Phonological profile changes in the MSB: Antagonism between ATR and interior vowels

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Workshop: "*West-central African linguistic history between Macro-Sudan Belt and Niger-Congo: Commemorating Diedrich Westermann's legacy and the 100th anniversary of the Berlin professorship for African languages*"

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Leibniz-Zentrum
Allgemeine Sprachwissenschaft

Introduction

- Our focus today is the areal distribution of two vocalic features in the Macro-Sudan Belt (MSB):
  - **ATR** contrast and harmony (e.g. /i u e o/ vs. /ɪ ʊ ɛ ɔ/)
  - **Interior** vowels (i.e. non-peripheral: central; front round; back non-round)
- We show that:
  - ATR and Interior vowel systems are in complementary areal distribution in the MSB, defining distinct **meso-areas**
  - The ATR and Interior vowel meso-areal signals are **strong and stable**: Languages change profiles when changing areas
    - Specifically, languages adapt their phonological profile to the area that they move into (and not the other way around, i.e. moving languages imposing their profile)

Introduction

- Roadmap:
  - 1. ATR/Interiority antagonism – Recap of the ALFA vowel database
  - 2. Changing profiles when changing areas: 3 case studies
  - 3. ATR/Interiority antagonism: where is the overlap?
- Stay tuned for a diachronic talk on this topic after the break, too

1. ATR / Interiority antagonism

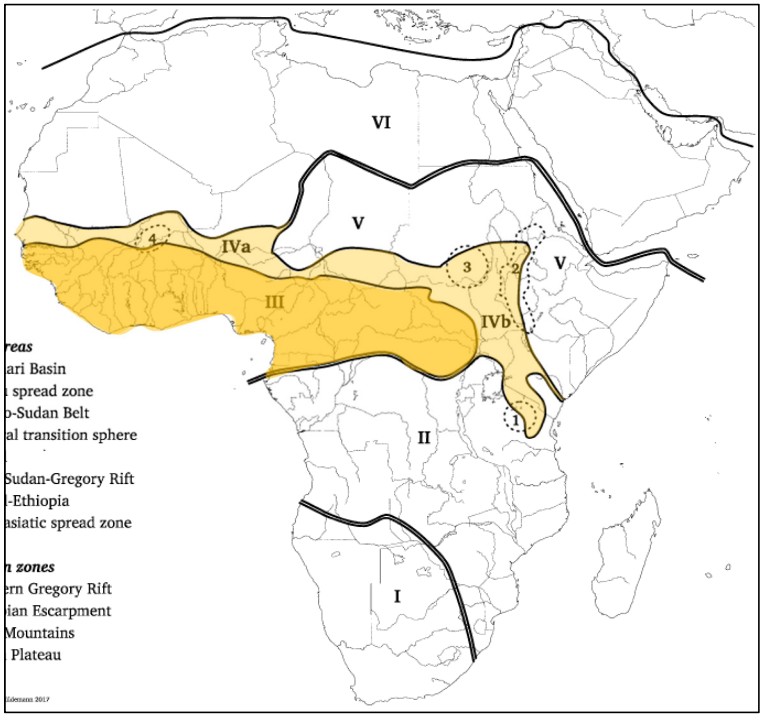
1.1 The ALFA vowel database

- Our starting point is Rolle, Lionnet, & Faytak's (2020) ALFA vowel database (*Areal Linguistic Features of Africa*)
- Coded for phonemic contrasts and allophonic variants in the vowel systems of 681 language varieties in the MSB
  - Online (abridged) version on google sheets: https://docs.google.com/spreadsheets/d/1F_5mtfCAxB0RcwKJ3Rx8uVPmz8dbQ9DwgNT_aX81XxQ/edit
  - Full supplementary materials (from *Linguistic Typology*): https://www.degruyter.com/document/doi/10.1515/lingty-2019-0028/html
- Sought to establish precise meso-areas within the MSB where vowels systems converge and diverge

