa 2002).

As can be seen in this table, the proximal and medial contracted forms almost correspond to the first and second syllables of the uncontracted basic forms, respectively.[5] For the distal, there are no contracted forms.

2.2 The wordhood of the contracted demonstrative

Monosyllabic verb stems are accompanied by the empty morph *ku-* when preceded by particular prefixes. In (3a), for example, *ku-* occurs between imperfective *na-* and the stem *-nywa* 'drink'. Only when the verb is followed by another constituent in the same clause, can the empty morph optionally be omitted, as the parentheses in (3b) suggest. Its omission is impossible when the verb occurs in the clause-final position.

(3) a. tu-na-ku-nywa
sm1pl-ipfv-KU-drink
'We are drinking.'

[4]While there are also reduplicated and compounded forms, they are not discussed in detail in this article.

[5]According to an informant of this study, the first syllable of the basic form of the class 18 proximal is the syllabic nasal m̩, lacking the vowel u, although Racine-Issa (2002: 69) describes it as mu.

Table 1: Forms of the demonstrative (Racine-Issa 2002: 69)

	Proximal		Medial		Distal
	Basic	Contracted	Basic	Contracted	Basic
cl1	*yuno*	*=yu*	*uyo*	*=yo*	*yulya*
cl2	*wano*	*=wa*	*wao*	*=o*	*walya*
cl3	*uno*	*=u*	*uo*	*=o*	*ulya*
cl4	*ino*	*=i*	*iyo*	*=yo*	*ilya*
cl5	*lino*	*=li*	*ilyo*	*=lyo*	*lilya*
cl6	*yano*	*=ya*	*yayo*	*=yo*	*yalya*
cl7	*kino*	*=ki*	*icho*	*=cho*	*kilya*
cl8	*vino*	*=vi*	*ivyo*	*=vyo*	*vilya*
cl9	*ino*	*=i*	*iyo*	*=yo*	*ilya*
cl10	*zino*	*=zi*	*izo*	*=zo*	*zilya*
cl11	*uno*	*=u*	*uo*	*=o*	*ulya*
cl16	*vano*	*=va*	*avo*	*=vo*	*valya*
cl17	*kuno*	*=ku*	*uko*	*=ko*	*kulya*
cl18	*muno (~m̩no)*	*=mu*	*umo*	*=mo*	*m̩lya*

b. tu-na-(ku-)nywa maji
   SM1PL-IPFV-KU-drink water
   'We are drinking water.'

When monosyllabic verbs lack *ku-*, they can be followed by basic forms of the demonstrative such as the class 16 proximal *vano* in (4a), but not by contracted forms such as *va=* in (4b). Contracted forms can be used only when the verb is accompanied by *ku-*, as in (4c).

(4) a. ka-na-ja vano
   SM1-IPFV-come DEM.PROX.16
   'S/he is coming here.' 'S/he comes here.'

   b. *ka-na-ja=va
   SM1-IPFV-come=DEM.PROX.16
   Intended: 'S/he is coming here.' 'S/he comes here.'

   c. ka-na-ku-ja=va
   SM1-IPFV-KU-come=DEM.PROX.16
   'S/he is coming here.' 'S/he comes here.'

Assuming that independent, but not dependent, forms can follow monosyllabic verbs when *ku-* is omitted, the difference in terms of acceptability between (4a) and (4b) can be attributed to the wordhood of the demonstrative; that is (4b) was not accepted because the contracted form lacks independence as a word. Based on this observation, I analyse the contracted demonstrative as a bound morpheme.

The contracted demonstrative can be attached not only to verbs, but also to other word classes. In (5), for example, the adjective *-tamu* 'sweet' hosts the class 7 medial form *=cho*, while in (6), the noun *ruhusa* 'permission' is followed by the class 1 medial *=yo*.

(5) kit^{h}u kitamu=cho
7.thing sweet.7=DEM.MED.7
'That is an attractive thing.'

(6) u-si-m̩-k^{h}e ruhusa=yo
SM2SG-NEG-OM1-give:SBJV permission=DEM.MED.1
'Don't give her permission (to go to take bathe).'

Amongst bound forms, clitics, but not affixes, tend to attach to almost any word class (Haspelmath & Sims 2010: 198, cf. Aikhenvald 2003). Against this background, I describe the contracted demonstrative as a clitic.

2.3 Difference from the bound pronoun

In Kimakunduchi, the defective verb *-na* 'have' and the copula verb *-wa* can be followed by bound morphemes which pronominally refer to a possessed item (7) and a place (8), respectively.[6]

(7) kisu ka-na-cho
7.knfie SM7-have-PRON7
'For the knife, s/he has it.' (Furumoto & Gibson 2022)

(8) ka-cha-wa-ko
SM1-FUT-COP-PRON17
'S/he will be there.'

[6]The copula stem *-wa*, unlike other monosyllabic verbal stems, obligatorily lacks the empty morph *ku-*.

These bound morphemes mostly share the shape with contracted forms of the medial demonstrative, as can be seen in Table 2. As their glosses suggest, however, they are analysed not as the demonstrative, but as a different morpheme, which I call the bound pronoun.

Table 2: Forms of the bound pronoun and medial demonstrative

	Bound pronoun	Medial demonstrative
cl1	*-e ~-ye*	*=yo*
cl2	*-o*	*=o*
cl3	*-o*	*=o*
cl4	*-yo*	*=yo*
cl5	*-lyo*	*=lyo*
cl6	*-yo*	*=yo*
cl7	*-cho*	*=cho*
cl8	*-vyo*	*=vyo*
cl9	*-yo*	*=yo*
cl10	*-zo*	*=zo*
cl11	*-o*	*=o*
cl16	*-vo*	*=vo*
cl17	*-ko*	*=ko*
cll8	*-mo*	*=mo*

This analysis stems from the observation that contracted forms of the proximal demonstrative cannot appear in the same position. For example, the class 17 proximal form *=ku* cannot follow the copula directly (9). If what the the copula verb hosts in (8) is the contracted demonstrative, the proximal form would also similarly co-occur with the copula.

(9) *ka-cha-wa=ku
 SM1-FUT-COP=DEM.PROX.17
 Intended: 'S/he will be here.'

For the difference between the two kinds of bound morphemes, there is an additional indication. In (10a), for example, the bound pronoun *-ko* refers to the same object as the co-occurring contracted proximal demonstrative *=ku*. The demonstrative never exhibits such a co-occurrence (10b).

(10) a. ka-cha-wa-ko=ku
SM1-FUT-COP-PRON17=DEM.PROX.17
'S/he will be here.'

b. *ka-cha-ku-ja=ko=ku
SM1-FUT-KU-come=DEM.MED.17=DEM.PROX.17
Intended: 'S/he will come (t)here.'

Note that synchronically, the contracted demonstrative and the bound pronoun should be distinguished. Diachronically, however, they may be related, considering that they can possibly be traced back to the same origin (cf. Nurse & Hinnebusch 1993: 206).

3 Reference to a topic

The contracted demonstrative can be co-referential with preverbal noun phrases, as already mentioned in §1. Below, I first re-articulate this syntactic feature and then analyse whether the contracted demonstrative only refers to a topic.

3.1 Correspondence to preverbal noun phrases

When the preverbal noun phrase is modified with a proximal basic form, the proximal, but not medial, contracted form of the same noun class can occur postverbally, as can be seen in (11a). In contrast, the medial basic form in the preverbal position can only correspond to the medial contracted form (11b). This observation confirms that the referent of the postverbal contracted form is the same as that of the preverbal noun phrase.[7]

(11) a. baskeli ino i-bomoko{=i/*=yo}
9.bicycle DEM.PROX.9 SM9-break:NEU:PFV=DEM.PROX.9/=DEM.MED.9
'This bicycle is broken.'

b. baskeli iyo i-bomoko{=yo/*=i}
9.bicycle DEM.MED.9 SM9-break:NEU:PFV=DEM.MED.9/=DEM.PROX.9
'That bicycle is broken.'

[7]For the distal, which lacks contracted forms (see also §2.2), basic forms in the postverbal position can be co-referential with preverbal noun phrases. This does not hold for the proximal and medial.

The contracted demonstrative can correspond not only to the subject, but also to other syntactic functions. For example, the contacted demonstrative *=yu* corresponds to the preverbal object *mwalimu yuno* 'this teacher' in (12).

(12) mwalimu yuno nyi-m̩-kut^{h}u=yu
1.teacher dem.prox.1 sm1sg-om1-meet:pfv=dem.prox.1
'For this teacher, I met her/him.'

In Kimakunduchi, the word order, which is SVO by default, can change according to the information structure. Assuming that the preverbal position hosts the topic constituent as in other Bantu languages (Kimenyi 1980, Yoneda 2011, van der Wal 2015, Downing & Hyman 2016), it is conceivable that the contracted demonstrative, which corresponds to preverbal noun phrases, refers to a topic.

Not only the subject and object, but also other constituents, such as locative nouns (13), temporal expressions (14), and possessor nouns (15) can co-occur with their corresponding contracted demonstratives. This observation suggests that the use of the contracted demonstrative is not related to indexing of any one syntactic function or semantic role, and supports that it serves to mark a topic (cf. Gundel 1988: 216).

(13) kajengwa nyi-okoto embe=ko
17.Kajengwa(pn) sm1sg-pick.up:pfv mango(es)=dem.med.17
'In Kajengwa, I picked up mangoes.'

(14) wakati a-Ø-o-vyaligwa mwanangu ny-evu
11.time sm1-pfv-rel11-bear:pass my:child sm1sg-pst:cop
m̩ji-ni=o
town-loc=dem.med.11
'When my son was born, I was in the town.'

(15) yuno mwanak^{h}ele baskeli yake i-bomoko=yu
dem.prox.1 1.child 9.bicycle his.9 sm9-break:neu:pfv=dem.prox.1
'For this child, his bicycle is broken.'

Note that if the contracted demonstrative actually refers to topics, the above three examples allow us to consider that the contracted demonstrative covers a frame-setting topic, which specifies a spatial, temporal, or individual domain within which the proposition holds (Chafe 1976: 50; Jacobs 2001: 656; Krifka 2008: 268–269).

3.2 Givenness/familiarity

It has been proposed that topic referents typically have a givenness/familiarity status; they are introduced in the discourse previously or identifiable for the hearer (Chafe 1987: 37; cf. Kuno 1973; Gundel 1988; Tomioka 2020), Alhough this is probably not always the case (see also Lambrecht 1994: 160ff; Krifka 2008: 265), we can consider that the contracted demonstrative is likely related to topic-marking if discourse givenness/familiarity is mandatory for the use of the contracted demonstrative.

The following two tests investigate whether the contracted demonstrative requires its referent to have already been given in the discourse. If the contracted demonstrative refers to a topic, the results of the two tests would be negative.

- Whether the contracted demonstrative corresponds to the subject when the entire clause is focused
- Whether the contracted demonstrative can have a brand-new referent

3.2.1 Correspondence to the subject of an 'event-reporting sentence'

Sentences which in their entirety convey new information are called event-reporting sentences (Lambrecht 1994: 124, 137ff., 166).[8] For example, the sentence used by B in (16), which answers A's question 'What happened', is a typical event-reporting sentence.

(16) A: What happened?
B: The children went to school.

In Kimakunduchi, the use of the contracted demonstrative in event-reporting sentences was not accepted. This is shown in (17), where A elicits an event-reporting sentence from B by using the verb *-na* 'have' accompanied by the class 16 subject prefix *va-*.

(17) A: va-na nini mbona wat^{h}u wengi
sm16-have what why 2.people many.2
'What is happening here? (lit. What are there here?)
Why are there many people?'

[8] Event-reporting sentences are otherwise called 'neutral descriptions' (Kuno 1972) and 'news sentences' (Schmerling 1976).

B: m̩zungu ka-na-cheza ngoma
1.white.person sm1-ipfv-play dance
'A white person is dancing.'
B': #m̩zungu ka-na-cheza ngoma=yo
1.white.person sm1-ipfv-play dance=dem.med.1
Intended: 'A white person is dancing.'

In this context, the subject *m̩zungu* 'a white person', the correspondent of the contracted demonstrative *=yo*, is newly introduced in the discourse together with remaining part of the sentence. Accordingly, it appears that B' in (17) was not accepted because of the gap between the context where this sentence was used and the information structure by which the use of the contracted demonstrative is licensed; the subject *m̩zungu* cannot be retrieved from the the hearer's previous knowledge, whereas the contracted demonstrative requires the subject to be already known.

3.2.2 Brand-new referents

The contracted demonstrative does not necessarily require the presence of corresponding preverbal noun phrases. In (18), for example, the class 16 proximal contracted form *=va* is used in a similar manner as the basic form *vano*.

(18) A: juma k-evu ka-ja vano
Juma(pn) sm1-pst:cop sm1-come:pfv dem.prox.16
'Did Juma come here?'
B: ee juma k-evu ka-ja vano
yes Juma(pn) sm1-pst:cop sm1-come:pfv dem.prox.16
'Yes, Juma came here.'
B': ee juma k-evu ka-ja=va
yes Juma(pn) sm1-pst:cop sm1-come:pfv=dem.prox.16
'Yes, Juma came here.'

However, the use of the contracted demonstrative is not allowed in some cases. Example (19) is one such case.

(19) A: juma k-evu ka-ja wapi
Juma(pn) sm1-pst:cop sm1-come:pfv where
'Where did Juma come?'

B: juma k-evu ka-ja vano
Juma(PN) SM1-PST:COP SM1-come:PFV DEM.PROX.16
'Juma came here.'
B': #juma k-evu ka-ja=va
Juma(PN) SM1-PST:COP SM1-come:PFV=DEM.PROX.16
Intended: 'Juma came here.'

The comparison of the two examples indicates that basic forms can be used regardless of the information structure; in contrast, contracted forms can be used when the referent of the demonstrative has already been introduced in the discourse, but not when the referent is newly introduced. This observation is also compatible with the expectation for the result of the test, indicating that the contracted demonstrative refers to a topic.

Note that in Kimakunduchi,[9] noun phrases cannot appear in the preverbal position when conveying new information, as exemplified by the object *embe* 'mangoes' in (20).[10] Therefore, it is impossible to examine whether the contracted demonstrative can co-occur with a preverbal noun phrase introducing new information since the unacceptability of such a sentence is attributable to the illicit word order, rather than the presence of the contracted demonstrative.

(20) A: ku-okoto nini
SM2SG-pick.up:PFV what
'What did you pick up?'
B: nyi-okoto embe
SM1SG-pick.up:PFV mangoes
'I picked up mangoes.'
B': #embe nyi-okoto
manoges SM1SG-pick.up:PFV
Intended: 'I picked up mangoes.'

3.3 Aboutness

3.3.1 Co-occurrence with *kila* 'every'

A prototypical feature of topic-marking strategies can be spelled out in the following way: using a topic construction or a topic marker, the speaker identifies

[9] According to an anonymous reviewer, other dialects of Swahili allow the object to occur preverbally in a context such as (20).

[10] While preverbal objects tend to require the corresponding object prefix to accompany verbs, the presence of the object prefix is not mandatory in (20) regardless of the object position.

an entity (topic) and expresses information (comment) *about* it (Hockett 1958: 201; Gundel 1988: 210; Lambrecht 1994: 131; Krifka 2008: 265). According to Jacobs (2001: 652), whether aboutness is encoded can be tested using non-referring expressions; when a strategy (e.g. a morphological marker, a particular word order) is specialised to encode the aboutness relation, it does not allow non-referring expressions such as universally quantified noun phrases to occur in the position hosting the topic constituent. This proposal is built on the following analysis: the knowledge and information that the speaker and hearer share at a given moment in the discourse can be perceived as a set of propositions. This set of propositions is updated constantly as information is newly added in the discourse. Newly added information is not stored in the form of unrelated/unstructured propositions, but associated with propositions already in the discourse. The aboutness topic functions as an identifier or address of the proposition (or the set of propositions) to which newly added information is linked (Reinhart 1981: 78–80; Jacobs 2001: 650–655; Krifka 2008: 264ff.). Therefore, topic constituents must be referential, which is incompatible with non-referring expressions.

In Kimakunduchi, the contracted demonstrative cannot co-occur with noun phrases including the quantifier *kila* 'every', as can be seen in (21).

(21) a. kila m̩t^{h}u nyi-m̩-kut^{h}u
every 1.person SM1-OM1-meet:PFV
'I met everyone.'

b. *kila m̩t^{h}u nyi-m̩-kut^{h}u=yo
every 1.person SM1-OM1-meet:PFV=DEM.MED.1
Intended: 'I met everyone.'

Noun phrases including *kila* are considered non-referential. If non-referring expressions cannot serve as an 'address' of the proposition(s), it appears that the contracted demonstrative can be used only when there is an aboutness relation between the referent of the contracted demonstrative and the proposition expressed by the rest of the same clause.[11]

[11]For the incompatibility of topic expressions with 'every', Endriss (2009: 40, 241) presents an alternative analysis through her observation on German. According to her, noun phrases quantified by 'every' can be construed as an address of the proposition, and its unacceptability in the left-dislocated position is attributable to the conflict of number: the singular quantifier like 'every', when left-dislocated, has to be resumed by a singular resumptive pronoun, whereas its referent is a plural object and thus requires a resumptive pronoun to be plural. Assuming that the Kimakunduchi contracted demonstrative functions as a similar resumptive pronoun, the unacceptability of (21b) might be attributed the same conflict, rather than the referentiality.

3.3.2 Restriction to the double occurrence of the contracted demonstrative

When there are two preverbal noun phrases, the contracted demonstrative in the postverbal position agrees with either of them. In (22a), the class 1 medial form *=yo* corresponds to the subject *fatuma*, whereas in (22b), the class 10 medial form *=zo* corresponds to the preverbal object *embe* 'mangoes'.[12] Notably, these contracted forms cannot co-occur, as exemplified in (22c). Their co-occurrence is impossible regardless of their order.

(22) a. fatuma embe ka-zi-okoto=yo
1.Fatuma(PN) 10.mangoes SM1-OM10-pick.up:PFV=DEM.MED.1
'Fatuma picked up the mangoes.'

b. fatuma embe ka-zi-okoto=zo
1.Fatuma(PN) 10.mangoes SM1-OM10-pick.up:PFV=DEM.MED.10
'Fatuma picked up the mangoes.'

c. *fatuma embe
1.Fatuma(PN) 10.mangoes
ka-zi-okoto=yo=zo
SM1-OM10-pick.up:PFV=DEM.MED.1=DEM.MED.10
Intended: 'Fatuma picked up the mangoes.'

Tomioka (2020: 18) has suggested that there can be only one aboutness topic per clause. If this suggestion is correct, the restriction to the double occurrence of the contracted demonstrative supports that the contracted demonstrative refers to an aboutness topic.

3.4 The role of the contracted demonstrative

Thus far, I have shown that the contracted demonstrative can refer to the same object as noun phrases in the preverbal position hosting a topic. The referent of the contracted demonstrative is obligatorily given in the discourse and can possibly be construed as an aboutness topic. These observations allow us to consider that the contracted demonstrative can be used only when its referent has a topic status. However, it is less likely that the contracted demonstrative is indispensable to topic-marking, considering that the contracted demonstrative does not always occur even when its corresponding lexical noun phrase expresses an aboutness topic. For example, in (23), retrieved from a narrated folktale, there

[12] The order of the subject and the object can be changed, and this does not affect the occurrence of the contacted demonstrative.

appear to be two clauses whose heads are both the imperfective form of the causative verb *-chesa* 'make laugh'. The topic in this example is the same lady who is referred to in several different ways. If the contracted demonstrative functions as a topic marker, the two clauses would both be expected to host the class 1 medial contracted form *=yo* which refers to the topic. However, the contracted demonstrative actually occurs after the first verb, but not after the second verb. This observation suggests that the role of the contracted demonstrative is not to simply denote a topic.

(23)

uyo	mwanam̩ke	ka-na-chesa=yo	we	uyo
dem.med.1	1.female	sm1-ipfv-laugh:caus=dem.med.1	you	dem.med.1

m̩kweo	uyo	m̩kwe	m̩t^{h}u	uyo
1.mother.in.law:your	dem.med.1	1.mother.in.law	1.person	dem.med.1

ka-na-chesa	kweli
sm1-ipfv-laugh:caus	really

'That lady makes (us) laugh. That your mother-in-law, that mother-in-law. That person really makes (us) laugh.'

For the crucial function of the contracted demonstrative, its morphosyntactic features provide some hints. A key observation is that the contracted demonstrative appears in the right-dislocated 'antitopic' position (cf. Chafe 1976; Lambrecht 1994). Lambrecht (2001: 1076) proposes that the English pronoun occurring in this position 'serves to secure the continued attention of an addressee, i.e. to maintain a given relation between a referent and a proposition.' This analysis may be applicable to the contracted demonstrative in Kimakunduchi, although further investigation is required.

Note that the right-dislocated position can host an 'afterthought' topic in addition to an antitopic (Hyman 1975). An afterthought serves as a repair mechanism; it is employed to correct the referential expression and/or help the hearer to identify the topic referent (Ziv 1994: 640). Therefore, afterthought expressions are expected to be realised with lexical noun phrases, rather than pronouns, which are typically used when the speaker assumes that the referent is already highly identifiable (cf. Lambrecht 1981, 1994). Furthermore, it has been proposed that there is a pause between an afterthought phrase and the preceding clause; in contrast, antitopic phrases form a single intonation unit with the preceding clause (Hyman 1975: 120; Ziv 1994: 639; Lambrecht 2001: 1076). The Kimakunduchi contracted demonstrative can be considered a pronominal clitic which is formally dependent on the preceding word (as described in §2.2). Therefore, it is less likely for the contracted demonstrative to express an afterthought.

4 Diachronic analysis of the contracted demonstrative

4.1 Post-stem object markers in Bantu languages

The way of object indexing varies among Bantu languages. In some languages such as Kimakunduchi, verbs can host the object marker only in the pre-stem position, while other languages allow it to appear after the verb (Beaudoin-Lietz et al. 2004, Marlo 2015). Example (24) demonstrates that in the Shimaore dialect of Comorian, the recipient and theme objects of the ditransitive verb *-ba* 'give' can be indexed through the pre- and post-stem markers, respectively (cf. Rombi 1983).

(24) tsi-m-ba-zo
 SM1SG-OM1-give-OM10
 'I gave it to her/him.' (Alnet 2009: 269 fn.)

Notably, the Kimakunduchi contracted demonstrative appears similar to such post-stem object markers. In (25), for example, the medial form of the Kimakunduchi contracted demonstrative *=zo* accompanies the verb.

(25) paukwa izo m̩-me=ga-tenda=zo
 10.story DEM.MED.10 SM1SG-PRF=INTS-do-DEM.MED.10
 'For those stories, I have already told them.'

For the development of the object marker in Bantu languages, it has been proposed that they can be traced back to anaphoric pronouns referring to topics (Givón 1976: 156–160; cf. Lambrecht 1981, Diessel 1999, Morimoto 2002, Siewierska 2004, Lehmann 2015). As already described, the Kimakunduchi contracted demonstrative only refers to a topic. Based on the observation of the formal and functional features, I propose that the Kimakunduchi demonstrative is on the path of change into a post-stem object marker.

4.2 Insights into the development of postverbal object markers

The contracted demonstrative has formally reduced and lost independence as a word. Furthermore, contracted forms occur in different contexts from uncontracted basic forms. These observations undoubtedly indicate that the Kimakunduchi contracted demonstrative has developed into a new grammatical item. However, it is necessary to underline that contracted demonstratives, like basic forms, exhibit proximal and medial distinction, and do not cover first and second person referents. Because of these original features, I consider that the contracted demonstrative is at a relatively early stage of the diachronic change.

Following this analysis, Kimakunduchi can be viewed as showing the missing in-between stage of the grammaticalisation of post-stem object markers; the Kimakunduchi contracted demonstrative, analysed as a clitic, can be located at an intermediate stage between independent demonstratives/pronouns and dependent pronominal suffixes/agreement markers.

More specifically, the observation of Kimakunduchi allows us to hypothesise that in a very early stage of the development, post-stem pronominal markers are attached to any word class and cover any topic constituent including the subject; in succeeding steps, they gradually acquire the selectivity in terms of the grammatical class of their host and the syntactic restriction of their referent. Furthermore, Kimakunduchi provides a suggestion for the use of multiple object markers, which is allowed in a number of Bantu languages; the occurrence of multiple object markers is probably restricted at the beginning rather than that it becomes restrictive later. If there can be multiple objects, but only one aboutness topic per clause, this restriction may be lifted as a result of the shift of referent of the marker from a topic to object. For the functional development, the object marker which indexes the syntactic relation can conceivably be traced back to the pragmatic marker signaling topic continuation and topic maintenance.

5 Conclusion

This study described unique and remarkable characteristics of the contracted demonstrative in the Kimakunduchi dialect of Swahili. Formally, the contracted demonstrative can be described as a clitic as it has, along with formal reduction, lost independence as a word. In functional terms, it is specialised to mark a topic. One indication of this feature is that the contracted demonstrative can be coreferential with noun phrases in the preverbal position, which typically hosts a topic in Bantu languages.

In Bantu linguistics, it has been proposed that the object marker attached to the verb is derived from an anaphoric pronoun referring to a topic. Against this background, I proposed that the Kimakunduchi contracted demonstrative, which has developed into a bound pronoun, can be located at an initial stage of the grammaticalisation into a post-stem object marker. This analysis is compatible not only with the observation that the contracted demonstrative denotes a topic but also with the fact that it still retains some original features of the demonstrative (e.g. proximal and medial distinction, incompatibility with first and second persons).

For the role of the contracted demonstrative, its morphosyntactic features suggest that it serves as an antitopic marker which facilitates topic maintenance. To confirm this suggestion, it may be helpful to re-examine the function of object markers in other Bantu languages, as well as investigate the use of the contracted demonstrative in Kimakunduchi. If the Kimakunduchi contracted demonstrative has actually taken a possible pathway of development of object markers, object markers in other Bantu languages conceivably hold a similar function.

I finally note that to the best of my knowledge, similar grammaticalisation of demonstratives has rarely been reported in other languages; accordingly, further descriptive studies are required to investigate the precise process and mechanism of the emergence of pronominal/agreement markers in Bantu. The present study may have shed a new light on the ongoing cross-linguistic discussion through the description and analysis of Kimakunduchi.

Abbreviations

1	first person
2	second person
3	third person
ACC	accusative
APPL	applicative
AUG	augment
CAUS	causative
CLA	class agreement
COMP	complementizer
COP	copula
DEM	demonstrative
DIST	distal
DJ	disjoint
DOWN	down particle
EXPL	expletive
FIN	finite
FUT	future
FV	final vowel
HAB	habitual
HORT	hortative
IMP	imperative
IMPF	imperfective
INCL	inclusive
IND	indicative
INF	infinitive
INTS	intensive
IPFV	imperfective
IRR	irrealis
LOC	locative
MED	medial
NEG	negative
NEU	neuter
NONPAST	nonpast tense
OBJ	object
OM	object marker
PASS	passive
PAST	past tense
PFV	perfective

PL	plural	REA	realis
PN	proper noun	REC	recent
PRES	present tense	REL	relative
PRF	perfect	REM	remote
PROG	progressive	SBJ	subject
PRON	pronoun	SBJV	subjunctive
PROX	proximal	SG	singular
PRS	present	SM	subject marker
PST	past	SUBJ	subjunctive mood
QUOT	quotative	TEMP	temporal/conditional marker

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Chapter 11

The behaviour of the Bantu morpheme *-ag-* in Greater East Ruvu

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The morpheme *-*ag*/*ang*- (and its various realizations) is found across the Bantu language family and is most often associated with imperfective meanings. This paper describes the behaviour of -*ag*- in six Greater East Ruvu (GER) Bantu languages spoken in the Morogoro region of Tanzania: Kagulu, Kami, Kutu, Kwere, Luguru and Zalamo. While -*ag*- shows evidence of both progressive and habitual interpretations in these languages, -*ag*- is not obligatory. Rather, -*ag*- is more commonly used for habitual meanings in GER languages today. We suggest that this narrowing of the meaning of -*ag*- from imperfective to habitual may be a result of two factors: (i) the lack of a grammaticalized habitual construction in GER languages, and (ii) the loss of the perfective morpheme -*ile* in ER languages. This development of -*ag*- confirms Nurse's (2008: 144) suggestion that there is a "cognitive connection between imperfective and habitual, excluding progressive". That -*ag*- is not obligatory in GER languages is consistent with features of the GER temporal/aspectual systems which lack much of the tense and aspect morphology typical across Bantu languages. However, the non-obligatoriness of -*ag*- in imperfective contexts suggests that the GER temporal/aspectual systems are continuing to evolve.

1 Introduction

Bantu languages are known for their abundance of tense, aspect and mood categories (Dahl 1985: 176). The Greater East Ruvu (GER) languages are unique within the Bantu family in that they exhibit a decidedly reduced set of temporal and aspectual morphemes (cf. among others, Bar-el & Petzell 2021, Petzell 2020, Petzell & Aunio 2019, Petzell & Edelsten 2024, Dom et al. 2022). In this paper we focus

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primarily on aspect, which Comrie (1976) describes as "different ways of viewing the internal temporal constituency of a situation" (2-3). A central contrast in aspectual systems is that between perfective and imperfective: perfective views a situation as a whole, without "explicit reference to the internal temporal constituency of the situation" (Comrie 1976: 21), while imperfective views part of a situation, from within, with "explicit reference to the internal temporal structure of a situation" (Comrie 1976: 24).

The morpheme *-*ag*/*ang*- (and its various realizations) is found across the Bantu language family and is most often associated with imperfective meanings, namely progressive and habitual (Nurse & Devos 2019, Rose et al. 2002: 41). While -*ag*- is generally required for imperfective readings in those languages where it surfaces, in GER languages -*ag*- is found in imperfective contexts, but is not obligatory. The goal of this paper is to describe the behaviour of -*ag*- in the GER languages and to explain its function with respect to the temporal/aspectual systems of these languages. We show that while -*ag*- shows evidence of both progressive and habitual interpretations, it is more commonly used for habitual meanings in GER languages today. We suggest that this narrowing of the meaning of -*ag*- to habitual may be a result of two factors: (i) the lack of a grammaticalized habitual construction in GER languages, and (ii) the loss of the perfective morpheme -*ile* in GER languages.

This paper is organized as follows: after a brief introduction to the GER languages in §2, we provide a general description of the morpheme -*ag*- in Bantu languages in §3. We then examine the progressive and habitual usage of -*ag*- in the GER languages in §4. In §5 we suggest an account for the preferred habitual reading of -*ag*-, and we conclude in §6.

2 Greater East Ruvu Bantu languages

The six Greater East Ruvu (ER) languages form a subset of the eight Greater Ruvu languages, all of which are members of the Bantu language family and are spoken in the Morogoro region of central Tanzania (Figure 1). The GER languages are classified as Guthrie's (1948) G-languages, following the Bantu tradition (henceforth NUG (Hammarström 2019)): Kagulu (ISO 639-3: kki, NUG code G12), Kami (ISO 639-3: kcu, NUG code G36), Kutu (ISO 639-3: kdc, NUG code G37), Kwere (ISO 639-3: cwe, NUG code G32), Luguru (ISO 639-3: ruf, NUG code G35), and Zalamo (ISO 639-3: zaj, NUG code G33). The number of L1 speakers range across the languages, from approximately 5,500 Kami speakers to over 400,000 Luguru speakers (Languages of Tanzania Project 2009).[1]

[1] These speaker numbers reflect those who consider themselves speakers of the respective languages. These numbers do not reflect an assessment of fluency.

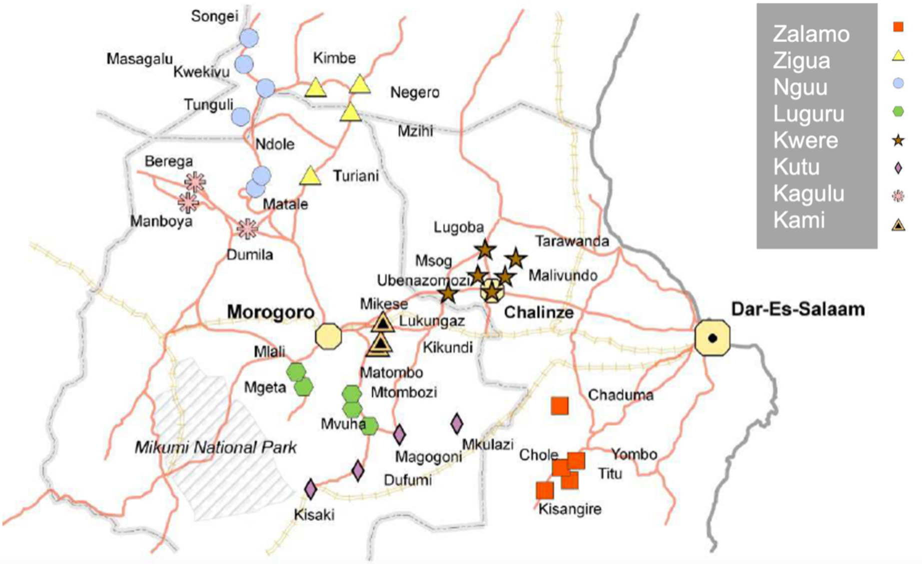

Figure 1: The linguistic centers of the eight Greater Ruvu languages (Petzell & Hammarström 2013).

There is relatively little research on the GER languages. There are some comparative works (Petzell 2012b, Petzell & Hammarström 2013), as well as grammatical descriptions of Luguru (Mkude 1974, Seidel 1898), Kagulu (Last 1886, Petzell 2008), and Kami (Velten 1900, Petzell & Aunio 2019). Additionally, there is some work on grammatical features in these languages (Bar-el & Petzell 2021, Petzell 2020, Petzell & Khül 2017, Dom et al. 2023, 2022).

The speakers consulted for this study are all first language speakers of their respective GER language variety and speak the language on a daily basis. All of them were born in the Morogoro region and still live in the region today. They are all bilingual in Swahili (Petzell 2012a) and many of them have worked as Bible translators and thus also speak English. The data on which this paper is based stem from fieldwork carried out in 2018-2019 with one to two speakers per language variety, and follow up digital correspondence in 2021-2022. A combination of direct translations, descriptive contexts and non-verbal stimuli were used to elicit the forms using both Swahili and English as metalanguages. We were unable to avoid translations altogether, however, we tried to minimize the impacts of translations from a metalanguage by supplementing translations with these other methodologies (e.g., asking speakers to describe acted out scenes, drawings, and asking for felicity judgements in the target languages). Apart from elicited forms, examples are also taken from a database comprising more than 10,000 token sentences collected between 2009-2019 that are tagged for tense, aspect, and negation, among other features (Petzell & Jordan 2022).

3 The morpheme *-ag-* in Bantu

The morpheme **-ag-* (and its reflexes) is "largely attested in Bantu" (Meeussen 1967: 110) and most commonly encodes imperfective (Nurse 2008). Of the two reconstructed shapes (**-ag-* and **-ang-*), *-ag-* is the most widespread (Nurse & Philippson 2006: 192). As an imperfective marker, *-ag-* typically yields progressive and habitual interpretations. For example, in Ndengeleko (ISO 639-3: ndg, NUG code P11) *-ag-* is described as an imperfective with both progressive (1) and habitual (2) interpretations.

(1) Ndengeleko (Ström 2013: 256)[2]
A-andik-**age** balua.
SM1-write-**PST**.**IPFV** 9/10.letter
'He was writing letters.'

(2) Ndengeleko (Ström 2013: 223)
A-andik-**aga** balua.
SM1-write-**IPFV.FV** 9/10.letter
'He usually writes letters.'

In some Bantu languages such as Haya (ISO 639-3: hay, updated NUG code JE22) and Ndali (ISO 639-3: ndh, NUG code M301), *-ag-* encodes habitual only. In a few Bantu languages, *-ag-* encodes progressive only (Nurse 2008: 144).

There are some Bantu languages where reflexes of *-ag-* have a wider distribution than imperfective constructions alone, and in this way they can behave atypically. In Nyamwezi (ISO 639-3: nym, NUG code F22), habitual meanings are expressed by verbal constructions containing *-ag-*, as illustrated in (3) for present tense and (4) for past tense (Kanijo 2019).

(3) Nyamwezi (Kanijo 2019: 57)
A-**kʊ**-zʊg-**ag**-a kílá lʊ́-shikʊ́.
SM1-**HAB**-cook-**IPFV**-FV every 11-day
'S/he cooks everyday.'

[2]For comparative purposes, throughout the paper, glosses from other sources are adapted to conform to the glossing used for GER languages. This primarily applies to the subject markers, which are glossed SM plus the noun class number, and *-ag-*, which is glossed IPFV, although it may also have different functions in other languages.

(4) Nyamwezi (Kanijo 2019: 57)
ʊ-**a**-zʊg-**ag**-é kílá lʊ́-shíkʊ́.
SM1-**PST**-cook-**IPFV**-FV every 11-day
'S/he used to cook everyday.'

However, *-ag-* in Nyamwezi also appears in verbal constructions that express meanings other than habitual, such as the hodiernal past (5), hortative (6), habitual hortative (7), and imperative (8) (Kanijo 2019).

(5) Nyamwezi (Kanijo 2019: 40)
ʊ-**á**-ɪmb-**ag**-á lɪɪmií.
SM1-**PST**-sing-**IPFV**-FV daytime
'S/he sang this afternoon.'

(6) Nyamwezi (Kanijo 2019: 67)
A-mál-**ag**-eé!
SM1-finish-**IPFV**-FV
'S/he should finish!'

(7) Nyamwezi (Kanijo 2019: 67)
A-**laa**-mal-**ag**-é!
SM1-**HAB_HORT**-finish-**PFV**-FV
'S/he should always finish!'

(8) Nyamwezi (Kanijo 2019: 67)
Mal-**ag**-á!
finish-**IPFV**-FV
'(You.sg) finish (it)!'

The imperative function of *-ag-* can also be seen in Manda (ISO 639-3: mgs, NUG code N11), where reflexes of **-a(n)g-* can function as an imperative marker (Bernander 2020).

4 *-ag-* in Greater East Ruvu

-ag- has been attested in GER languages since the late 1800s (though there exist grammatical sketches only of Kagulu, Kami and Luguru from that period). The most extensive documentation is found for the Luguru language where both Seidel (1898) and Mkude (1974) report usage of *-ag-*. Seidel refers to *-ag-* as an

imperfect (1898: 465), while Mkude suggests that *-ag-* in Luguru has a variety of potential meanings and that "[w]hether the meaning is habituality, repeatedness or persistiveness depends entirely on context and the semantic meaning of the verb in question" (1974: 104). Last (1886) documents *-ag-* in Kagulu, stating that it denotes "a continuous imperfect state" (1886: 56). Furthermore, Last suggests that as an "imperfect" *-ag-* denotes "an action incomplete at the time of speaking" (Last 1886: 58). Describing *-ag-* in Kami, Velten (1900) suggests that it had both progressive and habitual meanings. While he describes it as denoting 'length/lasting' ("die Dauer") as in *ni-to-ag-a* 'I am (in the process of) beating/farming' ("ich bin am Schlagen") (Velten 1900: 16), Velten also includes examples of *-ag-* with 'always', suggesting a habitual meaning as well, as illustrated in (9) and (10) below. These older sources demonstrate that in these languages *-ag-* had both progressive and habitual interpretations.

(9) Kami (Velten 1900: 16)
Ka-kall[3]-**ag**-a ku m-gunda.
sm1-be/live-**ipfv**-fv 17 3-farm
'S/he always lives on the plantation.'

(10) Kami (Velten 1900: 16)
Wa-law-**ag**-a.
sm2-go_away-**ipfv**-fv
'They always go out.'

Among contemporary speakers of the GER languages, the habitual interpretation of *-ag-* is far more predominant, though progressive interpretations are available for some speakers in some of the languages. Thus, even in the languages where the progressive interpretation of *-ag-* does not emerge in our data collection, earlier sources document this progressive interpretation of *-ag-*. In this section we demonstrate progressive interpretations (§4.1) and habitual interpretations (§4.2) of *-ag-* among contemporary speakers of GER languages.

4.1 Progressive interpretations of *-ag-* in GER

The progressive interpretation of *-ag-* is observed nowadays frequently in Kagulu and only occasionally in Kami and Luguru. The Kagulu sentence in (11) below yields an overlapping reading of the event in the clause containing the verb stem

[3] *kukala* 'to be/live' is no longer spelled with a geminate <l> in contemporary Kami.

tung 'bead' marked by *-ag-*, and the event in the temporal clause containing the verb *ingil* 'enter'. The example in (12) illustrates the same overlapping reading with the verb stem *som* 'read':

(11) Kagulu
Ha-ni-tung-**ag**-a salu fo-ya-ingil-e.
PST-SM.1SG-bead-**IPFV**-FV 9.bead TEMP-SM1-enter-FV
'I was beading beads when she entered.'

(12) Kagulu
Fo-ni-ingil-ile Leora ha-ka-som-**ag**-a.
TEMP-SM.1SG-enter-ILE Leora PST-SM1-read-**IPFV**-FV
'When I entered Leora was reading.'

The sentences in (13) and (14) below illustrate progressive interpretations of *-ag-* in Kami and Luguru, respectively. The Kami speaker was asked to translate a Swahili sentence containing the present progressive *-na-* (*Nyumbani, mwanafunzi anasoma.* 'In the house, a student is reading.'[4]). The Luguru sentence was the description given for a scene acted out by the authors.

(13) Kami
Ukaye ko-som-**ag**-a mw-anafunzi.
in_the_house SM1.non_pst-read-**IPFV**-FV 1-student
'In the house a/the student is reading.'

(14) Luguru
Leora ko-seg-**ag**-a ha-ku-ingil-a Malin.
Leora SM1.PRS-sweep-**IPFV**-FV TEMP-SM15-enter-FV Malin
'Leora is sweeping when Malin comes in.'

The Luguru sentences in (15) and (16) are examples containing *-ag-* in both clauses with progressive interpretations. The presence of the temporal adverbial *jana* 'yesterday' in (15) reinforces the progressive (rather than habitual) interpretation, as a habitual reading would not be expected for that time span.

[4] One reviewer suggests that the Swahili sentence could also be interpreted habitually. Our Swahili consultant confirms that while a habitual interpretation is possible, the default reading of this sentence is progressive. The same reviewer points out that speakers might be calquing when translating from Swahili. We recognize that a metalanguage can impact translations; however, in some cases when speakers are asked to translate Swahili sentences containing *-na-*, they do not offer corresponding GER sentences with *-ag-*.

(15) Luguru

Ahala Amina ha-tsum-**ag**-a jana ni-tow-**ag**-a
DEM Amina TEMP.SM-run-**IPFV**-FV yesterday SM.1SG-beat-**IPFV**-FV
makofi.
applause
'When Amina was running yesterday, I was clapping my hands.'

(16) Luguru

Amina ko-neneh-**ag**-a lugaluga.
Amina SM1.NON_PST-be/get_fat-**IPFV**-FV slowly
'Amina is getting fat bit by bit.'

However, *-ag-* is not obligatory for progressive interpretations in GER languages. When translating English or Swahili progressive constructions or providing descriptions of progressive contexts, speakers rarely offer *-ag-* constructions. For instance, when acting out contexts such as Leora sweeping at the same time that Malin enters, speakers did not use sentences containing *-ag-*.[5] This is illustrated by the Zalamo sentence in (17) below in which the overlapping interpretation of the two events is available: the event of sweeping was ongoing when the event of entering took place. Nevertheless, *-ag-* does not surface:

(17) Zalamo

Amina ka-fagil-a (kibigiti) vi-ni-vik-ile.
Amina SM1-sweep-FV (when) TEMP-SM.1SG-enter-ILE
'Amina was sweeping when I arrived.'

Example (19) from Kwere was elicited using a questionnaire in which speakers were asked to translate the progressive Swahili sentence in (18) consisting of the auxiliary *kuwa* 'to be' (bolded in (18)). The Kwere translation given in (19) does not include the *-ag-* affix:

(18) Swahili

Ni-li-**kuw-a** ni-ki-lim-a shamba l-angu
SM.1SG-PST-**be-FV** SM.1SG-IPFV-cultivate-FV 5.farm 5-POSS
a-li-po-fik-a.
SM1-PST-TEMP-arrive-FV
'I was cultivating my farm when s/he arrived.'

[5]The exception being the Luguru sentence in (14).

(19) Kwere

Ni-kal-a	no-lim-a	m-gunda	w-angu
sm.1sg-be/live-fv	sm.1sg.prs-cultivate-fv	3-farm	3-poss

vi-ya-vik-ile.
temp-sm.1sg-enter-ile
'I was cultivating my farm when s/he arrived.'

Progressive interpretations are available for non-past tense constructions without *-ag-*, as illustrated in the Kutu example in (20) below, or present tense constructions, as illustrated in the Kwere example in (21) below:

(20) Kutu

Amina	**ko-som-a**	sambi.
Amina	**sm1.non_pst-read-fv**	now

'Amina is reading now.' [context: I see her reading now as we speak]

(21) Kwere

Amina	**ko-kimbil-a**	vino	sambi.
Amina	**sm1.prs-run-fv**	dem	now

'Amina is running right now.'

To emphasize a progressive meaning, speakers of all languages but Kagulu offer the auxiliary *kala* 'be/live'. This is illustrated for Kami (22) and Zalamo (23) below. Kagulu makes use of *kuwa* 'to be', as shown in (24).

(22) Kami

Ni-kal-a	no-som-a	fi-ya-ingil-e	Saidi.
sm.1sg-be/live-fv	sm.1sg.non_pst-read-fv	temp-sm1-enter-fv	Said

'I was (in the process of) reading when Said entered.'

(23) Zalamo

Vi-ni-vik-ile	Amina	**ka-kal-a**	ku-som-a	ki-tabu.
temp-sm.1sg-arrive-ile	Amina	**sm1-be/live-fv**	15-read-fv	7-book

'When I arrived, Amina was reading a book.'

(24) Kagulu

Fo-ni-ingil-e	**ya-uw-ag-a**	ye-ku-som-a.
temp-sm.1sg-enter-fv	**sm1-be/live-ipfv-fv**	sm1-15-read-fv

'When I entered s/he was reading.'

In sum, a progressive interpretation of *-ag-* was documented in Kagulu, Kami and Luguru in older sources.[6] Contemporary data suggest that the progressive interpretation is available for speakers of Kagulu, is not as predominant as it once was in Kami and Luguru, and is absent altogether in the other GER languages. For all GER languages, alternative ways of expressing progressive meanings, such as auxiliaries or present/non-past tense morphology are available. These strategies are available in other Bantu languages as well, however, in many of those languages, *-ag-* is also obligatory.

4.2 Habitual interpretations of *-ag-* in GER

-ag- in the GER languages is more commonly used for habitual interpretations in both present and past contexts. This is illustrated for the present tense Kwere example in (25) below where the sentence is translated using the English adverb *normally*, emphasizing the habitual meaning. The past tense Zalamo example in (26) is translated in English using the past habitual construction *used to*:[7]

(25) Kwere
Ng'howo zo-ol-**ag**-a.
10.banana SM10.PRS-be(come)_rotten-**IPFV**-FV
'The bananas normally get rotten.'

(26) Zalamo
Amina ka-fagil-**ag**-a mu-lao u-bit-ile.
Amina SM1-sweep-**IPFV**-FV 3-year SM3-pass-ILE
'Amina used to sweep last year.'

-ag- can co-occur with temporal adverbials encoding habitual meanings, such as *chila siku* 'every day' in Luguru, as illustrated in (27). However, the temporal adverbial is not required for the habitual meaning, as illustrated by the optionality of *chila siku* in the Kami sentence in (28):

(27) Luguru
Amina ko-fagil-**ag**-a chila siku.
Amina SM1.PRS-sweep-**IPFV**-FV every 9.day
'Amina sweeps every day.'

[6]There is no previous documentation available for the other GER languages.

[7]Past tense is encoded in GER languages by null tense morphology; see Bar-el & Petzell 2021 for further discussion.

(28) Kami
Ti-gend-**ag**-a Iringa (chila siku).
SM.1PL-go-**IPFV**-FV Iringa (every 9.day)
'We used to go to Iringa (every day).'

We have seen that habitual meanings can be encoded by *-ag-*, and that *-ag-* can co-occur with habitual temporal adverbials. However, as demonstrated for progressive interpretations in §4.1 above, *-ag-* is also not obligatory for habitual interpretations. That is, a temporal adverbial alone can provide enough context for a habitual interpretation. This is illustrated for the present tense sentences in Kwere (29)-(31) and Luguru (32), and the past tense sentences in Kutu (33) and Zalamo (34). None of these sentences contain the morpheme *-ag-*, though they each consist of a habitual temporal adverbial/clause and have habitual interpretations.

(29) Kwere
Chila siku chilugulu Amina ko-legel-a.
every 9.day at.6pm Amina SM1.PRS-be/get_tired-FV
'Every day at 6pm Amina becomes tired.'

(30) Kwere
Amina ko-dumb-a **chila ya-ha-on-a umbwa**.
Amina SM1.PRS-be(come).scared-FV **every SM1-TEMP-see-FV dog**
'Amina is/becomes scared whenever she sees a dog.'

(31) Kwere
Lusita l-ose **cho-it-a** Dar es Salaam, vino samba
11.time 11-every **SM.1PL.PRS-go-FV** Dar es Salaam DEM now
cho-it-a Nairobi.
SM.1PL.PRS-go-FV Nairobi.
'Normally, we go to Dar Es Salaam, but this time we are going to Nairobi.'

(32) Luguru
No-lim-a m-gunda gw-angu **chila siku**.
SM.1SG.PRS-cultivate-FV 3-farm 3-POSS **every 9.day**
'I cultivate my farm everyday.'

(33) Kutu
Kila vi-wa-tow-ile ngoma tu-chez-a.
every TEMP-SM2-beat-ILE 9.drum SM.1PL-play/dance-FV
'Every time they played the drums, we danced.'

(34) Zalamo
Mu-lao u-bit-ile Amina **kila vi-ya-kal-ile yo-kimbil-a**
3-year sm3-pass-ile Amina **every temp-sm1-be/live-ile sm1-run-fv**
ka-donh-a.
sm1-be/get_tired-fv
'Last year, whenever/every time she ran, she got tired.'

Kagulu, Kami, Kutu, and Zalamo have non-past constructions that give rise to habitual present interpretations in addition to present progressive interpretations. In (35)-(38) we observe that sentences without *-ag-* that are marked with non-past morphology get habitual interpretations.

(35) Kagulu
Amina ye-ku-lut-a ku-soko chila i-juwa.
Amina sm1-non_pst-go-fv 17-market every 5-day
'Amina goes to the market every day.'

(36) Kami
Dimwe kwa dimwe cho-it-a Dar es Salaam.
one for one sm.1pl.prs-go-fv Dar es Salaam
'We go to Dar es Salaam frequently.'

(37) Kutu
Amina sambi ko-zeng-a ng'anda.
Amina now sm.1pl.prs-build-fv 9.house
'Amina builds a house (generally).'

(38) Zalamo
No-chas-a ki-valo chi-angu.
sm.1sg.non_pst-lose-fv 7-clothes 7-poss
'I usually lose my clothes.'

4.3 Optional present/non-past morphology with *-ag-*

In GER languages, present tense (in Kwere and Luguru) or non-past tense (in Kami, Kutu and Zalamo) is marked with the affix *-o-* (see (25) and (27) above). The exception is Kagulu[8] in which non-past is marked by the affix *-ku-*. In Kagulu,

[8] The marker *-o-* may be used for the future in Kagulu, but does not occur together with *-ag-* in our data.

Kami, Kutu, Luguru and Zalamo, when *-ag-* is added for present habitual meanings, the present/non-past marker *-o-* (*-ku-* in Kagulu) unexpectedly becomes optional.[9] It is usually absent, but can be present with no apparent change in meaning (see (40) and (43)). This is illustrated for Kami (39)-(40), Kagulu (41), Luguru (42)-(43) and Zalamo (44) below. The sentences have no overt tense marker, which typically yields a past tense interpretation (see Bar-el & Petzell 2021), yet the sentences marked with *-ag-* yield a present tense habitual interpretation.

(39) Kami
Malin ka-som-**ag**-a ki-tabu.
Malin SM1-read-**IPFV**-FV 7-book
'Malin has the habit of reading a book.'

(40) Kami
Amina ko-uk-**ag**-a mjini chila siku.
Amina SM1.NON_PST-read-**IPFV**-FV to town every 9.day
'Amina (usually) goes to town every day.'

(41) Kagulu
Ka-som-**ag**-a.
SM1-read-**IPFV**-FV
'S/he usually reads.'

(42) Luguru
Amina ka-tsum-**ag**-a chila siku.
Amina SM1-run-**IPFV**-FV every 9.day
'Amina is running every day.' [The answer to the question: 'What exercise does she normally do?']

(43) Luguru
Amina ko-tsum-**ag**-a.
Amina SM1.PRS-run-**IPFV**-FV
'Amina runs.' [sometimes/always]

(44) Zalamo
Esta ka-vitang-**ag**-a.
Esta SM1-know-**IPFV**-FV
'Esta usually knows.'

[9]The exception seems to be Kwere in our data, though we have not overtly tested for it (see below).

In Kutu (45) and (46), the sentences with null tense morphology can yield present or past habitual interpretations:

(45) Kutu
Amina ka-fagil-**ag**-a.
Amina SM1-sweep-**IPFV**-FV
'Amina usually sweeps.' – present habitual
'Amina used to sweep.' – past habitual

(46) Kutu
Rozadina ka-tung-**ag**-a u-salu.
Rozadina SM1-bead-**IPFV**-FV 14-bead
'Rozadina (normally) beads.' – present habitual
'Rozadina used to bead.' – past habitual [Speaker's comments: "Like it was her job"]

While Kwere marks present tense with the *-o-* morpheme, in our data *-o-* does not seem to be optional with *-ag-* sentences. In other words, present tense morphology is required in Kwere in order to get a present habitual interpretation. Thus, in our data, null tense marking plus *-ag-* is only interpreted as a past habitual in Kwere: *Nifagilaga* 'I swept (repeatedly)'. This stands out in relation to Kutu, which is grammatically most similar to Kwere (Petzell & Hammarström 2013: 149), where null tense plus *-ag-* can get either a past or a present reading (cf. (45) and (46)). We leave this issue for further research.

4.4 Preferred habitual interpretation

Across all the GER languages, the habitual interpretation is the preferred interpretation of constructions with *-ag-*. When asked to translate GER sentences containing *-ag-*, speakers tend to interpret them as habitual rather than progressive. This is illustrated for Kwere in (47) where the progressive interpretation is not available. This is also illustrated for Luguru in (48) where the unavailability of a progressive interpretation of the *-ag-* construction is reinforced by the infelicity of the temporal adverb *sambi* 'now' with the *-ag-* construction.

(47) Kwere
No-fagil-**ag**-a.
SM.1SG.PRS-sweep-**IPFV**-FV
'I normally sweep.' (#'I am sweeping.')

(48) Luguru
Amina ko-fagil-**ag**-a (#sambi).
Amina SM1.PRS-sweep-**IPFV**-FV (#now)
'S/he normally sweeps.' (#'S/he is sweeping).

The question remains: what accounts for this preferred habitual interpretation of *-ag-*? We take up an explanation in §5 below.

4.5 Summary

Table 1 below summarizes the distribution of *-ag-* in the six GER languages. Parentheses indicate optionality. For instance, when *-ag-* is present, the present/non-past marker *-o-* in four of the GER languages is not required for a present/non-past reading. Note also that, although available, the progressive readings are rare in Kami and Luguru, indicated by two asterisks (**) in the table.[10]

Table 1: Summary of the distribution of *-ag-* in the six GER languages.

PST	NON-PST/PRS	
Kagulu	(*ha*)-SM-V-*ag-a* = HAB/PROG	SM-*ku*-V-*ag-a* = HAB/PROG
Kwere	SM-V-*ag-a* = HAB	SM+*o*-V-*ag-a* = HAB
Luguru	SM-V-*ag-a* = HAB/PROG**	SM+(*o*) -V-*ag-a* = HAB/PROG**
Kami	SM-V-*ag-a* = HAB/ PROG**	SM+(*o*) -V-*ag-a* = HAB/ PROG**
Kutu	SM-V-*ag-a* = HAB	SM+(*o*)-V-*ag-a* = HAB
Zalamo	SM-V-*ag-a* = HAB	SM+(*o*)-V-*ag-a* = HAB

5 Explaining the preferred habitual reading

We have shown that the Bantu imperfective *-ag-* is observed in all the GER languages. The progressive and habitual interpretation of *-ag-* is documented in older sources for three of the GER languages. The habitual reading of *-ag-* is available for contemporary speakers of all six languages, while the progressive interpretation of *-ag-* is available (but rare) in only some of the languages. However, *-ag-* is not obligatory for progressive or habitual interpretations in any of the GER languages. We propose that the fact that *-ag-* is more commonly interpreted as a habitual for contemporary speakers is due to two factors: (i) the

[10]The habitual without *-o-* is the most common form.

absence of a grammaticalized habitual construction in GER languages (§5.1), and (ii) the loss of the perfective morpheme *-ile* in GER languages (§5.2).

5.1 No dedicated habitual morphology in GER

In many Bantu languages, reflexes of **-ag-* serve as a habitual marker (Nurse & Devos 2019), as illustrated for Mbala (ISO 639-3: mdp, NUG code H41) below in (49) with the reflex *-aang-*:

(49) Mbala (Ndolo 1972, as cited in Nurse & Devos 2019: 216)
Ga-loomb-**aang**-a.
SM1-request-**HAB**-PST
'She used to request.'

In some Bantu languages we observe other habitual constructions. For example, in Mbguwe (ISO 639-3: mgz, NUG code F34) there are two habitual constructions: SM-*ándaa*-ROOT-*a* (Habitual 1) and SM-*jéé*-ROOT-*a* (Habitual 2) (Wilhelmsen 2018: 140). These two constructions are illustrated in (50) and (51):

(50) Mbugwe (Wilhelmsen 2018: 131)
Á-**ándaa**-lang-a me-ikalɔ e-anɛ́ e-ɔ́nsɛ.
SM1-**HAB1**-look-FV 4-life 4-1SG.POSS 4-all
'She is the one who watches over my whole life.'

(51) Mbugwe (Wilhelmsen 2018: 73)
Vá-kee-mo-órekery-a ne kee o-**jée**-r´-a.
SM2-IPFV-OM1-ask-FV COP what SM.2SG-**HAB2**-eat-FV
'They asked her: "What do you usually eat?" '

The habitual is expressed in Swahili by the prefix *hu-*, as illustrated in (52) (Ashton 1944: 38):

(52) Swahili (Ashton 1944: 256)
Ma-yai **hu**-patikan-a soko-ni?
6-egg **HAB**-be_got-FV 9.market-LOC
'Are eggs usually to be got in the market?'

There is no corresponding reflex of the Swahili habitual *hu-* prefix in the GER languages, nor is there an alternate habitual morpheme or construction in these languages. The auxiliary *kuwa* can be used in Kagulu and occasionally Zalamo to convey a habitual meaning, as shown in (53) and (54):

(53) Kagulu
Esta **ye-kuw-a** ka-many-a.
Esta **SM1-be-FV** SM1-know-FV
'Esta used to know.'

(54) Zalamo
Esta **ko-uw-a** ka-vitang-a.
Esta **SM1.NON_PST-be-FV** SM1-know-FV
'Esta used to know.'

Even so, in none of the GER languages, including Kagulu, is *kuwa* used to express habitual meaning alone. In fact, in all GER languages its more common use is to express the future perfect. This is illustrated for Kutu in (55):

(55) Kutu
To-**kuw-a** tu-chez-a.
SM.1PL.NON_PST-**be-FV** SM.1PL-dance-FV
'We will have danced.'

Thus, the GER languages have only one grammaticalized morpheme available that can be used to convey habitual meaning: *-ag-*.

Although *-ag-* can be reconstructed for Proto-Bantu, it fell out of use in "Standard Swahili" (Abe 2009, Rugemalira 2010). Swahili developed two alternative ways to express habitual meaning: (i) the aforementioned prefix *hu-* (see (50) above) and (ii) the simple present construction combined with an adverbial phrase such as *mara nyingi* 'many times' (Abe 2009). However, *-ag-* is observed in most dialects of "Colloquial Swahili" and encodes habitual meaning. Its use is increasing in Colloquial Swahili (Abe 2009, Rugemalira 2010), and in some cases, *-ag-* is even re-entering into Standard Swahili (Abe 2009, Kutsukake & Yoneda 2019: 197; see also Rugemalira 2010). While this development of *-ag-* in Swahili is not entirely parallel to the development of *-ag-* in GER languages, it does point to the strength of the habitual meaning of this morpheme.

5.2 Loss of perfective *-ile* in GER

In Bantu languages in which the perfective is morphologically overt, it is typically encoded by the suffix *-ile* (and its associated constructions). Perfective *-ile* gives rise to simple past/perfective and perfect translations. This is illustrated for Southern Ndebele (ISO 639-3: nbl, NUG code S44) in (56):

(56) Southern Ndebele (Crane & Persohn 2019)
uSipho u-cul-**ile**.
Sipho sm1-sing-**pfv**
'Sipho sang.' / 'Sipho has sung.'

In GER languages, *-ile* has been lost in simple constructions. That is, simple past/perfective and perfect translations are conveyed by the past (null) tense alone, as illustrated for Kagulu in (57):

(57) Kagulu
Amina ka-imb-a.
Amina sm1-sing-fv
'Amina sang.' / 'Amina has sung.'

-ile is observed in GER languages, but only in dependent clauses, such as temporal clauses (58), relative clauses (59), and negative clauses (60), illustrated in Kami, Kutu and Kwere below:

(58) Kami
Fi-ni-fik-**ile** Amina ka-andus-a ku-som-a.
temp-sm.1sg-arrive-**ile** Amina sm1-start-fv 15-read-fv
'When I arrived, Amina started to read.'

(59) Kutu
Utamu u-ih-**ile** ng'ani Ukimwi.
14-disease sm14-bad-**ile** very Aids
'A disease which is very bad is Aids.'

(60) Kwere
Hu-lim-ile m-gunda w-ako igolo.
sm.2sg.neg-cultivate-**ile** 3-farm 3-poss.2sg yesterday
'You did not cultivate your farm yesterday.'

The morphemes *-ag-* and *-ile* are in complementary distribution in GER languages. Past tense in GER languages is not morphologically encoded. This is illustrated for Zalamo in (61). However, a negative sentence in the past appears with *-ile* as well as a negative subject marker (62). As we have seen, to convey the habitual in the past, *-ag-* is added (63). We might expect that a sentence conveying the negative habitual in the past would be encoded with both *-ag-* and *-ile*.

However, the sentence in (64) is infelicitous. In order to convey the negative habitual in the past, speakers offer an auxiliary construction plus *-ag-* on the main verb (65).

(61) Zalamo
Ni-lim-a.
SM.1SG-cultivate-FV
'I cultivated.'

(62) Zalamo
Si-lim-ile.
SM.1SG.NEG-cultivate-ILE
'I did not cultivate.'

(63) Zalamo
Ni-lim-ag-a.
SM.1SG-cultivate-IPFV-FV
'I used to cultivate.'

(64) Zalamo
#Si-lim-ag-ile.
SM.1SG.NEG-cultivate-IPFV-ILE
'I did not used to cultivate.'

(65) Zalamo
Ni-kal-a si-lim-ag-a.
SM.1SG-be/live-FV SM.1SG.NEG-cultivate-IPFV-FV
'I did not used to cultivate.'

The loss of *-ile* as a perfective marker and the narrowing of *-ag-* to habitual seem to correspond in GER languages. We suggest that as GER languages have lost perfective *-ile* in simple clauses, the morpheme *-ag-* is no longer necessary to contrast with *-ile*. Although languages likely deal with these morphological and contrastive losses in different ways, we suggest that while *-ag-* continues to encode "an unbounded situation that lasts over a period of time" (Nurse & Devos 2019: 212), its function has reduced this encoding to habituality in the GER languages. Our account of the narrowing of *-ag-* in GER mirrors the development of English modals. Cowper & Hall (2017: 86–87) suggest that the loss of the subjunctive in English led to the reanalysis of modality as a grammatical feature in contrast with the indicative. Conversely, the grammatically contrastive function of imperfectivity in -*ag*- may have evolved into an independent aspectual meaning in the GER languages, following the loss of perfective -*ile*. We leave further exploration of the evolution of -*ag*- for future research.

6 Conclusions

We have argued that the lack of a grammaticalized habitual morpheme in GER languages, in addition to the loss of the perfective -*ile* in simple clauses has led to a narrowing of the function of -*ag*- to habitual in GER languages. The development of -*ag*- in GER from an imperfective marker covering both habitual and progressive, towards a narrower habitual use perhaps confirms Nurse's (2008: 144) suggestion of a "cognitive connection between imperfective and habitual, excluding progressive". That -*ag*- is not obligatory in GER languages is consistent with features of the temporal/aspectual systems of GER languages which lack much of the tense and aspect morphology typical across Bantu (Bar-el & Petzell 2021, Petzell & Edelsten 2024), a language family known for its "extraordinarily rich" tense and aspect systems (Dahl 1985: 32). However, the observation that in several GER languages present tense morphology is not obligatory with -*ag*- suggests that the GER temporal/aspectual systems are continuing to evolve, an exploration we leave for future research.

Abbreviations

1, 2, 3 …	Bantu noun class
COP	Copula
DEM	Demonstrative
FV	Final vowel
ILE	The marker –*ile*
HAB	Habitual
HOR	Hortative
IPFV	Imperfective
NEG	Negative
NON_PST	Non-past (i.e. present or future).
OM	Object marker (the following number represent the Bantu noun class)
PFV	Perfective
PL	Plural
POSS	Possessive
PRS	Present tense
PROG	Progressive
PST	Past tense
SG	Singular
SM	Subject marker (the following number represent the Bantu noun class)
TEMP	temporal/conditional marker

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Chapter 12

Starting points for tense-aspect analysis: Deictic adverbs

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We examine tense-related adverbs across a range of West African languages. Our interest stems from the proposal by Nurse et al. (2016) that Proto-Niger-Congo lacked grammatical tense. At the outset we focus on equivalents for day/night cycle adverbs. We attend initially to Edoid, then its neighbors within West Benue Congo and East Benue Congo followed by more distantly related Kwa, Gur, Kru, and finally non-Niger-Congo major languages of the Wider Lake Chad Region. Two lexicalization patterns for day/night dominate, one analytic ('yesterday,' 'today,' 'tomorrow'), the other synthetic ('today' vs. 'yesterday/tomorrow'). To pursue this general pattern further in one Edoid language, we assessed gram expression for tense and its relation to temporal adverb types. Grams expressed tense proper and temporal distance. Relative to adverbs, we found that values for tense proper and temporal distance did not distribute evenly. Most temporal adverbs (80%) aligned with the tense values past and future. And most preferred distal over proximal as co-constituent.

1 Introduction

Natural languages express tense-aspect (T-A) qualifications within a clause via distinct constituent types, either grammatical morphemes at/near the verb or lexical items with an adverb status. In many descriptions, the starting point for T-A analysis is the verb and associated grams, as exemplified by studies of Bini (Èdó) from Nigeria's Edoid group (Amayo 1976, Omoruyi 1991, Yuka & Omoregbe 2011). An alternative initiates T-A inquiry with adverb elements followed by examination of corresponding gram expressions. We follow the latter strategy to

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illuminate one Edoid language system. We assume key components of such a system include at a minimum T-A grams and adverbs relevant to T-A expression.

Our center point for analysis is the group of Edoid languages spoken in south-central Nigeria. Within this group there are at least 30+ languages (Elugbe 1989), one of which is Emai, for which we have a relatively extensive database (Schaefer & Egbokhare 1999, 2007, 2016). Among others, this group includes Bini, Esan, Yekhee, Urhubo, Degema, and Engenni.

In addition to Edoid, we have compiled some initial data about T-A adverb elements and their corresponding grams from a range of language families also spoken in West Africa. These include West Benue Congo (WBC), East Benue Congo (EBC), Kwa, Gur, Kru, and major families of the Wider Lake Chad Region. Further impetus for this study comes from Nurse (2003, 2007, 2008), Nurse & Philippson (2006), and especially Nurse et al. (2016). The latter postulates that tense did not function as a gram in Proto-Niger-Congo or early Niger-Congo. Essentially, Proto-Niger-Congo expressed only aspect, with tense grams emerging in Bantu and its Benue-Congo predecessors. Relative to this general background, we aim to preview and contextualize the system of T-A grams in Edoid Emai and associated temporal adverbs.

We start with Edoid and equivalents for day/night cycle adverbs ('yesterday,' 'today,' 'tomorrow'). We adhere to Comrie (1985) in considering tense as the expression of location in time, grammatical and otherwise. Next, we assess the larger linguistic context of these adverbs, examining those in West Benue Congo, East Benue Congo with Plateau, Bantoid and Proto Bantu receiving attention, and more distantly the Niger-Congo phylum, specifically Kwa, Gur, and Kru. An even broader context arises from a brief survey of day-unit adverbs in major languages of the Wider Lake Chad Region: Hausa, Kanuri, and Nigerian Arabic. In the final section we consider Emai gram expression for tense and the combinatorial potential between tense values, i.e., temporal distance and tense proper, and temporal adverb types. As will be shown, values of tense proper distribute asymmetrically relative to adverbs, as do those of temporal distance.

2 Edoid temporal adverbs

Regarding day/night-cycle adverbs, we find two patterns in Edoid, a group within WBC. Adverbs for the day/night-cycle refer to day$_{-1}$, day$_{-0}$, day$_{+1}$, where day$_{-0}$ refers to deictic center, essentially 'today.' Coding of day/night in Edoid is geographically circumscribed and often conflational, as illustrated in Table 1 (orthographic vowel representations throughout are "e" for [ɛ] and "o" for [ɔ]). Distinct terms occur for each of day$_{-1}$, day$_{-0}$, day$_{+1}$ in some northern varieties of Edoid, e.g. Esan, whereas southern varieties conflate day$_{-1}$ and day$_{+1}$ under one term relative to a day$_{-0}$ term, e.g. Degema.

Table 1: Adverb forms for day/night cycle in Edoid relative to deictic center

	‘yesterday’ day$_{-1}$	‘today’ day$_{-0}$	‘tomorrow’ day$_{+1}$
NORTHERN			
Emai	òdẹ̀	ẹ́ẹ̀nà	ákhọ̀
Yekhee	ẹ́n-òdẹ̀	ẹ́ẹ̀lẹ̀	ákhùẹ̀
Esan	òdẹ̀	ẹ́lẹ́ẹ̀nà	éwíẹ̀
Bini	n-òdẹ̀	n-ẹ́rẹ̀	n-ákhùẹ̀
SOUTHERN			
Urhobo	òdẹ̀	n-ónẹ̀	odẹ̀-ọ́chà
Engenni	údhè	ínyáà	údhè
Degema	údéè	ínínà	údéè

3 Non-Edoid temporal adverbs

A similar tendency toward bipartite lexicalization is evident in Table 2 for WBC and Kwa.

Distinct day/night-cycle adverbs occur in languages such as Yoruba, Ebira, Ọkọ, and Akan. Languages like Igbo, Gwari, Ewe, and Fongbe on the other hand, conflate day$_{-1}$ and day$_{+1.}$ While variation in Edoid essentially followed a vertical trajectory (north to south), WBC and Kwa adverbs present a less geographically circumscribed condition. In both WBC and Kwa one finds distinct terms for day$_{-1}$ and day$_{+1}$ as well as conflation of day$_{-1}$ and day$_{+1}$ under a single term.

Among EBC language groups for which data is available, Plateau (Dũya) and Bantoid (Yukubẹn) exhibit distinct terms for day$_{-1}$ and day$_{+1.}$ Proto Bantu, on the other hand, displays term conflation, whereas daughter languages like Tswana tend toward distinctive coding of day/night cycle adverbs.

In languages of the Wider Lake Chad Region (Kanuri, Hausa, Nigerian Arabic) as well as in Gur (Dagaare, Kasem, Supyire) and Kru (Tepo), no conflation is evident; distinct terms prevail for each day unit.

Table 2: Adverb forms for day/night cycle relative to deictic center in West Benue Congo and Kwa

	‘yesterday’ day$_{-1}$	‘today’ day$_{-0}$	‘tomorrow’ day$_{+1}$
WBC			
Yoruba	ní àná	ní òní	ní òlá
Isekiri	ní o̱la		ní èjúmá
O̱ko̱	érán	ámó̱nè̱	usie
Ebira	è̱è̱rí	ajíni	ùhwó̱ó̱
Nupe	tsúwó	nyína	èsun
Gwari	ósù	ónyáyéè	ósù
Igbo	échí	táà	échí
Ekpeye	séle	tám	séle
KWA			
Akan	nne̱ra	e̱nne̱	o̱kyena
Ga	nye̱	ŋme̱ne̱	wo̱
Ewe	ètsò̱	égbè	ètsò̱
Fongbe	sò̱	égbè	sò̱

Table 3: Adverb forms for day/night cycle in East Benue Congo (including Plateau, Bantoid, and Proto Bantu)

	‘yesterday’ day$_{-1}$	‘today’ day$_{-0}$	‘tomorrow’ day$_{+1}$
CENTRAL NIGERIAN			
Dũya	àɽé̱ké̱	iɽérè̱	údáàn
Yukube̱n	í-li	ì-nəŋ	kò̱-húŋtu
BANTU			
P Bantu	dúbi	deedó	dúbi
Tswana	maabane	gompiêno	mosho

Table 4: Adverb forms for day/night cycle in Gur, Kru, and Wider Lake Chad Region

	'yesterday' day$_{-1}$	'today' day$_{-0}$	'tomorrow' day$_{+1}$
GUR			
Dagaare	zaameng	zenẹ	bieu
Kasem	dimm	zem	jwa
Supyire	táɲjáà	níɲjáà	nùmpanŋa
KRU			
Tepo	tu̱tu̱tu̱	kẹ́kẹ́gbo	ŋàŋà
WIDER LAKE CHAD			
Kanuri	bíska	kúù	bali
Hausa	jiyà	yáàu	gòbe
Nigerian-Arabic	ámis	alóom	ambáakər

The next two sections concern grammatical morphemes that code T-A in the Edoid language Emai and their co-occurrence with temporal adverbs.

4 Overview of T-A expression in Emai

In Emai, the formal expression of T-A can be characterized as a template of the following kind.

(1) PRONOUN T-D TENSE VERB ASPECT

This template combines a lexical morpheme that expresses a verb element along with grammatical morphemes (segmental, tonal or their combination) that convey a personal pronoun, temporal distance (T-D), tense proper, and aspect. Although the values for each of the five template elements can vary, we limit discussion for subject pronoun to third person singular and for verb to form *dumẹ* meaning 'pound.' Important to note about Emai is that neither subject pronouns nor verbs manifest lexical tone; they are lexically toneless and receive their tone from right adjacent morphotonemes, which may accompany a vowel segment or consist of a floating tone (´H or `L). Such tonal adjacency conditions prevail across the Edoid group of languages (Elugbe 1989). The values for remaining grammatical elements in the template consist of the following: temporal distance (T-D) as proximal (P) or distal (D); tense as past (PST), present (PRS), future (FUT); and aspect as perfective (PFV) or imperfective (IPFV). Also of note regarding template realization is that two elements, T-D and tense, consistently contrast in their tonal expression for tense values present and past but not for the value future. In this respect present and past expression reflect a predicative cluster, as discussed by Creissels (2006: 55).

Template elements have the following segmental and tonal realization. T-D appears as a floating ˊH for distal and ˋL for proximal; tense as *ọ́* or *ọ̀* for PRS; floating ˊH or ˋL for PST; and simply *lọ́* for future. Aspect in the PFV consists of verb suffix *-í*, whose overt appearance is controlled by a range of morphosyntactic conditions of the type known as metatony (Hyman & Lionnet 2012, Hyman 2017, Schaefer & Egbokhare 2021). In contrast, the IPFV consists of a floating low tone -ˋL.

A sample of segmental and tonal realization for Emai's T-A template is presented in (2). Underlying forms are shown on the right within forward slashes /x/ and surface level forms are on the left in brackets [x]. But before proceeding to template illustration, two tonal patterns require some comment. As already noted, perfective (PFV) aspect in Emai is signaled by verb suffix *-í* with high tone. This tone value spreads leftward across a verb stem. After its spread, the word boundary separating future marker *lọ́* from its verb exhibits a H H H condition. To adjust this H H H condition, Emai lowers the H at the verb's left edge to L ($H \rightarrow L \;/\; {}_{\text{FUT}}H\#[\ \_\_\ H]_{\text{verb}}$). The second pattern concerns the floating tones that express past tense and their relation to verb tone. Past tense tone assignment applies only after the high tone spread of perfective aspect. When past is a floating ˊH, it has no effect on verb initial high tone. When past is a floating ˋL, it lowers verb initial high tone by one step, i.e., the verb initial syllable is realized as downstep high ꜝ.

There are six T-A construction types in (2). Again, underlying forms are on the right within forward slashes /x/ and surface level on the left in brackets [x].

(2)	a.	[ọ́ ọ̀ dùmẹ̀ émà]	<	/ọ ˊH ọ̀ dumẹ-ˋL émà/
		'She pounds yam.'		3SG D PRS pound-IPFV yam
	b.	[ọ̀ ọ́ dùmẹ̀ émà]		/ọ ˋL ọ́ dumẹ-ˋL émà/
		'She is pounding yam.'		3SG P PRS pound-IPFV yam
	c.	[ọ́ ꜝdúmẹ́ émà]		/ọ ˊH ˋL dumẹ-í émà/
		'She pounded yam.'		3SG D PST pound-PFV yam

d.	[ò̱ dúmé̱ émà] 'She has pounded yam.'	/o̱ ˋL ˊH dume̱-í émà/ 3SG P PST pound-PFV yam
e.	[ó̱ ló̱ dùmé̱ émà] 'She will pound yam.'	/o̱ ˊH ló̱ dume̱-í émà/ 3SG D FUT pound-PFV yam
f.	[ò̱ ló̱ dùmé̱ émà] 'She is about to pound yam.'	/o̱ ˋL ló̱ dume̱-í émà/ 3SG P FUT pound-PFV yam

As will be seen shortly, each of these T-A constructions restricts its co-occurrence with deictic temporal adverbs. To provide a flavor of the next section, we illustrate the relation between T-A type and its canonical temporal adverb. Within each tense type, temporal adverbs contrast, their assignments being mutually exclusive. For instance, distal present (3a) permits the adverb *é̱dè̱é̱dè̱*, while proximal present allows the adverb *è̱nyáà*. Realignment of adverb type with T-A type is grammatically unacceptable.

(3) a. *ó̱ ò̱ dùmè̱ émá é̱dè̱é̱dè̱*
3SG:D PRS pound:IPFV yam daily
'She pounds yam daily.'

b. *ò̱ ó̱ dùmè̱ émá è̱nyáà*
3SG:P PRS pound:IPFV yam now
'She is pounding yam now.'

c. *ó̱ ꜜdúmé̱ émá òdè̱*
3SG:D PST:pound:PFV yam yesterday
'She pounded yam yesterday.'

d. *ò̱ dúmé̱ émá è̱ghé̱ è̱nà*
3SG:P PST:pound:PFV yam recently
'She pounded yam recently.'

e. *ó̱ ló̱ dùmé̱ émá ákhò̱*
3SG:D FUT pound:PFV yam tomorrow
'She will pound yam tomorrow.'

f. *ò̱ ló̱ dùmé̱ émá è̱nyáà*
3SG:P FUT pound:PFV yam now
'She is about to pound yam now.'

5 Temporal adverbs and T-A grams in Emai

To assess the relationship between Emai tense grams and temporal adverbs, we return to Nurse et al. (2016). They propose that Proto-Niger-Congo was essentially aspectual and devoid of grammatical tense specification. Over time, especially near the breakout of Benue-Congo and the eventual emergence of Bantu (Nurse 2007), they propose that tense categories, which we assume to mean tense grams, began to appear. At a minimum, there are two diachronic stages for gram expression advanced by Nurse and associates: Stage I when aspect was prominent; Stage II when tense became prominent.

Under the first of these proposed stages, conflation of day$_{-1}$ and day$_{+1}$ under one term relative to a day$_{-0}$ term could well be expected, i.e., today vs. not-today. This has implications for day/night cycle adverbs in Emai. Following the Nurse scenario, it would not be surprising to find distributional differences in day/night-unit terms. Similarly, it would not be surprising if the term for 'today' had a wider distribution in tense restricted temporal adverb positions than terms for 'yesterday' and 'tomorrow,' even though all three day/night-unit terms exist in the contemporary language.

Consider in this respect the following tables for temporal adverbs in Emai. They identify adverb co-occurrence with tense grams for present (PRS), past (PST), and future (FUT) as well as their temporal distance counterparts distal (D) and proximal (P). In Table 5 we find those day/night-cycle adverbs that are defined relative to day$_{-0}$ term *ẹ́ẹ̀nà* 'today.' The entire class of five terms identifies, in addition to day$_{-0}$, day-$_1$/day-$_2$ and day$_{+1}$/day$_{+2}$. Member occurrence with tense grams is highly restricted. Each day/night-cycle term is limited to one tense value, either past or future. Temporal distance aligns exclusively with the value distal. None of these day/night terms occurs with present tense or temporal distance value proximal.

The restrictive distribution of adverb types relative to tense types is maintained when day/night-cycle adverb terms occur in associative phrases headed by meronymic exponents. Day-partitive terms for morning, afternoon, evening, and night occur with all day/night-unit basic terms for day$_{-1}$ and day$_{+1}$ as well as day$_{-2}$, day$_{+2}$, and day$_{+9}$, as shown in Table 6 and 7. These associative phrases distribute relative to tense grams in the restricted fashion already indicated by Table 5. Each partitive phrase is limited to one tense value, either past or future, and to temporal distance value distal. None appears with present tense or proximal temporal distance.

Adverbs that group time units according to cycles other than day/night also restrict distribution vis-à-vis tense. They are shown in Table 8, where potential time unit (t-u) expressions are *úkpè* 'year,' *ọ̀sẹ̀* 'week,' and *ùkìn* 'month.'

Each time unit term is limited to one tense value, either past (*t-u lí ọ́ ráá rè* 't-u which passed,' *ẹ́lá t-u* 't-u we discussed') or future (*t-u lì ọ̀dè* 't-u which is

Table 5: Co-occurrence between day/night-cycle adverbs and tense values in Emai (where Dprs is Habitual and Pprs is Progressive/Continuous aspect). ‘d-b-y’ stands for ‘day before yesterday;’ ‘d-a-t’ stands for ‘day after tomorrow.’

Tense values	Temporal adverbs		
	òdè̱ ‘yesterday’ *é̱khè̱dé̱à* ‘d-b-y’	*é̱è̱nà* ‘today’	*ákhò̱* ‘tomorrow’ *òtíàkhó̱* ‘d-a-t’
Dprs			
Pprs			
Dpst	√		
Ppst			
Dfut		√	√
Pfut			

Table 6: Distribution of day-partitives with temporal adverbs for day$_{-1}$ *òdè̱*, day$_{-0}$ *é̱è̱nà*, day$_{+1}$ *ákhò̱*

Day-partitives	Temporal day-unit adverbs of basic tier		
	‘yesterday’ *òdè̱*	‘today’ *é̱è̱nà*	‘tomorrow’ *ákhò̱*
‘morning of’	égbíá òdè̱	égbíá é̱è̱nà	égbíá ákhò̱
‘afternoon of’	ódíánmí òdè̱	ódíánmí é̱è̱nà	ódíánmí ákhò̱
‘evening of’	é̱nwáá òdè̱	é̱nwáá é̱è̱nà	é̱nwáá ákhò̱
‘night of’	ásó̱n òdè̱	ásó̱n é̱è̱nà	ásó̱n ákhò̱

Table 7: Distribution of day-partitives with temporal adverbs for day$_{-2}$ (*e̱khẹ̀ḏẹ́à*), day$_{+2}$ (*òtíàkhọ̱*), and day$_{+9}$ (*ùsúmú*)

Day-partitives	Temporal day-unit adverbs of non-basic tier		
	‘day before yesterday’ *é̱khẹ̀ḏẹ́à*	‘9 days from today’ *ùsúmú é̱è̱nà*	‘day after tomorrow’ *òtíàkhọ̱*
‘morning of’	égbíá é̱khẹ̀ḏẹ́à	égbíá ùsúmú é̱è̱nà	égbíá òtíàkhọ̱
‘afternoon of’	ódíánmí é̱khẹ̀ḏẹ́à	ódíánmí ùsúmú é̱è̱nà	ódíánmí òtíàkhọ̱
‘evening of’	é̱nwáá é̱khẹ̀ḏẹ́à	é̱nwáá ùsúmú é̱è̱nà	é̱nwáá òtíàkhọ̱
‘night of’	ásọ̱́n é̱khẹ̀ḏẹ́à	ásọ̱́n ùsúmú é̱è̱nà	ásọ̱́n òtíàkhọ̱

Table 8: Co-occurrence relations between non-day time unit temporal adverbs and tense values (where t-u = time unit like *úkpè* ‘year,’ *ọ̱̀sẹ̱̀* ‘week,’ *ùkìn* ‘month’)

Tense values	Temporal adverbs		
	t-u lí ọ̱ ráá rè ‘t-u which passed’	*é̱lá t-u* ‘t-u we discussed’	*t-u lì ọ̱dè* ‘t-u which is coming’
DPRS			
PPRS			
DPST	√	√	
PPST			
DFUT			√
PFUT			

coming'). Temporal distance is consistently distal. None of these time unit terms occurs with present tense or the temporal distance value proximal.

There are additional adverbs in Emai that are not cyclic with respect to any temporal unit, neither day, week, month, nor year, or are weakly cyclic with respect to 'day' as a unit. They are shown in Table 9. Overall, these terms distribute in a highly restrictive fashion relative to tense values. Each non-cyclic term in Table 9 is limited to one tense value: present. Temporal distance is exclusively distal. These non-cyclic terms occur with neither past nor future tense value nor temporal distance value proximal.