1.1 The ALFA vowel database

- Sudanic Belt

Macro-Sudan Belt



1.1 The ALFA vowel database

index	language	iso	family	phoneme	allophone
id_0001	Mano	mev	EMande	i,ĩ,ii,ĩĩ,e,ee,ɛ,ɛ̃,ɛɛ,ɛ̃ɛ̃,a,ã,aa,ãã,u,ũ,uu,ũũ,o,oo,ɔ,ɔ̃,ɔɔ,ɔ̃ɔ̃	i,ĩ,ii,ĩĩ,e,ee,ɛ,ɛ̃,ɛɛ,ɛ̃ɛ̃,a,ã,aa,ãã,u,ũ,uu,ũũ,o,oo,ɔ,ɔ̃,ɔɔ,ɔ̃ɔ̃
id_0033	Tadaksahak	dsq	Songhai	i,ii,e,ee,ə,a,aa,u,uu,o,oo	i,ii,[ɪ]-i,e,[e]-i,ee,[ɛ]-ae,ə,a,aa,[ʌ]-ə,[ɑ]-a,u,uu,o,[o]-u,oo,[ɔ]-o
id_0559	Mungbam	mij	OBantoid	i,ɪ,e,ɨ,a,u,ʊ,o,ɔ	i,ɪ,e,%ɛ,ɨ,a,u,ʊ,o,ɔ
id_0065	Kaba	ksp	CSudanic	i,ĩ,e,ɛ̃,ə,ə̃,a,ã,u,ũ,o,ɔ,ɔ̃	i,ĩ,e,%ɛ,[ɛ]-e,ɛ̃,R[ɨ]-i/e/a/ɔ/o/u,ə,[ə]-e/a,ə̃,a,ã,u,ũ,o,ɔ,ɔ̃

1.2 ATR and ATR harmony

- Focus on two main variables
- One is Advanced Tongue Root vs. Retracted Tongue Root (harmony), i.e. ATR vs. RTR or +ATR vs. –ATR
  - In canonical ATR systems, vowels are split into two mutually exclusive groups within a relevant phonological domain (e.g. a phonological word)
  - In the [+ATR] group, a vowel canonically shows advancement of the tongue root, which widens the pharyngeal cavity, whereas [−ATR] vowels do not

1.2 ATR and ATR harmony

- Degema [deg]
  - [+ATR] [ubi mee] ‘my palm kernel’
  - [-ATR] [ʊbɪ mɛɛ] ‘my book’
- Acoustically, [+ATR] vowels tend to have a lower first formant frequency (F1) than their [−ATR] counterparts
- Since F1 is also the primary cue to contrasts in tongue height, [+ATR] vowels are often transcribed using a phone with a higher tongue body position compared to its [−ATR] counterpart
  - E.g. [+ATR] [e] vs. [−ATR] [ɛ]
- Cf. IPA: [+ATR] i̙ e̙ a̙ o̙ u̙ (= i e ɜ o u) vs. [-ATR] i̘ e̘ a̘ o̘ u̘ (= ɪ ɛ a ɔ ʊ)

Refs: Kari (2007); Starwalt (2008)

1.2 ATR and ATR harmony

- Degema has full set of ATR contrasts:
  - [+ATR] /i e ɜ o u/ vs. [−ATR] /ɪ ɛ a ɔ ʊ/
- However, in ATR languages often [+ATR] [+LOW] is missing ([ɜ]~[ə])
  - E.g. a language next door, Kalabari
  - [+ATR] /i e o u/ [−ATR] /ɪ ɛ ɔ ʊ/ Neutral /a/

Refs: Kari (2007); Harry (2004)