Table 9: Co-occurrence relations between non-day/night- cycle temporal adverbs and tense values

Tense values	Temporal adverbs			
	é̱dè̱é̱dè̱ 'daily'	*é̱ghè̱é̱ghè̱* 'all the time'	*ìghéèghé* 'generations ago'	*sàá* 'usually'
Dprs	√	√	√	√
Pprs				
Dpst				
Ppst				
Dfut				
Pfut				

Another group of temporal adverbs in Emai are non-cyclic with respect to time units such as day, week, month, or year. They refer to event duration or event moment. Relative to tense values, these terms distribute in two highly restrictive patterns. Pattern one (*è̱dè̱dé̱*, *títítí*, *wè̱é̱é̱*) is limited to tense value past. Temporal distance is exclusively distal. No pattern one term occurs with present or future tense or with proximal as the temporal distance value. Pattern two is not limited to a single tense value. It has a single adverb exponent, *è̱nyáà* 'just/right now,' which refers to moment of speech as deictic center. It allows present and future tense. Its temporal distance value in both instances is proximal. Pattern two fails to occur with past tense or temporal distance value distal.

Table 11 offers a different class of adverbs. All derive from the basic term for day$_{-0}$, viz. *é̱è̱nà* 'today.' Today-derivatives are synthetic compounds (*è̱ghé̱è̱nà* 'recently,' *ùkpé̱è̱nà* 'this season') or syntactic phrases (*ùsúmú é̱è̱nà* '9-days from today'). As in preceding tables, these terms restrict co-occurrence with tense grams.

Table 10: Co-occurrence between adverbs of duration/moment of utterance and tense values

Tense values	Temporal adverbs			
	è̱dè̱dé̱ ‘short time ago’	*títítí* ‘for long time’	*wè̱é̱é̱* ‘for short time’	*è̱nyáà* ‘now’
Dprs				
Pprs				√
Dpst	√	√	√	
Ppst				
Rfut				
Pfut				√

No similar adverbs link to day$_{-1}$ *òdè̱* or day$_{+1}$ *ákhò̱*. Today-related adverbs reflect three patterns vis-à-vis tense. Pattern one with *é̱è̱nà* and *ùsúmú é̱è̱nà* is limited to tense value future. Temporal distance is consistently distal. No other tense or temporal distance values appear in pattern one. Pattern two with *è̱ghé̱è̱nà* is limited to tense value past. Temporal distance is restricted to proximal. No other tense or temporal distance value is allowed. Pattern three, which is restricted to *ùkpé̱è̱nà*, allows tense values past and future. Temporal distance is proximal for past and distal for future. No other tense or temporal distance values are permitted in pattern three.

Temporal adverbs of an emphatic nature are presented in Table 12. Members are all lexical compounds that retain a reduced form of linker *li* that designates adjectival dependents. In addition, the initial word unit *è̱dè̱* in the compound shows low tone, rather than the high low tone of lexical *é̱dè̱* ‘day.’ In dependent position these emphatic adverbs show forms derived from the day$_{-0}$ term *é̱è̱nà* as well as day$_{+1}$ *ákhò̱*, day$_{+2}$ *òtíàkhó̱*, and day$_{+9}$ term *ùsúmú*. Nonetheless, these emphatic adverbs align in a highly restrictive fashion with tense grams. Each emphatic adverb is limited to tense value future. Temporal distance is exclusively distal. No emphatic term allows present or past tense, or temporal distance value proximal.

Restricted in a different fashion are adverbs structured by nominal *é̱dè̱* ‘day.’ It occurs in synthetic compounds that express temporal punctuality (e.g. ‘on the second day’) or duration (‘for three days’ vs. ‘within three days’). Synthetic

Table 11: Co-occurrence between ‘today’ derivative adverbs and tense values

Tense values	Temporal adverbs			
	é̱è̱nà ‘today’	*ùsúmú é̱è̱nà* ‘9-days from today’	*è̱ghé̱è̱nà* ‘recently’	*ùkpé̱è̱nà* ‘this season’
Dprs				
Pprs				
Dpst				
Ppst			√	√
Dfut	√	√		√
Pfut				

Table 12: Co-occurrence between emphatic adverbs and tense values

Tense values	Temporal adverbs			
	è̱dè̱-lí-é̱è̱nà emphatic ‘today’	*è̱dè̱-lí-ùsúmú* emphatic ‘9-days from today’	*è̱dè̱-lí-ákhò̱* emphatic ‘tomorrow’	*è̱dè̱-lí-òtíàkhó̱* emphatic ‘day after tomorrow’
Dprs				
Pprs				
Dpst				
Ppst				
Dfut	√	√	√	√
Pfut				

compounds have the shape prefix-verb-noun, as in *ú-kpa-é̱dè̱* [sg-apportion-day]. Compounds with *é̱dè̱* appear as temporal adverbs in a phrasal construction with either an ordinal (*ó̱zèvà*) or cardinal numeral. Each of these *é̱dè̱*-based adverbs permits the tense values past or future. Temporal distance in either instance is restricted to distal. No *é̱dè̱*-based term allows present tense or temporal distance proximal.

Table 13: Co-occurrence between *é̱dè̱* adverbs and tense values

Tense values	Temporal adverbs		
	vbí úkpé̱dé̱ lí ó̱zèvà 'on the second day'	*íkpé̱dè̱ èéà* 'for three days'	*vbí é̱ké̱ín íkpé̱dè̱ èéà* 'within three days'
Dprs Pprs			
Dpst Ppst	√	√	√
Dfut Pfut	√	√	√

As one last point, we note that Emai exhibits adverb expressions based on the temporal lexeme *é̱ghè̱* 'time.' Two of these have an anaphoric function relative to an event that antecedes it. As might be expected, they are frequent in discourse narratives. Each also manifests a non-anaphoric function. Temporal adverbs associated with *é̱ghè̱* reveal three patterns. Pattern one for anaphoric uses is limited to tense value past. Temporal distance is restricted to value proximal. Neither the *é̱ghé̱ áìn* nor *ó̱lí é̱ghè̱* anaphor occurs with present or future tense or with temporal value distal. Pattern two, which is aligned with *é̱ghé̱ áìn* 'those times,' is limited to tense value present. Its temporal distance is confined to the distal value. Pattern two disallows past and future tense values and temporal distance proximal. Finally, pattern three shows tense values present and past but not future. Temporal distance is exclusively distal; there is no role for proximal temporal distance in pattern three.

Table 14: Co-occurrence between *é̱ghè̱* adverbs and tense values

Tense values	Temporal adverbs			
	é̱ghé̱ áìn ‘at that time’ anaphoric	*é̱ghé̱ áìn* ‘at those times’	*ó̱lí é̱ghè̱* ‘the time’ anaphoric	*vbí ó̱lí é̱ghè̱* ‘at the time’
Dprs		√		√
Pprs				
Dpst				√
Ppst	√		√	
Dfut				
Pfut				

6 Conclusion

In preceding sections, we undertook a four-fold assessment of temporal qualifications in selected languages of West Africa, although our most extensive examination fell to the Edoid group of south-central Nigeria. Inspiring our investigation were studies of Niger-Congo languages by Nurse (2007) as well as Nurse et al. (2016). Combined they argued for the grammatical emergence of temporal qualities in a two-stage evolutionary process. The later diachronic stage centered on grammatical coding of tense. An earlier stage was limited to grammatical expression of aspect.

For our study we investigated temporal qualifications from four perspectives to contextualize and center our findings. At the outset, with respect to Edoid and selected non-Edoid languages of West Africa, we identified the coding of day/night-cycle adverbs equivalent to ‘yesterday,’ ‘today,’ and ‘tomorrow.’ This pinpointed two lexicalization patterns for day/night-cycle terms. One was analytic, a separate term for each deictically defined day; the other was synthetic since it lexicalized ‘yesterday’ and ‘tomorrow’ under one lexeme and ‘today’ under another.

In a final section, focused on Emai, we considered co-occurrence relations between various temporal adverbs relative to grammatical morphemes that expressed tense values. Included among the latter were grams that signaled the tense values present, past, and future alongside grams that conveyed the temporal distance values distal and proximal.

The combinatorial potential between temporal adverb forms and overall tense values was restricted. Relative to adverbs, we found that temporal distance values distributed asymmetrically. Similarly, tense values proper did not distribute evenly. We assessed 35 temporal adverbs in Emai for their interaction with values for tense proper and temporal distance. Of the 35 adverbs aligned with tense proper, a rather low percentage linked to present tense (20%). Each of past and future received 40% of the assignments. That is most temporal adverbs combined with either past or future tense, significantly fewer with present tense. Of the 35 adverbs, a rather low percentage accepted the temporal distance value proximal. Proximal co-occurred with 17.1% of adverb assignments. In contrast, distal aligned with 82.9% of adverbs. As a co-constituent in the expression of tense, the value distal clearly exceeded that of proximal. Relative to each value for tense proper, distal was the preferred co-constituent. Proximal was preferred far less often. If our findings point in a useful direction, the emergence of tense in Niger-Congo may involve more grammatical and lexical components than initially assumed by Nurse and colleagues.

The preference for distal as a temporal distance feature in Emai tense expression correlates with a tonal preference for high over low on the subject pronoun. This high tone bias combines with the primacy of past and future over present as the other co-constituent in the expression of tense. Interestingly, both past and future mark their verb with perfective aspect, which as we saw earlier was signaled by a high tone suffix *-í* that spreads leftward across a lexically toneless verb. In Emai, for tonal marking of actualized and non-actualized events that are removed from the moment of speech there is a strong preference for high tone. It is at or near the moment of speech that a preference for low tone prevails. This interpretation of tonal patterning suggests that syntactic relations within an Emai clause, particularly at constituent edges, will seek recognition through tonal adjustments, such as the shift from high-to-low on the initial syllable of the verb following future tense gram *ló̱* or the shift from high-to-high downstep on the verb-initial syllable following distal past. Our initial focus on temporal adverbs as a starting point for analysis of temporal qualifications within West African languages thus informs our understanding of not only potential morphosyntactic complexities of tense but also variation in its tonal expression.

Abbreviations

ABS	absolute	P	proximal temporal distance
ART	article	PFV	perfective aspect
D	distal temporal distance	PL	plural
FUT	future tense	PRS	present tense
IG	ingressive	PST	past tense
IPFV	imperfective aspect	SG	singular
LOC	locative	T-A	tense-aspect
NEG	negation	T-D	temporal distance

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Chapter 13

An initial look at object marking in Cinyungwe

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Cinyungwe is an under-researched Bantu language spoken in Mozambique. This paper is an initial investigation of object marking and related properties of the postverbal domain in Cinyungwe. We show that object marking occurs independently of right-dislocation of objects (though they can co-occur) and that object marker doubling is associated with an emphatic reading of the sentence. We propose that object marking is generated by a functional projection in the middlefield of the clause that also introduces the semantic operator generating emphasis.

1 Introduction to Cinyungwe object marking

This paper addresses object markers (OMs) in Cinyungwe, a Bantu language (N43) spoken in Mozambique.[1] We show a basic example of object marking below in (1):

(1) a. Baba a-da-phik-a ci-mbamba.
1.father 1SM-PST-cook-FV 7-beans
'Father cooked beans.'

[1]All data in this paper represent the linguistic intuitions of the first author.

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b. Baba a-da-ci-phik-a.
1.father 1sm-pst-7om-cook-fv
'Father cooked them (beans).'

In (1), the morpheme *ci-* is used instead of *cimbamba* 'beans' to anaphorically refer to the object of the sentence.

Previous work on OMs in Bantu languages focuses on whether they can co-occur with (i.e. **double**) overt objects (and if they can, under what conditions) (Marten et al. 2007, Marten & Kula 2012). More specifically, the literature explores how object markers come to occur in the positions that they occur in, debating whether OMs are pronominal forms, agreement markers, or some other kind of element (Kramer 2014, Baker & Kramer 2018, Riedel 2009). A core diagnostic is whether OMs are in complementary distribution with an overt *in situ* lexical object.

Object marker doubling (OM-doubling) is possible in Cinyungwe, but there tends to be a prosodic break between the verb and the OMed object (prosodic breaks are annotated with a comma).

(2) Baba a-da-ci-phik-a , ci-mbamba.
1.father 1sm-pst-7om-cook-fv 7-beans
Approx: 'Father cooked beans.' (details below on available interpretations)

Patterns like this have commonly been analyzed as instances of OMed objects moving out of the verb phrase, an analysis which we will adopt for examples like (2).[2]

(3) Proposal for structure of (2):
Baba a-da-ci-phik-a ~~ci-mbamba~~ $]_{vP}$ ci-mbamba.
1.father 1sm-pst-7om-cook-fv 7-beans
'Father cooked beans.'

To the extent that we have observed thus far, animacy does not influence an object's ability to be object marked (OMed; examples throughout) and object marking (OMing) is never obligatory in main clauses in Cinyungwe.[3] In addition, Cinyungwe only allows a single OM on the verb, as shown in (4).

(4) a. Mw-ana w-a-pas-a ma-kaka yavu.
1-child 1sm-pst-give-fv 6-cucumbers 1grandmother
'The child gave cucumbers to grandmother.'

[2]Zulu is a prominent model, discussed below in §3.
[3]One possible exception is with locative objects.

b. * Mw-ana w-a-ma-mu-pas-a.
1-child 1SM-PST-6OM-1OM-give-FV
Intended: 'The child gave them (cucumbers) to her (grandmother).'

c. * Mw-ana w-a-mu-ma-pas-a.
1-child 1SM-PST-1OM-6OM-give-FV
Intended: 'The child gave them (cucumbers) to her (grandmother).'

This paper has two primary goals. The first is to document the core empirical patterns of Cinyungwe object marking and show that (i) OM-doubling triggers obligatory focal effects on *v*P (§2) and (ii) OM-doubling naturally (but non-obligatorily) co-occurs with object movement (§4). The second goal is to outline our current working hypothesis: we propose that (i) object movement is dissociated from OM-triggering Agree (§4), and (ii) the head bearing the OM-generating φ-features also introduces emphatic interpretations to the clause (§4).

2 Cinyungwe OMing interacts with focus

2.1 Non-doubling OMs, focused and not

The acceptability of non-doubling OMs is dependent on the discourse context at hand.

2.1.1 Non-doubling OMs: pragmatically neutral contexts

In pragmatically neutral contexts, the non-doubled OM pattern is asymmetrical. That is, it is natural to represent the structurally higher object with an object marker, but marginal to OM the structurally lower object.[4] In (5), only the structurally higher benefactive, *akazi* 'women', can be acceptably represented by an OM.

(5) a. Kapenu a-ndza-wa-gas-ir-a moto.
Kapenu 1SM-FUT-2OM-start.fire-APPL-FV 3.fire
'Kapenu will start fire for them (women).'

b. #Kapenu a-ndza-wu-gas-ir-a a-kazi.
Kapenu 1SM-FUT-3OM-start.fire-APPL-FV 2-women
'Kapenu will start it (fire) for the women.'

[4]Following a Minimalist approach to generative grammar (Chomsky 2000, 2001), we assume the well-established hierarchy of arguments where subjects are structurally higher than recipients and recipients are higher than themes: see, for example, Baker (1997).

In a context where both objects are discourse-given, null object drop of the lower object is natural. In (6), the structurally lower theme, *moto* 'fire', is omitted altogether (whereas *akazi* 'women' is represented by an OM).

(6) A: Semo a-mba-gas-ir-a a-kazi moto ntsiku zentse.
Semo 1SM-HAB-start.fire-APPL-FV 2-women 3.fire every day
'Semo starts fire for the women every day.'

B: Neye, Kapenu a-ku-wa-gas-ir-a lero.
no Kapenu 1SM-PRS-2OM-start.fire-APPL-FV today
Approximately: 'No, Kapenu is starting it for them today.'

2.1.2 Non-doubling OMs: focused contexts

While OMing the structurally lower object is unnatural in pragmatically neutral contexts, it becomes entirely acceptable in certain focus contexts. In (7), the Q&A context places focus on the benefactive object *akazi* 'women'. Though previously unnatural in (5b), in this context with the benefactive focused, it is acceptable to OM the theme *moto* 'fire'.

(7) Q&A congruence: focus in bold

Q: Kapenu a-ndza-gas-ir-a **yani** moto?
1.Kapenu 1SM-FUT-start.fire-APPL-FV 1.who 3.fire
'Who will Kapenu start fire for?'

A: Kapenu a-ndza-wu-gas-ir-a **a-kazi**.
1.Kapenu 1SM-FUT-3OM-start.fire-APPL-FV 2-women
'Kapenu will start it (fire) for THE WOMEN.'

2.2 OM-doubling generates emphatic interpretations

In OM-doubling constructions, emphatic interpretations are always generated, though the exact interpretation differs depending on the position of the DP object (and as we mention in §6.2, which kind of emphatic interpretation occurs appears to have complex interactions with syntactic structure). Example (8) below demonstrates OM-doubling. Here, the low temporal adverb *dzulo* 'yesterday' is used to mark the edge of the verb phrase.[5] (8a) shows the canonical word order,

[5]A reviewer notes that a low position of temporal adverbials is not universally assumed: we assume that temporal adverbs have a structurally low position; see Ernst 2014, 2020 on the syntax of adverbs, who argues that "[t]ime-related adverbials are free to adjoin anywhere after the core eventuality has been constituted" (Ernst 2020: 95). Additionally, Sikuku & Diercks (forthcoming) show that temporal adverbs group with other low adverbials in Lubukusu for a number of grammatical purposes.

with low adverbs following objects within the verb phrase (S V O Adv). When the object is doubled, however, we see the object naturally moving to the right of the low adverb, presumably out of *v*P.[6] In this doubling construction—shown in (8c)—focus/emphasis naturally falls on the material to the left of the object; here, on *dzulo*.

A different emphatic interpretation arises, however, when the object is doubled and remains in its usual linear position. As shown in (8b), this results in (what we will refer to as) a verum-like reading, which we are currently translating with the English adverbial *really/certainly* (in these instances, the emphasis does not appear to apply to any particular *v*P constituent more or less than any other).

(8) Temporal adverb

a. Baba a-da-phik-a ci-mbamba dzulo.
1.father 1SM-PST-cook-FV 7-beans yesterday
'Father cooked the beans yesterday.'

b. Baba a-da-ci-**phik-a** **ci-mbamba** **dzulo**.
1.father 1SM-PST-7OM-cook-FV 7-beans yesterday
'Father really/certainly COOKED THE BEANS YESTERDAY.'
*'Father cooked the beans yesterday.'

c. Baba a-da-ci-phik-a **dzulo** , ci-mbamba.
1.father 1SM-PST-7OM-cook-FV yesterday 7-beans
'Father cooked the beans YESTERDAY.'

We see the same patterns arising in sentences with manner adverbs: a doubled object very naturally moves to the right edge, which places focus on the manner adverb. Natural contexts for this construction are included here in (9).

(9) Doubling + movement = Focus on manner adverb
Baba a-da-ci-phik-a **bwino** , ci-mbamba.
1.father 1SM-PST-7OM-cook-FV well 7-beans
'Father cooked the beans WELL.'

- *Natural contexts include:*
  - *answers to manner questions*
  - *corrections about manner*

[6] This kind of right-dislocation is a well-documented property of object marking in some Bantu languages, e.g., Chichewa (Bresnan & Mchombo 1987), Zulu (Zeller 2012, 2015), Haya (see Riedel 2009 for an overview), Ikalanga (Letsholo 2013, Letsholo et al. forthcoming), and Tswana (Creissels 1996), to name a few.

And as seen before, OM-doubling with the object *in situ* creates a verum-like reading of the sentence that does not differentiate emphasis on sub-constituents of *v*P.

(10) *in situ* OM-doubling = Predicate focus
Baba a-da-ci-**phik-a** **ci-mbamba** **bwino**.
1.father 1SM-PST-7OM-cook-FV 7-beans well
'Father really/certainly cooked the beans well.'

- *Natural contexts include:*
  - *disagreements about whether this event happened*
  - *clarification of a previous assertion*

This verum-like focus reading is strongly reminiscent of Lubukusu OM-doubling contexts, where OM-doubling is linked with an emphatic interpretation of the sentence. Sikuku et al. (2018) analyzed this reading as verum, readily translated with English emphatic *do*.

(11) OM-doubling in Lubukusu (Sikuku et al. 2018: 366)

a. N-a-bon-a baa-soomi.
1SG.SM-REM.PST-see-FV 2.2-students
'I saw the students.'

b. *Context: I told you that I saw the students, but you doubt me, saying that you do not believe that I did. I can respond:*
N-á-ba-bon-a baa-soomi.
1SG.SM-REM.PST-2OM-see-FV 2.2-students
'I DID see the students!'

As discussed by Sikuku et al. (2018) as well as a range of relevant literature (e.g. Gutzmann & Castroviejo Miró 2011, Hartmann & Zimmermann 2007, Gutzmann et al. 2020, among others), verum readings of sentences (like English emphatic *do*) have properties that are distinct from focus. Instead, verum readings seem to be linked with conversational meaning and ought to be analyzed as a use-conditional item that introduces a separate dimension of meaning, similar to conventional implicatures (Potts 2005); we discuss this in more depth below.

3 Relevant case study: Zulu OMing

Object marking in Zulu bears a number of relevant similarities to Cinyungwe, as well as several notable differences. In this section, we summarize relevant research on Zulu OMing to lay a foundation for further discussion of Cinyungwe data and analysis. There is a long history of research on Zulu object marking; here, we are relying mainly on recent research from Zeller (2012, 2014, 2015) for our brief recounting of the Zulu facts.[7]

First, similar to Cinyungwe, Zulu only allows a single object marker on the verb form: attempts to pronominalize both objects of a ditransitive verb via OMs on the verb are unacceptable, as (12) shows.

(12) Zulu (Zeller 2012: 220)

a.

U-John	u-nik-e	a-ba-ntwana	i-zi-ncwadi.
AUG-1a.John	1SM-give-PST	AUG-2-child	AUG-10-book

'John gave books to the children.'

b. *

U-John	u-ba-zi-nik-il-e.
AUG-1a.John	1SM-2OM-10OM-give-DJ-PST

c. *

U-John	u-zi-ba-nik-il-e.
AUG-1a.John	1SM-10OM-2OM-give-DJ-PST

To pronominalize both objects of a ditransitive verb, one pronominalization must be represented as an OM morpheme on the verb, while the other must be represented via a free pronoun. But, while Zulu only allows one OM on the verb, the grammar does not restrict *which* object may be represented as an OM (illustrated below in (13)).

(13) Zulu (Zeller 2012: 220)

a.

U-John	u-ba-nik-e	zona.
AUG-1a.John	1SM-2OM-give-PST	10PRON

'John gave them to them.'

b.

U-John	u-zi-nik-e	bona.
AUG-1a.John	1SM-10OM-give-PST	2PRON

'John gave them to them.'

Zulu's acceptance of having either object represented via an OM is known as object "symmetry" in the literature on Bantu languages (Bresnan & Moshi 1990 and many others). While some languages are asymmetrical and may only allow a particular (primary) object to carry properties such as verbal OMing, Zulu allows

[7] Among others, see Adams (2010), Buell (2005, 2006), Cheng & Downing (2009), Halpert (2012), Van der Spuy (1993), Zeller (2012, 2014, 2015).

either object to be OMed on the verb. This so-called symmetry plays a major role in Zeller's (2012, 2014) analysis.

Further, OM-doubling is possible in Zulu. As Zeller describes, the long history of work on this issue in Zulu shows that these OM-doubled objects are right-dislocated, moving out of the verb phrase. This is evident in (14), where the OM-doubled object (obligatorily) moves to the right of the manner adverb as in (14d), being unacceptable to leave *in situ* (14b).

(14) Zulu (Zeller 2015: 20)

a. Si-bon-a i-n-kosi kahle.
1sg.sm-see-fv aug-9-chief well
'We are seeing the chief well.'

b. *Si-yi-bon-a i-n-kosi kahle.
1sg.sm-9om-see-fv aug-9-chief well

c. *Si-bon-a kahle i-n-kosi.
1sg.sm-see-fv well aug-9-chief

d. Si-yi-bon-a kahle i-n-kosi.
1sg.sm-9om-see-fv well aug-9-chief
'We are seeing him well, the chief.'

An important piece of data here is (14c), which shows that right-dislocation of the object is unacceptable without the OM; Cinyungwe contrasts with this pattern, as we will show below in (19).[8]

(15) shows the structure of this right-dislocation, which sees OM-doubling necessarily linked with movement of the OMed object to the right edge of *v*P.

(15) Structure of (14d) (Zeller 2015: 20)
. . . siyibona kahle]$_{vP}$ . . . inkosi

This right-dislocation analysis is supported by the fact that, in Zulu, it is well-documented that *v*P is a focal domain:[9] focused items must occur in *v*P, while non-focused items cannot be in *v*P. This is illustrated with a wh-subject construction in (16). (16a) shows that preverbal wh-subjects are unacceptable; instead, wh-subjects appear postverbally as in (16b):

[8] There are a range of additional relevant diagnostics arguing for this conclusion, including conjoint/disjoint distinctions and distribution of focused elements, among other things.

[9] See, among others, Sabel & Zeller (2006), Cheng & Downing (2009), Cheng & Downing (2012), and Halpert (2016).

(16) a. *U-bani u-sebenz-ile?
AUG-1a.who 1SM-work-PST

b. Ku-sebenz-e bani?
17.EXPL-work-PST 1a.who
'Who worked?'
(Zeller 2015: 20)

Additionally, elements focused with *kuphela* 'only' cannot be OM-doubled.

(17) a. Ngi-bon-e **u-Sipho kuphela**]$_{vP}$.
1SM-see-PST AUG-1a.Sipho only
'I saw only Sipho.'

b. *Ngi-m-bon-ile]$_{vP}$ **u-Sipho kuphela**.
1SM-1OM-see-PST AUG-1a.Sipho only
(Buell 2008: (6))

These facts led Zeller (2015) to argue for an analysis in which object markers arise via an agreement relation with a functional head on the edge of *v*P, which triggers movement of the relevant object to a right-facing specifier of the functional projection. Figure 1 sketches this analysis.

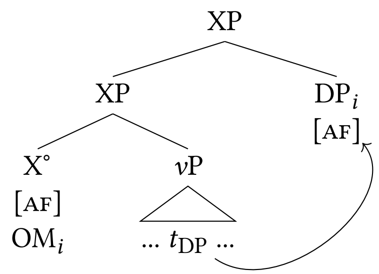

Figure 1: Zeller's analysis of Zulu object marking (based on Zeller 2015: (65)); [AF] = anti-focus

The analysis laid out in Figure 1 accounts for the fact that, in Zulu, OMing is "symmetrical" (i.e., either object of a ditransitive verb can be OMed). On Zeller's account, the probe that generates OMing is an anti-focus (AF) probe. The [AF] probe does not necessarily find the closest DP; instead, the anti-focus probe seeks the closest anti-focus-marked DP, which may in fact be the structurally lower object in a ditransitive.

4 Cinyungwe: dissociations between movement and OMing

Cinyungwe shares many similarities with Zulu, as we will continue to outline as the discussion proceeds, but the object marking patterns in Cinyungwe and Zulu are not identical. A central distinction regards the (dis)association of movement with object marking. In Zulu, rightward movement is necessarily linked with object marking, such that attempted right-dislocation without OMing is unacceptable, as shown above in (14c). In Cinyungwe, on the other hand, OM-doubling and right-dislocation are not necessarily linked. OM-doubling of right-dislocated objects is quite natural and at times is preferred (depending on the discourse context), but right-dislocation occurs independently of OM-doubling, and OM-doubling occurs independently of movement of objects. This will play an important role in our analysis.

4.1 Rightward movement of objects for focus-background purposes

In non-doubling contexts, objects may be *in situ* or moved to the right edge of the sentence. (18) is an example with no movement and no object marking, which simply retains canonical word order, a pragmatically neutral sentence.

(18) Baba a-da-phik-a ci-mbamba mwakankulumize.
1.father 1SM-PST-cook-FV 7-beans quickly
'Father cooked the beans quickly.'

The sentence in (19) differs minimally: again there is no object marking, but the object is moved to the right of the manner adverb, and there is a prosodic break between the manner adverb and the object.

(19) Baba a-da-phik-a mwakankulumize , ci-mbamba.
1.father 1SM-PST-cook-FV quickly 7-beans
'Father cooked the beans QUICKLY.'

There is an interpretive distinction between (18) and (19); while (18) is pragmatically neutral, in (19) attention is being brought to the manner of cooking; there is a sense that what is being talked about is the manner of cooking. The interpretive shift appears to be more of a "lightweight" focus: it does not create a strong sense of emphasis, but instead a redirection of the addressee's attention onto the remaining *v*P-internal elements. Currently, we are thinking of this as an interpretive distinction between discourse-given material (moved to the right edge) and focused material (remaining in *v*P).[10] There is a long history in the literature documenting this pattern, and this analysis bears a lot of similarity to Zeller's analysis of Zulu OMing (though here, again, we are not yet discussing OMing in Cinyungwe, only rightward movement of objects).

This is somewhat similar to the Zulu restrictions on focused *v*P content above, but there are crucial differences. Namely, whereas *v*P is always a designated focus domain in Zulu, in Cinyungwe, these effects only seem to arise in instances of right-dislocation or OMing, and they do not introduce the same restrictions on focused content outside *v*P. This is illustrated in (20), showing that wh-subjects in Cinyungwe are not restricted to postverbal, *v*P-internal positions (whether or not there is OM-doubling).

(20) Mbani a-da-(ci-)phik-a ci-mbamba mwakankulumize?
1who 1SM-PST-(7OM)-cook-FV 7-beans quickly
'Who (really/certainly) cooked beans quickly?'

This contrasts with Zulu, where focused subjects cannot occur preverbally, as shown above in (16). Therefore, while movement of objects is linked with focal effects in Cinyungwe, this movement still does not create the same kind of focus restrictions that occur in Zulu.

Kratzer & Selkirk (2020) suggest that discourse-given material is marked syntactically by a [G] feature. Let us assume that a functional projection at the edge of *v*P can bear a [G] probe, which attracts presupposed/given material to its edge and marks its complement as non-presupposed, that is, focused. Sikuku & Diercks (forthcoming) propose a projection that performs these focus/givenness functions for Lubukusu, which bears a focus operator (Rooth's 1992 ∼ (squiggle) operator). Per standard assumptions, the ∼ (squiggle) operator presupposes the presence of a focused element in its complement (Rooth 1992, Büring 2016, Kratzer & Selkirk 2020). Given the distinct properties of this head from heads generally referred to as "Focus Phrases" (which attract focused elements to their specifier) we avoid a FocP label. Instead we adopt the label "Comment Phrase," as proposed for a parallel projection by Sikuku & Diercks (forthcoming), borrowing from the terminological tradition of "topic-comment" distinctions for such information structure dynamics.

[10]Based on the data we have provided so far, another potential analysis could be that focused material moves left to a position immediately after the verb (as opposed to the rightward movement of given material). This possibility is ruled out by benefactive applicative constructions (whose standard word order is S V IO DO) where the recipient follows both the theme and a manner adverb; see (29b). Cheng & Downing (2012) arrive at the same conclusion for Zulu.

This is illustrated in Figure 2, where a Comment Phrase (ComP) is headed by a Com head (Com°), which bears a [G] probe, which probes its c-command domain for a [G]-marked phrase.

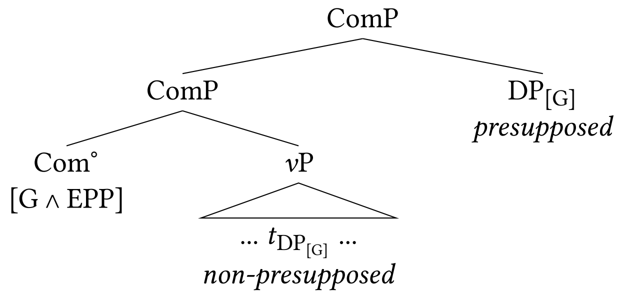

Figure 2: Schematic tree of Cinyungwe movement for givenness

This creates a focus-background structure in the sense of backgrounding (presupposing) some information and drawing attention to other information. Critically, this focus-background structure lacks the additional emphasis that is introduced by OM-doubling, which we describe below.

These information structure effects are evident in multiple ways. First, as we might expect, object movement constructions are unnatural in out-of-the-blue contexts:

(21) *Scenario: A Cinyungwe-speaking newscaster gets on the radio as part of a news report.*

a. Baba a-da-phik-a ci-mbamba mwakankulumize.
1.father 1SM-PST-cook-FV 7-beans quickly
'Father cooked the beans quickly.'

b. # Baba a-da-phik-a mwakankulumize , ci-mbamba.
1.father 1SM-PST-cook-FV quickly 7-beans
'Father cooked the beans QUICKLY.'

In this context, (21b) sounds as if the speaker is calling the attention of the audience to *mwakankulumize* 'quickly,' but in an out-of-the-blue context, this sounds unnatural. Instead, it feels as if this should be part of a conversation in which the cooking of beans was already under discussion: it is not possible to walk up to someone out of nowhere and say (21b).

Another prediction of this account is that phrases that resist interpretations as discourse-given should be unable to undergo rightward movement. Negative polarity items (NPIs) are one such sort of phrase: being inherently non-referential, they cannot refer to a discourse-familiar referent. As (22) below shows, it is illicit to move an NPI object to the right. This is precisely what is predicted if this is a movement driven by a [G] feature.

(22) a. Kapenu a-libe ku-won-a na-mu-nthu-yo dzulo.
1.Kapenu 1sm.pst-neg 15sm-see-fv npi-1-person-npi yesterday
'Kapenu didn't see anyone at all yesterday.'

b. *? Kapenu a-libe ku-won-a dzulo , na-mu-nthu-yo.
1.Kapenu 1sm.pst-neg 15sm-see-fv yesterday npi-1-person-npi
Intended: 'Kapenu didn't see anyone at all yesterday.'

4.2 OM-doubling for emphasis

We now move our attention to OM-doubling. As noted above, movement (of objects) is dissociated from object marking. That means that both movement and non-movement constructions are available without OM-doubling. Here, we see that OM-doubling constructions are possible with both movement and non-movement of the OM-doubled object, though with interpretive distinctions that offer insight into the analysis of both constructions. In an OM-doubling construction, if the doubled object has been moved to the right, focus falls on the material remaining in the verb phrase to the left of the moved object. In (23) this results in focus on the manner adverb.

(23) Baba a-da-ci-phik-a **mwakankulumize** , ci-mbamba.
1.father 1sm-pst-7om-cook-fv quickly 7-beans
'Father cooked the beans quickly.'

- *Acceptable in manner focus contexts, such as:*
  - *an answer to a manner question*
  - *a clarification about the manner in which beans were cooked*

As noted in the comments below (23), this construction is acceptable in contexts where the manner adverb is focused.

In the absence of movement of the doubled object, undifferentiated emphasis falls on the entire predicate, yielding a verum-like reading of the sentence. This is illustrated in (24).

(24) Baba a-da-ci-**phik-a** **ci-mbamba** **mwakankulumize**.
1.father 1sm-pst-7om-cook-fv 7-beans quickly
'Father really/certainly cooked the beans quickly.'

- *Acceptable in contexts where the entire predicate is focused, such as:*
  - *there is a disagreement about whether the event occurred*
  - *the speaker wants to emphasize that this is in fact what happened*
- *Unacceptable in the manner-focus contexts noted above for (23)*

As noted below the translation, (24) is unacceptable in the manner focus contexts from (23). Instead, a construction like (24) is only possible in something like predicate focus contexts or verum focus contexts.

It can be quite tricky to disentangle these interpretive effects, and while this work is still underway we do have some initial evidence showing how the emphatic use of OM-doubling occurs in different positions from the focus effects of object movement. (25) gives a mini-discourse, where the initial assertion from Person A in (25A1) is in the discourse-neutral word order. When Person B replies to correct their assertion, contrastive focus is placed on the corrected phrase (the theme object) by moving the discourse-familiar recipient object to the right. If Person A insists on their first assertion as in (25A2), however, Person B may then restate their correction, this time felicitously using OM-doubling in (25B2).

(25) A1: Kapenu a-gul-ir-a mayi ci-manga.
1.Kapenu 1SM.PST-buy-APPL-FV 1mother 7-maize
'Kapenu bought mother maize.'

B1: Neye, Kapenu a-(#mu)-gul-ir-a **ma-figu** , mayi.
no 1.Kapenu 1SM.PST-(#1OM)-buy-APPL-FV 6-bananas 1mother
'No, Kapenu bought mother BANANAS.'

A2: Neye, Kapenu a-gu-lir-a **ci-manga** , mayi.
no 1.Kapenu 1SM.PST-buy-APPL-FV 7-maize 1mother
'No, Kapenu bought mother MAIZE.'

B2: Neye, Kapenu a-mu-gul-ir-a **ma-figu** , mayi.
no 1.Kapenu 1SM.PST-1OM-buy-APPL-FV 6-bananas 1mother
'No, Kapenu really did buy mother BANANAS!'

The interpretation of (25B2) is that Person B is making a move to end the conversation, to offer the definitive statement on an issue that is currently under debate. For this reason, OM-doubling is infelicitous in (25B1): doubling at that stage of the discussion is simply too aggressive, as a mere disagreement about facts does not merit the kind of emphasis that OM-doubling generates. But note that in each of (25B1), (25A2), and (25B2) there is object movement, with contrastive focus placed on the unmoved object that is now positioned immediately after the verb.

This affirms the analysis of object movement as linked with givenness and focus (like in Zulu) but also affirms OM-doubling in Cinyungwe as grammatically and interpretively distinct from object movement and givenness/focus alone.

This interpretation is very similar to an interpretation generated by OM-doubling in Lubukusu, as illustrated above in (11b) and as described/analyzed by Sikuku et al. (2018). Sikuku et al. argue that OM-doubling is generated by an Agree relation initiated by a φ-probe on a functional projection that introduces a verum operator to the syntax: they refer to that projection as an Emphasis head (Emph°). If we assume that Emph° occurs in Cinyungwe, bears a φ-probe, and can also introduce a verum operator, we can explain a large range of the OM facts that we have encountered.

Therefore, we propose that OMs arise via an Agree relation generated by a φ-probe on Emph°, a projection that sits atop *v*P (or ComP, when it is present). This is illustrated in Figure 3. We assume this Emph° projection introduces a use-conditional operator in the sense of Gutzmann & Castroviejo Miró (2011) and Sikuku et al. (2018). This operator contributes a meaning that is related not to a sentence's truth conditions but to the conditions under which it can be felicitously used. Specifically, to create a verum-like interpretation of the clause, the operator communicates the speaker's desire to remove a particular question from the Question Under Discussion (a set of unresolved questions relevant to the conversation)—in other words, the speaker's desire to settle an issue that is being discussed. (We leave the details for future research, as there are complexities we are still investigating; see §6.2).

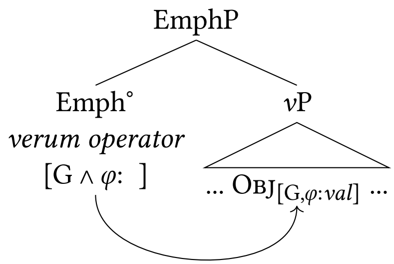

Figure 3: Structure of OM-doubling in Cinyungwe

You will notice the presence of a givenness feature ([G]) as part of the features of the probe on Emph° in Figure 3, requiring that the Goal be a G-marked element (the detailed mechanics of the Agree mechanism are important, but we leave the structure of the probe somewhat underspecified here for the purposes of an initial description/analysis). In Cinyungwe, OM-doubled objects are obligatorily familiar/specific. This is evidenced in (26); the bare noun *munthu* 'person' can be naturally used in negative contexts to mean 'anyone,' as in (26a). When the same construction contains OM-doubling in (26b), however, the object must receive a specific interpretation ('a particular person').

(26) OM-doubled objects are specific

a. Kapenu a-libe ku-won-a mu-nthu dzulo.
1.Kapenu 1SM.PST-NEG 15SM-see-FV 1-person yesterday
'Kapenu didn't see anyone yesterday.'

b. Kapenu a-libe ku-mu-**won-a** **mu-nthu** **dzulo**.
1.Kapenu 1SM.PST-NEG 15SM-1OM-see-FV 1-person yesterday
'Kapenu really/certainly didn't see a particular person yesterday.'
NOT: 'Kapenu really/certainly didn't see anyone yesterday.'

In addition to the bare nominal in an NPI-like usage, Cinyungwe allows *munthu* to be more explicitly constructed as an NPI with the additional morphology "*na-* *-yo*": *namunthuyo* 'anyone at all.' This strict NPI object cannot be OM-doubled.

(27) Kapenu a-libe ku-(*?mu-)-won-a na-mu-nthu-yo dzulo.
1.Kapenu 1SM.PST-NEG 15SM-(*?1OM)-see-FV NPI-1-person-NPI yesterday
'Kapenu (*?really/certainly) didn't see anyone at all.'

This is consistent with the finding above in (22) that the NPI *namunthuyo* 'anyone at all' is incompatible with givenness-driven movement to the right edge of ComP.

Both of these pieces of evidence (obligatory specific readings and restrictions on NPIs) suggest that OM-doubled objects are obligatorily interpreted as discourse-given, i.e., specific and identifiable in context.

5 Summarizing the analysis

5.1 Mechanics of current working hypothesis

Putting together the components of the analysis that we have discussed above, OM-doubling is generated by a φ-probe, which is located on a functional head at the edge of the verb phrase domain (Emphasis°). The φ-probe on Emph° requires its Goal to be discourse-given, which we have informally represented with a G feature conjoined with the φ-probe. This is represented in Figure 4. We assume

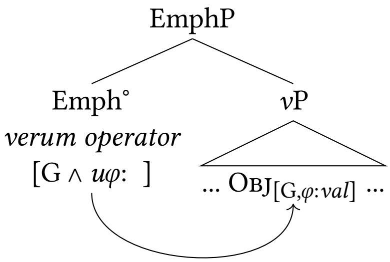

Figure 4: OM-doubling: verum reading when the predicate bears no information structure bifurcation

that ComP may be absent, in which case there is no information structure bifurcation within the predicate. The emphasis that is introduced in these instances therefore is interpreted in an undifferentiated manner on the predicate.

The properties of ComP may readily interact with the probe on Emph°, however. On the account we have developed, right-dislocation to the edge of Com° (movement for givenness) feeds OM-doubling. When the G probe on Com° triggers movement, any discourse-given element may move to the edge of ComP (and the squiggle operator on Com° presupposes that its complement, *v*P, is focused). From that position, a dislocated object DP will necessarily be the target of Agree by the φ-probe on Emph°, which sits atop ComP (when ComP is present).

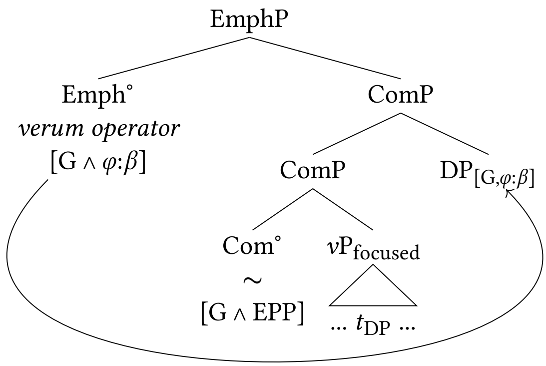

Figure 5: OM-doubling with object movement: focus on *v*P

5.2 Testing analytical predictions

This account makes several key predictions, which we test here.

5.2.1 Asymmetry in predicate focus

First, for undifferentiated verum emphasis on the predicate (which we are translating as 'really/certainly'), we predict that only the highest object can be OM-doubled. This is because "symmetrical" object marking of lower objects is fed by the (low) right-dislocation of presupposed objects, which creates an information structure bifurcation amongst the *v*P content. This is confirmed in (28): when putting emphatic focus on the entire predicate, OM-doubling is only natural on the higher object.

(28) a. Kapenu a-ndza-wa-**gas-ir-a** **a-kazi** **moto**
1.Kapenu 1SM-FUT-2OM-start.fire-APPL-FV 2-women 3.fire
mwakankulumize.
quickly
'Kapenu will really/certainly start the fire for the women quickly.'

b. *? Kapenu a-ndza-wu-**gas-ir-a** **a-kazi** **moto**
1.Kapenu 1SM-FUT-3OM-start.fire-APPL-FV 2-women 3.fire
mwakankulumize.
quickly
Intended: 'Kapenu will really/certainly start the fire for the women quickly.'

5.2.2 Dislocated (presupposed) objects intervene in OM-doubling

Second, we predict that only particular sorts of interactions are possible between movement and OM-doubling. (29) demonstrates what we have seen throughout: OM-doubling of a right-dislocated object is very natural.

(29) a. Kapenu a-ndza-gas-ir-a a-kazi moto
1.Kapenu SM-FUT-start.fire-APPL-FV 2-women 3.fire
mwakankulumize.
quickly
'Kapenu will start the fire for the women quickly.'

b. Kapenu a-ndza-wa-gas-ir-a moto mwakankulumize , a-kazi.
1.Kapenu 1SM-FUT-2OM-start.fire-APPL-FV 3.fire quickly 2-women
'Kapenu will start the fire for the women quickly.'

c. Kapenu a-ndza-wu-gas-ir-a a-kazi mwakankulumize , moto.
1.Kapenu 1SM-FUT-3OM-start.fire-APPL-FV 2-women quickly 3.fire
'Kapenu will start the fire for the women quickly.'

As we mentioned above, our analysis is that right-dislocation of discourse-given objects to the edge of ComP feeds OM-doubling by moving a Goal object into a (more) local relationship with the φ-probe on Com°. This suggests that the OM probe should be unable to target *v*P-internal material when an object is right-dislocated.

The prediction is upheld: it is quite unnatural to OM-double a non-presupposed (*in situ*) object when another object has been moved to the right edge as a presupposed object. In the context of a right-dislocated recipient, OM-doubling the *in situ* theme is unacceptable (30a). And the converse in (30b) is also unacceptable: right-dislocation of the theme disrupts OM-doubling of the *in situ* recipient.

(30) a. *? Kapenu a-ndza-wu-gas-ir-a moto mwakankulumize , a-kazi.
1.Kapenu 1SM-FUT-3OM-start.fire-APPL-FV 3.fire quickly 2-women
'Kapenu will start the fire for the women quickly.'

b. *? Kapenu a-ndza-wa-gas-ir-a a-kazi mwakankulumize , moto.
1.Kapenu 1SM-FUT-2OM-start.fire-APPL-FV 2-women quickly 3.fire
'Kapenu will start the fire for the women quickly.'

This follows from our analysis: dislocated objects are structurally closest to the φ-probe on Emph°; therefore, if an object is right-dislocated to the edge of ComP it will intervene in an Agree relation between the φ-probe on Emph° and a *v*P-internal object.

5.3 Non-doubling OMs

As we have established, OM-doubling is possible both with and without object movement, but it requires particular pragmatic contexts and results in verum-like emphatic interpretations. These contexts are not necessary in constructions with non-doubling OMs such as (31) (i.e., constructions with an object marker but without the object it refers to), nor are non-doubling constructions associated with verum interpretations.

(31)

Ine	nda-tsuk-a	ci-mbamba	ndipo	baba	a-da-ci-phik-a.
I	1SG.SM.PST-wash-FV	7-beans	and	1.father	1SM-PST-7OM-cook-FV

'I washed the beans, and then father cooked them.'

We assume that non-doubling OMs are incorporated pronouns and are not generated by agreement with Emph°, following the same proposal by Sikuku et al. (2018) and Sikuku & Diercks (forthcoming) for Lubukusu.[11]

6 Conclusions

6.1 Summary of findings

We have seen above that object marking is linked with focal/emphatic effects in the verb phrase (*v*P). Whether the emphasis is associated with undifferentiated information structure within the predicate or interpreted in concert with a more narrow focus on a particular constituent depends on whether backgrounded/discourse-given constituents have moved out of the verb phrase (Cheng & Downing 2012).

There are clear empirical differences (both in interpretation and grammatical mechanisms) between the marking of focus/givenness and the marking of verum emphasis. Movement out of the *v*P to the right edge distinguishes presupposed/backgrounded postverbal content (moved) from non-presupposed content (remaining in *v*P). This redirects addressee attention in a focus-background structure, but is not emphatic in the same way that OM-doubling is. OM-doubling creates an emphatic interpretation that appears to be closely associated with verum emphasis in many instances, though object-marked objects must nonetheless be discourse-familiar/specific.

[11] There appear to be some distinctions between Cinyungwe and Lubukusu concerning non-doubling OMs and focus in the clause, as it is not clear that Lubukusu has the same focal requirements. We leave this as an issue for future research, but it could be explained if ComP is optional in Lubukusu but obligatory in Cinyungwe.

On our account, movement to the right edge is driven by [G] features on a functional head at the edge of *v*P (ComP). OM-doubling is generated by *φ*-features on a head at the edge of the *v*P/ComP (which we refer to as Emph°). Crucially, Com° bears a focus operator, presupposing that its complement is focused. Emph° also bears a semantic/pragmatic operator that (at least) introduces a meaning similar to verum, a discourse move to end conversation on an issue. That said, as we note below in §6.2, in Cinyungwe (as in Lubukusu) OM-doubling can be linked with other kinds of meanings that are also reasonably analyzed as use-conditional meanings, which suggests that the properties of Emph° in Cinyungwe need further investigation.

6.2 Issues for future research

In this section we note several relevant facts that require additional research.

6.2.1 OM-doubling linked with mirative contexts

Despite the proposed link between verum emphasis and OM-doubling in Lubukusu by Sikuku et al. (2018), more recent ongoing research has shown that OM-doubling in Lubukusu is linked with a broader range of licensing contexts than simply verum (Sikuku & Diercks forthcoming). Sikuku & Diercks (forthcoming) argue that Lubukusu OM-doubling is also linked with mirative focus contexts, where the focused element is being emphasized with a mirative conventional implicature marking that it is a particularly unlikely proposition. (32) is drawn from Sikuku & Diercks (forthcoming).

(32) *Context: In Lubukusu culture, a young man should not marry a widow. If this is to happen, it is considered highly scandalous. In the situation being considered, a father has gone away for some time, and returns only to have his wife inform him that their 19-year-old son Wafula has married an older widow. In this instance, the wife can report to her husband:*
Wafula a-mu-bey-a namulekhwa!
1Wafula 1SM-1OM-marry-FV 1widow
'Wafula married a widow!'

We see a similar effect in Cinyungwe, as illustrated by (33):

(33) *Context: As you know, my father doesn't know how to cook beans. When we left school I ran home to cook, but do you know what!? I found out that he had really cooked them nicely!*

Baba a-da-ci-phik-a ci-mbamba!
1.father 1SM-PST-7OM-cook-FV 7-beans
'Father actually cooked the beans!'

It is not clear (either in Lubukusu or for Cinyungwe) whether these kinds of contexts are analytically linked with the verum-like readings that arise naturally in disagreements/debates and in confirmation/correction contexts. For the first author here, they feel intuitively similar, but future research is necessary to determine if they occur in different contexts (discourse contexts or grammatical contexts). In ongoing work, we are focusing on the range of emphatic interpretations associated with OM-doubling in Lubukusu, Cinyungwe, and other Bantu languages (Lippard et al. 2023).

6.2.2 Exceptional instances of obligatory OMs

While in most instances OM-doubling is not grammatically obligatory, we have found one instance where it appears to be, which we have yet to understand or explain. In general, it appears that OMing an extracted object in a relative clause or a cleft is grammatical but optional; we have not yet identified instances where it is ungrammatical. But there are certain predicates where OMs are obligatory in object relative clauses. For other predicates, the OM is optional. As shown in (34), the verb *-wona* 'see' requires an OM in a relative clause, but for the verb *-werenga* 'read,' the OM is optional.[12]

(34) a. livu lomwe ni-da-*(li)-won-a
5.book 5.that 1SG-PST-*(5OM)-see-FV
'the book that I saw'

b. livu lomwe nda-(li)-wereng-a
5.book 5.that 1SG.PST-(5OM)-read-FV
'the book that I read'

[12] An anonymous reviewer suggests that this pattern may be related to incremental theme verbs (i.e., perhaps OMs are required in relative clauses with verbs whose objects are required and optional with verbs whose objects are optional). While such an analysis would be consistent with the data in (34), it does not explain the full range of predicates for which OMing in relative clauses is optional. For example, *-gula* 'buy' is not an incremental theme verb and does not require an OM in a relative clause.

The reviewer also suggests that perhaps some verbs or verb classes might subcategorize specifically for OMs; the issue requires further research. A similar situation occurs with Kiluguru, as the verb *-ona* 'see' requires an OM (Marten & Ramadhani 2001). However, this requirement is not restricted to relative clauses as in Cinyungwe.

In a similar fashion, we have found that recipient objects are obligatorily OM-doubled when extracted, but we have not found this to be true for any other kind of object.

(35) a. Wa-na omwe u-ndza-*(wa)-pas-a ma-livu
2-children 2.that 2SG-DIST.FUT-*(2OM)-give-FV 6-book
a-fik-a.
6SM.PST-arrive-FV
'The children that you will give the books to arrived.'

b. Ma-livu yomwe u-ndza-(ma)-pas-a wa-na
6-book 6.that 2SG-DIST.FUT-(6OM)-give-FV 2-children
a-fik-a.
2SM.PST-arrive-FV
'The books that you will give the children arrived.'

These are effects we do not yet understand and they require additional research.

6.2.3 OM-doubling and left-dislocation

In this paper we have focused on object marking and its interactions with right-dislocation (of objects), but objects can also appear at the left edge of the sentence in Cinyungwe. This is possible both with and without an OM, as shown in (36), but there are interpretative differences. In (36a), the object *cimbamba* 'beans' appears to be the topic of the sentence; for example, this sentence would be appropriate in a context where someone was looking for (uncooked) beans and the speaker wants to explain what happened to them.

By contrast, (36b) has an emphatic interpretation. This sentence can be used to express the speaker's confidence that it was beans, not something else, that father cooked, or to emphasize how well the beans were cooked. These two available readings may be instances of verum and mirative emphasis, but more work is necessary on left-dislocation and its interactions with OM-doubling in Cinyungwe.

(36) a. Ci-mbamba , baba a-da-phik-a.
7-beans 1.father 1SM-PST-cook-FV
'The beans, father cooked them.'

b. Ci-mbamba , baba a-da-ci-phik-a.
7-beans 1.father 1SM-PST-7OM-cook-FV
Approximately: 'The beans, father really cooked them.'
Natural contexts include:
- *disagreement about what father cooked*
- *the beans were cooked very nicely*

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Chapter 14

Strategies of Clausal Complementation in Rere

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This paper describes three attested complementation strategies in Rere (also known as Koalib, ISO: KIB; Kordofanian). A special focus is drawn on two types of morphologically impoverished complements which lack verbal class agreement. The "non-finite complement' strategy shows two syntactic patterns for the position of co-referent subjects that are dependent on the matrix verb, similarly to object vs. raising distinctions. The"finite complement" strategy is special in three ways: 1) it is only available when the matrix is a control predicate, 2) the complement has one of three left-edge markers sensitive to matrix Tense-Aspect-Mood (TAM), and 3) it employs subject and object pronominal marking instead of referencing one of the arguments with verbal class agreement, as attested in matrix clauses. This final complementation strategy opens a discussion about the morphological effects of a TAM system in clausal complements.

1 Overview

Rere or ŋ̀rɛ́ːɽɛ́ (alternatively Koalib; Quint (2009), Quint (2020)) is a language from the Kordofanian grouping[1], traditionally spoken in the Nuba Mountains in the southern part of Sudan. Novel data shows Rere exhibits three strategies of clausal complementation, dubbed "full clausal" complements, "non-finite" complements, and "finite" complements. The goal of this paper is to describe their distribution and morphological properties in comparison to matrix declarative clauses and

[1] I follow Greenberg (1963) in using Kordofanian for a group of languages in the Nuba Mountains of Kordofan in Sudan, but there is debate as to whether these form a branch within the Niger-Congo language family or even their own family. See Belch (2014) for more details.

José Armando Fernández Guerrero. 2024. Strategies of Clausal Complementation in Rere. In James Essegbey, Brent Henderson, Fiona McLaughlin & Michael Diercks (eds.), *Pushing the boundaries: Selected papers from the 51–52 Annual Conference on African Linguistics*, 297–311. Berlin: Language Science Press. DOI: 10.5281/zenodo.14038757

in comparison to one another. All linguistic data presented in this article comes from elicitation work with a native male speaker, unless otherwise cited.

A special focus is drawn to the latter two types, which are morphologically impoverished in contrast to full clausal complements and matrix declarative clauses. Both the non-finite and finite complements lack class agreement. The non-finite complement strategy lacks any Tense-Aspect-Mood (TAM) distinctions. Meanwhile, the finite complement has less TAM distinctions than matrix declaratives, and these TAM expressions are organized differently. The morphological expression of TAM in the finite complements is tightly correlated with the matrix TAM, but there can be exceptions. The finite complements occur only with a subset of matrix predicates and can be alternatively expressed with a non-finite complement.

The breath of complementation strategies and their relation to matrix predicates in languages of the Nuba Mountains is a relatively understudied area. Moreover, a analogous pattern to the Rere finite complementation strategy and its distribution has not been previously reported elsewhere in the Kordofanian grouping, thus opening a discussion about the morphological effects of a TAM system in clausal complements.

This paper is organized as follows. In §2, I briefly describe the morphosyntactic properties of matrix clauses in Rere, focusing on class agreement and TAM marking. I then introduce the three complementation strategies starting with full clausal complements in §3, then moving onto non-finite complements in §4, and finally to finite complements in §5. In §4, I discuss the non-finite complements' lack of pronominal marking §4.1, their distribution §4.2, and the two syntactic patterns available only to raising predicates §4.3. In §5, I describe the distribution of finite complements §5.1, their pronominal marking §5.3, and the TAM distinctions in these complements §5.2. I summarize the facts and takeaways in §6.

2 Matrix clauses

If the object argument is a lexical NP, a transitive clause in Rere is SVO, as shown with a perfective clause in (1). Note that the class agreement on the verb is with the NP subject *kwór* 'man,' which is a member of the *kw-* class. Moreover, the object *ţìɲɛ́n* 'dog' is case-marked for accusative case. Case-marking on Rere NPs is lexically determined and employs a variety of segmental and tonal strategies. Accusative case-marking appears to be optional, although more research is need to conclude such a suspicion. (Boychev (2013)).

(1) Perfective
kwór kw-èːɟ-à ʈìɲɛ́n-ù
CLA.kw.man CLA.kw-see.PFV-FV CLA.ʈ.dog-ACC
'The man saw the dog.'

In Rere, TAM may be indicated by different simultaneous morphological strategies: the tonal melody, a final vowel suffix, and tonal or a segmental prefix preceding the verb root. While (1) has no segmental prefix, the grammatical tone on the verb stem is LL, as attested in perfective clauses. Moreover, similarly to the accusative marking, the final vowel is lexically determined for each verbal predicate in each TAM configuration; in the case of the verbal root *ɛːɟ-* 'see' the perfective shows an *-a* as the final vowel.

To illustrate the morphological effects of TAM further, below is a transitive, habitual clause. The habitual is marked with a segmental prefix *t̪-* that incurs a H tone, which then spreads to give HH melody on the verb root. Unlike (1), the final vowel is *-ɛ*. (For more information on verbal tone patterns, TAM, matrix pronominal marking, and their interaction in object-marked verbs, see Rose (2020)). Pronominal subjects are part of the *kw-* class.[2]

(2) Habitual
ɲí-gw-t̪-ɛ́ːɟ-ɛ́ ʈòːròm
1.SG-CLA.kw-HAB-see-FV CLA.ʈ.star
'I (always, habitually) see a star.'

Kordofanian class agreement may reference other arguments besides the subject in matrix clauses. For example, in the case that the referent is an object previously mentioned in the discourse, class agreement references the object instead of the subject, as in (3). The object *ʈèʈìŋgé* 'donkey' is part of the *ʈ-* class, and it is referenced on the verb below with class agreement. The subject, on the other hand, occurs post-verbally in this construction. Other cases where class agreement does not reference the subject argument include ex-situ content interrogatives, where class agreement references the interrogative pronoun (cf. Chai et al. (2022)).

(3) Class agreement with object
ʈ-ɛ̀ːɟ-á kwòr
CLA.ʈ-see.PFV-FV CLA.kw.man
'The man saw it (the donkey).'

[2]Particularly in rapid speech, two phonological processes occur: the labialization of the class agreement consonant causes the preceding vowel on the prefix to round to [u]. The other is that the class agreement consonant is voiced.

In the next sections, I describe the properties of complement clauses in contrast to matrix clauses by focusing on the morphological strategies of TAM marking, (lack of) class agreement, and pronominal marking.

3 Full clausal complements

The first complementation strategy is described as a full clause because the arguments expressed and the inflectional morphology on the verb in these complements are the same as those found on the matrix clause. These complements are attested with factive and communication verbs as in (4-5). There is an optionally overt quotative marker *-ŋò* suffixed onto the communication verb.

(4) Factive
ŋá-kw-óðóðún-á [ʈɔ́ːŋɔ̀r ʈì-t̪-áβíð-í]
2SG-CLA.kw-forget.PFV-FV CLA.ʈ.boy CLA.ʈ-HAB-play-FV
'You forgot the boy played (habitually).'

(5) Communication
ámmá kw-àr-ò(-ŋò) [ʈɔ́ːŋɔ̀r ʈ-ìð-ì
Amma CLA.kw-say.PFV-FV(-QUOT) CLA.ʈ.boy CLA.ʈ-eat-PFV
ʃìrìm-í ɣìlìɣìn]
CLA.kw.corn-ACC yesterday
'Amma said that the boy ate the corn yesterday.'

Subjects may be co-referential, as in (6) where the complement clause has the same class agreement as the matrix verb and both agree with the matrix subject ʈɔ́ːŋɔ̀r 'boy' (ʈ-class).

(6) ʈɔ́ːŋɔ̀r ʈ-òðòðùn-á ʈì-t̪-áβíð-í
CLA.ʈ.boy CLA.ʈ-forget.PFV-FV CLA.ʈ-HAB-play-FV
'The boy forgot he played (habitually).'

4 Non-finite complements

The next strategy is that of non-finite complements. The term non-finite is used to describe these complements because the dependent clause's morphology has no indication of being influenced by tam-related alternations in the superordinate clause.[3] Instead, there is a fixed verbal root in the complement that employs the same final vowel and (lexical) tonal melody of the verb. For example, the final vowel of the verbal root *bubl-* ‘wrestle’ is *-ɐ* for matrix perfective-marked verb root as in (7). However, when the verbal root is in a non-finite clause, the final vowel consistently shows up as *-i*, as in (8).

(7) Matrix perfective
kwʊ̀-bùbl-$\boxed{\text{ɐ̀}}$ kwò:r-ò
cla.kw-wrestle.pfv-fv cla.kw.man-acc
‘He wrestled the man.’ (Rose 2020)

(8) Non-finite complement embedded in matrix perfective
kwâw kw-òkwàɟ-à ʈɔ̀:ŋɔ́r-á àðə̀-bùbl-$\boxed{\text{í}}$
cla.kw.woman cla.kw-order.pfv-fv cla.ʈ.boy-acc inf-wrestle-fv
kwò:r-ò
cla.kw.man-acc
‘The woman ordered the boy to wrestle the man.’

In matrix clauses, there are two sets of tam forms. The first set of tam forms exhibits an h tone on the verb stem (either on the root or the final vowel suffix), which is a lexical tone. Meanwhile, the second set of forms are all l-toned. The non-finite complements consistently employ lexical tone: lh for *bubl-* ‘wrestle’ (8), hl for *ɖárm-* ‘draw’ (9), and hh for *mɐ́tɕ-* ‘help’ (10).

(9) kwâw kwʊ̀-ŋ-ɛ́mɟ-í ðə̀-ɖárm-à ŋòrpò
cla.kw.woman cla.kw.impf-2.obj-let-fv inf-draw-fv tomorrow
‘The woman will let you draw tomorrow.’

(10) kwâw kwʊ̀-ŋ-ɛ́mɟ-í ðə̀-mɐ́tɕ-í ʈɔ̀:ŋɔ́r-à
cla.kw.woman cla.kw.impf-2.obj-let-fv inf-help-fv cla.ʈ.boy-acc
‘The woman will let you help the boy.’

Non-finite complements are additionally distinguishable by their complete lack of class agreement. Instead of class agreement prefixes, there is an marker *àð-*, which has different allomorphs: *ð-*, *at̪-*, and *t̪-*. The following paragraphs will

[3]That said, I specifically remain agnostic as to whether these non-finite clauses should be analyzed semantically or syntactically as nominalized clauses vs. embedded, verbal phrases with an infinitival verbal predicate. More remains to be researched to have clear diagnostics of nominalization in Rere, as well as for non-finiteness, as the immediate goal here is to describe the morphological configuration and overall inventory of phrasal complements.

refer to this as an infinitive marker (INF) due to its distribution, without a commitment to its lexical status or morphosemantic content. It is possible that this marker is diachronically derived from a class agreement prefix, but I leave that for further research.

(11) kwʊ̀-ɽìð-í-ɲí àð-àβìð-àlò
CLA.kw-prevent.PFV-FV-1.OBJ INF-play-DOWN
'He prevented me from playing.'

(12) kwʊ̀-ɽìð-í-ɲí ð-àβìð-àlò

(13) kwʊ̀-ɽì-ð-í-ɲí t̪-àβìð-àlò

4.1 Pronominal marking

An additional characteristic of the verbal complex of non-finite complements is that they not host subject or object pronominal markers, in contrast to matrix clauses. In matrix clauses, pronominal markers may precede or follow the verbal root, dependent on TAM; they follow the verb in perfectives (14), but precede it in TAM constructions that have a TAM marker before the verbal root, such as the habitual in (2). Meanwhile in the non-finite complement in (15), there is no pronominal marker; instead, there is a ACC-marked 2.SG pronoun ŋá-ŋò.

(14) Matrix clause
ɲí-gwʊ́-búbl-á-ŋá
1.SG-CLA.kw-wrestle.PFV-FV-2.OBJ
'I wrestle you.'

(15) Non-finite complement
ʈɔ́ːŋɔ̀r ʈ-ùɣðàð-í-ɲí àðə-βùbl-í ŋá-ŋò
CLA.ʈ.boy CLA.ʈ-convince.PFV-FV-1.OBJ INF-wrestle-FV 2SG-ACC
'The boy convinced me to wrestle you.'

4.2 Distribution

Non-finite complements are attested with a variety of verb types. They can occur with aspectual predicates (sometimes termed "phasal" predicates; Cristofaro 2003), as in (16). They also occur with predicates expressing desire, obligation, or persuasion (17).

(16) Aspectual

ŋá-gw-ànàɲnàṯ-à	ð-àβìð-ì
2SG-CLA.kw-continue.PFV-FV	INF-play-FV

‘You continued to play.’

(17) Desire

ʈɔ́:ŋɔ̀r	ʈ-ìnàɲn-á-ɲ	àð-àβìð-àlò
CLA.ʈ.boy	CLA.ʈ-want.PFV-FV-1.OBJ	INF-play-DOWN

‘The boy wanted me to play.’

These examples additionally show that the matrix and embedded subjects do not need to be co-referential.

4.3 Subject-to-object-raising vs. object control

The morphosyntax of non-finite complements has two patterns dependent on the matrix verb. Some verbs may participate in optional Subject-to-Object Raising (SOR) of the lower clause’s agent, shown in (18-19) with a lexical NP. The raised subject is part of the matrix clause in (19), as evidenced by the optional ACC-marking on the lexical NP *kʊ́làw* ‘cat.’

(18)

ʈɔ́:ŋɔ̀r	ʈ-ùɣìðàð-ù	[àðə-kʊ́làw	ùm-í	lùrjà]
CLA.ʈ.boy	CLA.ʈ-hope-PFV	INF-CLA.kw.cat	catch-FV	CLA.l.mouse

‘The boy hoped the cat caught mice.’

(19)

ʈɔ́:ŋɔ̀r	ʈ-ùɣìðàð-ù	kʊ́làw(-á)	[àð-ùm-í	lùrjà]
CLA.ʈ.boy	CLA.ʈ-hope-PFV	CLA.kw.cat-ACC	INF-catch-FV	CLA.l.mouse

‘The boy hoped the cat caught mice.’

There are a couple possibilities that may be considered to explain the distribution of the subject after the infinitive marker in (18). On one hand, there exist morphosyntactic configurations in Rere that can occur with the TAM marker split from the rest of the verbal complex, such that a post-verbal subject occurs between the split TAM marker and the rest of the verb.[4] Therefore, (18) may be another instance of such a construction. On the other hand, the infinite marker àð- may be analyzed as a C head, which then demarcates the left edge of the dependent clause. More evidence is needed to decide between these analyses, among others, for the infinitive marker.

Importantly, SOR is not available when the lower agent is co-referential with the matrix verb’s patient. In such cases, the lower agent must occur as an object in the matrix clause.

[4] This is the case for non-subject wh-ex-situ questions; see Chai et al. (2022) for more details.

(20) kwâw kw-òkwàɟ-à ʈɔ̀ːŋɔ́r-á àðə̀-βùbl-í
cla.kw.woman cla.kw-order.pfv-fv cla.ʈ.boy-acc inf-wrestle-fv
kwɔ̀ːr-ɔ̀
cla.kw.man-acc
'The woman ordered the boy to wrestle the man.'

(21) * kwâw kw-òkwàɟ-à àðə̀-ʈɔ́ːŋɔ̀r bùbl-í
cla.kw.woman cla.kw-order.pfv-fv inf-cla.ʈ.boy wrestle-fv
kwɔ̀ːr-ɔ̀
cla.kw.man-acc
Intended: The woman ordered the boy to wrestle the man.

The distinction between the verbs that allow two orders is similar to cross-linguistic distinctions between subject-to-object raising and object control verbs. However, I leave the strict application of these labels to Rere's predicates for further research. In §5, I show that the latter class of predicates that do not have the sor option can instead optionally employ the finite complement strategy.

5 Finite complements

The finite complement strategy has four defining characteristics. The first characteristic is the lack of class agreement, which it shares with the non-finite strategy. The next three are unique to the finite complements. First, finite complements have the same distribution as non-finite complements that do not have optional sor. Next, they are termed finite because they show morphology that correlates with matrix tam distinctions, but they show less tam distinctions than do matrix declarative clauses in terms of the range of final vowels and tonal melodies. Lastly, these complements may express either subject or object of the dependent verb with pronominal marking on the verbal complex of the complement. This contrasts with matrix delcarative clauses (and full clausal complements), where one of the arguments must be referenced class agreement. It additionally contrasts with non-finite complements because no subject or object pronominal marking occurs on the verb.

5.1 Distribution

The finite complementation strategy is attested when the patient of the matrix verb is co-referenced with the agent of the dependent verb. The agent of the complement clause as a subject pronominal marker in the complement clause while also being co-referenced in the matrix clause with a ACC-marked NP (22), with class agreement if the referent was previously mentioned in the discourse (23), or with a pronominal object marker (24). The marker *n(ì)-* occurs in these TAM configurations, but it is discussed further in §5.2. The difference between first person subject and object pronominal markers is tonal (cf. Rose (2020)).

(22) ɲú-gw-ɛ̀mɟ-ì ɲ-ɔ̀ŋɔ́r-á [n-r-áβíð-í]
1SG-CLA.kw.-let.PFV-FV CLA.ɲ-boy-ACC REA-3PL-play-FV
'I let the boys play.'

(23) ɲ-ɛ̀mɟ-ɛ̀-ɲ-ɟí [n-r-áβíð-í]
CLA.ɲ-let.PFV-FV-1.SBJ-PL.OBJ REA-3PL-play-FV
'I let them (the boys) play.'

(24) ʈɔ́:ŋɔ̀r kə́rù ʈ-ìlìŋìð-ɐ́-ɲí [nì-ɲ-ɐ̀:rí kúmbàrà]
CLA.ʈ.boy CLA.ʈ.PROG CLA.ʈ-instruct-PFV-1.OBJ REA-1.SBJ-play CLA.k.lyre
'The boy is teaching me to play the lyre.'

As mentioned earlier, an alternative way of expressing a construction with a finite complement is to use a non-finite complement. Contrast 24 with 25.

(25) ʈɔ́:ŋɔ̀r kə́rù ʈ-ìlìŋìð-ɐ́-ɲí [àð-ɐ̀:rí kúmbàrà]
CLA.ʈ.boy CLA.ʈ.PROG CLA.ʈ-instruct-PFV-1.OBJ INF-play CLA.k.lyre
'The boy is teaching me to play the lyre.' TK12062019-3:12:46.8

5.2 TAM

There are three different left edge markers that can appear in these finite clauses, dependent on the TAM of the matrix clause. First, there is the marker *ní-* that occurs when the matrix clause is perfective (26), progressive (27), recent perfect (28), and remote perfect (29). The progressive verbal complex is the same as the perfective, but the clause differs in the additional class-marked auxiliary that precedes the verbal complex (*ŋg*^{w}*ó* in 27) .

(26) Perfective
kw-ɛ̀mɟ-ɛ́-ɲ $\boxed{\text{nì}}$-ɲ-βùbl-í ɣìlìɣìn
CLA.kw-let.PFV-FV-1.OBJ REA-1.SBJ-wrestle-FV yesterday
'He let me play yesterday.'

(27) Progressive
ŋgwó gw-ɛ̀mɟ-ɛ́-ɲ $\boxed{\text{nì}}$-ɲ-βùbl-í krɛ̀kkrɛ̀m
CLA.kw.PROG CLA.kw-let-PFV-1.OBJ REA-1.SBJ-wrestle-FV now
'He is letting me play now.'

(28) Recent perfect
kwʊ̀-mí-ɲ-ɛ́mɟ-í $\boxed{\text{nì}}$-ɲ-βùbl-í krɛ̀kkrɛ̀m
CLA.kw-REC.PFV-1.OBJ-convince-FV REA-1.SBJ-wrestle-FV now
'He (just recently) let me wrestle now.'

(29) Remote perfect
kwʊ̀-mí-ɲ-ɛ́mɟ-à $\boxed{\text{nì}}$-ɲ-βùbl-ɛ̀
CLA.kw-REM.PFV-1.OBJ-let-REM.PFV REA-1.SBJ.wrestle-REM.PFV-FV
ŋòrpànà 'He let (long ago) me wrestle in the morning.'
morning

Meanwhile, a zero-marker occurs on the complement when the matrix clauses are imperfective or imperative (30-31). Finally, the left-edge marker *t̪-* occurs with habitual matrix clauses (32). Note that the habitual left-edge marker does not lenite to ð, similarly to the habitual prefix in matrix clauses but unlike the non-finite left-edge marker in §4.

(30) Imperfective
gwʊ̀-ɲ-ɛ́mɟ-í $\boxed{\text{Ø}}$-ɲì-βùbl-í ŋòrpò
CLA.kw-1.OBJ-let.IMPF-FV IRR-1.SBJ-wreslte-FV tomorrow
'He will let me wrestle tomorrow.'

(31) Imperative
ɛ̀mɟ-ɛ́-ɲ-í $\boxed{\text{Ø}}$-ɲì-βùbl-í ŋòrpò
let-IMP-1.OBJ IRR-1.SBJ-wrestle-FV tomorrow
'Let me wrestle tomorrow.'

(32) Habitual
kwʊ̀-t̪í-ɲ-ɛ́mɟ-í $\boxed{\text{t̪ì}}$-ɲ-βùbl-í ɖòkɖòk 'He (habitually)
CLA.kw-HAB-1.OBJ-let-FV HAB-1.SBJ-wrestle-FV daily
let me wrestle daily.'

The working assumption is that the left-edge markers make a distinction between realis, irrealis, and habitual aspects, given their distribution summarized in Table 1.[5] The realis marker occurs with the perfective, progressive remote perfect, and recent perfect, while the habitual marker occurs with the habitual TAM, and the zero marker occurs with the imperative and imperfective. Regardless of the labeling of the left-edge markers, the division of the TAM in complement

[5]While I present the underlying tones of the left-edge markers here, it is important to note that these may be overridden by pronominal markers, similarly to matrix clauses as shown by Rose (2020).

Table 1: Matrix clause vs. finite complement tam

tam	Matrix	Left-edge	Complement
pfv	ll	*n(ì)-*	Lexical tone
prog	ll	*n(ì)-*	Lexical tone
rem	*m(ì)-*ll	*n(ì)-*	ll
rec	*m(ì)-*Lexical tone	*n(ì)-*	Lexical tone
hab	*t̪í-*Lexical tone	*t̪í-*	Lexical tone
impf	Lexical tone	*Ø-*	Lexical tone
impf	Lexical tone	*Ø-*	Lexical tone

clauses has fewer distinctions in comparison to matrix clauses. Moreover, both systems internally divide the tam differently with each morphological strategy: final vowel, tonal melody, and prefixes/left-edge markers.

In addition to the left-edge markers, the complement clause that occurs with a matrix remote perfect clause shows grammatical tone and a different final vowel than the rest of the verb complexes in finite complements. The verbal root *bubl-* 'wrestle' has a lexical tone lh and the final vowel is *-i* in finite complement clauses (33), except with the remote perfect, where the grammatical tone is ll and the final vowel is *-a* in the finite complement of a remote perfect clause (34). The verb (i.e. stem, final vowel, & tonal melody) in the remote perfect complement is the same as as it would be in a matrix clause.

(33) Imperative
ɛ̀mɟ-ɛ́-ɲ Ø-ɲì-βùbl-$\boxed{\text{í}}$ ŋòrpò
let-imp-1.obj irr-1.sbj-wrestle-fv tomorrow
'Let me wrestle tomorrow!.' TK03262021:16:24

(34) Remote perfect
kwʊ̀-mí-ɲ-ɛ́mɟ-à nì-ɲ-βùbl-$\boxed{\text{è}}$ ŋòrpànà
cla.kw-rem.pfv-1.obj-let-rem.pfv rea-1.sbj-wrestle-rem.pfv morning
'He let (long ago) me wrestle in the morning.' TK03262021:05:55

In spite of the strong tendencies of the left-edge markers to match the matrix tam as in Table 1, mismatches are available under specific contexts. In (35), the context forces a habitual reading of the complement clause. Thus, the complement clause shows the habitual left-edge marker *t̪í* while the matrix clause is perfective.

(35) CONTEXT: *I am the teacher who grants permission to whom can and cannot play at school and when. A group of boys wants to form a soccer team and play every day. They only had to ask me for permission one time.*

ɲú-ɡ-ɛ̀mɟ-ɛ̀	ɲɔ̀ːŋɔ́r-á	t̪í-r-ákàð-í	kùrà
1SG-kw-let-PFV	CLA.ɲ.boy-ACC	HAB-3.PL-pass-FV	CLA.kw.ball

'I let the boys (habitually) play soccer.' TK03092021:30:30

In this case, there is a ACC-marked, lexical NP in the matrix clause that is co-referenced with a third person plural *r-* pronominal marker on the lower verb.

5.3 Pronominal marking

Similar to non-finite complements, finite complements have no class agreement. Unlike non-finite complements, subjects can be referenced with subject pronominals on the complement's verbal complex, attested in (36) with 1.INCL.

(36)

kwâw	kwí-ɲ-ɟ-ɔ́kwáʝ-í	Ø-r̀-βùblí	ŋòrpò
CLA.kw.woman	CLA.kw.IMPF-1.OBJ-PL.OBJ-order-FV	IRR-1.INCL.SBJ-wrestle	tomorrow

'The woman will order us (all) to wrestle tomorrow' TK02232021:01:34:07

The subject pronominal marker in the complement (L-toned *r-* for 1.INCL in 36) can co-occur with an object marker in the matrix clause that is co-referent with the dependent verb's agent. However, object pronominal markers make less distinctions for first person than subject pronominal markers attested in these finite dependent clauses and in matrix clauses. The first person inclusive is co-referenced in the matrix clause with a first person pronominal marker *ɲ-* and a plural object marker *ɟ-* in (36).

Subject pronominal markers are attested in matrix clauses. However, these occur when the verbal class agreement references another argument, such as an object previously mentioned in the discourse, as discussed in §2. In such cases, the subject pronominal occurs in the same position as an object pronominal, and, for first and second person, it is tone that distinguishes them. A minimal pair is provided in below, where (37) shows an object pronominal and (38) shows a subject pronominal, differing only in tone.

(37) kwí-ɲ-búbl-í
CLA.kw-1.OBJ-wrestle.IMPF-FV
'He will wrestle me' (Rose 2020)

(38) kwì-$\boxed{\text{ɲ}}$-bùbl-í
CLA.kw-1.SBJ-wrestle.IMPF-FV
'I will wrestle him' (Rose 2020)

Subject pronominal markers thus occur when the class agreement is not available; be it because it is already used to reference another argument in matrix clauses or because class agreement is simply not available in finite complements.

The distribution of finite clauses, as well as their internal TAM and pronominal marking characteristics have not been previously described and open many questions beyond the scope of this paper. The pronominal marker facts present an interesting cross-linguistic puzzle about the Kordofanian morphological template and what occurs when class marking is unavailable. Meanwhile, §5.2 presents the left-edge markers but leaves open their syntactic analysis and why they are sensitive to matrix TAM. These could be TAM-agreeing complement heads or a different TAM head. However, I have refrained from labeling the left-edge markers as either a T or C head, given that more needs to be known about this structure before committing to either label.

6 Conclusion

I conclude by restating the diversity of complement clauses in Rere. First, there are complements that are identical to matrix clauses, dubbed full clausal complements. Then, there are two morphologically impoverished complements.

The morphologically impoverished complements include the finite and non-finite complements, which lack class markers and whose distribution partially overlaps. Non-finite complements can have two syntactic constructions depending on whether or not SOR is optional to a specific matrix verb. If a verbal predicate does not have optional SOR (i.e. the agent of the complement *must* occur in the matrix clause), then such a predicate's complement may also exhibit the finite complement strategy.

Beyond the overlap in distribution, these two complement strategies differ both in how they reference arguments and their interaction with TAM. Non-finite complements do not show core argument pronominals on their verbal complex, while finite complements can show both subject and object pronominals on their verbal complex. Non-finite complements do not differ based on matrix TAM, but instead consistently show a fixed form with an infinitive marker, the tonal melody, and final vowel. Meanwhile the finite complements may show different inflections on their left edge, largely dependent on matrix TAM. With exception of the remote past, the complements also show lexical tone and a single lexicalized final vowel.

Some further directions this work can take is to pin down the synchronic syntactic status of the left-edge markers in both the finite and non-finite complements, as well as their origins. Also, while only the finite complements have been attested with both subject and object pronominals in a single verbal complex, similar morphosyntax seems to apply to clausal (temporal) adjuncts and a narrative register of Rere. In short, this is a fertile area of research I hope is addressed more in the near future.

Abbreviations

1	first person	IRR	irrealis
2	second person	OBJ	object
CLA	class agreement	PFV	perfective
DOWN	down particle	PL	plural
FIN	finite	PROG	progressive
FV	final vowel	REA	realis
HAB	habitual	REC.PFV	recent perfect
IMP	imperative	REM.PFV	remote perfect
INCL	inclusive	SBJ	subject
INF	non-finite	TAM	tense-aspect-mood
IMPF	imperfective		

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Chapter 15

Extraposition and word order: Evidence from Wolof

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In this paper I use data from Wolof, among other languages, to describe and analyze a word order constraint on extraposition—a form of rightward displacement. Specifically, I show that extraposition of a constituent from a nominal phrase can only apply when that constituent's non-displaced position is at the right edge of the nominal phrase. Since the analysis of extraposition is a point of disagreement in current syntactic theory, I discuss how this constraint can be derived under several different approaches to extraposition.

1 Introduction

In this paper, I use fieldwork data from Wolof[1] (Niger-Congo) to explore the limitations of *extraposition*—a variety of rightward displacement generally applicable to relative clauses and other constituents classified as adjuncts of NP.[2]

[1]All Wolof data reported here, unless otherwise cited, comes from my fieldwork at the Massachusetts Institute of Technology in 2018 with three speakers from the Dakar area of Senegal. Fieldwork elicitation sessions consisted of asking speakers to translate test sentences from English into Wolof (both orally and in writing), and to rate the acceptability of pre-prepared Wolof test sentences.

[2]Here I am concerned with rightward displacement of adjunct phrases like relative clauses. Arguments are capable of rightward displacement (for instance, via Heavy NP Shift and Right Node Raising in English) but previous literature has shown that rightward displacement of adjuncts and arguments are likely attributable to different derivations (Fox & Nissenbaum 1999, Nissenbaum 2000, Overfelt 2015, 2016, a.o.). Since I have not had the opportunity to research rightward argument displacement in Wolof, I do not discuss this here.

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Extraposition of this form is highly productive in Wolof, English, and many other languages. Here I will focus on relative clause extraposition, illustrated in (1):

(1) Relative clause extraposition

a. Wolof

Gis-naa	[**ab**	**fas**	t_2]	démb	[**wu**	**nga**	**sopp**]$_2$.
see-1SG	a	horse		yesterday	that	you	like

'I saw a horse yesterday that you like.'

b. *English*

I bought [**a book** t_1] yesterday [**that someone recommended to me**]$_1$.

There are a variety of proposals about the mechanisms that derive extraposition (Akmajian 1975, Guéron 1980, Culicover & Rochemont 1990, Borsley 1997, Büring & Hartmann 1997, Asakawa 1979, Bianchi 2000, Nissenbaum 2000, Fox 2002, Sheehan 2010, Overfelt 2015, Reeve & Hicks 2017). See Baltin 2006 for a general overview. Research on extraposition has observed that its properties are generally unlike those of leftward movement of the more familiar sort, even once we abstract away from the fact that extraposition happens to involve rightward rather than leftward displacement. However, the empirical complexity of extraposition has made its exact nature a topic of continuous debate.

This paper has two goals. The first is to use data from Wolof, along with previous observations from relevant literature, to make salient a word order constraint that is unique to extraposition. The second goal is to discuss how this constraint relates to the proposals under debate in current research about how extraposition is achieved.

In §2 below, I use data from Wolof to demonstrate the constraint on extraposition defined in (2):

(2) Right Edge Extraposition Constraint (REEC)
Only an XP that appears at the right linear edge of a given DP is available for rightward extraposition from that DP. Thus, if other material in that DP appears to the right of that XP, XP cannot extrapose.

The predictions of the REEC can be schematized as in (3) below. While §3 will overview the competing analyses of extraposition, for the moment, assume for presentational simplicity that extraposition is rightward phrasal movement. The REEC states that extraposition of some constituent XP from DP is legal if XP originates at the right linear edge of DP (3a), but not if XP originates deeper inside of DP (3b), in which case XP would need to cross over some content in DP (here α) in the process of extraposing:

(3) a. Extraposition from right linear edge of DP
√ [$_{\text{DP}}$ D N α XP] ... XP

b. *No extraposition from linear interior of DP*
* [$_{\text{DP}}$ D N XP α] ... XP

A constraint of this nature has been discussed by a few previous works (Nissenbaum 2000, Jenks 2011, 2013a,b, Fox & Pesetsky 2009), but has otherwise received little attention. The fact that the REEC holds in Wolof, as §2 will show, provides important cross-linguistic support for its existence.