1.2 ATR and ATR harmony

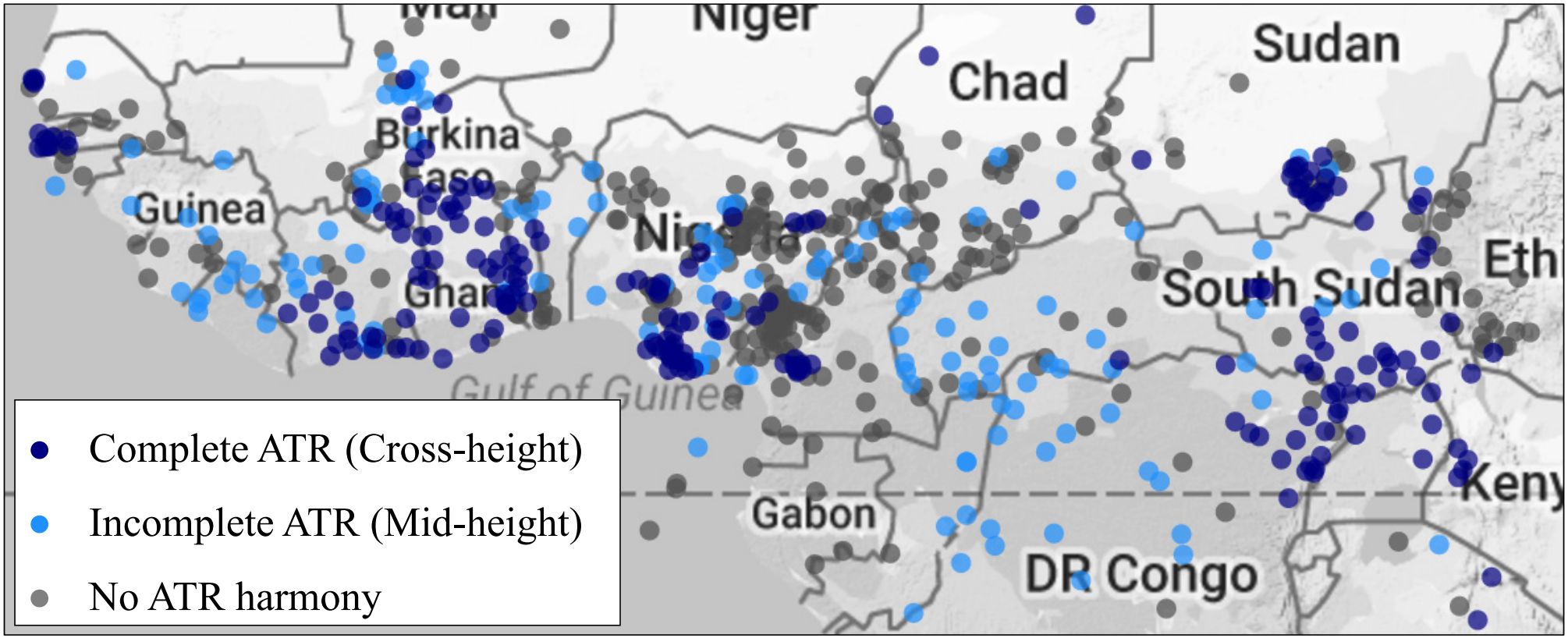
- Two types of ATR systems:
  - Complete (i.e. Cross-Height harmony or Five-Height systems)
    - → **Degema, Kalabari**
  - Incomplete (i.e. Mid-Height harmony or Four-Height(M) systems)
- Incomplete/Mid-Height harmony
  - Typically have inventory /i e ɛ (ə) a ɔ o u/
  - Lack the [−ATR] high counterparts ɪ and ʊ

1.2 ATR and ATR harmony

- Standard Yoruba [yor] is a prototypical example of Incomplete/ Mid-Height system
  - Mid-close vowels /e o/ do not co-occur with mid-open /ɛ ɔ/
- [+ATR] [oko] ‘farm’ (*okɔ)
  [ètè] ‘lip’ (*etɛ)
- [-ATR] [ɔkɔ] ‘husband’ (*ɔko)
  [ɛ̀tɛ̀] ‘leprosy’ (*ɛte)
- Cf. [ebi] ‘hunger’ [ife] ‘cup’
  [ɛ̀bi] ‘guilt’ [idɛ] ‘brass’

Refs: Awobuluyi (1967); Bamgbose (1967); Oyelaran (1973)