In §3, I will discuss how the REEC relates to the varying analyses of extraposition under debate in the literature. First, I show that this constraint can be captured by a theory which combines the proposal that extraposition is extraction from DP (Ross 1967, Akmajian 1975, Guéron 1980, Guéron & May 1984, Büring & Hartmann 1997, Reeve & Hicks 2017) with the word-order-centric theory of successive-cyclic movement in Fox & Pesetsky (2005a,b) and much following work. An account of this variety has been sketched by Jenks (2011, 2013a,b), which this paper aims to strengthen and contextualize in greater detail. Second, I argue that the REEC cannot be captured by a theory in which extraposition involves base generation of the extraposed phrase outside of DP, which a number of works have argued is at least one option for achieving extraposition (Culicover & Rochemont 1990, 1997, Koster 2000, Sheehan 2010, Reeve & Hicks 2017).[3] Finally, I discuss a relevant proposal about extraposition from Nissenbaum 2000, in the context of a theory in which extraposition involves late merger (Lebeaux 1988, 1991) after covert movement of the DP that extraposition appears to have exited (Fox & Nissenbaum 1999, Nissenbaum 2000, Fox 2002, Johnson 2012, Overfelt 2015). While Nissenbaum's approach makes the right predictions, it raises conceptual problems for which I discuss some potential ways of resolving.

It is beyond the scope of this paper to provide a decisive analysis of extraposition. However, by providing new cross-linguistic support from Wolof for the REEC, this paper clarifies the unique empirical character of extraposition, while also making salient the challenges that remain for a unified analysis of this phenomenon.

[3]These works vary in whether they posit that extraposition is always, or only sometimes, a result of base generation outside of DP. I argue that if a constraint like (2) in fact holds cross-linguistically (a proposal supported by the Wolof data, but in need of further study) a base generation derivation is never available.

2 Evidence for the REEC from Wolof and beyond

In this section I present the evidence from Wolof for the REEC. The syntax of Wolof is primarily head-initial, though it shows variance in the head directionality of determiners, which will be an important aspect of the facts I discuss here. I will set the details of Wolof syntax aside, since mere word order is for the most part all that we need to be aware of for the purposes of this paper. Here we will see many relative clauses, whose complementizers take on a wide variety of forms in Wolof depending on the characteristics of the NP that the relative clause is construed as modifying. For more information about complementizer agreement in Wolof, and Wolof syntax more generally, see Torrence 2012, 2013 and references therein.

Relative clause extraposition is productive in Wolof, though as far as I am aware, this fact has not been examined in previous literature. Some initial illustrative pairs of examples are shown in (4):

(4) Wolof relative clause extraposition

a. Lekk-naa [**gato** [**bu nex lool(u)**]] démb.
ate-1SG cake that tasty very yesterday
'I ate a very tasty cake yesterday.' (Unextraposed)

b. Lekk-naa [**gato** t_1] démb [**bu nex lool(u)**]$_1$.
ate-1SG cake yesterday that tasty very
'I ate a very tasty cake yesterday.' (Extraposed)

c. Sacc-naa [**xar** [**bu ndaw**]] tey.
stole-1SG sheep that small today
'I stole a small sheep today.' (Unextraposed)

d. Sacc-naa [**xar** t_1] tey [**bu ndaw**]$_1$.
stole-1SG sheep today that small
'I stole a small sheep today.' (Extraposed)

e. Gis-naa [**kër** [**gu yaatu**]] démb.
see-1SG house that big yesterday
'I saw a big house yesterday.' (Unextraposed)

f. Gis-naa [**kër** t_1] démb [**gu yaatu**]$_1$.
see-1SG house yesterday that big
'I saw a big house yesterday.' (Extraposed)

In (4) above we see extraposition from bare NPs. Extraposition is also possible from DPs containing pre-nominal material, as we see for indefinite determiners and numerals in (5) below. Since Wolof relative clauses follow N, just as in languages like English, the fact that extraposition is possible here is not surprising: in these situations extraposition does not "cross" any material in DP, and so the REEC is satisfied.

(5) Wolof extraposition compatible with pre-nominal material

a. Gis-naa [**ab** fas [**wu nga sopp**]] démb.
see-1SG a horse that you like yesterday
'I saw a horse that you like yesterday.' (Unextraposed)

b. Gis-naa [**ab** fas t_1] démb [**wu nga sopp**]$_1$.
see-1SG a horse yesterday that you like
'I saw a horse yesterday that you like.' (Extraposed)

c. Sacc-naa [**ñaar-i xar** [**yu ndaw**]].
stole-1SG two sheep that small
'I stole two small sheep.' (Unextraposed)

d. Sacc-naa [**ñaar-i xar** t_1] tey/démb [**yu ndaw**]$_1$.
stole-1SG two sheep today/yesterday that small
'I stole two small sheep today/yesterday.' (Extraposed)

Wolof demonstratives and definite determiners follow N as well as any co-occurring relative clauses. Assuming that these elements are head-final instances of D, we indeed expect them to occur to the right of relative clauses, given the common proposal that relative clauses are merged to the NP, structurally below D (Quine 1960, Stockwell et al. 1973, Partee 1975, Heim & Kratzer 1998, a.o.). We see this fact in (6) below, as well as the fact that placing a relative clause after post-nominal D is unacceptable:

(6) Wolof relative clauses must precede head-final D

a. Sacc-naa xar [**bu ndaw**] **bi**.
stole-1SG sheep that small the
'I stole the small sheep.'

b. * Sacc-naa xar **bi** [**bu ndaw**].
stole-1SG sheep the that small
'I stole the small sheep.'

c. Lekk-naa gato [**bu nga indi**] **bi**.
eat-1SG cake that you brought the
'I ate the cake that you brought.'

d. * Lekk-naa gato **bi** [**bu nga indi**].
eat-1SG cake the that you brought
'I ate the cake that you brought.'

Given the REEC, we expect head-final D to block relative clause extraposition. Since head-final D intervenes between the original position of the relative clause (speaking in terms of an extraction analysis for convenience) and the right edge of DP, extraposition would have to cross over that D, thus violating the REEC. Such examples are indeed unacceptable (7):[4]

(7) No extraposition with post-nominal determiner/demonstrative in Wolof

a. Gis-naa [fas [**wu nga sopp**] **wi/wee**] démb.
see-1SG horse that you like the/that yesterday
'I saw the/that horse that you like yesterday.' (Unextraposed)

b. * Gis-naa [fas t_1 **wi/wee**] démb [**wu nga sopp**]$_1$.
see-1SG horse the/that yesterday that you like
'I saw the/that horse yesterday that you like.' (Extraposed)

c. Sacc-naa [juroom-i xar [**yu ndaw**] **yii/yee**] tey.
stole-1SG 5 sheep that small the/these today
'I stole the/those five small sheep today.' (Unextraposed)

d. * Sacc-naa [juroom-i xar t_1 **yii/yee**] tey [**yu ndaw**]$_1$.
stole-1SG 5 sheep the/these today that small
'I stole the/those five small sheep today.' (Extraposed)

[4]A reviewer notes that seemingly head-final determiners could actually be head initial, but involve movement of NP to a pre-D position. This is a possibility that I cannot rule out here. If this is the case, it could be that extraposition is banned in the presence of post-nominal determiners due to the well-known difficulty of movement out of moved elements (often termed "freezing": see Corver 2017 for a recent overview). In particular, if extraposition simply involves extraction of the extraposed element from NP, and if NP moves to spec-DP (thus deriving the post-nominal position of the relevant determiners) before extraposition can apply, then extraposition from NP would be bled by prior movement of NP. Two issues with this analysis are that it relies on a particular stipulation about the order of operations, as well as the assumption that extraposition is indeed extraction. As discussed in §3, there are reasons to think that extraposition at least some of the time does not involve extraction from NP. Finally, regardless of how post-nominal determiners in Wolof are in fact derived, their interaction with extraposition continues to fit the REEC, which as I discuss in §2.1 has cross-linguistic support, for which this issue about Wolof syntax is not relevant in any case.

Analogously, extraposition cannot cross a post-nominal quantifier (8):

(8) No extraposition with post-nominal quantifier in Wolof

a. Sacc-naa [xar [**yu ndaw**] **yëpp**].
stole-1SG sheep that small all
'I stole all the small sheep.' (Unextraposed)

b. * Sacc-naa [xar t_1 **yëpp**] tey [**yu ndaw**]$_1$.
stole-1SG sheep all today that small
'I stole all the small sheep today.' (Extraposed)

c. Lekk-naa [mango [**yu rëy**] **yëpp**] démb.
eat-1SG mango that big all yesterday
'I ate all the big mangos yesterday.' (Unextraposed)

d. * Lekk-naa [mango t_1 **yëpp**] démb [**yu rëy**]$_1$.
eat-1SG mango all yesterday that big
'I ate all the big mangos yesterday.' (Extraposed)

The facts shown above give some evidence for the REEC, but this is not all the evidence that Wolof provides. Additional evidence for this constraint can be found by examining further facts about potential positions for demonstratives in Wolof. Importantly, this language allows normally head-final demonstratives to appear in an initial position in the DP when focused, as (9) demonstrates:

(9) Fronted focused demonstrative in Wolof[5]
Gis-naa [(**yii**) góór [**yu njool**] (**yii**)].
see-1SG (THESE) men that tall (these)
'I saw these/THESE men who were tall.'

As (10) below shows, when head-final demonstratives are "fronted" in this way and thus do not linearly intervene between a relative clause and the right linear edge of the DP, relative clause extraposition is permitted. This is precisely what we expect, given the REEC.

(10) Fronted focused demonstrative in Wolof permits extraposition

a. Lekk-naa [**bii** gato [**bu nex lool**]] tej.
ate-1SG THIS cake that tasty very today
'I ate THIS very delicious cake today.'

[5] I use smallcaps to indicate focus.

b. Lekk-naa [**bii** gato t_1] tej [**bu nex lool**]$_1$.
ate-1SG THIS cake today that tasty very
'I ate THIS very delicious cake today.'

c. Gis-naa [**yii** góór t_1] démb [**yu njool**]$_1$.
see-1SG THESE men yesterday that tall
'I saw THESE men yesterday who were tall.'

d. Gis-naa [**bii** muus t_1] demb [**bu rey lool**]$_1$.
saw-1SG THIS cat yesterday that big very
'I saw THIS cat yesterday that was very big.'

e. Indi-nga [**bii** mango t_1] demb [**bu rey lool**]$_1$.
brought-2SG THIS mango yesterday that big very
'You brought THIS mango yesterday that was very big.'

If the instances of D in Wolof that are normally head-final were incompatible with extraposition for some independent reason aside from their head-final position, then we would expect extraposition to continue to be illicit even when such elements are fronted to a DP-initial position. However, if such elements are normally incompatible with extraposition purely because they cause a REEC violation, then we predict that the fronting of such elements out of the right linear edge of the DP should make extraposition possible. We have seen that the latter of these predictions is correct. This indicates that what we are seeing here is specifically a constraint on linear word order.[6]

2.1 Other evidence for the REEC

The constraint that I have termed the REEC has been noticed by a small amount of previous research. As far as I know, the first observations in this vein come

[6]A reviewer notes that in examples like those in (10) where the demonstrative precedes the noun, some Wolof dialects allow duplication of the noun class marker in such a way that may suggest the presence of additional syntactic complexity, thus opening up the potential for alternative analyses. The reviewer also suggests that these examples could involve something like NP ellipsis rather than extraposition (presumably involving two syntactic instances of the relevant NP and ellipsis of only one, creating the appearance of a displaced relative clause). If there is any possibility of such an alternative analysis, the same would be applicable to all examples of Wolof extraposition I have shown. However, I do not currently have any data that clarifies this point. Notice, however, that regardless of the exact analysis of extraposition assumed (several possibilities for which are discussed in §3 below), the Wolof facts shown here do fit the REEC, which I show in the next subsection has cross-linguistic support.

from Nissenbaum 2000, who argues based on the contrast between English adjectives and relative clauses in (11) that only rightmost constituents of DP can be extraposed. As we see here, while adjectives and relative clauses are both presumably adjuncts, the former originate preceding N and cannot extrapose, while the latter originate after N and can extrapose. PP adjuncts of NP, which also originate post-nominally, can extrapose as well (11e).

(11) Left/right asymmetry in extraposition: relative clause versus adjective
  a. I saw [a **man** t_1] yesterday [**who was very tall**]$_1$.
  b. * I saw [a t_1 **man**] yesterday [**very tall**]$_1$.
     (Adapted from Nissenbaum 2000, pg. 208, ex. 33)
  c. I saw [a **dog** t_1] yesterday [**that was wearing a blue collar**]$_1$.
  d. * I saw [a t_1 **dog**] yesterday [**extremely large and intimidating**]$_1$.
  e. I saw [a **dog** t_1] yesterday [**with a silly hat on**]$_1$.
     (My examples)

Since the adjective undergoing attempted extraposition in (11b) is phonologically small, we might posit that this example is unacceptable due to a prosodic problem. This is a reasonable hypothesis, given that another rightward displacement phenomenon, Heavy NP Shift, is well-known to be unacceptable if the shifted nominal does not have enough phonological weight. To rule out this hypothesis, I have included example (11d), in which we see that an increase in phonological weight does not make adjective extraposition acceptable. This is what we expect, if what we are really dealing with here is a word order restriction.

Nissenbaum 2000 also shows (citing personal communication from Danny Fox) that in Hebrew, which has post-nominal adjectives, adjective extraposition is possible. This fact is also noted by Fox & Pesetsky 2009, who report that while extraposition of an originally post-nominal adjective or modifier succeeds in Hebrew (12a-12b), extraposition of an originally pre-nominal modifier does not (12c):

(12) Left/right extraposition asymmetry in Hebrew
  a. ? Yosef raʔa [**iša** t_1] etmol [**gvohaa beyoter**]$_1$.
     Yosef saw woman yesterday tall in-more
     'Yosef saw a very tall woman yesterday'
  b. ? Yosef raʔa [**anašim** t_1] etmol [**rabim meʔod**]$_1$.
     Yosef saw people yesterday many-PL a_lot
     'Yosef saw very many people yesterday'

c. * Yosef raʔa [t_1 **anašim**] etmol [**harbe meʔod**]$_1$.
Yosef saw people yesterday many a-lot
'Yosef saw very many people yesterday'
(Fox & Pesetsky 2009, ex. 6-7)

Fox & Pesetsky 2009 go on to show (reporting an observation they credit to Alex Grosu) that, in English, adjective extraposition from the compound quantifier phrase *someone* is possible. This is expected, since adjectives originate on the right side of this variety of DP, as we see in (13a). I observe that the same pattern holds for adjectives with analogous quantifier phrases, as (13) illustrates:[7]

(13) Post-nominal adjectives of certain quantifiers can extrapose
a. I saw [**someone / somebody** [**quite tall**]] yesterday.
b. ? I saw [**someone / somebody** t_1] yesterday [**quite tall**]$_1$.
c. Mary met [**everyone / everybody** [**somewhat interesting**]] just now.
d. ? Mary met [**everyone / everybody** t_1] just now [**somewhat interesting**]$_1$.
e. I talked to [**nobody** / **no one** [**particularly unusual**]] tonight.
f. ? I talked to [**nobody** / **no one** t_1] tonight [**particularly unusual**]$_1$.

The adjectives in (13) are unlikely to be reduced relative clauses, since if they were, they should be able to post-nominally merge in typical DPs as well, contrary to fact:

(14) No post-nominal adjectives in typical English DPs
a. * I saw a person **quite tall** yesterday.
b. * Mary met every person **somewhat interesting** just now.
c. * I talked to no people **particularly unusual** tonight.

[7]The extraposed adjectives in example (13) all include either an intensifier, or some other element relating to a degree. In my judgment, the absence of a degree-encoding item makes this variety of extraposition significantly degraded:

(i) a. * I saw **someone** today **tall**.
b. * Mary met **everyone** just now **interesting**.
c. * I talked to **nobody** tonight **unusual**.

For reasons yet to be examined contingent on the presence of a degree, note that the degree-encoding element in examples (11b/11d) and (12c) above does not facilitate extraposition in those contexts. This shows that word order is a primary constraining factor in any case.

Additional facts of a similar character are examined by Jenks 2011, 2013a,b, who investigates quantifier float in East Asian languages. Jenks focuses on Thai facts like (15), in which we see that a quantifier can be displaced to the right of the corresponding DP:

(15) Rightward quantifier displacement in Thai
Nák.rian ʔaan nàŋsʉ̌ʉ mʉ̂ʉawaannı́i **thúk-khon**.
student read book yesterday every-CLF$_{\text{Person}}$
'Every student read a book yesterday.'
(Adapted from Jenks 2013b, ex. 1)

Jenks argues that in Thai, numeral quantifier float of this variety is extraposition, in contrast to the proposal for other languages like Korean and Japanese that Q-float is derived (at least in some cases) by stranding (Saito 1985, Ko 2014, Miyagawa 2017, a.o.). Jenks states that this form of rightward quantifier float is attested in languages that independently allow N < Q order such as Khmer, Tibeto-Burman, and Southwestern Tai, but not in those that only allow Q < N order such as Vietnamese, Chinese, Hmong-Mien, as well as North and Central Tai. Jenks suggests that this correlation may be a sub-case of Nissenbaum's original observation that extraposition is only possible for elements that originate at the right edge of the source DP. While Jenks does not consider data from all languages mentioned in great detail, and thus potentially conflates instances of Q-float that are not syntactically homogeneous, Jenks' observation is clearly in a similar vein to the REEC.

3 Comparing analyses of extraposition and the REEC

We have seen that Wolof provides clear evidence for the REEC—a word order constraint on extraposition for which there is some cross-linguistic support. In this section, I will examine how this constraint relates to the main analyses of extraposition proposed in the literature.

3.1 Extraposition as extraction

A number of works take extraposition to involve extraction from DP, at least some of the time (Ross 1967, Akmajian 1975, Guéron 1980, Guéron & May 1984, Büring & Hartmann 1997, Reeve & Hicks 2017). A simplified structure for such a derivation is shown in Figure 1 below.

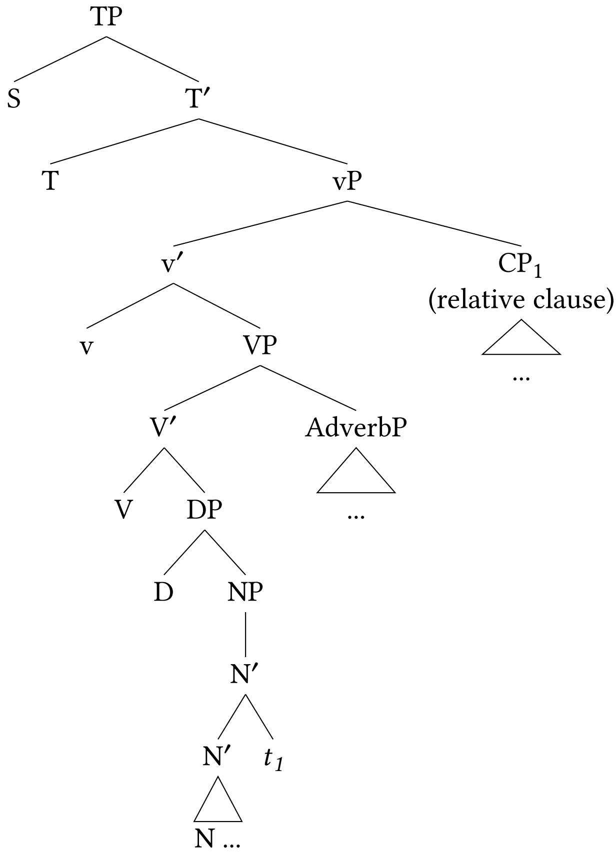

Figure 1: REEC-satisfying extraposition

The structure in Figure 1 would satisfy the REEC, since here the extracted relative clause is displaced from a structural position that corresponds to the right linear edge of DP. This sort of example, involving a head-initial determiner, matches the form of Wolof examples like (5b) above. We also saw in (8) above, for instance, that when D is head-final extraposition is banned in Wolof. Assuming an extraction analysis of extraposition, such an unacceptable example would have the form in Figure 2.[8]

[8]In Figure 1 and Figure 2 I have included an adverb phrase adjoined in VP, since all of the examples of extraposition we have seen above include an adverb which acts as a landmark to make extraposition evident (though the adverb itself is not causal factor in achieving extraposition).In Figure 1 and Figure 2 I have also assumed that the extraposing extraction lands in a right-adjoined specifier of vP, though nothing of significance hinges on the exact landing site for extraposition.

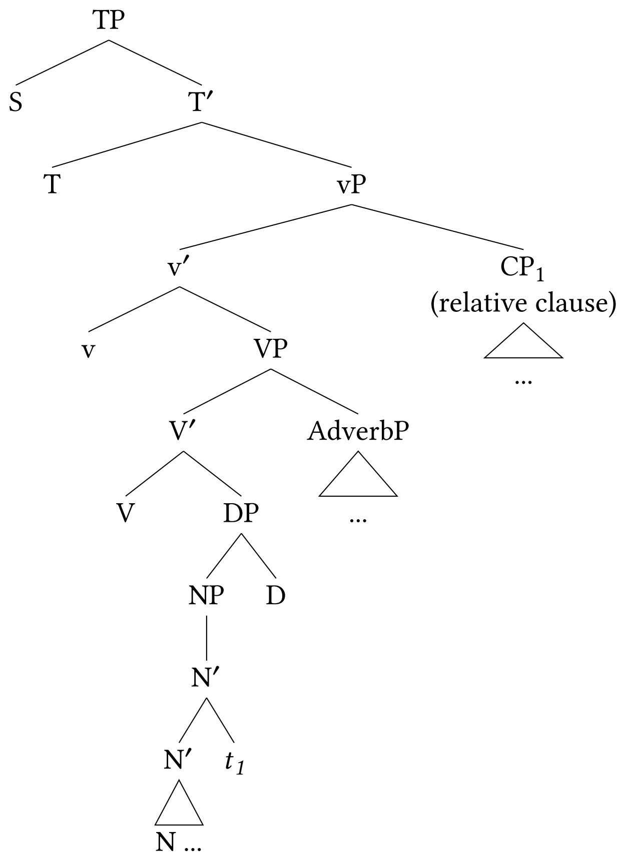

Figure 2: REEC-violating extraposition

While it is clear that Figure 1 obeys the REEC and Figure 2 violates it, the REEC is essentially a descriptive generalization which it is necessary to identify an explanation for. Describing explicitly how the REEC can be derived in the context of an extraction analysis of extraposition is what I do next.

3.1.1 Deriving the REEC under an extraction analysis

I argue that if extraposition in fact involves rightward extraction, we can explain the REEC by adopting the *Cyclic Linearization* (CL) theory of phases (Fox & Pesetsky 2005a,b, Ko 2014, Davis 2021, a.o.) as well as a few auxiliary assumptions that I will explain shortly. CL differs from the original theory of phases in Chomsky 2000, 2001 in a few important ways, so I will summarize Chomsky's theory before then describing CL.

Much research has argued that movement paths are at least sometimes composed of multiple shorter paths connected by intermediate landing sites, in *successive-cyclic* fashion. See Chomsky 1973, 1986, Du Plessis 1977, McCloskey 2000, 2001, 2002, Sauerland 2003, Bruening 2001, Barbiers 2002, Torrence 2012, Abels 2003, Wiland 2010, Henry 2012, and many others. Chomsky 2000, 2001 and much following work argues that movement must pass successive-cyclically through the edges of phases (vP, CP) in order to escape *spell-out*—an operation endemic to phases. For this theory, after a phasal phrase is built, spell-out transfers the complement of that phrase to the interfaces of PF and LF, which respectively assign linear ordering to and interpret that content, among other processes. Chomsky proposes that spelled-out structure is inaccessible for the rest of the syntactic derivation (as defined by the Phase Impenetrability Condition) and that therefore a phrase moving from a phase's complement must reach the phase edge before spell-out, to avoid being trapped. Example (16) below shows this for *wh*-movement from a vP and CP.

(16) Successive-cyclic movement from vP and CP
What do they think [$_{\underline{\text{CP}_{\text{[Phase]}}}}$ *t* that you will [$_{v\text{P}_{\text{[Phase]}}}$ *t* ∅ eat *t*]] ?

In contrast, for the CL theory spell-out applies to entire phasal constituents, including their head and specifier(s). This hypothesis necessitates abandoning the Phase Impenetrability Condition, since in this system all movement from a phase is necessarily of material that has undergone spell-out within that phase. As such, for CL, successive-cyclic movement through phase edges does not occur because edges are exempt from phase-level spell-out. Rather, under this approach successive-cyclic movement through phase edges is motivated by the information-preserving property of spell-out, *Order Preservation*:

(17) Order Preservation
Information about linearization, once established at the end of a given Spell-Out domain, is never deleted in the course of a derivation.
(Fox & Pesetsky 2005a: pg. 6)

If Order Preservation holds, it is not possible to revise established ordering information to save derivations for which phase-by-phase spell-out has generated contradictory linearization instructions. Therefore, to avoid a crash at PF, syntax must be able to form a structure with linearization information that is consistent for all phases in the derivation in question. As the works on CL cited above argue, exiting a phase via its linear edge serves to prevent movement from yielding a linearization contradiction: By passing through the linear edge of each phase exited, phase-exiting phrases are determined by spell-out to precede the content of each phase in question. This is ultimately consistent with a final representation where the moved material surfaces preceding the content of all phases that it has exited.

Although CL requires movement to be order preserving within each phase crossed, movement will not actually be surface-evidently order-preserving when it is successive-cyclic. However, another prediction of this reasoning is that movement will indeed be surface-evidently order-preserving when it is not able to be successive-cyclic. I argue that these considerations reveal an explanation for the REEC, provided we assume that DP is a phase (Heck & Zimmermann 2004, Bošković 2005, 2016, Newell 2008, Newell & Piggott 2014, Syed & Simpson 2017, Simpson & Park 2019) as well as a version of *anti-locality*—the hypothesis that movement must not be too short (Bošković 1997, 2005, Ishii 1999, Grohmann 2003, Abels 2003, 2012, Erlewine 2015, a.o.).

First let us consider the derivation for the REEC-violating structure in Figure 2 above, which contains a head-final determiner like many unacceptable examples of Wolof extraposition that we saw in the previous section. If DP is a phase, then when a head final DP is constructed as in Figure 3, it will then be spelled-out and assigned linear order as in (18):[9]

(18) Linearization:
N < CP < D

Next the vP is constructed and extraposition applies, as in Figure 4. When this vP spells-out, it determines how its contents are linearized with respect to the content of the previously constructed DP, as (19) shows.

(19) Linearization when DP spelled-out:
N < CP < D [as in (18) above]
Linearization information added at spell-out of containing vP:
V < N, D < AdverbP < CP

Importantly, extraposition creates an ordering contradiction here: when the head-final DP was spelled-out, it was established that the relative CP precedes D, but after extraposition and spell-out of vP, this CP was determined to follow D.

[9]The symbol "<" encodes relative linear precedence, not strict adjacency or concatenation. Thus an ordering [$\alpha < \beta$] is consistent with α later moving away from β, with the result that other material ultimately intervenes between them, as in [$\alpha\ \gamma\ \beta$]. This is because α still precedes β after such movement, despite no longer being adjacent to it.

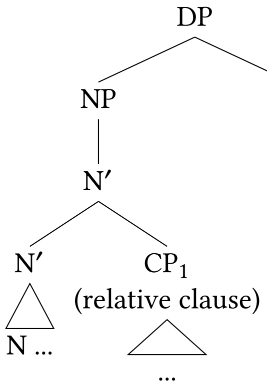

Figure 3: Construction and linearization (see (18)) of head-final DP

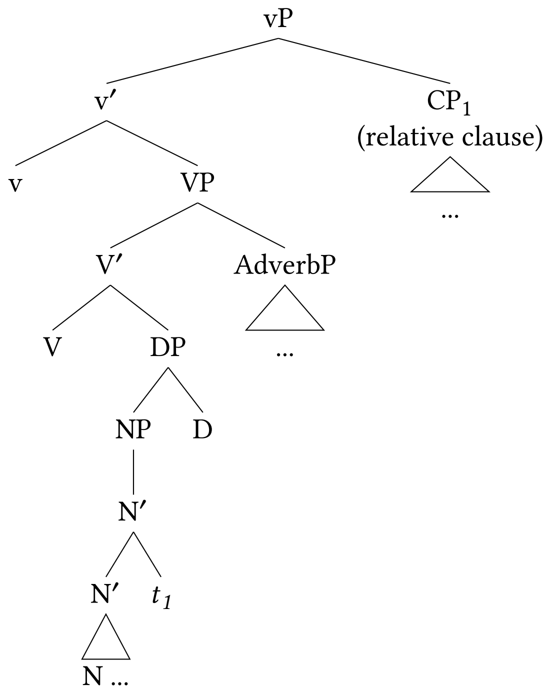

Figure 4: Construction and linearization (see (19)) of vP after extraposition from head-final DP

By hypothesis, due to this contradiction the derivation crashes at PF. As we have seen, Wolof examples fitting this schema are indeed unacceptable. Additionally, notice that when D is pre-nominal, D will simply precede the relative CP for the entire derivation—a fact that is not changed by extraposition, as we saw in Figure 1. We thus do not expect extraposition to cause an ordering contradiction when D is head-initial. We have seen that Wolof examples of this sort are acceptable. When analyzed in this way, the REEC is simply an order preservation effect.

Jenks (2011, 2013a,b) sketches an account of precisely this sort. However, Jenks does not address the fact that there is another hypothetical derivation to consider. Recall that for CL, ordering contradictions can be avoided by performing successive-cyclic movement through phase edges. Given this prediction, we expect Wolof extraposition to be legal even in the presence of a head-final determiner provided that the extraposed phrase successive-cyclically passes through (a right-leaning) spec-DP, as Figure 5 shows.

Since such examples are in fact unacceptable, it is necessary to rule out such a derivation.

I argue that anti-locality is applicable here. While there are several varieties of anti-locality proposed in the literature, works such as Bošković 2005, 2016 and Erlewine 2015, 2017 develop a definition of anti-locality which bans movement from the edge (specifier or adjunct) of a given phrase XP to the edge of the phrase that immediately dominates XP. Since DP immediately dominates NP and since relative clauses are adjuncts of NP, extraction of a relative clause from NP to spec-DP is banned by this form of anti-locality. This account accurately rules out derivations like Figure 5, thus maintaining the REEC.

3.2 Against a base generation theory of extraposition

Several works have argued that extraposition does not in fact involve extraction, but rather base-generation of the extraposed constituent outside of DP (Culicover & Rochemont 1990, 1997, Koster 2000, Sheehan 2010, Reeve & Hicks 2017). The result of such a derivation would look like the one in (16a) above, for instance, but omit the trace in the NP.

There is indeed syntactic and semantic evidence (involving binding and reconstruction, for instance) for a non-movement derivation of extraposition, which works of the sort mentioned in the next section also take seriously. However, one disadvantage of base-generation theories is that they must assume a special mechanism that allows the extraposed constituent to be semantically united with the NP that it modifies, despite never having any structural relationship to it. I

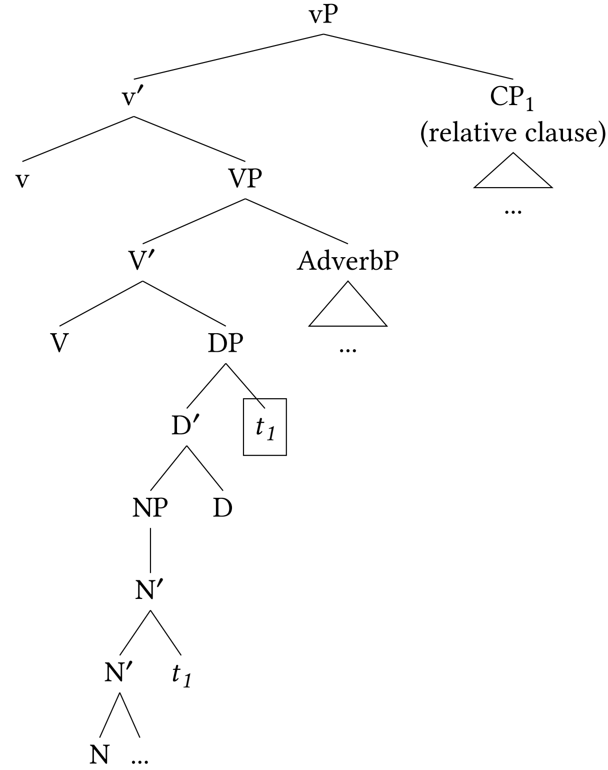

Figure 5: Hypothetical relative clause extraction via spec-DP

argue that another disadvantage of such theories is that they cannot straightforwardly account for the REEC. Since under a base generation theory there is in fact no syntactic dependency between the extraposed constituent and corresponding NP, it is unclear why there should be any word-order constraint mediating the relationship between the two, since under such a theory there is no syntactic relationship between them to speak of. Therefore, to the extent that the REEC is correct, it suggests that there really is a syntactic dependency between an extraposed phrase and the "source" NP.

3.3 Extraposition as covert movement plus late merge

While a simple base-generation analysis is not clearly compatible with the REEC, there is a hybrid base-generation analysis that fares better in this regard. This analysis takes advantage of the proposal from Lebeaux 1988, 1991 that it is possible to move a constituent, and then externally merge an adjunct to it. Lebeaux originally used this hypothesis to discuss certain facts involving (non-)reconstruction with overt leftward movement, but a variety of works have argued that when a DP covertly moves, and then late merger of an adjunct applies to it, the result is extraposition (Fox & Nissenbaum 1999, Nissenbaum 2000, Fox 2002, Johnson 2012, Overfelt 2015). This is illustrated in Figure 6, where there are two co-indexed copies of the relevant DP, the higher of which is covert (as indicated by the crossing-out of the terminals it contains) and to which late merge of a relative CP applies.

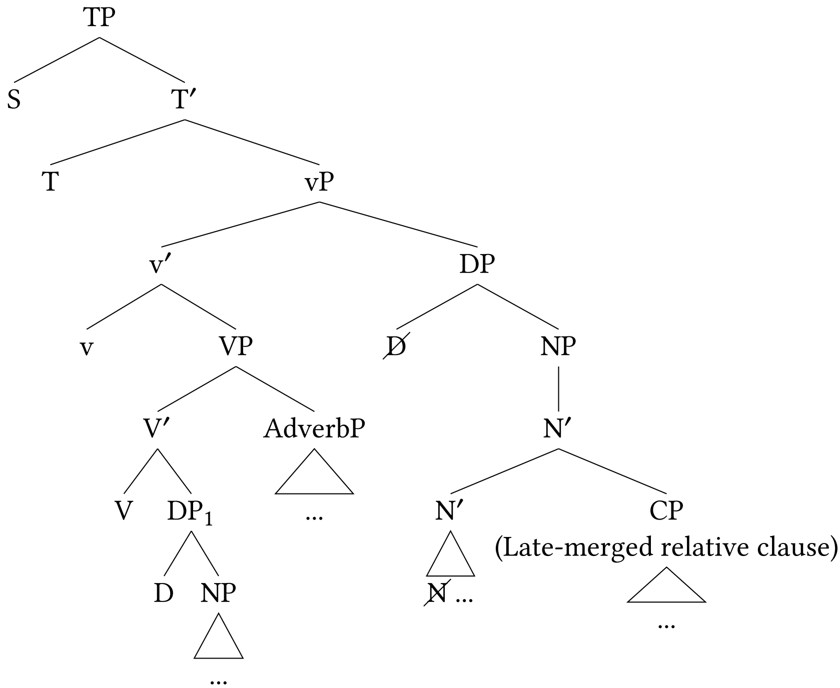

Figure 6: Extraposition as covert movement + late adjunction

See Fox & Nissenbaum 1999, Nissenbaum 2000, and Overfelt 2015 for syntactic and semantic arguments for this proposal from phenomena like scope and (non-) reconstruction.[10]

This hybrid analysis captures some empirical details about extraposition that a pure extraction analysis does not obviously explain. However, the CL analysis of the REEC that I offered above is not clearly compatible with this analysis of extraposition.

As discussed in §2, Nissenbaum (2000) was aware that a constraint like the REEC holds due to facts from English and Hebrew. To account for this constraint, Nissenbaum (2000: 201) hypothesized the *Linear Edge Condition*, which allows

[10] Fox & Nissenbaum point out, citing Taraldsen 1981, that extraposition can circumvent violations of principle C in the way shown in (i) below. We also see here that failing to perform extraposition while holding everything else constant prevents principle C circumvention, as expected if this effect is indeed dependent on the application of extraposition here:

(i) a. I gave him$_1$ a picture yesterday [**from John's$_1$ collection**].
b. ??/* I gave him$_1$ a picture [**from John's$_1$ collection**] yesterday.
c. I gave him$_1$ an argument yesterday [**that supports John's$_1$ theory**].
d. ??/* I gave him$_1$ an argument [**that supports John's$_1$ theory**] yesterday.
e. I told you that he$_1$ will accept the argument, when you and I last spoke, [**that I presented to John$_1$**] yesterday.
f. ??/* I told you when you and I last spoke that he$_1$ will accept the argument [**that I presented to John$_1$**] yesterday.
(Fox & Nissenbaum 1999, ex. 11)

For Fox & Nissenbaum, in (i) covert movement of DP creates a position above the relevant pronoun where an adjunct can be late merged, allowing that adjunct to contain an R-expression which, due to never being c-commanded by that pronoun, can be co-indexed with it without violating principle C. Importantly, in Wolof principle C normally holds (iia-b), but extraposition circumvents it (iic), suggesting that English and Wolof derive extraposition by the same mechanisms:

(ii) a. Gis-na muusu Ada.
see-3SG cat Ada
'She$_{1/*2}$ saw Ada$_2$'s cat.'
b. Jang-na [téére [bu xaritu Roxaya sopp lool]] démb.
read-3SG book that friend Roxaya like very yesterday
'She$_{1/*2}$ read a book that Roxaya$_2$'s friend really likes yesterday.'
c. Jang-na [téére t_1] démb [bu xaritu Roxaya sopp lool]$_1$.
read-3SG book yesterday that friend Roxaya like very
'She$_{1/2}$ read a book yesterday that Roxaya$_2$'s friend really likes.'

late merger of material into a phrase only at its linear edge. Importantly, Nissenbaum assumes that covert material, despite being silent, possesses linear ordering. Since the late merged relative CP in Figure 6 above appears at the right edge of the covert higher copy of the moved DP, this instance of late merge is legal. In contrast, if late merge would have to apply to a non-edge position extraposition will fail. This would be the case for attempted extraposition of a usual pre-nominal adjective in English (11), or a relative clause in the context of a head-final D in Wolof (7). The tree in Figure 7 below shows the relevant ungrammatical Wolof scenario:

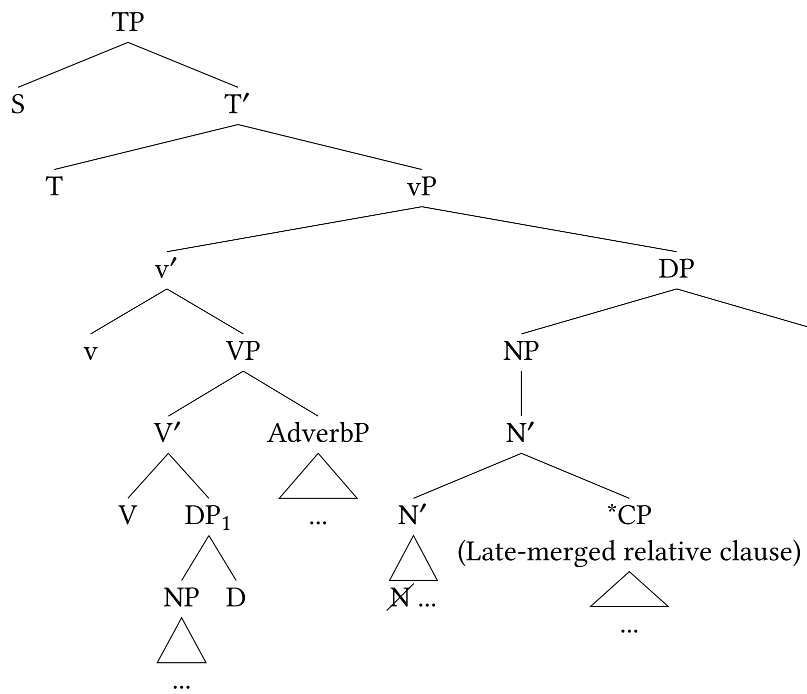

Figure 7: Wolof: Head-final D prevents late merger at the linear edge of DP

Nissenbaum's account thus does indeed capture the REEC. However, there are a few aspects of this account worth questioning. First, it is not obvious why the Linear Edge Condition should exist, since (as far as I know) it does not stem from any independent linguistic principles. Thus, the Linear Edge Condition is more like a descriptive generalization than an explanation. Second, as mentioned above, Nissenbaum's use of this condition requires the assumption that covert material has linear order. This is an uncomfortable proposal, given that linear order describes the temporal order in which a set of elements is pronounced—a consideration that is irrelevant to silent material. An analogous point of discomfort is applicable to the covert movement plus late merge analysis of extraposition more generally, since this theory (at least as proposed by Fox & Nissenbaum 1999) requires assuming that covert movement is in fact linearly rightward, which causes material late merged to the site of covert movement to lean rightward in the way characteristic of extraposition. In closing, I will offer some discussion of how these potential issues might be understood.

The Linear Edge Condition resembles other proposals in the literature about the limitations of late merge. In particular, a number of works note that late merge that is in some sense "too deep" is not permitted (Tada 1993, Sauerland 1998, Stepanov 2001, Stanton 2016, Safir 2019). Consequently, late merge tends to occur in peripheral positions. While this intuition does not align exactly with that of the Linear Edge Condition, it is worth noting that the works cited above do not agree about how exactly to define the depth limitation of late merge. Therefore, this is a more general open question, the correct answer to which may subsume the Linear Edge Condition. It is also possible that the Linear Edge Condition may be reducible to some version of the CL theory, though this remains to be seen.

While Nissenbaum's proposal that covert material is ordered is potentially counter-intuitive (as he himself notes), this possibility is actually permitted by some morpho-syntactic theories. Specifically, a few works argue that linearization precedes the assignment of morpho-phonological form (Embick 2010, Arregi & Nevins 2012, Haugen & Siddiqi 2016). Importantly, notice that if linearization occurs first, the linearization process does not have access to information about whether the material it is ordering will ultimately be pronounced or not. Thus it is possible that linearization applies blindly to all syntactic nodes present, but that some of those nodes happen to not be assigned morpho-phonological form. This would result in material that has been linearized, but is covert. From this perspective, Nissenbaum's proposals about covert material and linear order are much more natural.[11]

[11]Fox & Pesetsky 2009 sketch a theory that addresses many of the considerations mentioned here, and attempts to reduce the Linear Edge Condition to CL while also making more general proposals about the nature of the covert versus overt movement distinction. They leave many of the details for future work, however, and it is beyond the scope of this paper to engage with this topic fully.

4 Conclusion

In this paper, I showed that Wolof provides new cross-linguistic evidence for a word order constraint on extraposition, which I termed the REEC. This constraint has precedent in previous literature, but has received little attention. If this constraint is indeed cross-linguistically robust, it is valuable because it reveals a distinction between extraposition and usual leftward movement which clarifies the criteria for an empirically adequate theory of extraposition. More cross-linguistic research on this topic is definitely necessary, however.

I went on to discuss how the REEC relates to the three main proposals about extraposition in the literature. I argued that a base generation analysis likely cannot account for the REEC, and summarized Nissenbaum's Linear Edge Condition account in the context of the late merge theory of extraposition. I suggested that Nissenbaum's account is by itself not satisfying, and discussed some ways of connecting it to other hypotheses that might strengthen it. Overall, in my evaluation an extraction analysis of extraposition allows the most appealing explanation for the REEC, since in this context it is entirely reducible to other well-supported concepts from current syntactic research (CL, DP phasehood, anti-locality). However, as mentioned, there are good reasons why a number of works on extraposition do not adopt an extraction analysis. Resolving the debate about the explanation for extraposition is beyond the scope of this paper, but I hope to have made the relevant issues clear.

Acknowledgments

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Chapter 16

A corpus study of Swahili's dual complementizer system

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We examine the distribution of the complementizers *kwamba* and *kuwa* in a corpus of Tanzanian Swahili. Our findings suggest that the complementizers are not in free variation, as is standardly assumed. Instead, their use is sensitive to a variety of factors known to affect complementizer choice crosslinguistically, specifically lexical class of the embedding predicate, person features of the main clause subject, and mood of the embedded clause. Given the distinct factors shown to predict the two complementizers, we suggest that *kwamba*/*kuwa* differ in terms of "relative belief," where *kuwa* is used to express a more general belief, while *kwamba* is used to express a privately held belief.

1 Swahili's two complementizers

Swahili[1] is reported to have two functionally interchangeable complementizers, *kwamba* and *kuwa*, shown in (1).

(1) a.

Hamisi a-li-ni-ambia	**kwamba**	a-na-penda	kusoma
Hamisi 1SM-PAST-1SG.OM-tell	COMP	1SM-PRES-like	INF.read

'Hamisi told me that he likes to read.'

[1]Swahili is not monolithic; there are a number of dialects with significant differences between them (Maho 2009). Our claims here are about the pedagogical resources and descriptive grammars of Swahili, which uniformly report the ambiguity in (1). Ultimately, we restrict the findings of this paper to Tanzanian Swahili, as used in literature, news, and government reports.

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b. Hamisi a-li-ni-ambia **kuwa** a-na-penda kusoma
Hamisi 1SM-PAST-1SG.OM-tell COMP 1SM-PRES-like INF.read
'Hamisi told me that he likes to read.' (Mpiranya 2015: 220)

Crosslinguistically, it is relatively common to find languages that have two (or more) lexical complementizers or complementation strategies. For instance, Greek has two complementizers, *oti* and *pu*, which are used to introduce finite, indicative subordinate clauses. Unlike Swahili, however, Greek's complementizers are well-known to correlate with distinct meaningful contributions. *Pu* gives rise to factive inferences, while *oti* does not. Indeed, the crosslinguistic pattern is clear: as a rule, when a language has more than one strategy for clausal embedding, the strategies have distinct distributions and/or meanings (Boye & Kehayov 2016).

The purpose of this paper is to ask whether Swahili also fits this pattern. Do the complementizers *kwamba* and *kuwa* have different functions in introducing an embedded clause? We investigate this question using a corpus of Swahili, probing whether known factors that influence complementizer choice crosslinguistically are present in Swahili as well. We focus on three factors: the effect of lexical class, the effect of the person features of the main clause subject, and the effect of mood in the embedded clause.

Ultimately, we find positive correlations for all the factors that we look at. *Kwamba* and *kuwa* are not in free variation, but in fact have distinct distributions, affected by well-known factors. Based on these preliminary findings, we suggest that *kuwa* and *kwamba* make a distinction between knowledge bases: *kwamba* expresses a "solipsistic" belief, while *kuwa* expresses a "general" belief. Our findings situate Swahili among more well-studied dual-complementizer systems.

2 Background: factors that affect complementizer choice

A variety of factors have been observed to have an effect on complementization strategy. Our study focuses on three factors: predicate class, person features of the matrix subject, and mood of the embedded clause. Our choice of these three factors was determined by feasibility in a corpus study.

2.1 Predicate class

The most widely documented factor that has been shown to have an effect on the complement clause is *predicate class*: different classes of predicates select different kinds of complement clauses (Kiparsky & Kiparsky 1971, Hooper & Thompson 1973, Noonan 2007), among many others. Moreover, such distinctions are crosslinguistically stable. We find that the same classes tend to pattern similarly across languages. Aspectual verbs (*start, stop*) tend to appear with "reduced" or nonfinite clauses, while doxastic verbs (*believe, think*) tend to appear with finite clauses.

(2) a. Mary started/stopped smoking.
    b. Mary believes/thinks that Sue left.

There are a number of proposed classifications of embedding predicates, depending on which factors are taken into consideration. In our study, we initially coded a subset of verbs reflecting the classification in Hooper & Thompson (1973), shown in (3).

(3) a. Speech act non-factives (*say*)
    b. Doxastic non-factives (*believe*)
    c. Doxastic factives (*know*)
    d. Emotive factives (*love*)
    e. Response predicates (*deny*)

In the end, our data suggests a broad two-way classification, which collapses the classes in (3) into (a) the predicates that comment on a mental state (*Attitude verbs*), and (b) the predicates that comment on (reported) speech (*Reportative verbs*) (c.f. Anand & Hacquard 2014 for the distinction between *private states* and *communicative acts*).

(4) a. *Attitude verbs*: Doxastic non-factives, doxastic factives, emotive factives
    b. *Reportative verbs*: Speech act non-factives, response predicates

This broad division crosscuts the fine-grained classifications of the above cited authors. Still, we also note that a more sophisticated corpus analysis might reveal distinct subclasses. The division in (4) is shown to influence the choice of complementizer in Swahili, but it is still expected that predicate classes may have other effects in Swahili, for instance, govern a finite/nonfinite distinction.

Theoretically, there are a number of ways to understand the effect of predicate class. The standard explanation is simply c-selection: some classes of verbs arbitrarily select for a particular complementizer/complementation strategy (as in, e.g., Roussou 2010). Ultimately, (lexico-)semantic factors are likely responsible for why a particular class correlates with a particular complementation strategy.

2.2 Person of subject

A second factor that has been observed to have an effect on complementizer choice is the person features of the main clause subject. For instance, in Kinyarwanda, the complementizer *kongo* is not possible with a 1st-person subject.

(5) a. yiibagiwe kongo amazi yari mare-mare
3SG.forgot COMP water was deep
'He forgot that the water was deep (and I doubt it).'

b. * yiibagiwe kongo amazi yari mare-mare
1SG.forgot COMP water was deep
'I forgot that the water was deep (and I doubt it).'
(Givón & Kimenyi 1974: 110)

The explanation for why *kongo* is possible in (5a) but not (5b) reduces to the meaning contribution of the complementizer. In (5a), *kongo* expresses doubt based on hearsay: the speaker expresses doubt toward the beliefs of the matrix subject because the source of the information was hearsay (Givón & Kimenyi 1974). The sentence in (5b) is ungrammatical because the complementizer *kongo*[2] expresses speaker doubt, but the verb *kwibagiwa*, a factive, commits the speaker to the truth of the embedded proposition. Such an explanation is predicated on the fact that complementizers are not simply functional linkers that connect clauses, but may bear meaningful content. Note moreover that there is an interaction between the person features of the subject and verb class in (5). The effect of subject person on the use of *kongo* is revealed with factive predicates because these commit the speaker to the truth of the embedded proposition and therefore do not allow the speaker to cast doubt on the beliefs of a 1st-person subject.[3] Other predicate classes, i.e., nonfactives, are compatible with *kongo* in the presence of 1st-person subject (Givón & Kimenyi 1974).

2.3 Mood in the embedded clause

A third factor that affects complementizer choice is the mood of the embedded clause. It is widely noted, particularly in Indo-European languages, that certain complementizers are correlated with certain moods (Ledgeway 2000, Roussou

[2] *Kongo* is arguably bimorphemic, composed of the independent complementizers *kó* and *ngo* (Botne 2020).

[3] Givón & Kimenyi 1974 show that *kongo* is similarly unavailable with 2nd-person matrix subjects, an effect they attribute to the addressee status of a 2nd-person subject; since the addressee is discourse present, they can supply the correct information.

2000, 2010, Giannakidou & Mari 2021). For instance, in Greek, subjunctive mood is strictly correlated with the complementizer *na*, thus found under desideratives in (6a). In contrast, under emotive factives, only the "indicative complementizer" *pu* (giving rise to a factive inference) is available.

(6) a. Thelo na kerdisi o Janis
want.1SG that.SUBJ win.NONPAST.3SG the John
'I want John to win.'

b. O Pavlos lipate pu efije i Roxani
the Paul be.sad.PRES.3SG that.IND left.3SG the Roxanne
'Paul is sad that Roxanne left.' (Giannakidou & Mari 2021: 13)

Clearly, mood in the embedded clause is also affected by the lexical class of the embedding predicate: certain predicates require certain moods. However, crosslinguistically we also find variability. In Italian, for instance, doxastic verbs like *credere* 'believe' may take either indicative or subjunctive complements.

(7) Credo che sia/è bella
believe.1SG that be.SUBJ/be.IND cute
'I believe that she is cute.' (Giannakidou & Mari 2021: 28)

The meaning difference between indicative and subjunctive embedded verbs will not be relevant below. What is important in these data is that (a) in some languages, the mood of the embedded clause is reflected in the choice of complementizer, and (b) in some languages, the mood of the embedded clause is not always predictable from the embedding verb. In Swahili, subjunctive mood is overtly expressed with final vowel *-e*.[4]

3 Methodology

This project employs a (logistic) regression[5] analysis of Swahili clause-embedding data to address the question of complementizer choice in Swahili. The data in this project were specifically extracted from the Annotated Version of the Helsinki Corpus of Swahili 2.0 (Bartis & Hurskainen 2016), a restricted-access corpus of the Language Bank of Finland. As one of the largest Swahili corpora available,

[4]Though we remain neutral as to the exact meaning contribution of the subjunctive in Swahili, our analysis of the corpus results in §5 aligns with the account in Portner 2018, which treats subjunctive mood as involving subjective or "solipsistic" belief on behalf of the speaker.

[5]A logistic regression is a statistical model that predicts the likelihood of an observation falling into one category of a dichotomous variable given a set of defined independent variables.

the Helsinki Corpus of Swahili 2.0 is a repository of over 26 million individual tokens across four distinct sub-corpora, with each sub-corpus containing data from a different source. As such, the four sub-corpora differ slightly in the types of tokens they include, with the *Bunge* (parliament) corpus including official political documents taken from the Tanzanian Parliament between 2004-2006, the *Books* corpus including complete or partial Swahili texts published prior to 2003, and the *News (old)* and *News (new)* corpora including transcribed interviews from prior to 2003 (News, old), and 2004-2015 (News, new) respectively.[6]

Importantly, the entirety of the Helsinki Corpus of Swahili 2.0 is morphologically tagged; each word in the corpus has been indexed according to the relevant features of its particular part of speech, with nouns being annotated with information relative to noun class, and verbs being annotated with information relative to subject marking, TAM marking, negation, and mood, for example. With respect to our focus on the distribution of *kwamba*/*kuwa* under clause-embedding predicates, such featural information allowed us to isolate and extract only those tokens in which *kwamba*/*kuwa* introduces a selected finite clause under a finite matrix verb.[7]

In total, 26,065 such tokens were identified and extracted from the corpus for our analysis. Of these, roughly 60% involved the use of *kuwa*, while just under 40% involved the use of *kwamba*, shown in Table 1. This imbalance was considered and accounted for by our regression model, and will be discussed in §3.2.

3.1 Data coding

As discussed above, this project considers the effect of three factors on complementizer choice in Swahili: class of the matrix predicate, person of the matrix subject, and mood of the embedded clause. Upon extraction from the corpus, each token was tagged according to its relevant features for each of these three factors.

[6]Although the nature of the data within the *News (old)*/*News (new)* sub-corpora precludes this corpus from being composed of strictly Tanzanian Swahili, we assume the data within the Helsinki Corpus of Swahili 2.0 to be predominantly of Tanzanian origin given that the *Bunge* sub-corpus consists of Tanzanian Parliamentary documents, and the two News sub-corpora consist of data from Tanzanian news channels.

[7]Tokens were identified and extracted using the following search string (i), which filters tokens based on the linear adjacency of a finite matrix verb (V_{Fin}), *kwamba*/*kuwa*, an optional (subject) nominal, and a finite embedded verb (V_{Fin}).

(i) V_{Fin} + *kwamba*/*kuwa* + (Noun) + V_{Fin}

To avoid any ambiguity with their infinitival verb forms, the syntactic function of *kwamba*/*kuwa* was marked as 'complementizer/conjunction' in the search string.

Table 1: Token distribution by complementizer

kwamba		*kuwa*	
Total tokens	% of overall corpus	Total tokens	% of overall corpus
10,364	.398	15,700	.602

To investigate the effect of predicate class on the choice of complementizer, we initially coded a subset of the most pervasive predicates in the corpus based on the five embedding-predicate classes employed in Hooper & Thompson 1973 (e.g. Doxastic Factives, Doxastic Non-Factives, Emotive Factives and Response Predicates). It was necessary to select only those predicates for which there are substantial tokens to make accurate statistical inferences. As noted above, ultimately, this classification was collapsed into a broad distinction between *Attitude verbs*, or those predicates that attribute a mental state to their local subject, and *Reportative verbs*, or those predicates that introduce (reported) speech. When considered in our regression model, the factor 'Predicate Class' describes the class identity of the matrix predicate of a particular token (i.e. whether it as an *Attitude verb*, *Reportative verb*, or an unmarked baseline verb). For the sake of illustration, a few exemplars of these two classes are provided in Table 2.

Table 2: Predicate classification

Attitude		**Reportative**	
-amini	'believe'	*-ambia*	'tell'
-dhani	'guess'	*-jibu*	'answer'
-fikiri	'think'	*-ongeza*	'add'
-furahi	'be happy'	*-sema*	'say'
-tumai	'hope'	*-taja*	'announce'

The person feature of the matrix subject is the second factor considered in this project (§2.2). Using the morphological information provided in the corpus, each token was indexed by matrix subject person based on the subject morphology (e.g. the subject marker)[8] present on the matrix verb. In total, six person-number

[8]Swahili exhibits robust subject noun class agreement on the verb. The subject agreement pattern for noun class 1/2 — which includes human nouns — varies according to person and number: *ni-* (1SG), *u-* (2SG), *a-* (3SG), *tu-* (1PL), *m-* (2PL), *wa-* (3PL).

combinations were considered: 1sg/1pl, 2sg/2pl, and 3sg/3pl (equivalent to noun class 1/2). All other subject markers (e.g. noun classes other than NC 1/2) were marked as null and treated as the baseline by the model.

The final factor investigated in this project is the mood of the embedded clause (§2.3). Again using the featural information available in the corpus which encodes whether the verb is subjunctive or not, tokens were classified as either subjunctive or non-subjunctive, with the latter serving as the classificational baseline.

3.2 Data training

For each observation (i.e. instance of clause-embedding) in the data, our logistic regression model considers three independent variables (e.g. matrix predicate class, matrix subject person, and mood of the embedded clause), and predicts the likelihood of that observation, including the use of *kwamba*.[9]

As previously mentioned however, the overall distribution of *kwamba*/*kuwa* in our data set is imbalanced (see Table 1), as *kuwa* occurs in roughly 60% of the extracted tokens. To ensure that such an imbalance in the dependent variable would not have any effect on the results of the multi-factor analysis, each of our candidate regression models was explicitly trained prior to model testing.

The following procedure outlines the training process. The complementizer data set was first chunked into two distinct sample populations, with 14,510 tokens being allocated to a training dataset (i.e. the development sample), and 11,554 to a separate test dataset (i.e. the validation sample). The training data consisted of an equal distribution of *kwamba* and *kuwa* tokens, with 7,255 individual instances of each complementizer being randomly selected from the data. The equal population sizes making up the training data is of crucial importance here; this distribution allows each candidate model to be trained/created using an unbiased data set, meaning that any relationship found to hold between some factor(s) and complementizer selection could not simply be the result of a skewed distribution of the dependent variable (i.e. it cannot be influenced by the fact that *kuwa* is statistically more prevalent). As such, each candidate regression model was trained using the evenly distributed training data, before being compared and ultimately ranked according to their ability to account for the distribution of the unbalanced data in the validation sample.

[9] Since our data set consists exclusively of clause-embedding tokens involving either *kwamba*/*kuwa*, it is irrelevant which category (complementizer) is used as the 'indicated' dependent variable category — assuming that the sample size for each is equivalent. If the model instead predicted the likelihood of *kuwa* given the coded factors, the results would be the same.

4 Results

Following data training, potential models[10] were compared based on their ability to account for data in the test sample using simple ANOVA model comparisons. The results of these model comparisons found that for every addition of a predictor variable, the resultant model showed a statistically significant difference in predictive power relative to its predecessor, suggesting that each of the three factor variables under investigation does, to some extent, account for the distribution of *kwamba* and *kuwa* in the data. As such, it was ultimately the maximal three-variable model — the model that includes matrix subject person, matrix predicate class and mood of the embedded clause as predictive factors — that was found to be the model of best fit. Using a basic predict function, we find that the trained model accurately predicts 72% of the test data (n=11,554 tokens). In the following sections, we walk through each factor in turn.

4.1 Predicate class

With respect to matrix predicate class, both *Attitude verbs* and *Reportative verbs* were found to be significantly predictive of complementizer choice (see Table 3). Moreover, the results of our regression analysis indicate a clear distinction between the two classes; *Attitude verbs* correlate with the use of *kwamba*, while *Reportative Verbs* instead correlate with the use of *kuwa*.

Table 3: Predicate class correlations and significance

Predicate class	Predicted complementizer	Significance
Attitude	*kwamba*	$p < .001$ ***
Reportative	*kuwa*	$p < .001$ ***

To illustrate the predictive output of our regression model, the results of our analysis for predicate class (and other subsequent factors) are presented in terms of complementizer likelihood – specifically the likelihood of *kwamba* appearing given the presence of some predictive factor. Complementizer likelihood can be understood as follows. For every token in the extracted data, the regression

[10]Potential models included all possible combinations of 1 or more predictor variables (i.e. factor) and all possible interactions between variables. Possible models therefore included one-factor models that consist of only one predictor variable (e.g. predicate class), two-factor models (e.g. predicate class + mood), the maximal three-factor model, as well as interaction models.

model considers the relevant factors at play (e.g. the class of the matrix predicate, the person of the main clause subject, etc.), and predicts which complementizer is most likely to appear given those factors. Specifically, the model assigns a predicted complementizer value based on a likelihood scale from 0 to 1, where 0 denotes a 100% likelihood of occurrence with *kuwa*, and 1 denotes a 100% likelihood of occurrence with *kwamba*. When considered at scale, this output allows us to analyze the dispersion of predicted complementizer values given specific, individual factors (e.g. predicate class) in order to get a broader view of the relationship between factor(s) and complementizer choice. The results of this analysis for predicate class are illustrated in Figure 1. When compared to the null baseline (i.e. tokens involving unclassified predicates), the dispersion of predicted complementizer values again distinguishes the two predicate classes based on the complementizer they predict; while tokens with *Attitude verbs* generally yield a predicted complementizer value closer to 1 (i.e. more indicative of *kwamba*), *Reportative verbs* yield a predicative value closer to zero (i.e. more indicative of *kuwa*).

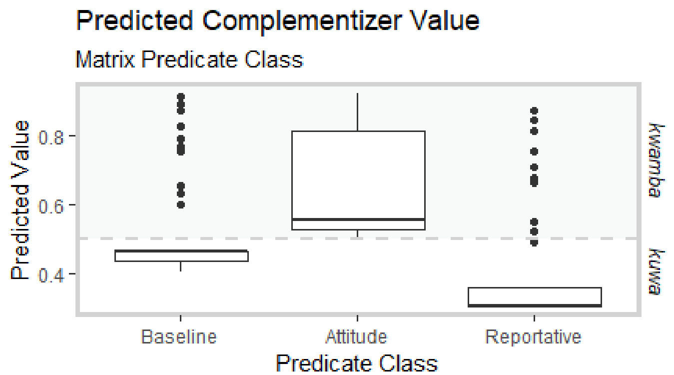

Figure 1: Dispersion of predicted complementizer values by embedding predicate class, as compared to baseline (i.e. tokens with unclassified matrix predicate)

4.2 Person of subject

Turning now to matrix subject person, the results of the regression analysis identify all six person-number feature combinations as being significantly predictive of complementizer choice (see Table 4). Though slightly variable in strength of significance, a clear pattern emerges across the six person-number combinations with respect to complementizer choice: 1st/2nd-person subject morphology correlates with the use of *kwamba*, while 3rd-person subject morphology correlates with *kuwa*. Ultimately, we focus our discussion of matrix subject person on the dichotomy between 1st/3rd-person in §5.[11]

Table 4: Person correlations and significance

Predicate class	Predicted complementizer	Significance
1SG	*kwamba*	$p < .001$ ***
1PL		$p < .001$ ***
2SG		$p < .01$ **
2PL		$p < .001$ ***
3SG	*kuwa*	$p < .001$ ***
3PL		$p < .05$ *

Using the same likelihood scale as described with predicate class in §4.1 — where 0 denotes a 100% likelihood of occurrence with *kuwa*, and 1 denotes a 100% likelihood of occurrence with *kwamba* — the dispersion of predicted complementizer values can be seen for each person-number combination in Figure 2 below. When compared to the classificational baseline (i.e. tokens involving non-1st/2nd/3rd-person subject morphology), the dispersion of the data is again indicative of a dichotomy between 1st/3rd-person subjects; 1st-person subjects correlate with *kwamba*, while 3rd-person subjects correlate with *kuwa*.

4.3 Mood of embedded clause

As for the third factor under consideration, the regression model identifies the presence of the subjunctive mood in the embedded clause as significantly predictive of complementizer choice. Specifically, it was found that subjunctive marking on the embedded verb correlates with the use of *kwamba* (see Table 5).

Considering again the same likelihood scale used in previous sections, we can compare the dispersion of predicted complementizer values for tokens that include the subjunctive in the embedded clause and those that do not. As can be seen in Figure 3, the presence of the subjunctive yields a higher predicted complementizer value (i.e. *kwamba* is more likely) than the absence of the subjunctive.

[11]We omit any discussion of 2nd-person due to lack of sufficient data. Compare the following token counts for each person/number combination: 1SG (n=1463), 1PL (n=1322), 2SG (n=129), 2PL (n=104), 3SG (n=4626), 3PL (n=2310).

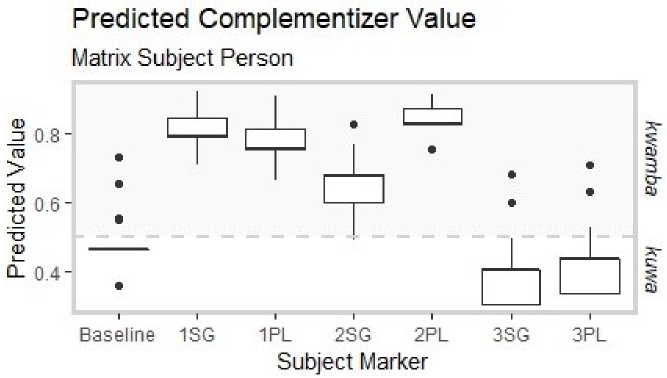

Figure 2: Dispersion of predicted complementizer values by matrix subject person morphology, as compared to baseline (i.e. tokens with any other subject marker)

Table 5: Mood correlations and significance

Mood	**Predicted complementizer**	**Significance**
Subjunctive	*kwamba*	$p < .001$ ***

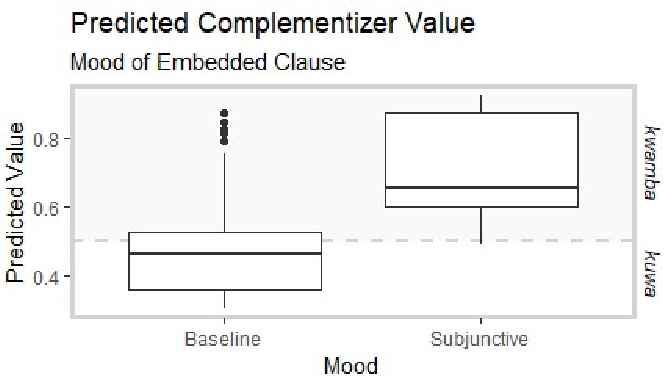

Figure 3: Dispersion of predicted complementizer values for tokens involving the subjunctive in the embedded clause, as compared to baseline (i.e. tokens without subjunctive)

4.4 Summary of results: factor strength

The results of our analysis are summarized in Table 6. Overall, we find a distinction in the specific factors that predict each complementizer, as 1st-person subjects, attitude predicates and subjunctive marking on the embedded verb correlate with the use of *kwamba*, while 3rd-person subjects and reportative predicates correlate with *kuwa*.

Table 6: Summary of correlations

Complementizer	Predictor
kwamba	1st-person Attitude predicates Subjunctive
kuwa	3rd-person Reportative predicates

Given that the results of our analysis found that all three coded factors are statistically significant predictors of complementizer choice, we conducted a follow-up dominance analysis (Budescu 1993, Azen & Budescu 2003) to identify the relative contribution of each factor to overall predictive power of the model. Using the McFadden index (McFadden 1993) as the measure for individual factor contribution,[12] our analysis found that the average contribution of matrix subject person (R^2M = 0.061) outweighs both predicate class (R^2M = 0.017) and mood (R^2M = 0.006), making it the most dominant individual factor in the model.

5 Discussion

There are two broad takeaways from our study. First, the complementizers *kwamba* and *kuwa* are not in free variation. Rather, their use is affected by a variety of factors. Second, even given the predicting factors, the choice of *kwamba* or *kuwa* is not categorical. For instance, while 1st-person strongly correlates with *kwamba*, we still find examples in which 1st-person subjects co-occur with *kuwa*. Similarly, we find that while attitude predicates occur more frequently with *kwamba*, *kuwa* still appears with such verbs.

[12] See Azen & Traxel 2009 for a more detailed discussion of measuring factor contributions in logistic regressions.

Both takeaways point to the conclusion that neither *kwamba* nor *kuwa* is directly selected by an element in the higher clause (as argued for Greek in Roussou 2010). Such a direct link would predict a categorical distinction between syntactic environments that require *kwamba* and those that require *kuwa*. Instead, it must be the case that the correlating factors we illustrate above only bear an "indirect" link to *kuwa* and *kwamba*.

Any analysis of these results should start from the observation that both *kuwa* and *kwamba* have non-complementizer functions. Synchronically, *kuwa* is the infinitival form of the copula. *Kwamba* is diachronically the infinitival form of the verb meaning 'say.' (It survives in its applicativized form *kwambia* 'tell,' shown in (1).) The informal analysis that we sketch here takes this lexical distinction as a starting place.

We suggest that the difference between *kwamba* and *kuwa* (as complementizers) is that *kwamba* situates the embedded clause from the perspective of a particular individual. This treats *kwamba* like other *say*-complementizers: it anchors the embedded clause to the local subject and projects the thoughts/beliefs/knowledge/etc. of that individual. *Kuwa*, on the other hand, situates the embedded proposition relative to a topical situation. When a speaker uses *kuwa*, they are indicating that there is a situation, in some cases a real-world situation, in which the embedded proposition is true.

The distinction between the complementizers is therefore not tied to any particular syntactic element. Rather, the complementizers play a role in the discourse; they are used to indicate something close to *relative belief*: *kwamba* indicates that the embedded clause is a "solipsistic" belief (Giannakidou & Mari 2021), while *kuwa* presents in some cases a more general belief, and in some cases remains neutral.

This characterization of the difference between *kwamba* and *kuwa* accounts for the corpus patterns above in the following way. The strong correlation between *kwamba* and 1st-person subjects in the main clause follows from the fact that speakers are self-aware: a speaker is able to confidently report her own thoughts, but may not be cognizant of the thoughts of others. This notion of self-awareness also explains the correlation between *kuwa* and 3rd-person: it is difficult for a speaker to confidently report on the thoughts of another attitude holder. On the other hand, using *kuwa*—even with a 1st-person subject—indicates potentially a more general or less "private" belief. "I believe *kuwa* P" can be employed to indicate something like "I believe (the situation is) P."

The weaker correlation between attitude predicates and *kwamba* also follows from this. Attitude predicates project the thoughts/beliefs/knowledges/etc. of an individual. A speaker will therefore use *kwamba* when they can confidently report what those thoughts are. This will of course be nearly all of the time with 1st person subjects, but may also reflect the thoughts of a third person subject.

Finally, the correlation between subjunctive and *kwamba* is accounted for in a similar manner. Assuming that subjunctive mood involves some kind of "subjectification" (Portner 2018), then the appearance of *kwamba* again is used to report a "self-centered" belief.

6 Conclusion

Our corpus study of Swahili's dual complementizer system demonstrates that native speakers use the two complementizers *kwamba* and *kuwa* distinctly. This puts Swahili in line with other more well-studied languages that have more than one complementizer or complementation strategy. Further investigation may shed light on more subtle distinctions that cannot be investigated in a corpus, like the influence of questions in the matrix clause, the affect of a topicalized/focused elements in the embedded clause, and the effect of a 2nd person subject in the main clause.

Abbreviations

Kinyamulenge has 20 noun classes. Following Bantuist convention, we mark noun classes via numerals at the beginning of nouns and verbs.

COMP	Complementizer	PAST	Past tense
IND	Indicative mood	PRES	Present tense
INF	Infinitive	SG	Singular
FV	Final vowel	SM	Subject marker
NONPAST	Nonpast tense	SUBJ	Subjunctive mood
OM	Object marker		

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Chapter 17

The concepts of discerned and designed languages and their relevance for Africa

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This paper starts by pointing out that pleas for increased use of African languages, for example as medium of instruction in education, seem to have fallen on deaf ears and attract almost no following from non-linguist circles. The paper argues that this is partly due to a linguistic focus on language as spoken, especially with regard to Africa, overlooking the importance of language in its written, formal forms. This is coupled to a lack of attention to language policy in linguistic research. A way out of this conundrum is proposed, inspired by earlier work of Kloss. The paper introduces a distinction between language as discerned and language as designed or formalized. Making this distinction makes it possible to consider using one designed (standardized) language to serve speakers of several related discerned languages (as happens in many parts of the world). In contrast to current thinking, such a designed language need not be mutually intelligible with all languages it serves – as long as it is easy to learn. For Africa, this means that rational choices for developing a limited number of languages into formalized form become possible. The paper proposes five principles that could guide such choices. The paper discusses the issue of 'ease of language learning', arguing that the limited research available points to its relevance for Africa. The paper concludes by pointing to a number of new research questions, related to the policy choices that need to be made and the planning that will be necessary in order to achieve a proper implementation of a transition to using African languages in formal domains.

1 Introduction

Over the years, various authors have argued in favor of increased use of African languages at all levels, including in higher education (for a good overview, see Wolff 2016). However, their pleas have fallen on deaf ears. To this day, authors

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can write about "decolonizing education" in Africa without mentioning language (Ndofirepi & Gwaravanda 2019); policy briefs on education can be written that do not mention language.[1] Kaschula & Nkomo (2019: 619) characterize the lack of attention to the language issue as "the 'elephant in the room' when it comes to development in Africa". The importance of increasing African language use in higher education remains a minority plea, without much influence in practice.

In part, this lack of progress is due to the prevalence of ways of looking at African languages that, in my view, are not helpful for the African situation. Based on a discussion of that, this article introduces the related concepts of discerned and designed languages (inspired by the concepts of "Abstand" and "Ausbau" languages as proposed by Kloss 1967). Using these concepts, it becomes possible to think about introducing a limited number of African languages for use in higher education. However, in order to come to rational choices in this area, sound principles will be needed. The article proposes five such principles. It ends with a discussion of the further research questions these concepts help to highlight and with some concluding remarks.

2 Ways of looking at language

There are different ways of looking at language – as production of sounds, as means of communication, as means of constructing meaning – and there are probably other ways as well. For the purpose of discussing language in Africa, this paper discusses languages as social phenomena – as instruments of power. Consider the metaphor of road building: in olden times, roads (or paths) emerged naturally, as a result of people walking from A to B along a similar route. But little by little, roads became the preserve of engineers and planners, from the army routes in Roman times to the highways of modern times. In the same way, languages originated by people talking to one another, but gradually evolved into complex social constructions, planned, maintained and extended using elaborate mechanisms. Thus, in France, the *Alliance Française* is an institution specifically set up to promote and protect the French language.[2] Internationally, the *Organisation Internationale de la Francophonie* serves the same purpose.[3] In the English-

[1]Thus, for example this two-pager on educational reform: https://includeplatform.net/wp-content/2019/11/Prioritising-issues-for-education-in-Africa_11_2019-2.pdf accessed 26 July 2021.

[2]https://www.fondation-alliancefr.org/?cat=536 retrieved 22 October 2019.

[3]https://www.culture.gouv.fr/Sites-thematiques/Langue-francaise-et-langues-de-France/Politiques-de-la-langue/Multilinguisme/Francophonie retrieved 26 April 2020: *les francophones peuvent s'appuyer sur un dispositif institutionnel voué à promouvoir la langue française* – 'Francophones can rely on an institutional mechanism dedicated to promoting the French language' (author's translation).

speaking world, hosts of style guides and armies of editors work tirelessly to keep English standardized and understandable for ever larger numbers of people. In Africa, this process of language formalization and extension took place as well: Africans attempted to preserve indigenous knowledges and thought for posterity through writing for example in *Ajami* script, or in the ancient *Ge'ez* language and script of Ethiopia. These social innovations took place in Africa like in other parts of the world – however, they were severely influenced and in fact all but halted during the colonial period. The process of committing knowledge and thoughts to writing in African languages became almost the sole monopoly of Western missionaries, who in this domain, as in so many others, manipulated and altered African languages to suit their own purposes (see for example Makoni & Meinhof 2006). Thus, Djité (2008) asks: "[I]sn't it the case that some languages have simply not been *allowed* to develop as others have? Isn't it the case that evidence of literacy tradition in some languages has intentionally been destroyed (…), forbidden (…) or ignored (…)?" Kaschula & Nkomo (2019: 607) also make this point:

> The arrival of foreign traders, explorers, missionaries, and colonial settlers resulted in cross-cultural encounters and the transformation of economic, cultural, religious, and political domains, which devalued indigenous knowledge and African thought systems. This not only alienated indigenous people from the socioeconomic and political organizational structures of the new societies, but also de-intellectualized their languages.

Some authors who look at language choose not to see this process of language formalization and extension: they concentrate on language as spoken and object to seeing languages as "bounded, countable objects", in line with the thinking of Pennycook (2010). These are authors who prefer to talk about "language registers" or "languoids", rather than about languages. A very well-developed example of this type of thinking and what it leads to is provided in the work of Lüpke & Storch (2013). Their starting point is a description of the linguistic situation in the Casamance region of Southern Senegal. They show that the linguistic situation in that region is very different from that in Europe or the Americas.[4] In Europe or the Americas, young people are brought up in one language (their mother tongue) and they typically learn additional languages in school. In this part of Africa, though, young people are typically brought up in several languages and

[4]Note, though, that recently they have come under criticism for over-generalizing the experience from one particular area of the Casamance to the rest of the region and indeed to Africa as a whole: see Sagna & Hantgan (2021).

they learn to use those languages (or "registers") in different social situations, depending on the circumstances. Lüpke and Storch argue that it makes little sense to introduce formal literacy training in standardized local languages under those circumstances. In day to day use, people need more than one language; linguistic variation within every "language" is considerable; people have few opportunities and little utility for using formal written forms. Instead, they favour an approach that valorises the multilingual abilities of speakers and takes that as a starting point, also in classroom situations.[5] These kinds of multilingualisms, they argue, are rare in other parts of the world, but common in Africa.

The approach advocated by Lüpke and Storch has advantages and disadvantages. The advantages operate mostly at the level of languages as spoken. It is true that the differences construed by foreign observers may not correspond to the differences perceived by speakers and it may also be true that those differences can be much more situational and much less absolute than what the terminology leads one to believe. A teaching approach that takes the actual linguistic repertoires of learners as its starting point and values them all as resources seems to make eminent sense. This is in fact the practice that has become known as "translanguaging". In an African context, it usually means making use of different languages in classroom settings, for example, both Pidgin English and British English, or Xhosa alongside English (see for example Makalela 2015). In many situations, translanguaging can be advantageous when compared to earlier forced monolingualism. However, it has limitations as well. For example: if the language of formal examination remains the former colonial language, then the net effect will be that these strategies instrumentalize a language with lower status in order to learn a language with higher status – thus in fact maintaining and even reinforcing the existing diglossic language systems in Africa. In addition, translanguaging will work only in specific settings: it requires a situation where all or most in class have some familiarity with the same set of languages or language repertoires. Furthermore, it is an open question what translanguaging will mean for intergenerational language transmission: it could be that it will in fact be a contributor to intergenerational language loss.

The disadvantages of the approach by Lüpke and Storch are mostly at the level of language policy. It leads to an exclusive focus on "what language actually is to speakers and hearers" (Lüpke & Storch 2013: 347) and blinds them to the role (implicit or explicit) of language policy and language planning. In a way, they

[5]This has given rise to the LILIEMA project, https://soascrossroads.org/2018/01/11/liliema-phase-two-bringing-language-independent-literacies-to-an-international-forum-by-friederike-lupke/ retrieved 4 October 2019.

situate Africans in a type of reserve where they live their "natural" lives, only marginally influenced or affected by governmental or institutional policies (for example in the area of language). These policies are relegated to a vague "context" that they seem to accept as unchanging and not subject to being influenced by Africans as actors at that level. Where I would see harmonized and standardized languages as a form of social innovation that has its benefits, they see them as a colonial imposition.[6] Even though Lüpke and Storch themselves unquestioningly make use of the advantages offered to them by a conventionalized use of the English language and take these for granted, they seem to deny the utility of conventionalized language to African languages. Yet conventionalized languages are the medium of instruction at the levels of secondary and higher education. Following the analytical framework of Lüpke and Storch would lead to a neglect of language policy and language planning and would lead to an unquestioning acceptance of the political choice to use French and other international languages as medium of instruction in secondary and higher education. As Bamgbose (2011: 6) remarked: "absence of a policy is indeed a policy, for whenever there is no declared policy in any domain, what happens is a continuation of the status quo." The same could be said of neglect of the policy element in linguistic research: the absence of such research is a policy choice, for neglect of this field means an unquestioning acceptance of the *status quo*.

Another line of reasoning that is sometimes followed in support of the current status quo is that it is what Africans *prefer*. Africans themselves, it is argued, demand education in the former colonial language and are against education using indigenous languages as medium of instruction. An example of this type of argument is found in Beyogle (2014) (for a somewhat different view, also from Ghana, see Yevudey & Agbozo 2019). However, this is a chicken-and-egg type problem: if parents perceive that education in a formal colonial language is a passport to economic success in life, they will seek such an education for their children and will tend to have a negative attitude to indigenous languages. If, however, the context would change, allowing for educational opportunities and economic success also by using indigenous languages, then attitudes would surely change.

My approach has no issue with the analysis of multilingual situations that Lüpke and Storch make for certain areas in Africa and with the recommendations for teaching that they draw from it. However, for a discussion of the role of policy, the approach of Lüpke and Storch is inadequate and, I would argue, dangerous.

[6] Of course, language harmonization and standardization are not European inventions: these processes were around in other parts of the world long before they became commonplace in Europe.

An example of how this type of thinking can in fact be disempowering and can confuse even the brightest minds can be seen in Heugh (2016: 253). She writes:

> From a theoretical perspective, acceptance of diversity and its inevitability requires a different trajectory from one based [on] the diminishing of variability. This last perspective dovetails with a third possibly more profound consideration, an emerging debate which questions the very foundations of nineteenth and twentieth-century colonial linguistics.

This creates a false contradiction. As Joswig (2020: 96) rightly points out: "A language standard adds a written variety to a complex dialect situation, but in itself it does not remove any diversity. Spoken language diversity has proven to be very resilient in the face of written standards."

In other words, it is perfectly possible to combine a standard form of language as used in instruction with a great diversity of speech forms (as is indeed the case for the English language). If the result of "questioning the foundations of colonial linguistics" means that language policies are rejected as irrelevant and going against "inevitable" diversity, then this leaves African languages worse off than they were before and inevitably will lead to a strengthening of the position of international languages, English first of all. A stark example of such a development is provided by Chebanne (2016: 295), who shows that the Khoisan languages are threatened because of "the lack of an adequate language development policy". In his analysis, "[i]t is important that Khoisan languages go beyond the insular and idiosyncratic developments that have been promoted under the guise of preserving ethnic and linguistic identity. Pursuing this separate, narrow, and myopic approach can only further marginalize these beleaguered languages."

In fact, the same holds true for almost all African languages. What is needed, then, is to highlight this distinction between language as spoken and language as used in formalized ways and to examine what this distinction may mean for language policy in Africa. In order to do that, I propose to use the concepts of "discerned" and "designed" languages, as outlined in the next section.

3 Discerned and designed?

The concepts suggested in this paper are inspired by proposals put forward as far back as 1952 by the German sociolinguist Heinz Kloss.[7] They were published by him in English in 1967.

[7]These proposals are inspired by Kloss, but the change of emphasis I propose and their application to Africa represents a novel development that bears no relationship to the rest of the ideas or writings of Kloss.

Kloss (1967) introduces a distinction between what he calls *Abstand* and *Ausbau* languages. These words have not been translated into English in the sociolinguistic literature; therefore, I venture to propose the terms of "discerned" versus "designed" languages as English approximations. The term "discerned" (or "Abstand") languages is, according to Kloss, a linguistic concept that refers to all languages, whether they have a developed writing system and grammar or not. He assumes that linguists have a way of determining the "intrinsic distance" between languages and to decide on the borders between languages using those criteria (Kloss 1967: 30). The concept of "designed" (or "Ausbau") languages, on the other hand, is not a linguistic concept: it is *sociological.* It refers only to those languages that have been deliberately shaped and built to become standardized vehicles of literary and scientific expression (which could include oral cultures). Many language names are used for both: these are languages for which the same name is used for their discernible form as spoken language and for their literary form. But this is not always the case. Kloss gives the example of Czech and Slovak: at the spoken level, he sees them as one language,[8] encompassing a number of different dialects. However, at the literary level, they have developed different standardized forms and here we have therefore one "Abstand" (discerned) language at the spoken level but two "Ausbau" languages at the formal, literary level. The way Kloss describes his concept of "Ausbau" languages is very similar to the concept of "intellectualisation". Prah (2017: 216) quotes the definition of Sibayan from 1999: an intellectualised language is a "language which can be used for educating a person in any field of knowledge from kindergarten to the university and beyond". This terminology is also used by Kaschula & Nkomo (2019: 604), who quote Havránek in making a distinction between "folk and standard languages" and Sibayan in making a distinction between "intellectually modernized" and "popularly modernized" languages. They see intellectualization of languages "as a counterhegemonic process that seeks to empower communities through language" (Kaschula & Nkomo 2019: 606).