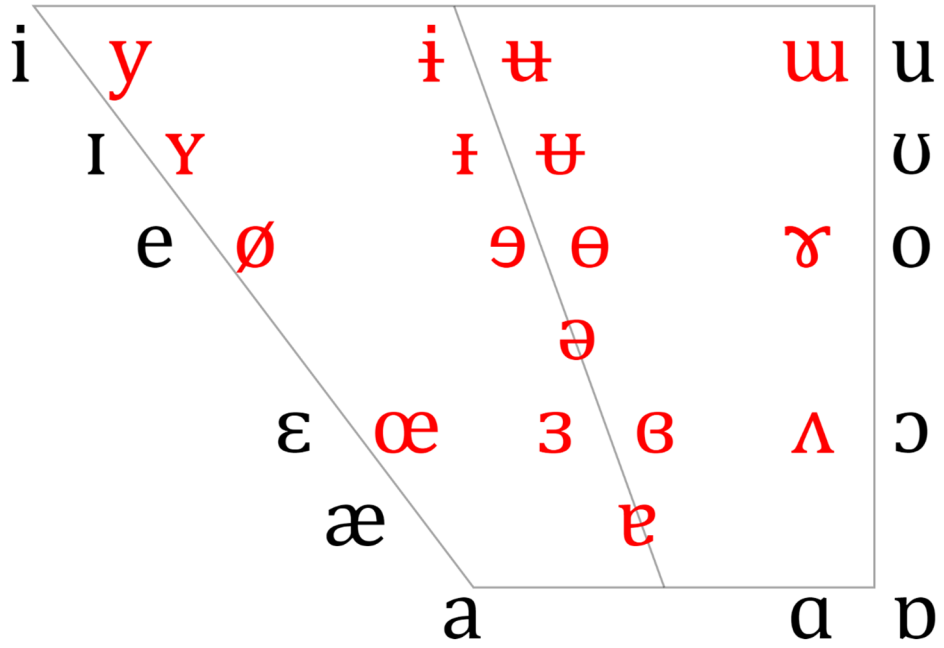
1.2 ATR and ATR harmony



Ref: Rolle, Lionnet, & Faytak (2020) – Complete ATR (n = 217), Incomplete ATR (n = 142), No ATR (n = 322)

1.3 Interior vowels

- The second variable we examine is the presence of interior vowels
  - **Peripheral**
  - **Interior**



1.3 Interior vowels

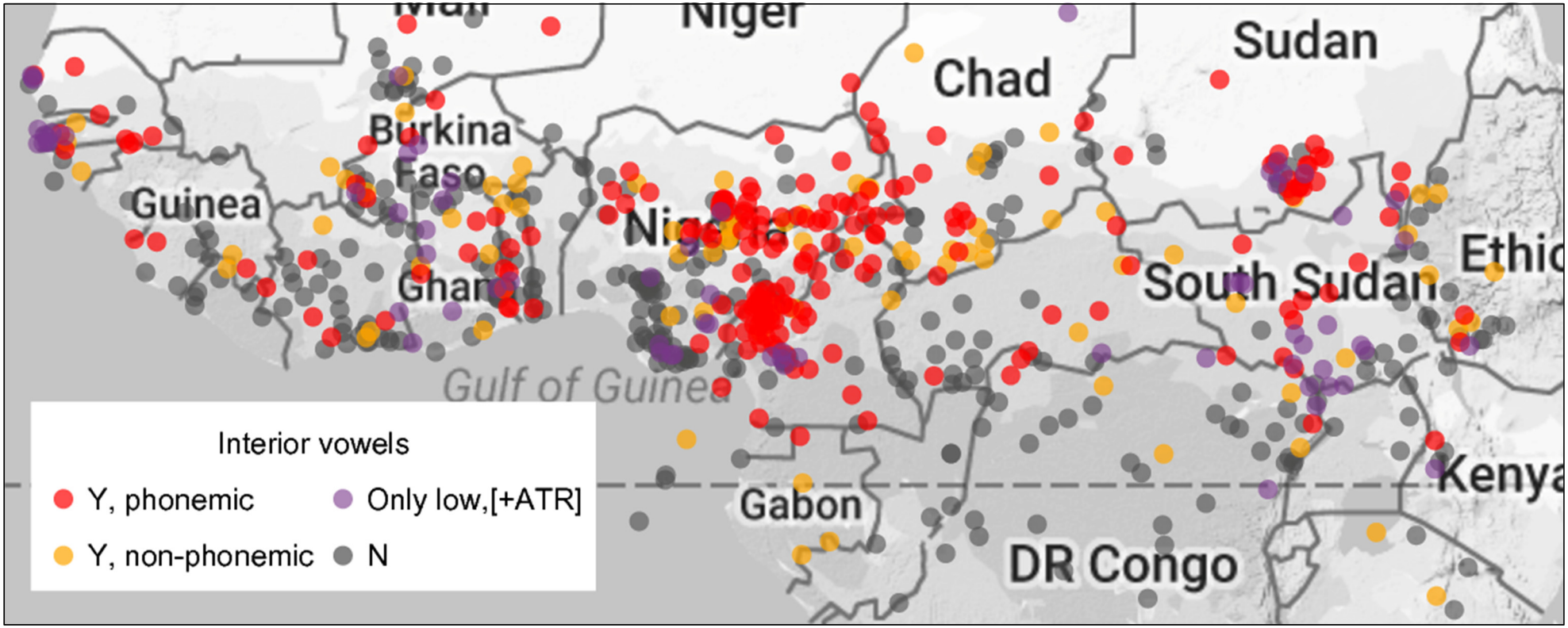
- Interior vowels are a well-known feature of many language families in Central Africa, such as Bantoid and Chadic
- Kejom [bbk] (a.k.a. Babanki – Grassfields: Cameroon)
  - Minimal set for interior vowels /ɨ ʉ ə/ and peripheral vowels /i e u o/
  - /i/ tʃî ‘in-law’ /ɨ/ tʃɨ́ ‘fireplace’ /ʉ/ tʃʉ́ ‘spit’ /u/ kàntʃù ‘cat sp.’
    /e/ tʃê ‘minimize’ /ə/ tʃə́ ‘kick’ /o/ tʃô ‘pass’