Now that the concepts have been clarified, a further explanation of my shift of emphasis compared to Kloss is in order. The most straightforward translation of *Abstand* into English is distance. Kloss proposes to use this term for dialects or speech registers that are so distant from one another that it is justified to speak of different languages. The word "discerned" places a slightly different emphasis,

[8]The *ethnologue* would disagree with Kloss here, and sees these as two languages, denoted by the ISO 693-3 codes <ces> for Czech and <slk> for Slovak. However, the *ethnologue* also asserts: "All Czech and Slovak dialects [are] mutually inherently intelligible". https://www-ethnologue-com/language/ces accessed 30 March 2020.

pointing to the act of discerning – the political and social act of pronouncing a dialect to be a language. The word *Ausbau* means extension or expansion in English. Kloss thus refers to the act of extending a spoken language into a standardized language, including its written form. The word “designed” in a way reinforces this meaning, again pointing to the social process that is involved here. This reinforcement is intentional. Many languages (including French, German, Italian, but certainly also Bahasa Indonesia or Turkish) have an explicit and strong design element to them. In the Anglo-Saxon world, this design element is much less explicit and remains to a certain extent hidden below the surface. An equivalent of the Académie Française, with its strong mandate of protecting the French language, does not exist in the Anglo-Saxon world. Yet, the “Queen’s English” or “BBC English” is in fact a form of standardized language developed in elite institutions in the UK and actually spoken and used in that form by only a small minority of the UK population.[9] Thus, even if there is no official body “designing” the language in the Anglo-Saxon world, English as a designed language is (re)produced just as effectively as what happens with other languages. This process can easily be mistaken for a “natural” development and can create a type of myopia, causing some linguists to overlook the fact that both American and British standard English are created, designed, through social, power-structure mediated processes using different mechanisms but with the same effects as with the majority of other designed languages of the world.

Kloss stresses that in order to master a designed language a certain amount of formalized learning is always required. This is what Lo Bianco (2008: 114) refers to as “secondary lingual socialization”. It also helps to explain why in countries that use an indigenous language as medium of instruction this language is also taught as a subject in its own right, usually up to the end of secondary school. Kloss gives the example of German (Kloss 1967: 35): linguists might disagree as to whether spoken High German (*Hochdeutsch*) and Lower Saxon (*Plattdeutsch*) are in fact part of one “discerned” language or indeed two languages (the *ethnologue* is of the latter opinion). However, speakers of both forms of German use written Standard German as their common “designed” language, but this standardized version is different from both spoken languages and requires learning in order

[9] In a curious form of English idiom this is referred to as the “received pronunciation”. Trudgill (2002: 171) claims that it is spoken by around 3% of the British population. Many a bright youngster who has studied English as a foreign language and who has little difficulty in watching for example the BBC World TV station will find to his or her surprise on a first visit to England that he or she has great difficulty in understanding the ordinary English person. Adichie describes a similar phenomenon for her Nigerian characters in their encounters with U.S. English. For an overview of different varieties of spoken English, see the Electronic World Atlas of Varieties of English, https://ewave-atlas.org/, accessed 19 June 2020.

to master it. However, learning standard written German is easier for speakers of high German and of lower Saxon than it would be for speakers of, for example, Polish.

The advantage of using these two concepts together is that they point to the possibility that one designed (or intellectualized) language serves the speakers of several discerned languages. In a country like Germany, this is in fact the case: the *ethnologue* discerns no fewer than fifteen living German-like languages spoken in the country[10] – yet speakers of all of these fifteen languages use the designed *Hochdeutsch* in formal domains such as law, governance and (higher) education. In Africa, it would be entirely conceivable to make similar choices. Thus, the various forms of Gbe (including Aja, Ewe and Fon), spoken in an area that stretches from Eastern Ghana to western Nigeria, are often regarded as dialects of a single language (Prah 1998). Within that dialect continuum, a standard form could probably be developed that would be easy to learn for speakers of all discerned languages in this continuum. The speakers of various Ubangian languages in the Central African Republic together make use of Sango, a *lingua franca* based on Ngbandi, one of the languages discerned in this group. Sango could be developed to serve as a designed language for use in formal domains in the area. Alexander (1998) has pointed to the large similarities between the Nguni languages spoken in South Africa (including Swazi, Xhosa and Zulu), as well as between the Sotho-Tswana languages. He has proposed developing standard varieties that could serve the speakers of these languages.

Where in Europe, the historical processes that led to the development of certain forms of language as designed languages was a historical process that has more or less come to an end,[11] such a process has never taken place in Africa. This has contributed to the persistent and disempowering trope that using African languages in higher education would be a practical impossibility, because it would involve the development of all 2,000+ languages that databases like the *ethnologue* manage to discern on the continent. Thus, the African Union has avoided the problem of choosing certain languages over others by designating "any" African language as "official".[12] However, in so doing the AU has at the same time re-

[10]https://www.ethnologue.com/country/DE/languages accessed 27 July 2021.

[11]But note for example the recent development of Catalan from a discerned into a designed language, now used at all levels of education.

[12]https://au.int/en/about/languages accessed 20 July 2019. Note, though that the AU's African Academy of Languages (ACALAN) has chosen to concentrate on 41 Vehicular Cross-Border Languages: https://acalan-au.org/viewcontent3.php?tab=10 accessed 7 April 2022. In addition, the work of CASAS in South Africa has been of great importance in developing standard and unified orthographies for a great many African languages: https://www.uwc.ac.za/study/all-areas-of-study/centres/centre-for-advanced-studies-of-african-society/publications accessed 7 April 2021.

moved any practical meaning of the term "official language": it is a case of paying lip service only. It is through the distinction between discerned and designed languages that we can see a way out of this problem; but where in Europe, the issue of language choice has largely been solved, this is not the case for Africa. This represents a problem, but also a possibility and a challenge. There is a possibility for agency here: Africans can make informed policy choices in this area. However, in order to do so, a set of sound policies and principles would be needed. What could those be? That is the topic of the next section.

4 Principles for rational language choices

What reasons could there be for choosing one language as the basis for further development into a designed language, in favour of others? Isn't just asking the question itself a recipe for trouble, contestation and (ethnic) strife? If left to the powers that be, that will inevitably be the case. Therefore, it is necessary to depoliticize choices to the extent possible. A first step would be to search for and adopt a number of sound principles, that would make choices possible based on equitable, democratic and scientifically sound bases. Based on a search in the literature, I would suggest that five such principles are necessary.

Note that language design does not necessarily mean taking one language as a template that cannot be altered. Thus, the design process itself could lead to simplification if that makes learning easier. One of the greatest successes of designed languages in the world today is Indonesian (Bahasa Indonesia), a designed language based on but not identical to Malay. It is currently used as first or second language by over 150 million people. In Bahasa, to give an example, the plural is not marked – to make a word plural, it is repeated. In general, Bahasa was consciously formed to make it as easy as possible to learn for as many people as possible, making it different from related but much more complex languages such as Javanese.

In line with the concepts of discerned and designed languages, the *first principle* that I would propose is that it will be necessary to develop a *limited number* of designed languages for education. This idea was suggested already by Chumbow (2005: 177) and also by Brock-Utne (2017). Not only is it not practical, it is also not necessary to aim to develop all discerned languages into designed languages.

The *second principle* that I would propose follows from the first: these designed languages should be chosen in such a way that they are *easy to learn* for as many speakers of discerned languages as possible – a principle that was already suggested by Nwoye (1978), as cited by Laitin (1992: 154).

As a complement to the second principle, the *third principle* would be to strive for *inclusivity*, in other words, to choose the various designed languages in such a way that, as much as possible, all have to exert a relatively low but relatively equal effort to learn them.[13] Thus, for speakers of Occitan, standard French might be relatively easy to learn as a designed language. For speakers of lower Saxon, standard German might serve the same purpose. Using standard German as the designed language for speakers of Occitan would place them at a disadvantage compared to the speakers of lower Saxon. Therefore, both French and German are needed in order to ensure inclusivity. Another strategy is thinkable: Mandarin Chinese could be chosen as the designed language for both groups, which would make learning extremely but equally difficult for both. Such a strategy would be very damaging to France and to Germany, because it would effectively bar large sections of the population from gaining access to meaningful education and to public discourse and would therefore stunt the possibilities of both countries for economic and social development. Of course, this is precisely the strategy that is currently presented as the only rational alternative for many African countries.

Then, a *fourth principle* seems appropriate: namely that of making use of *existing bilingualism* as a resource. Multilingualism in Africa should be seen as a resource to be mobilized to advantage. As hinted to above, this is probably useful only for a minority of cases: true bilingualism is difficult to achieve and depends on significant exposure to the two languages from a very early age. However, there may be areas where this exists. There could be situations where finding an easy to learn designed language for discerned language A is difficult or impractical, but if those children also speak language B it might be possible to find a cost-effective, inclusive solution.

Lastly, it is important to avoid fragmentation and ethnically-based enmity wherever possible. For policy, this would mean the adoption of measures to *encourage linguistic collaboration* among linguistically related communities as a *fifth principle*.

An important element in these principles is the idea that people should be able to gain access to knowledge through a designed language that is "easy to learn" for them. But is ease of language learning an important factor and is it of equal importance for all sections of the population? Unfortunately, this is an area that is very much under-researched. However, there is an indicator based on practical

[13] This principle is related to the second principle of what a multicultural state should look like, as described by Kymlicka (2003: 150). This entails the requirement that all citizens should have equal access to state institutions, without linguistic barriers imposed on some but not on others: "The state accepts an obligation to accord the history, language and culture of non-dominant groups the same recognition and accommodation that is accorded to the dominant group."

experience by the US Foreign Service Institute in teaching many different foreign languages to interested groups of adolescents or young adults. This has led them to classify languages into four categories and one lower category, for learning a closely related language (US State Department 2015).[14] These categories can be ranked from very easy to very difficult; the difference in the amount of learning required is considerable, as shown in Figure 1 below.

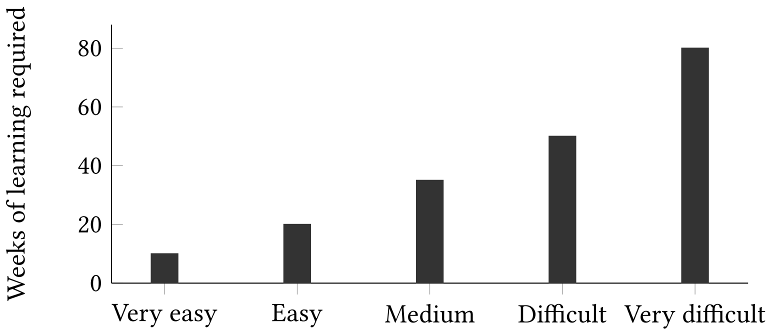

Figure 1: Ease of language learning

The graph clearly illustrates that the difference in effort required to learn an “easy” language compared to a “difficult” language is indeed substantial – although the number of weeks should be taken as an indicative value only. In addition, this is based on language learning of young US students. It could be that the differential is different for African children – this is an area that has not been researched and would deserve further work. In addition, it is highly likely that the differential varies for people with varying language aptitudes. Li (2016) has shown that language aptitude is a valid construct. This construct is related to, but independent of general intelligence. As with other kinds of aptitude, language learning abilities are not spread evenly over the population: some people are good at learning languages, others are not.

The issue of which languages are more easy or more difficult to learn and for whom has not received wide attention in the literature. Van Pinxteren (2020: 137) points out:

> the question of what ease or difficulty of language learning means for large groups of learners and for an education system has not been asked in the literature in that way. Yet, this is a question of key relevance for Africa, where

[14]The document quoted in reference is no longer current; however, a similar description is available at https://www.state.gov/foreign-language-training/.

> populations are supposed to be taught in a language that most learners do not speak from birth.
>
> Common sense suggests to start from the principle that languages that are close to one another are easier to learn and to be taught in formal education than languages that are very different from one another. In other words, the distance between any two languages can be taken as an indicative or rough measure for how easy or difficult it may be to learn another language for a speaker of a given language or to teach the new language to large groups of learners.

Van Pinxteren then goes on to propose a way of approximating ease and difficulty of language learning for speakers of specific language pairs, based on normalized edit distances between those languages.

What would the application of the principles outlined above mean for rational language choices in different African countries, given their different language ecologies? This remains to be researched; such research will require concerted efforts by African linguists and educators for years to come. An example of how this could work out for Botswana has been elaborated by Chebanne & van Pinxteren (2021). For Tanzania, Van Pinxteren has argued that Swahili is easy to learn for most Tanzanians, since the great majority of them speak a language from the "Narrow Bantu" family, a group of languages that are closely related. However, for most other African countries the situation may be much more complicated – how much more remains to be explored in individual cases.

5 Conclusions: the way forward

What this paper has shown is that language documentation as such is perhaps not the only way forward for (socio-)linguistic research. A number of questions need to be answered, questions that are highly relevant for the development of Africa-centred policy options. These include, among others:

- If a transition towards designed language use in Africa is desirable, which combinations of discerned and designed languages can work?
- What policies are needed to move towards use of designed African languages?
- How should a transition be planned? What phases would be needed?

Over the years, many authors have argued for increased use of African languages – but on the ground, very little, if any, progress has been made: if anything, in some countries there has been a retrograde movement, in favour of introducing education in international languages only at ever earlier ages. Apparently, current theory does not provide sufficient arguments to help bring about change in this area. This paper has shown, at least in principle, that the joint concepts of discerned and designed languages can help us re-focus on the importance of policy and on the possibility and need for African agency in this area. What is especially relevant is that the concepts make it possible to consider the possibility of using *one* designed (standardized) language to serve *several* discerned languages. In contrast to current thinking, such a designed language need not be *mutually intelligible* with all languages it serves – as long as it is easy to learn. In order to make further progress in this area, a set of scientifically sound and democratic principles and policies will be needed. An initial proposal was presented in this paper for five such principles, based in part on existing literature. Adopting this line of reasoning will open up the road to a vast and exciting new research agenda, highlighting the need for increased involvement in policy debates by African (socio-)linguists.

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Chapter 18

Vowel systems in Nigerian languages: Genetic typology vs areal characteristics

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SIL Nigeria

Nigerian languages display an impressive variety of vowel systems, ranging from those with ten basic phonemic vowel qualities to those that have been analysed with just a single vowel. Although certain systems like the symmetrical seven or nine vowel systems are fairly common, a variety of less common systems are also found, like the one, two or three vowel systems of certain Central Chadic languages, or the various asymmetric six and seven vowel systems with different numbers of front and back vowels. This paper presents the findings of a survey of 247 Nigerian vowel systems, including dozens of minority languages that have little or no previous documentation. It covers languages from 25 different sub-families, and reveals 45 different basic vowel inventories.

The results reveal certain typological patterns such as the widespread five and six vowel systems of West Chadic languages, or the nine vowel systems of many Ijoid and Edoid languages. Some largely contiguous groups like Defoid, Idomoid and Ijoid have fairly homogenous vowel systems, whereas more fragmented groups like Jukunoid, Cross-River and Plateau have much more diverse systems. The paper also shows where certain vowel features (e.g., ATR harmony and nasality) have crossed genetic boundaries through language contact. Furthermore, very few Benue-Congo languages are shown to have retained the proposed, original 10-vowel system (Williamson 1989). Such systems are mostly restricted to a few small geographic pockets, suggesting that a larger vowel inventory is more likely to be preserved if it is in contact with other languages with similarly rich vowel inventories.

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1 Introduction

Nigeria is by far and away the language diversity hotspot for Africa, with over 500 indigenous living languages from three of Africa's four main language phyla. Such diversity is perhaps not so surprising given that southern Nigeria is considered to be the likely birth place of Benue-Congo, and possibly also of Niger-Congo, the world's largest and most widespread language phylum (Blench 2006: 126–134).

A number of authors have looked at vowel systems in specific language phyla or families (e.g., Bendor-Samuel 1989, Williamson 2004, Hyman et al. 2019 for Niger-Congo, Jungraithmayr 1992 for Chadic, Gravina 2014 for Central Chadic), noting some of the more common systems and a few of the less common ones. One of the main aims of this paper is to take a closer look at vowel systems within a number of sub-families within both Chadic and Benue-Congo to begin to build a better understanding of their typological characteristics. However, much less research has been done on which aspects of vowel systems have crossed genetic boundaries, and so this paper also aims to further explore such phenomena. The methodological validity of using a non-genetic entity like a country for the basis of a partly typological investigation might at first seem rather questionable. However, areal linguistic studies are proving to be an increasingly popular and fruitful area of linguistic research (e.g., Dimmendaal 2001, Heine & Leyew 2008, Ziegelmeyer 2016, Zogbo 2016, Rolle et al. 2020). Furthermore, as Nigeria is such a vast melting pot of language sub-familes, many of which have all their languages spoken in Nigeria, and some of which have clear evidence of sustained interaction, it seems a highly suitable geographic area for investigating both typological patterns and areal diffusion.

The sources of data used in the study include first-hand data as well as published and unpublished sources[1] on 247 Nigerian vowel systems, considerably more than in most, if not all, previous comparative studies.[2] The 25 different sub-families included in the survey are listed in Table 1, along with the number of languages from each sub-family. Sub-families printed in italics are those with

[1]For reasons of space, the complete list of sources of data for vowel inventories in each of the 247 languages is not listed in this paper, but is available upon request.

[2]The only database that comes close is the Areal Linguistic Features of Africa database (Rolle et al. 2020), which contains data on 681 language varieties across West and Central Africa, although it is not recorded how many of these are spoken in Nigeria. By comparison, the largest online database of phonemic inventories (the PHOIBLE database; Moran et al. 2014) with data from 1672 languages, includes only 94 Nigerian languages, and the Systèmes alphabétiques des langues africaines online database (Chanard 2006), with data from 227 African languages, includes only 21 Nigerian languages.

all their languages spoken in Nigeria. Table 1 shows that most sub-families are reasonably well represented, although Adamawa and Southern Bantoid are notable exceptions, primarily because not much data was available on the Nigerian languages belonging to these groups. The Kainji languages included are almost all Western Kainji languages, with Eastern Kainji languages standing out as being extremely poorly documented, possibly one of the least documented genetic groups in the whole of Africa. It should also be noted that the classification of some languages, particularly some Adamawa and Cross River languages is still under dispute.[3]

In considering the vowel inventories of the various languages, the primary interest was in basic vowel qualities or oral configurations. Hence for the purposes of this survey, diphthongs, long vowels and nasal vowels were not considered to be part of the basic vowel inventory, as the analysis of such segments is often unclear. For example, diphthongs are frequently analysable as VC segments, where C is a semi-vowel, and long vowels are often associated with a phonological timing tier rather than the segmental tier (e.g., Hausa, Clements 2000: 141–143). In any case, the set of short, oral vowels in a language typically includes all the vowels that have long or nasal counterparts. Only in two cases (Bade and Ngizim) were there long vowels with no short vowel counterparts.

There are several complicating factors inherent in a survey like this. Firstly, there is often disparity among sources about the number of vowels in individual languages, depending on which level of analysis is chosen, whether the underlying contrastive level, the output of the regular phonology, or the surface phonetic level (see Kiparsky 2018). Most striking is the case of certain Central Chadic languages, such as Hdi, for which Langerman (1994) identifies 2 underlying vowels (/a/ and /ə/), Frajzyngier (2002) reports 6 surface vowels (/i/, /e/, /ə/, /a/, /o/ and /u/), and Gravina (2014) posits 4 phonological vowels (/i/, /ə/, /a/ and /u/). For the purposes of this survey, where there was disparity among the sources, generally the more conservative (underlyingly contrastive) figure was used, unless it was deemed there was good evidence to the contrary. Secondly, even when sources agree on the number of contrastive vowels, they may not agree on their quality. For example, several West Chadic languages are sometimes analysed with the vowels /i/, /e/, /a/, /o/, /u/, but at other times analysed with the open-mid vowels /ɛ/ and /ɔ/ instead of /e/ and /o/. Phonetically, it is likely that the actual vowels

[3]For example, 29 languages classified as Adamawa according to the Ethnologue (Eberhard et al. 2021) are classified as Gur or other non-Adamawa languages according to the Glottolog (Hammarström et al. 2016) and so for the purposes of this study, the classification from Eberhard et al. (2021) was followed.

Table 1: Languages in the sample

Phylum	(Sub-)Family	Total[a]	Sample	Examples in Nigeria
Niger-Congo				
	Mande	6	5	Busa, Boko, Kyenga, Shanga, Sorko
	Atlantic	3	1	Fulfulde (Nigerian, Adamawa, Benin)
	Ijoid	10	8	Defaka, Ịjọ, Ịzon
	Kwa	1	1	Gungbe
	Gur	1	1	Baatonum
	Adamawa	45	9	Longuda, Awak, Mumuye
	N. Bantoid	14	6	Mambila, Samba Daka, Vute
	S. Bantoid	40	13	Tiv, Bankal, Ejagham
	Cross River	67	29	Efik, Ibibio, Mbembe
	Jukunoid[b]	19	13	Jukun Takum, Kutep, Jibu
	Kainji	57	19	C'Lela, Cicipu, Reshe
	Plateau	59	26	Berom, Tarok, Gyong
	Defoid	7	7	Yoruba, Igala, Iṣekiri, Ayere, Arigidi
	Edoid	31	22	Degema, Engenni, Edo
	Idomoid	9	9	Idoma, Eloyi, Etulo
	Igboid	10	7	Igbo, Ekpeye, Ikwere, Ika, Izi, Ogbah
	Nupoid[c]	11	12	Nupe, Gbari, Ebira
	Other B-C	3	3	Ukaan, Akpes, Oko-Eni-Osayen
Afro-Asiatic				
	West Chadic A	44	22	Hausa, Ngas, Mwaghavul
	West Chadic B	27	11	Bade, Miya, Ngizim, Saya
	Biu-Mandara	40	19	Bura, Kamwe, Glavda
	Semitic	1	1	Shuwa Arabic
	Berber	1	1	Tamajaq
Nilo-Saharan				
	Saharan	4	1	Kanuri, Tedaga, Manga Kanuri
	Songhai	2	1	Dendi, Zarma
Total		512[d]	247	

[a]The numbers given in this column are the numbers of Nigerian languages in each sub-family according to Eberhard et al. (2021).

[b]Jukunoid is printed in italics here, although there is one Jukunoid language (Beezen) which is spoken in a single village in northwest Cameroon near the Nigerian border.

[c]The number of Nupoid languages used in the sample is greater than the number listed in Eberhard et al. (2021) since Nupe and Nupe-Tako are listed as a single language in the Ethnologue but have different vowel inventories and are sometimes considered separate languages.

[d]This figure is less than the 531 listed in Eberhard et al. (2021) because it doesn't include various minority categories such as sign languages, extinct languages, pidgins, creoles, and non-indigenous languages.

lie somewhere between the two. In such cases, the two inventories were considered identical, and simply listed using a slash (i.e. e/ɛ and o/ɔ). Thirdly, languages sometimes either have dialects with different number of vowels, as is the case with Yoruba and Ibibio, or are in the process of neutralising certain contrasts, as in the case of Igede. Related to the dialect problem is the urban/rural problem. Abuan, for example, has 10 vowels in rural villages, but only 7 vowels in the Port Harcourt lect (Roger Blench, personal communication). Where there was dialectal or other variation, the most widely accepted inventory was generally used. Hence Ibibio, for example, which has 7–10 vowels depending on dialect, was counted as a 7-vowel system, since that is the most widely reported view, whilst Abuan, which also has 7–10 vowels, was counted as a 10-vowel system for the same reason. A list of the 45 different vowel inventories in the database is given in the Appendix.

The paper is structured as follows: following this introduction, §2 gives an overview of Nigerian vowel systems within each main sub-family, illustrating the most common inventories and some more unusual ones. §3 then looks at a number of West Chadic languages which have highly unusual vowel systems, and offers some explanation as to how these systems developed. It also looks at the distribution of languages with 9 and 10 vowel systems, and shows how many of these have been preserved by being in contact with each other. §3 ends with some comments about the presence of fricative vowels in some Southern Bantoid languages. Finally, §4 gives a brief summary of the findings, and discusses their implications for further research.

2 A typological overview of Nigerian vowel systems

Perhaps the clearest observation from the survey of Nigerian vowel systems is that, with one possible exception, no Nigerian language has so far been found with more than 10 vowels. This is in line with the suggestion that Proto-Niger-Congo had a symmetric 10-vowel system (Williamson 1989), since one might expect all its daughter languages to have 10 vowels or less. Chadic languages rarely have more than 6 vowels, as Proto-Chadic is considered to have had between one and four vowels (Wolff 2008, Newman 2006). However, since some Eastern Kru languages have up to 13 vowels, which have likely developed from a Proto-Kru system with 9 vowels (Zogbo 2016), and even just across the border from Nigeria, Voll (2017: 33–43) describes a 17-vowel system for Mundabli [boe] in Cameroon which has developed four additional vowels from a 13-vowel system, there is no reason to assume that a similar process could not have occurred in Nigerian languages.[4] Indeed, in the case of Dadiya [dbd], which constitutes the sole exception to the 10-vowel limit, such a process does appear to have taken place: an original 9-vowel system has produced two extra vowels through the centralisation of mid-vowels in non-prepausal contexts (Coleen Starwalt, personal communciation). Table 2 shows the number of Nigerian languages with each number of vowels. Niger-Congo, West Chadic and Central Chadic languages have been split up since their vowel systems are quite distinct, and so lumping them altogether is not particularly helpful in terms of revealing typological patterns.

Another observation from the data in Table 2 is that there are relatively few languages (n=16) which have retained the proposed 10-vowel system of Proto-Niger-Congo. Over three quarters of Niger-Congo languages have reduced 7, 8 or 9 vowel systems, with a 7-vowel system seeming reasonably stable since it accounts for 43% of languages. Only two Niger-Congo languages were found with fewer than 5 vowels.

Table 2: Vowel systems in Niger-Congo, West Chadic and Central Chadic

	Niger-Congo (189)		West Chadic (33)		Central Chadic (19)	
No. vowels	*n*	%	*n*	%	*n*	%
10	15	8	1	3	-	-
9	32	17	1	3	-	-
8	26	14	-	-	1	5
7	81	43	2	6	-	-
6	19	10	18	55	-	-
5	14	7	10	30	-	-
4	2	1	-	-	5	26
3	-	-	-	-	6	32
2	-	-	1	3	6	32
1	-	-	-	-	1	5

The data in Table 2 is perhaps more helpfully illustrated in Figure 1, which shows the percentage of languages within each family with different numbers of vowels.

[4] The bracketed abbreviation following language names indicates the ISO 693-3 code for the language.

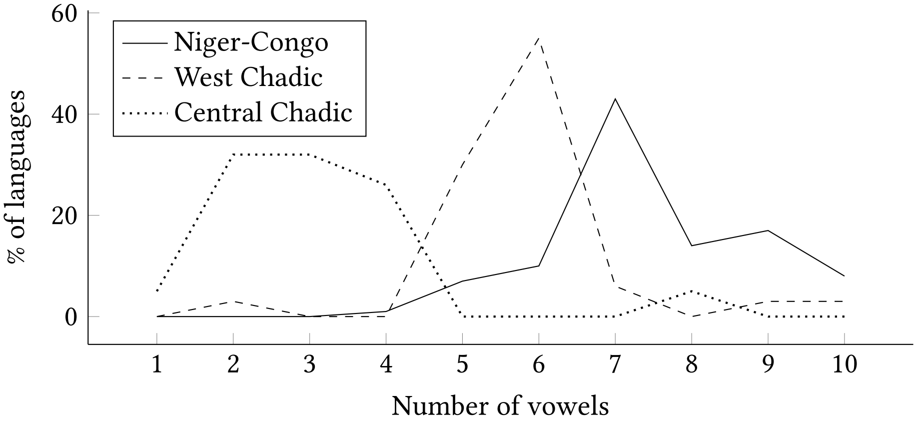

Figure 1: Basic vowel inventory size in Nigerian language families

Taking a closer look at Niger-Congo, it is clear that the different sub-families don't all have the same distribution of vowel systems. Some, like Defoid, Idomoid and Ijoid have fairly homogenous vowel systems, whereas others, like Jukunoid, Cross-River and Plateau have fairly diverse systems. Table 3 shows the distribution of vowel systems within several of the sub-families of Niger-Congo. Significantly, Cross-River (the largest sub-family in Nigeria) has the most languages with a full 10-vowel system, with twice as many such languages as all the other sub-families put together. This, together with its diverse range of vowel systems, and the fact the Cross-River area is one of the main language diversity hotspots (in terms of number of distinct languages) on the planet, is consistent with the hypothesis that it was the original homeland of Proto-Niger-Congo.[5] Nupoid on the other hand is the sub-family with the most reduced vowel systems, with half of its languages now having a 5-vowel system.

Unsurprisingly, the four most common vowel systems (>10%) are symmetrical, triangular systems, that make maximal use of the phonetic vowel space. The four inventories in Figures 2 and 3 account for 62% of the 247 languages in the survey. The 9 and 7 vowel systems are particularly common among Niger-Congo languages, whilst the 6 and 5 vowel systems are typical of West Chadic languages. In the latter two cases, there is often ambiguity about the exact realisation of the high central vowel [ɨ/ə] and/or the mid vowels [e/ɛ] and [o/ɔ], which is why these pairs have been lumped together in the West Chadic inventories in Figure 3.

[5]The same principle of locating the area of greatest diversity was used by geneticists to trace the original homeland of modern man to Eastern sub-Saharan Africa (Cook 2003: 13).

Table 3: Vowel systems within some sub-groups of Niger-Congo

# of vowels	Ijoid (8)	Cross-River (29)	Kainji (19)	Plateau (26)	Edoid (22)	Idomoid (9)	Igboid (7)	Nupoid (12)	Defoid (7)	Jukunoid (13)	Bantoid (19)	Adamawa (9)
10	-	10	1	-	1	-	-	-	-	1	-	2
9	6	1	1	4	6	1	4	2	-	1	2	3
8	-	3	7	1	2	-	3	-	-	-	8	2
7	2	13	2	15	13	7	-	4	7	2	6	1
6	-	1	8	1	-	-	-	-	-	5	3	1
5	-	1	-	2	-	1	-	6	-	3	-	-
4	-	-	-	1	-	-	-	-	-	1	-	-

9 vowels		7 vowels	
i	u	i	u
ɪ	ʊ		
e	o	e	o
ɛ	ɔ	ɛ	ɔ
a		a	

29 languages (11.7%)
e.g., Ịjọ, Ikwere

67 languages (27.1%)
e.g., Berom, Igala

Figure 2: Most common vowel systems (mainly Niger-Congo)

6 vowels			5 vowels	
i	ɨ/ə	u	i	u
e/ɛ		o/ɔ	e/ɛ	o/ɔ
	a		a	

31 languages (12.6%)
e.g., Angas, Saya

26 languages (10.5%)
e.g., Hausa, Bole

Figure 3: Most common vowel systems (mainly West Chadic)

The 7-vowel system listed in Figure 2 may not turn out to be as common as first thought. It has often been assumed by analysts that the near-high vowels /ɪ/ and /ʊ/ are missing from such a system, but it is entirely possible that it is actually the mid vowels /e/ and /o/ that are missing instead, especially as the [ɪ]/[e] and [ʊ]/[o] distinctions are notoriously difficult for Western researchers to hear. However, if the language has vowel harmony, then a quick look at vowel distributions may reveal which is the more likely answer. The Plateau language Iten [etx] is just such an example of a language which has recently been re-analysed as having [ɪ] and [ʊ] instead of [e] and [o] (Kutsch-Lojenga, personal communication). Indeed, an identical system has been posited for Proto-Guang (Stewart 1970) and Proto-Bantu (Stewart 1983), and is found in many present day Bantu languages such as Kinande [nnb], as well as elsewhere, both inside and outside Niger-Congo (Casali 1995). It is also possible that some languages that have been analysed as 7-vowel languages are in fact 9-vowel languages, and that [ɪ] and [ʊ] have not been distinguished from either [i] and [u] or [e] and [o], as discussed in Boyd (2015) and Casali (2017). Koro Wachi [bqv] is one recent example, where the [i]/[ɪ] and [u]/[ʊ] distinctions had not been fully detected until closer phonetic analysis and vowel harmony cooccurence restrictions showed otherwise. Furthermore, there are languages with 9 phonemic vowels, in which /ɪ/ and /ʊ/ have merged phonetically with /e/ and /o/, even though their distinction is still maintained at a phonological level. Such a situation is found in south-west Edoid languages like Okpẹ (Hoffman 1973), Uvwiẹ (Omamor 1973) and Urhobo (Aziza 2008). Elugbe (1983) reports that in some other Edoid languages, /ɪ/ and /ʊ/ have instead merged with /i/ and /u/ or occasionally with /ɛ/ and /ɔ/.

The next most common systems (5–10%) are the symmetric, triangular 10 and 8 vowel systems, shown in Figure 4.

10 vowels				8 vowels		
i		u		i		u
ɪ		ʊ				
e	ə	o		e	ə	o
ɛ		ɔ		ɛ		ɔ
	a				a	
15 languages (6.1%)				11 languages (4.5%)		
e.g., Abureni, Awak				e.g., Mbembe, Lokəə		

Figure 4: Other common vowel systems

Like the 7 and 9-vowel systems, these systems are almost exclusively found in the Benue-Congo family. The picture that emerges, assuming that at least

Proto-Benue-Congo did have a 10-vowel system, is that the first vowels to disappear were typically [ə], followed by [ɪ] and [ʊ], as shown by Elugbe (1983) for a number of Edoid languages. As noted by Casali (1995: 111), the prevalence of 7 and 9-vowel systems across language subfamilies within Benue-Congo is hard to explain without positing that such losses occurred on multiple occasions. It is likley that some of the resulting 7-vowel languages subsequently regained a schwa-type vowel through a process of centralisation in certain contexts, similar to what has happened in several Kru languages (Zogbo 2016). The same process has almost certainly produced the extra central vowel in most of the Chadic 6-vowel systems from the equally common 5-vowel systems shown in Figure 3. This can be seen from comparing cognates in related languages such as Bole [bol] and Karekare [kai], where words in Bole such as [bìdò] 'monkey' and [bùtó] 'ashes' appear in Karekare as [bɨ̀dò] and [bɨ̀tó] (my transcription) respectively (Schuh 2009: vi).[6]

The Central Chadic languages present a particularly interesting contribution to the list of vowel inventories, since they account for they vast majority of the 1, 2 and 3 vowel systems, shown in Figure 5. Proto-Central-Chadic has been reconstructed with a maximum of three vowels (Gravina 2014), although Wolff (2017) reports that most Central Chadic languages can be analysed with maximally two vowels (/a/ and /ə/), or just one (/a/) or none at all, depending on the level of abstractness.

1, 2 or 3 vowels

(ɨ)

(ə)

a

10 languages (4%)
e.g., Glavda, Nzanyi, Guɗe

Figure 5: Typical Central Chadic vowel systems

The analysis of such languages is frequently ambiguous; on the surface, many appear to have a 7-vowel system with three central, two front and two back vowels, with all 7 vowels seemingly contrastive. However, underlyingly most of them

[6]Interestingly, even though Karekare speakers pronounce both of these words with a high central vowel, they are still aware that the vowels in question are underlyingly different, and they write them as ⟨i⟩ and ⟨u⟩ accordingly.

can be analysed as having either one or two vowels, with an additional, non-low, epenthetic vowel, which is entirely predictable. Nzanyi [nja], for example, has a 2-vowel system (/a/ and /ə/), plus an epenthetic [ɨ], which is inserted during the process of syllabification. The two non-low, central vowels interact with labialised and palatalised consonants as shown in Table 4, to produce a surface 7-vowel system.

Table 4: Nzanyi vowel changes with labialised and palatalised consonants

Unmodified	Palatalised	Labialised
Cɨ	Ci	Cu
Cə	Ce	Co
Ca	C^{j}a	C^{w}a

The nature of the underlying vowels can be seen from certain morphological processes, such as nominal and verbal plurality, which in Central Chadic languages often involve an infixed /a/ or /ə/ (Harley 2021). In Nzanyi, the plural /ə/ infix is shown by the data in Table 5.

Table 5: Nominal plurality in Nzanyi (data from Benson (2013))

Gloss	Singular		Plural	
	Surface	Underlying	Surface	Underlying
‘man’	[múɾə́]	/m^{w}ɾ-ə/	[móɾí]	/m^{w}-ə-ɾ-j/
‘bead’	[músɨ̀ɾə́]	/m^{w}sɾ-ə/	[mósə̀ɾí]	/m^{w}-ə-s-ə-ɾ-j/
‘thief’	[màhɨ́ɾə́]	/mahɾ-ə/	[màhə́ɾí]	/mah-ə-ɾ-j/
‘whiteness’	[púɗə́]	/p^{w}ɗ-ə/	[póɗí]	/p^{w}-ə-ɗ-j/
‘thing’	[sə́]	/s-ə́/	[ʃí]	/s-j́/

All other vowel systems found in the database could be considered marginal (<4%), including the balanced triangular systems, shown in Figure 6.

The 8-vowel system in Figure 6 is found in a few Western Kainji languages, and the 7-vowel system occurs in some Plateau languages. The four vowel system occurs only in Central Chadic languages. Asymmetric systems are far less common than symmetric systems. Back-heavy systems with more back vowels than front vowels (shown in Figure 7) tend to be more common than front-heavy

8 vowels		
i	ɨ	u
e		o
ɛ		ɔ
	a	

6 languages (2.4%)
e.g., C'Lela, Dukawa

7 vowels		
i	ɨ	u
e/ɛ	ə	o/ɔ
	a	

7 languages (2.8%)
e.g., Jju, Tyap

4 vowels		
i	ɨ/ə	u
	a	

5 languages (2%)
e.g., Bura, Tera

Figure 6: Less common triangular systems

systems with more front vowels than back vowels (shown in Figure 8). This is perhaps surprising as worldwide studies on vowel systems have found that the reverse is true, namely front-heavy systems tend to be more common than back-heavy systems (Schwartz et al. 1997, Ruhlen 2004, Moran et al. 2014, Hitch 2017, Maddieson & Precoda 2018).

These back-heavy systems show that the front mid vowels [e] and [ɛ] and the near-close vowel [ɪ] tend to be much more unstable than the high or low vowels, either merging with other vowels, or becoming centralised to [ə] or [ɨ]. An analogous situation occurs among front-heavy systems, which are usually missing the near close vowel [ʊ] and one or more of the mid vowels [o] and [ɔ], as shown in Figure 8.

There are a number of general observations that can be made from these inventories. Firstly, with the exception of Kamwe, one can say that if a Nigerian language has any front vowels at all, they will include /i/. Secondly, with the exception of Limbum, if a language has any back vowels, they will include /u/. Thirdly, with the exception of Afade, if a language has any central vowels, they will include /a/. If you exclude the Central Chadic languages, which constitute a somewhat unusual case, then with the exception of Limbum, one can say that all Nigerian languages contain the three vowels /i/, /a/ and /u/, although no Nigerian language contains only these three vowels. These facts together with the general preference for 9, 7 and 5 vowel triangular systems suggests that there is a strong tendency to maximise the phonetic vowel space, and that the five vowel system with two high, two mid and one low vowel is stable enough to resist any further attempts at reduction.

10 vowels

i		u
ɪ		ʊ
e		o
		ɔ
	a	ɑ

e.g., Wannu

9 vowels

i		u
ɪ		ʊ
	ə	o
ɛ		ɔ
	a	

e.g., Kuce

9 vowels

i	ɨ	ɯ u
		ʊ
e		o
ɛ		ɔ
	a	

e.g., Len Mambila

8 vowels

i		u
ɪ		ʊ
e		o
		ɔ
	a	

e.g., Igbo, Ika

8 vowels

i	ɨ	u
e	ə	o
		ɔ
	a	

e.g., Vute

8 vowels

i		u
		ʊ
e		o
ɛ		ɔ
	a	

e.g., Ẹmalhẹ, Ibilo

8 vowels

i	ɨ	u
		ʊ
e		o
		ɔ
	a	

e.g., Iceve-Maci

8 vowels

i		u
e		ɤ o
ɛ		ɔ
	a	

e.g., Afade

7 vowels

i		u
e	ə/ʌ	o
		ɔ
	a	

e.g., Ibibio

7 vowels

i	ɨ	u
		o
ɛ		ɔ
	a	

e.g., Iyive, Mada

6 vowels

i		u
e		o
		ɔ
	a	

e.g., Tiv, Cicipu

4 vowels

i		u
		o
	a	

e.g., Jibu

Figure 7: Asymmetric back-heavy vowel systems

9 vowels

i		u
ɪ		
e	ə	o
ɛ		ɔ
	a	

e.g., Hõne

9 vowels

i y		u
e		o
ɛ œ		ɔ
	a	

e.g., Gaa

8 vowels

i		u
ɪ		
e		o
ɛ		ɔ
	a	

e.g., Ito

7 vowels

i	ɨ	
e		o
ɛ		ɔ
	a	

e.g., Limbum

7 vowels

i y		u
	ə/ʌ	o
ɛ		
	a	

e.g., Western Ejagham

7 vowels

i		u
ɪ		
e	ə	o
	a	

e.g., Yamba

7 vowels

i	ɨ	u
e		o
æ	a	

e.g., Kuteb

7 vowels

i	ɨ/ə	u
e		o
ɛ		
	a	

e.g., Hyam

6 vowels

i		u
e		
ɛ		ɔ
	a	

e.g., Rigwe

4 vowels

i		
e	ə	
	a	

e.g., Fali, Kirya

3 vowels

i		
	ə	
	a	

e.g., Dghweɗe

3 vowels

e	ə	
	a	

e.g., Kamwe

Figure 8: Asymmetric front-heavy vowel systems

3 Areal features and the effect of language contact on vowel inventory

From a large survey of languages such as this, it is easy to spot certain typological anomalies. The question then arises as to the causes of such innovations. This section looks at a number of such cases, and argues that language contact is the likely cause in each case. §3.1 looks at some of the few West Chadic languages with more than 6 vowels. §3.2 then examines the loss and retention of vowels in the 9 and 10 vowel systems of various families in southern Nigeria. Finally, §3.3 comments on the presence of "fricative" vowels in a couple of Bantoid languages.

3.1 West Chadic

According to Eberhard et al. (2021), there are 71 West Chadic languages in total, all located in Nigeria (shown in purple in Figure 9).[7] The three circles in Figure 9 contain areas where there are West Chadic languages with typologically anomalous (for West Chadic) properties, and it is clear that these are precisely the areas in which West Chadic is most fragmented and therefore have potentially had the most contact with non-Chadic languages. As mentioned earlier, most West Chadic languages have standard 5 or 6 vowel systems, with either one or two central vowels. Indeed, 27 out of the 33 West Chadic languages in this survey (82%) have such systems. Only four West Chadic languages in the database (Ywom, Goemai, Kushi and Tangale) have more than 6 vowels. The first two are located within the middle circle in Figure 9 and the latter two in the right hand circle.

3.1.1 Ywom and Goemai

Ywom [gek] and Goemai [ank] (both located in the middle circle in Figure 9) have typologically unusual vowel systems in that they both have 7 vowels, including 3 central vowels, as shown in the inventory in Figure 10, and they are the only West Chadic languages known to have such an inventory.

Few non-Chadic languages in Nigeria have 3 central vowels, but one of the few that does is Tarok, which happens to be an immediate neighbour of both Ywom and Goemai, as shown in Figure 11. This immediately raises the possibility that they picked up their extra central vowel through contact with Tarok. The question then is: Is there any evidence of contact between these three languages?

[7] All the maps in this paper were produced, with permission, using the Ethnologue GIS dataset (Lewis 2009) and adapted using the QGIS mapping software program.

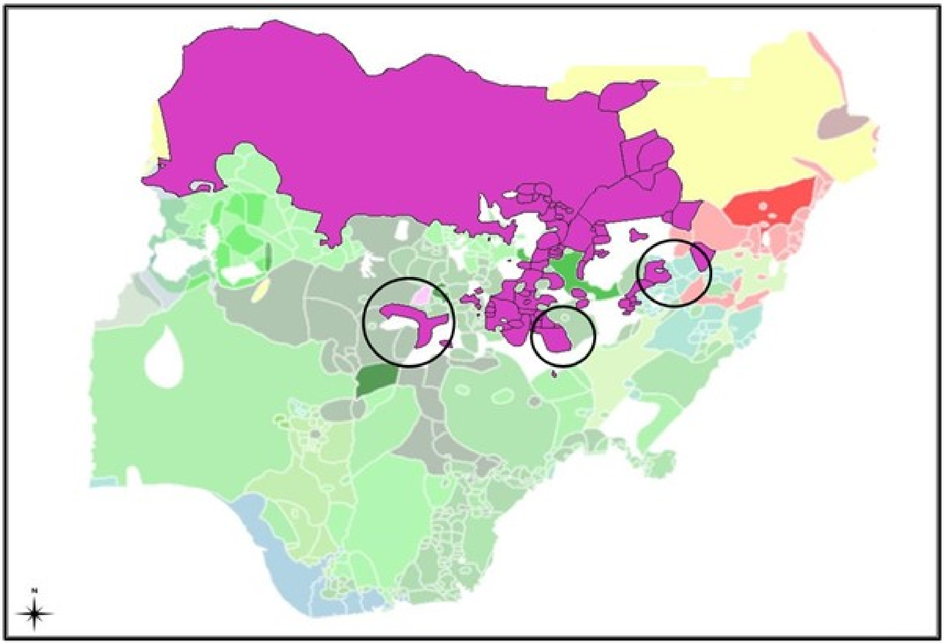

Figure 9: The three main areas of atypical vowel systems in West Chadic

i	ɨ	u
e	ə	o
	a	

Figure 10: Ywom and Goemai vowel inventory

As it turns out, there is quite a lot of evidence. Firstly, Tarok and Goemai are among the main second languages spoken by the Ywom, suggesting that the Ywom have had a long exposure to both languages. Secondly, Ywom oral tradition says that the first Ywom clan, the Pitop, originally came from the Goemai (Blench 2013), and some Tarok clans also trace their origin to the Ywom and the Goemai (Longtau 2004). This is further supported by the fact that many southern Tarok place names are of Ywom origin, and it is likely their inhabitants are in part assimilated Ywom (Blench 2013). Thirdly, among the cognates between Tarok and various Chadic languages, the overwhelming number are of Tarok origin, suggesting that the direction of borrowing was from Tarok into Chadic.

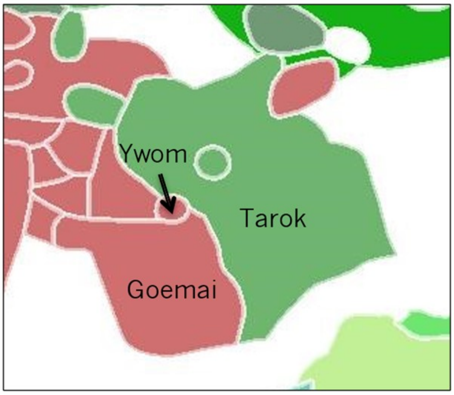

Figure 11: Ywom, Goemai and Tarok

However, it must also be pointed out that Ywom also has the labial-velar plosives /kp/ and /gb/, which are highly unusual for a Chadic language, but few words containing them have cognates in Tarok, suggesting many of them have their origin in other nearby Benue-Congo languages. Nevertheless, the likelihood that both Ywom and Goemai developed an additional central vowel through contact with Tarok remains fairly strong.

3.1.2 Tangale and Kushi

Tangale [tan] and Kushi [kuh], located in the right hand circle in Figure 9, have developed even larger vowel inventories, with 9 and 10 vowels respectively, shown in Figure 12. Such systems are extremely rare within Chadic, and indeed Kushi is the only Chadic language (out of about 190) known to have 10 vowels. Furthermore, both languages have acquired cross-height vowel harmony based on the feature ATR, equally rare in Chadic.

	Kushi				Tangale	
i		u		i		u
ɪ		ʊ		ɪ		ʊ
e	ə	o		e		o
ɛ		ɔ		ɛ		ɔ
	a				a	

Figure 12: Kushi and Tangale vowel inventories

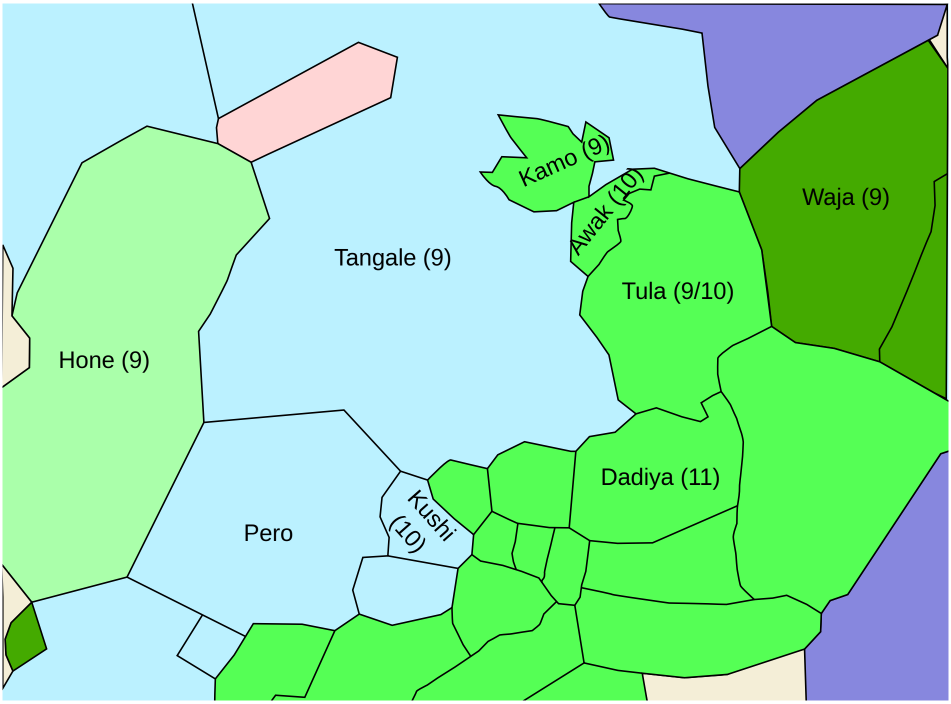

Figure 13: Kushi, Tangale and neighbouring languages

Kushi and Tangale form part of a band of Chadic languages (in light blue in Figure 13) sandwiched between a band of Adamawan languages (in dark green) on the right, and Hõne, a Jukunoid language (in light green) on the left. Several of these surrounding languages (including Hõne, Awak and Waja) have 9 or 10 vowel systems with ATR harmony, and many of them are potential sources of these features in Kushi and Tangale (Kleinewillinghöfer 1990). Hõne emerges as the primary candidate, as there are numerous Jukunoid loans in neighbouring Chadic and Adamawa languages, but very few Chadic loans in Jukunoid. Storch (2002) attributes this to the cultural and political superiority of the Jukun speaking groups during the medieval Kororofa empire. She comments that, "Closely knit economic networks, slavery, intermarriage, and – above all – the spiritual and magic powers of the Jukun sacred kings and priest chiefs were [catalysts] for an intensive contact and diglossia situation" (Storch 2002: 12). This is supported by the fact that most Jukun loan words in Chadic belong to the religious and socio-political semantic domains (e.g., yámbà 'mother creator God'). However, Storch also shows how expanded vowel systems have had a variety of causes in some Jukunoid and Chadic languages, including compensation for morphological reduction, the loss of certain consonant distinctions, or as a device for noun classification and number marking (Storch 2002: 7–9). ATR harmony has also been identified as a feature of the old Central Nigeria Sprachbund (Jungraithmayr & Leger 1993, Kleinewillinghöfer 2002), as well as Clements & Rialland's (2008) "Sudanic belt" and Güldemann's (2008) "Macro-Sudan belt" although the more recently proposed "West African ATR zone" (Rolle et al. 2020) does not extend quite as far east as Kushi and Tangale and the neighbouring Adamawan languages. Instead these languages form a rather anomalous geographic cluster of 9/10 vowel languages with ATR harmony towards the western end of their "Central African ATR-deficient" zone, a situation which remains to be fully explained.

3.1.3 Gwandara

Gwandara [gwn], spoken just to the northeast of the capital Abuja, is arguably the West Chadic most isolated from the rest of the group, and is the language most closely related to Hausa. To the northeast lie the Plateau languages Ashe, Waci, Duya and Nyankpa (shown in light green in Figure 14); to the northeast, east and southeast lie the Nupoid languages Gbagyi, Gbari and Gade (shown in dark green); and to the south and southwest lie heavily populated urban areas with mixed language populations (shown in white). Gwandara has a typical Chadic 5-vowel system (/i/, /e/, /a/, /o/, /u/) but most unusually for Chadic, it also has three nasal vowels (/ĩ/, /ã/, /ũ/), quite possibly the only West Chadic language to do so.

All of the surrounding languages except Gade and Nyankpa have nasal vowels, although Gbagyi lacks /ã/, so Gbari or any of several Plateau languages to the northeast are possible candidates. However, there are also three isolated pockets of Gwandara further east, surrounded by swathes of other Plateau languages, so one possible scenario is that at some point Gwandara got cut off from the main L1 Hausa speaking area and was subsequently fragmented by a Plateau expansion, during which there would likely have been a reasonable degree of interaction between the two groups. Unfortunately, there is not enough data available to comment on shared cognates between the two groups, and so the origin of nasal vowels in Gwandara still remains unclear. However, elsewhere in Nigeria, Rolle (2013: 243) showed that the distribution of nasal vowels in Edoid is more determined by areal proximity than it is by genetic affiliation, with Western and Southern Edoid languages acquiring nasal vowels through contact with Yoruba and Ijoid respectively.

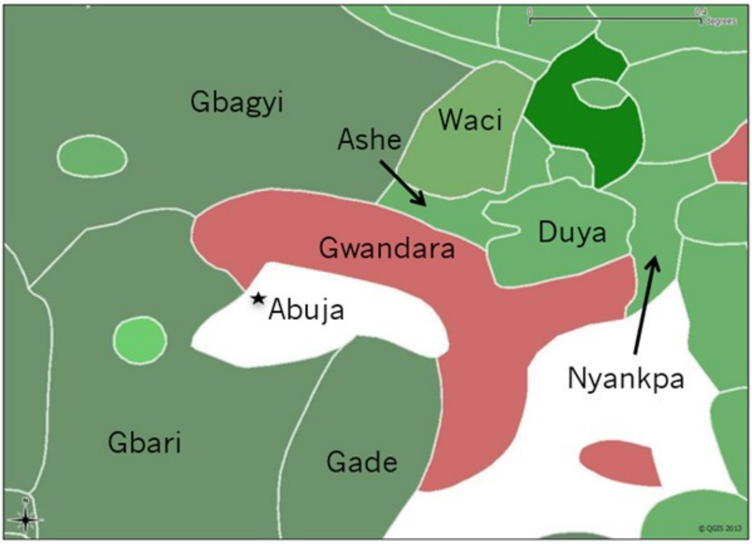

Figure 14: Gwandara and its neighbours

3.2 Southern language clusters with 9 and 10 vowel systems

Assuming Williamson's (1989) claim of Proto-Niger-Congo having a triangular 10-vowel system is correct, it is perhaps surprising that so few current Niger-Congo languages in Nigeria have retained such a system. Only 14 of the 189 Niger-Congo languages in the database have such as system, with a further 28 having lost the schwa, resulting in a triangular 9-vowel system. One might expect these to fairly evenly scattered throughout Nigeria, but from looking at the distribution of such languages, what is striking is that the vast majority of them are in close contact with each other, regardless of which family they belong to. This suggests a direct link between vowel inventory size and language contact, namely that languages with large vowel inventories are most likely to retain them if they are in contact with languages with similar inventories, and conversely that languages are more likely to lose certain vowel contrasts if they are in regular contact with other languages with smaller inventories. The outcome of this is that there is a area in the southern coastal region of Nigeria which can be termed the "main 9/10-vowel retention zone" in Nigeria. Evidence for this will be presented by looking at languages within three different sub-families within Niger-Congo: Ijoid, Edoid, and Cross River.

3.2.1 Ijoid

The Ijoid family comprises 10 languages spoken along the coastal belt of the central Niger Delta, as shown in Figure 15.

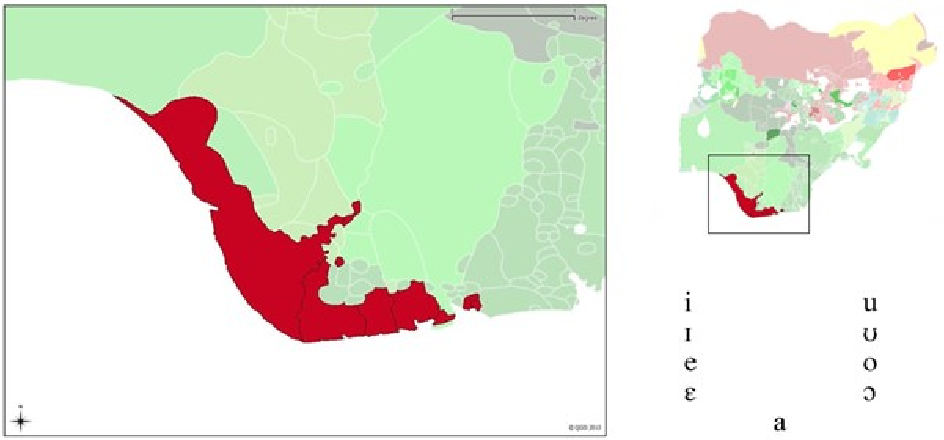

Figure 15: The Ijoid languages and a typical Ijoid vowel system

Proto-Ijoid has been reconstructed with 10 vowels (Williamson & Blench 2004), although all but two Ijoid languages currently have the 9-vowel system shown in Figure 15. A small eastern enclave of two Ijoid languages, Defaka and Nkọrọọ, are separated from the main swathe of Ijoid by a number of geographically compact Cross River languages, and both languages have a 7-vowel systems, having lost /ɪ/ and /ʊ/. Today, Defaka is in a moribund state, with most Defaka people speaking Nkọrọọ, which is itself highly threatened.

Both languages share an eastern border with Obolo (see Figure 16), a fairly widely spoken Cross River language with 6 vowels, and it is certainly possible, as Williamson (1989: 110) suggests, that both Defaka and Nkọrọọ lost /ɪ/ and /ʊ/ due to extensive interaction with their Obolo neighbours. Thus it appears that being separated from the rest of the 9-vowel Ijoid group, plus being in contact with a language with a smaller vowel system were both factors in the reduction of their vowel systems.

3.2.2 Edoid

Edoid is a family of 31 languages, mostly located in a broad column to the west of the Niger River from the Ijoid area up to the Niger-Benue confluence at Lokoja (Figure 17). Proto-Edoid has been reconstructed with 10 vowels (Elugbe 1983),

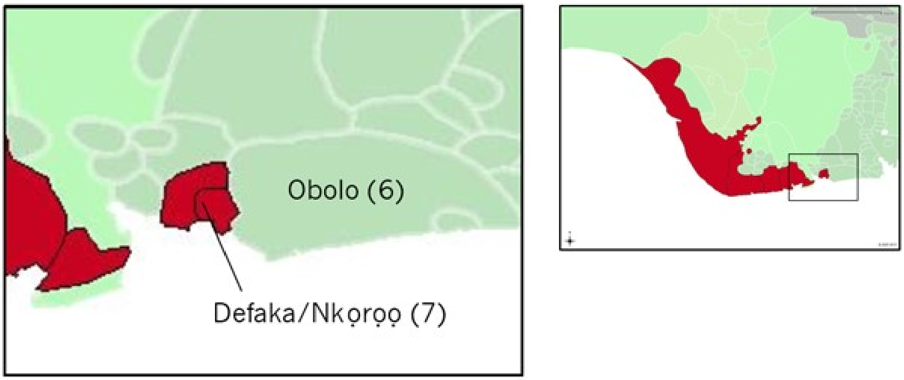

Figure 16: Defaka and Nkọrọọ

although in the database (22 Edoid languages) only one Edoid language, Dẹgẹma, has retained the original system. A further six languages having a reduced 9-vowel system, two others, Okpamheri and Ibilo, having an 8-vowel system, and the rest having a 7-vowel system.

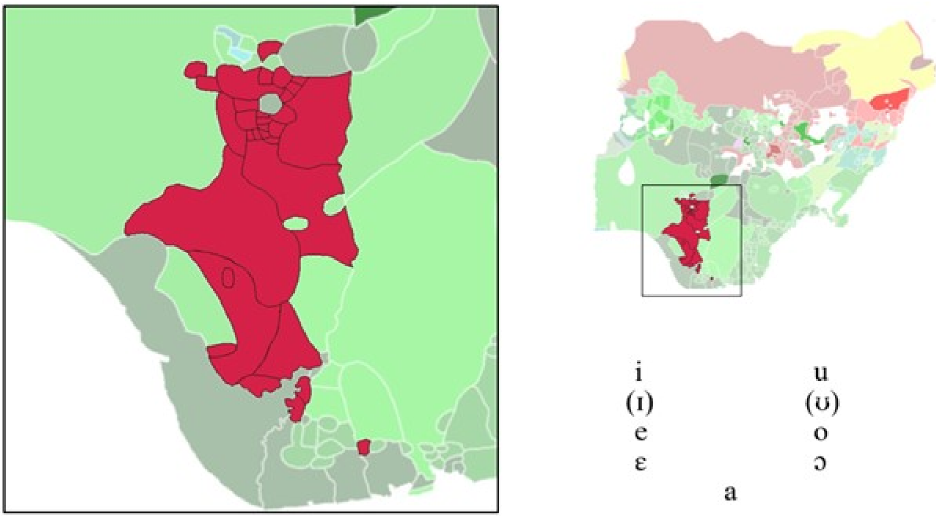

Figure 17: The Edoid languages and a typical Edoid vowel system

Edoid presents one of the clearest pieces of evidence for the relationship between language contact and vowel inventory. Firstly, the southern-most Edoid language, Dẹgẹma (the only Edoid language with 10 vowels), is not only cut off from the rest of Edoid, but also happens to be adjacent to a cluster of Cross River languages, all of which have 10 vowel systems (Figure 18).

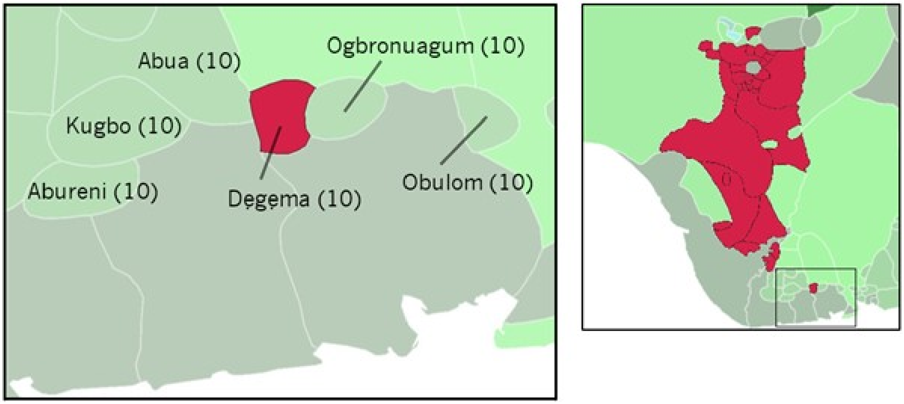

Figure 18: Dẹgẹma and the surrounding languages

Secondly, all six of the 9-vowel Edoid languages are at the southern end of the Edoid column, and are in contact with Ijoid and or other 9-vowel languages such as Ekpeye (Figure 19). The only other Edoid language in that southern cluster is Urhobo, which has recently reduced its vowel system from 10 to 7, although it could be argued that /ɪ/, /ʊ/ and /ə/ still function at an abstract level (Aziza 2008). This reduction is likely due to the influence of its large northern neighbour Edo. Okpẹ, which is completely surrounded by Urhobo, is similar, with an underlying 9-vowel system, in which /ɪ/ and /ʊ/ have merged phonetically with /e/ and /o/ (Hoffman 1973).

Thirdly, there are two northern Edoid lects in the database with 8 vowels, Ibilo and Emalhe, listed in the Eberhard et al. (2021) as dialects of Okpamheri. This seems a little surprising, as all the surrounding Edoid languages have 7 vowels. However, there is a geographically isolated pocket of the Nupoid language, Ebira, with 9-vowels, located immediately to the south of Okpamheri, and all three lects are connected by a main road running from Ibilo to Igarra, which has presumably resulted in a reasonable degree of contact between them, resulting in a delayed reduction in their vowel systems.

It is also noticeable that several Igboid and Defoid lects which are adjacent to the 9-vowel Edoid area also happen to have 9-vowel systems. To the east of the Edoid area, the three Igboid languages, Ikwere [ikw], Ekpeye [ekp], and Ukwuani [ukw] all have 9-vowel systems, whilst nearly all other Igboid languages have 8-vowel systems. To the west of the Edoid area, several eastern dialects of

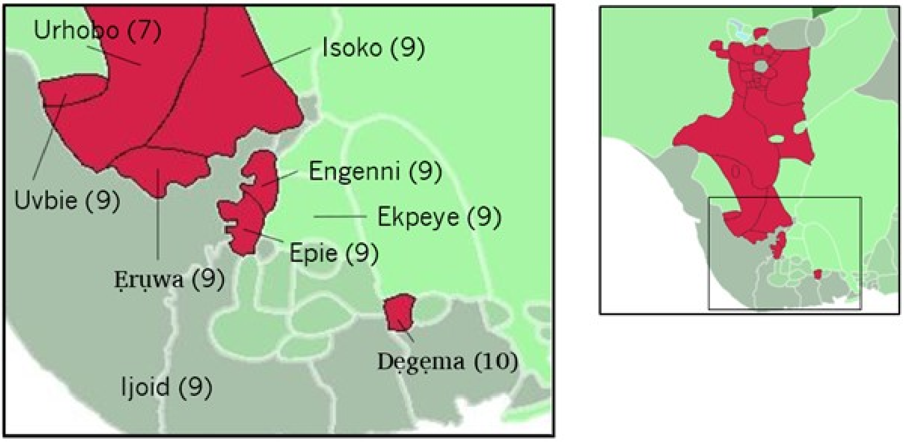

Figure 19: The 9-vowel Edoid languages

Yoruba (e.g., Ijẹṣa, Irun, Ifaki, and Ekiti) all have 9-vowel systems, whilst other dialects have 7-vowel systems. Capo (1985) attributes this to prolonged contact with 9 and 10-vowel Edoid languages and the 9-vowel Nupoid language Ebira, spoken on the eastern Yoruba borderland. He reports that what happened in Yoruba is that the rather unstable nasal vowels /ẽ/ and /õ/ merged with /ɛ̃/ and /ɔ̃/ in most dialects, but in the eastern dialects, stem-final /ẽ/ and /õ/ became /ɪ̃/ and /ʊ̃/, which eventually led to a 9-vowel system with cross-height vowel harmony through assimilation.

3.2.3 Cross River

The Cross River family represents the largest and most diverse of Nigeria's language families listed in Table 1, with 67 languages. They are located in south-eastern Nigeria between the Niger Delta and the southern Nigeria-Cameroon border, as shown in Figure 20. No previous studies have attempted to identify the vowels of Proto-Cross River, although as Cross River contains more than three times as many 10-vowel systems in the database as all the rest of Benue-Congo, together with the fact that Proto-Benue-Congo is thought to have had such a system, it is reasonable to posit that Proto-Cross-River also had a 10-vowel system. Today, Cross River languages have between 5 and 10 vowels, with the majority having either 7 or 10, and some languages, like Ibibio, having different vowel systems depending on the dialect (Essien 1984, 1990). Faraclas (1986) attributes the loss of vowel contrasts in Lower Cross languages to a process of assimilation between root vowels and prefix vowels (Faraclas 1986: 45).

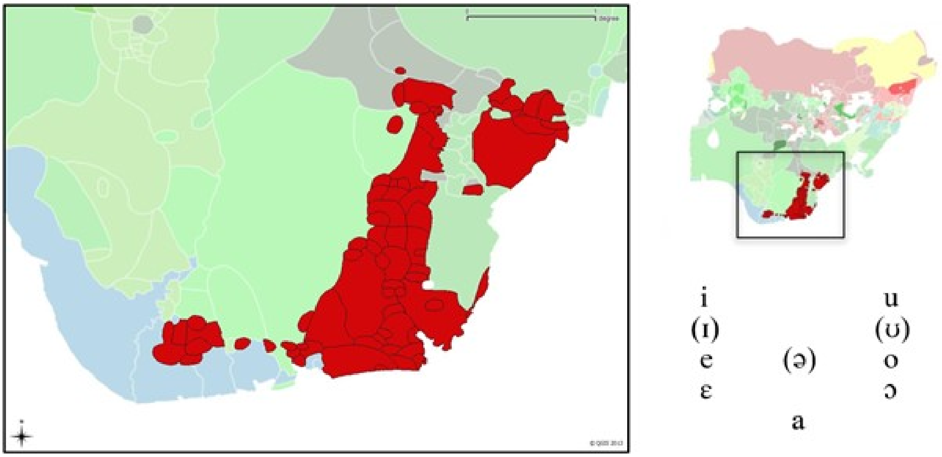

Figure 20: The Cross River languages and their vowel systems

From the map of Cross River languages, one can see that there is a isolated cluster of languages on the south-western side, just north of the Ijoid area in the Niger Delta (see Figure 21). These comprise the eight Central Delta languages, one of the main sub-branches of Cross River. All eight languages have 10-vowel systems, making it the primary cluster of such systems anywhere in Nigeria, and possibly anywhere within the whole of Benue-Congo.

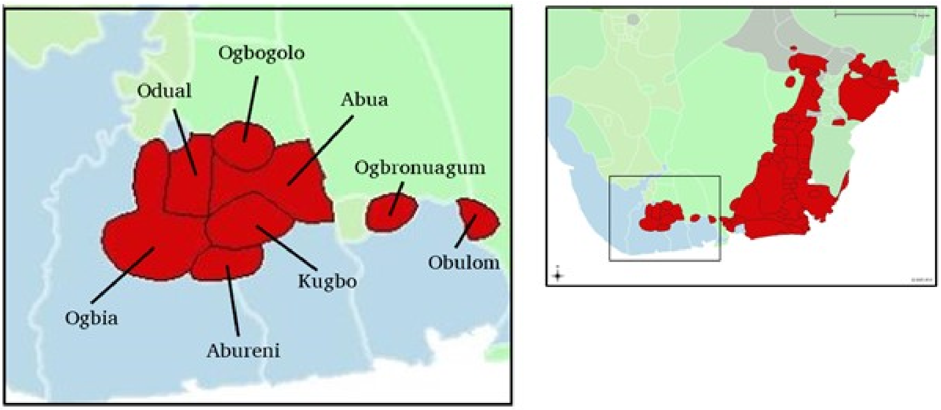

Figure 21: The Central Delta languages

The other two Cross River languages in the database with a 10-vowel system are Agoi [ibm], and Hohumono [bcs], spoken in the area either side of the town of Ugep, about two-thirds up the main central column of Cross River languages.

They are not contiguous languages, but both share a border with Agwagwune [yay], which has 9 vowels and Lokəə [yaz], which currently has an 8-vowel system, recently reduced from a 10-vowel system (Runsewe 1982). The contrast between the +/-ATR high vowels in Lokəə doesn't occur on the surface, but shows up when high vowel stems take mid vowel prefixes (Akinlabi 2009).

3.2.4 The main 9/10 vowel retention zone in Nigeria

From the preceding discussions of Ijoid, Edoid, Igboid, Defoid and Cross River, it is clear that the majority of the remaining languages with triangular 9/10 vowel systems in Nigeria form a contiguous area in the southern coastal region covering the whole of the Ijoid area and the adjacent areas to the north, as shown in Figure 22.

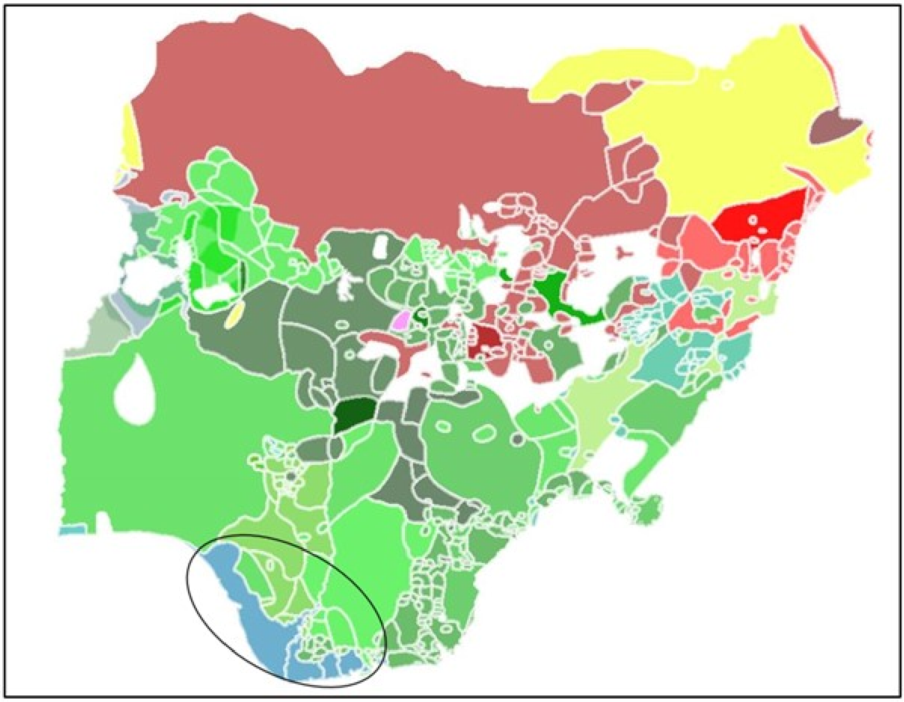

Figure 22: The main 9/10 vowel retention zone in Nigeria

Among the Nigerian Niger-Congo languages in the database, 9 out of 14 languages with a triangular 10-vowel system fall in this area, as do 17 out of the 28 languages with a triangular 9-vowel system. In other words, 62% of all Niger-Congo languages in the database with triangular 9 or 10 vowel systems occur in this area, making it the main 9/10 vowel retention zone in Nigeria. The reason for this is likely due to geography. Being a coastal region, mostly comprised of mangrove or fresh-water swamps or wet lowland rain forest, migratory movements in and out would have been greatly restricted compared to most other areas in Nigeria, which generally have drier, more accessible landscapes. Thus, limited contact with languages with smaller vowel systems would have slowed down the loss of vowel contrasts in this area, meaning that languages would be more likely to retain the proposed 10-vowel system of Proto-Benue-Congo. The main 9/10 vowel retention area in Nigeria could thus be considered a refuge zone (cf. Idiatov & Van de Velde 2021, Nichols 1990, 1992), an area where environmental conditions restrict contact between insiders and outsiders.

3.3 Fricative vowels in Bantoid

A final example of language contact affecting vowel inventory comes from the Len dialect of the Northern Bantoid language, Mambila [mzk], spoken on the Mambila Plateau, on both sides of the Nigeria-Cameroon border. This area is one of considerable linguistic diversity, characterised by relatively small linguistic populations, where several languages either have recently become extinct or are on the verge of extinction (Connell 1997). Eberhard et al. (2021) list 13 Mambiloid languages, although Mambila itself could more accurately be considered a dialect continuum comprising at least 20 different lects (Blench 1993, Connell 2007: 21). Vowel systems in Mambiloid, and in other Bantoid languages of the region, are extremely varied, having between 5 and 10 vowels with highly unusual inventories, often asymmetrical. One of the most striking features of Len Mambila and some nearby Grassfields Bantu languages such as Limbum [lmp], Yamba [yam], and Kom [bkm] is the presence of fricative vowels, vowel-like sounds involving either labiodental or palatal friction. Len Mambila is described by Connell (2007) as having a single fricative vowel with two allophones, /v͡ɯ/ and /ʑ͡i/, the first of which has labiodental friction, and the second which has alveolopalatal friction and only occurs following voiced labial stops and postalveolar fricatives. Elsewhere in Southern Bantoid, Faytak (2015, 2017) reports that fricative vowels have been attested in several Grassfields Bantu languages of northwestern Cameroon, particularly in the Ring and Mbam-Nkam subgroups, as well as in three Beboid languages (e.g., Noone [nhu], Hyman 1981), three Narrow Bantu languages of the A70 group (e.g., Fang [fan], Kelly 1974), and the Ekoid language Ekajuk[8] [eka] (Kleiner & Kleiner 1976). These latter two cases are interesting as

[8]In Ekajuk, the fricative vowel occurs with bilabial friction after bilabials and labiodental friction elsewhere. It is represented orthographically as ⟨v⟩.

they are located a considerable distance from the main Grassfields area, suggesting that there has been some historical contact between them and Grassfields languages, or fricative vowels (or at least the circumstances that might have given rise to them) should be reconstructed for Southern Bantoid.

In discussing how fricative vowels arose in Len Mambila, Connell (2007: 20) notes that Len is the only Mambiloid lect in which these sounds occur. This, together with the fact that Len is geographically close to many of the Grassfields Bantu languages that feature them, leads him to conclude that language contact was the cause. He suggests that, "the area now inhabited by Len speakers was formerly a Grassfields speaking region; the encroachment of Mambila speakers, conceivably intermarrying with Grassfields speakers, resulted in the assimilation of the Grassfields speakers and, ultimately, in the formation of Len" (Connell 2007: 31). Supporting this conclusion is the fact that there are many lexical items in Len which do not have cognates in other Mambila lects but do have cognates in nearby Grassfields languages (e.g., 'knee': Len - /dv͡ɰ/, Kom - /əlvʊ/, Proto-Bantu *du). As this example shows, fricative vowels often correspond to the first degree high vowels *i and *u typically reconstructed for Proto-Bantu, an observation that leads Connell to wonder whether such vowels were original produced with friction in Proto-Bantu, and were the trigger of the widespread process of consonant spirantisation, in which stops became fricatives before /i/ or /u/ (Schadeberg 1994-95). Faytak (2015) is doubtful of such a situation however, preferring to see high vowel fricativization and Bantu spirantization (as well as consonant aspiration as found in Bamileke languages) as distinct innovations to reinforce the unstable contrast between the first degree vowels *i and *u and the second degree vowels *ɪ and *ʊ of Proto-Bantu. He argues that fricative vowels are a fairly recent innovation, as they post-date several subgroup specific sound changes, such as the simplification of VV sequences in Proto-Central-Ring (Hyman & Jisa 1978). Their occurrence in languages further afield (like Ekajuk [eka] and Fang [fan]) are then explained as having arisen independently in various subgroups of Southern Bantoid (Faytak 2014: 94). Nevertheless, both Faytak and Connell agree that the occurrence of fricative vowels in northern Grassfields Bantu languages and several contiguous language communities is the result of contact-induced sound change.

4 Conclusion

This paper has presented an overview of the vowel systems of Nigerian languages, as found in a survey of 247 languages (i.e. roughly half of Nigeria's indigenous living languages). The three major language families (Niger-Congo, West

Chadic and Central Chadic) each showed quite different typological trends, with Niger-Congo typically having 7–9 vowels, West Chadic having 5–6, and Central Chadic having 2–4. Both Niger-Congo and West Chadic tended to have symmetric, triangular systems, whilst Central Chadic had vertical systems with no front or back vowels. Within Niger-Congo, some largely contiguous groups like Defoid, Idomoid and Ijoid have fairly homogenous vowel systems, whereas more fragmented groups like Jukunoid, Cross-River and Plateau show much more diversity, suggesting that the more that languages come into contact with languages from other families, the more likely their vowel systems are to develop innovations.

Within West Chadic, a number of examples were given to illustrate this. Ywom and Goemai, at the southern central tip of West Chadic, were shown to have picked up a third central vowel from the neighbouring Plateau language, Tarok. Tangale and Kushi, at the southeastern tip where there is a major intersection of Chadic, Adamawa, and Benue-Congo languages, are even more striking, having acquired not only a 9 or 10 vowel system from neighbouring Jukunoid languages, but also full cross-height vowel harmony. Indeed, Kushi is the only known Chadic language with 10 vowels. Gwandara, at the southwestern tip of West Chadic, is equally unusual, being the only known Chadic language with nasal vowels, likely acquired through contact with the neighbouring Nupoid or Plateau languages.

The paper also looked at a number of southern Niger-Congo families containing languages with 9 or 10-vowel systems, which most closely reflect the proposed vowel system of Proto-Niger-Congo. These languages tend to occur in a contiguous area, which I have called the "Niger-Congo 9/10-vowel retention zone", located in and around the Central Niger Delta. The swampy coastal terrain and the surrounding wet lowland forest would have restricted interactions with other languages, thus protecting vowel systems from reduction.[9] Outside this area, Nigerian Niger-Congo languages tend to have reduced vowel systems, regardless of which sub-family they belong to. Within the retention zone, there is a smaller pocket where three quarters of all Nigeria's Benue-Congo languages with the proposed Proto-Niger-Congo vowel system are found. These observations clearly indicate that languages with large vowel inventories are most likely to retain them if they are in contact with languages with similar inventories. The converse is also true, that languages are more likely to lose certain vowel contrasts if they are in regular contact with other languages with smaller inventories.

[9] An Indo-European analogy to this is Icelandic, which has changed very little over the last 1000 years because of its extreme isolation, compared to languages like English which have changed a great deal during the same period through extended periods of contact with other European languages.

The third case of language contact and vowel inventory considered was the occurrence of fricative vowels which are found in some Southern Bantoid languages. In the case of Len Mambila, it seems clear that these were acquired through contact with neighbouring Grassfields languages, but their presence in Fang and Ekajuk, located a considerable distance away in different directions from the Grassfields area remains to be explained.

This paper has offered contact-based explanations for just a few of the typologically unusual vowel systems found in Nigerian languages. In some cases, there exists good lexical comparative data to support these claims, but in others, that remains to be done. Languages can of course develop extra vowels through innovation rather borrowing, as seen in the centralisation of front and back vowels in Dadiya and Bole, and as shown extensively for Kru languages in Zogbo (2016). Teasing these two processes apart will always remain a major issue for any study involving historical reconstructions, but the more large-scale comparative work that is done, the clearer the picture will hopefully become.

Appendix A Vowel systems in 247 Nigerian languages

	Languages	
Vowel system	Count	Examples
10 vowels		
i ɪ e ɛ ə a ɔ o ʊ u	15	Awak, Kushi
i ɪ e ɛ a ɑ ɔ o ʊ u	1	Wannu
9 vowels		
i ɪ e ɛ a ɔ o ʊ u	29	Ịzọn, Waci
i ɪ e ɛ ə a ɔ o u	1	Hõne
i e ɛ ɨ ə a ɔ o u	1	Baangi
i ɪ ɛ ə a ɔ o ʊ u	1	Kuce
i e ɛ ɨ a ɔ o ɯ u	1	Len Mambila
i y e ɛ œ a ɔ o u	1	Gaa
8 vowels		
i e ɛ ə a ɔ o u	11	Mbembe, Lokəə
i e ɛ a ɔ o ʊ u	2	Ẹmalhẹ, Ibilo
i ɪ e a ɔ o ʊ u	3	Igbo, Ika, Ogbah
i ɪ e ɛ a ɔ o u	1	Ito
i e ɛ a ɑ ɔ o u	1	Bankal
i e ɛ ɑ ɔ o ɤ u	1	Afade
i e ɛ ɨ a ɔ o u	6	Dukawa, Utma'in, Ugare
i e ɨ a ɔ o ʊ u	1	Iceve-Maci

Vowel system												Languages	
												Count	Examples
i		e			ɨ	ə	a	ɔ	o		u	1	Vute
7 vowels													
i		e	ɛ				a	ɔ	o		u	67	Yoruba, Berom, Mumuye
i		e	ɛ		ɨ		a	ɔ	o			1	Limbum
i	ɪ		ɛ				a	ɔ		ʊ	u	1	Eten
i		e			ɨ	ə	a		o		u	6	Jju, Tyap, Gworog, Ywom
i		e				ʌ	a	ɔ	o		u	1	Ibibio
i			ɛ			ə	a	ɔ	o		u	2	Iyive, Mada
i			ɛ		ɨ	ə	a	ɔ			u	1	Tarok
i	y		ɛ			ə	a	ɔ			u	1	Western Ejagham
i	ɪ	e				ə	a		o		u	1	Yamba
i		e		æ	ɨ		a		o		u	1	Kuteb
i		e				ə	a	ɔ	o		u	1	Anaang
i		e	ɛ			ə	a		o		u	1	Hyam
i		e	ɛ		ɨ		a		o		u	1	Mbembe Tigon
6 vowels													
i		e/ɛ				ə	a	ɔ/o			u	19	Saya, Kanuri, Dera
i		e			ɨ		a		o		u	8	Angas, Geji, Kwalla, Bade
i		e					a	ɔ	o		u	6	Tiv, Obolo, Cicipu, Mambila
i		e	ɛ				a	ɔ			u	1	Rigwe
i			ɛ		ɨ		a	ɔ			u	4	Mwaghavul, Tal, Kamuku
5 vowels													
i		e/ɛ					a	ɔ/o			u	26	Hausa, Fulfulde, Nupe
4 vowels													
i						ə	a				u	3	Bura, Hdi, Lamang
i					ɨ		a				u	2	Tera, Shall-Zwall
i		e				ə	a					1	Fali of Kirya
i							a		o		u	1	Jibu
3 vowels													
i						ə	a					3	Sukur, Wandala, Dghweɗe
					ɨ	ə	a					2	Bata, Psikye
		e			ɨ		a					1	Kamwe
2 vowels													
						ə	a					5	Daba, Həba, Mafa, Nzanyi
					ɨ		a					2	Gude, Miya
1 vowel													
							a					1	Glavda

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Name index

Subject index

Pushing the boundaries

This volume contains some of the papers there were presented at ACAL 51–52, which was organized virtually at the University of Florida. A couple were accepted for presentation at ACAL 51, which was canceled because of COVID-19. The theme of ACAL 51–52 was *African linguistics: Pushing the boundaries.* There are 18 papers and an introduction: two phonetics papers, five phonology papers, nine syntax papers, one sociolinguistics paper and one typology paper.