1.3 Interior vowels

- Interiority may manifest both as *bona fide* phonemes as well as allophonic variants of peripheral vowels
- Ibibio [ibb] (Delta Cross) vary as to whether interior vowels [ɨ ʉ ə ʌ] are phonemic, likely reflecting dialectal differences
- At the surface level, however, all occur in 'General Ibibio' as conditioned variants of /i u o/
  - /kím/ 'sew' [kɨ́m]~[kə́m]
  - /ùkù/ 'fox-like animal' [ùkù]~[~~ʉ~~k~~ʉ~~]
  - /kpók/ 'cut into pieces (with a knife)' [kpók]~[kpə́k]

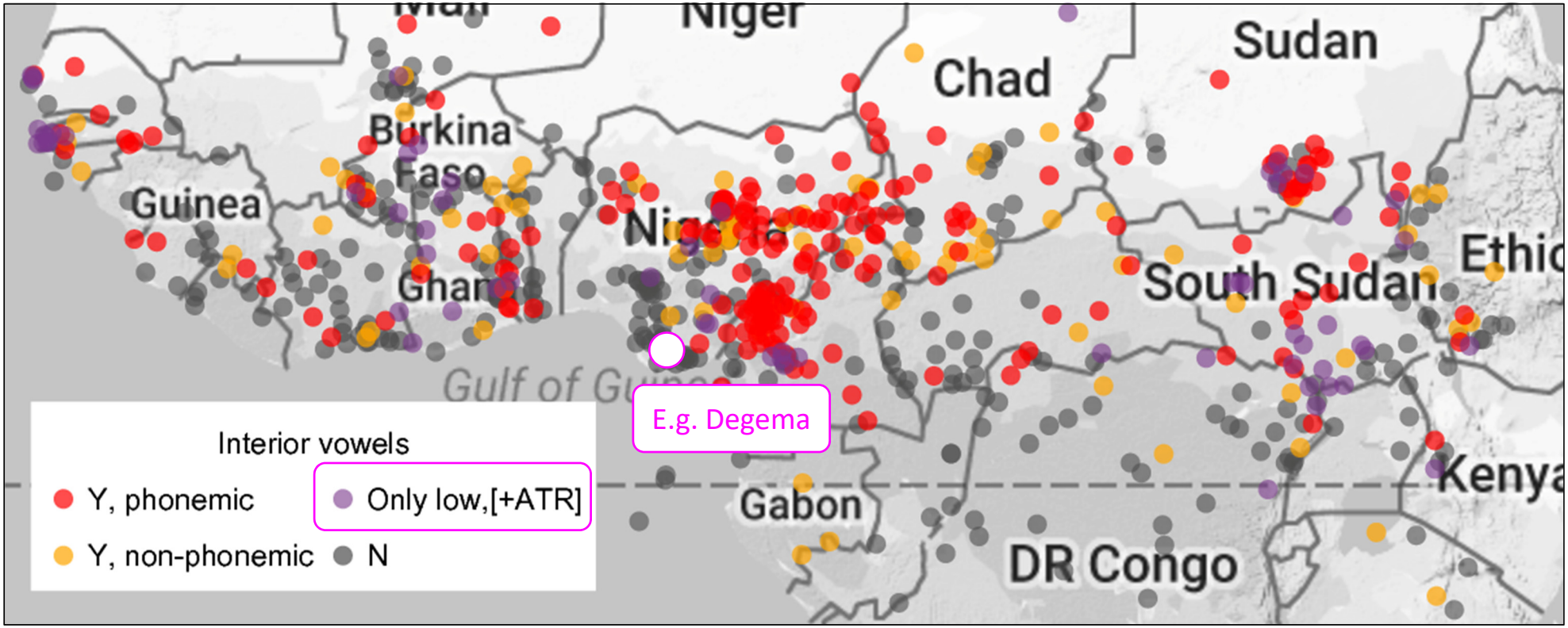
Ref: Urua (2000: 30)

1.3 Interior vowels



Ref: Rolle, Lionnet, & Faytak (2020) – Phonemic (n = 204), Non-phonemic (n = 83), [+ATR, + low] only (n=69), None (n=325)

1.3 Interior vowels



Ref: Rolle, Lionnet, & Faytak (2020) – Phonemic (n = 204), Non-phonemic (n = 83), [+ATR, + low] only (n=69), None (n=325)

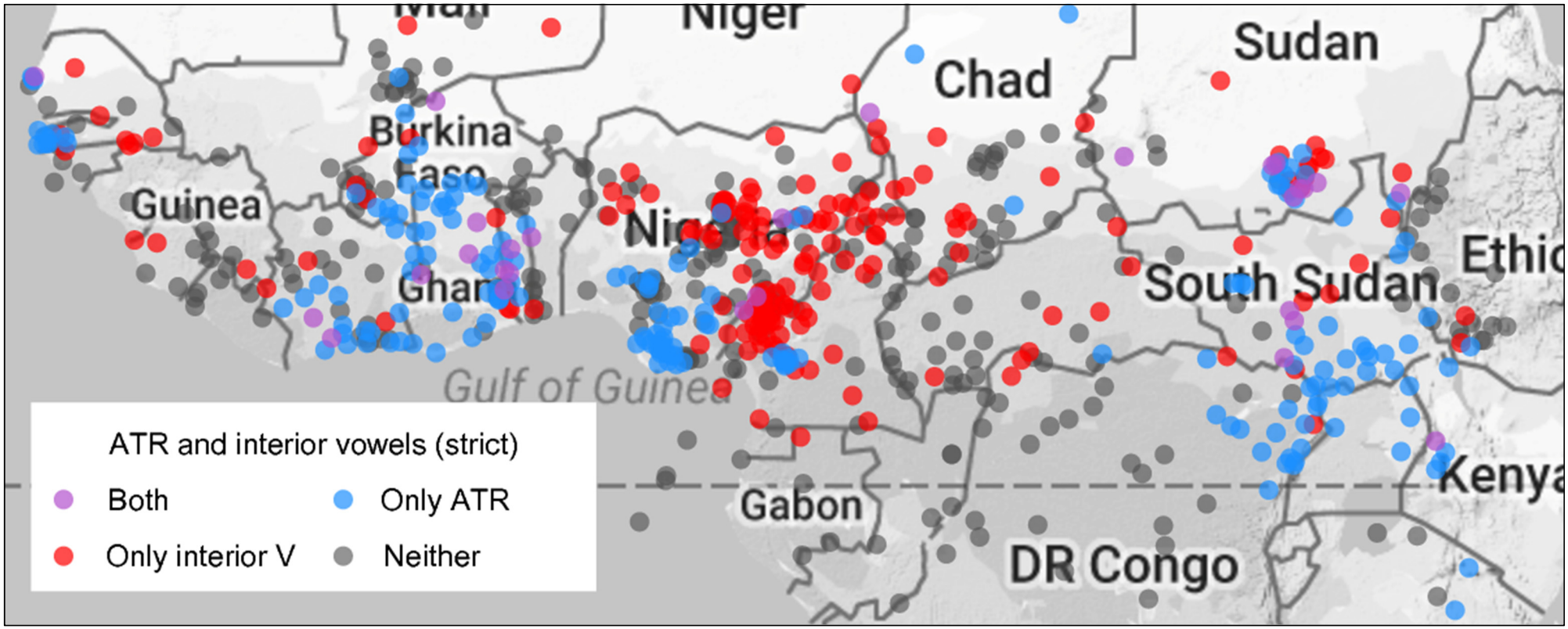
1.4 ATR/interiority antagonism

- Can ATR and interiority co-occur? Possible – e.g. Kanembu [kbl]

- …but very rare:
  - ATR harmony (both complete/ cross-height and incomplete/mid-height) negatively correlates the presence of interior vowel phones

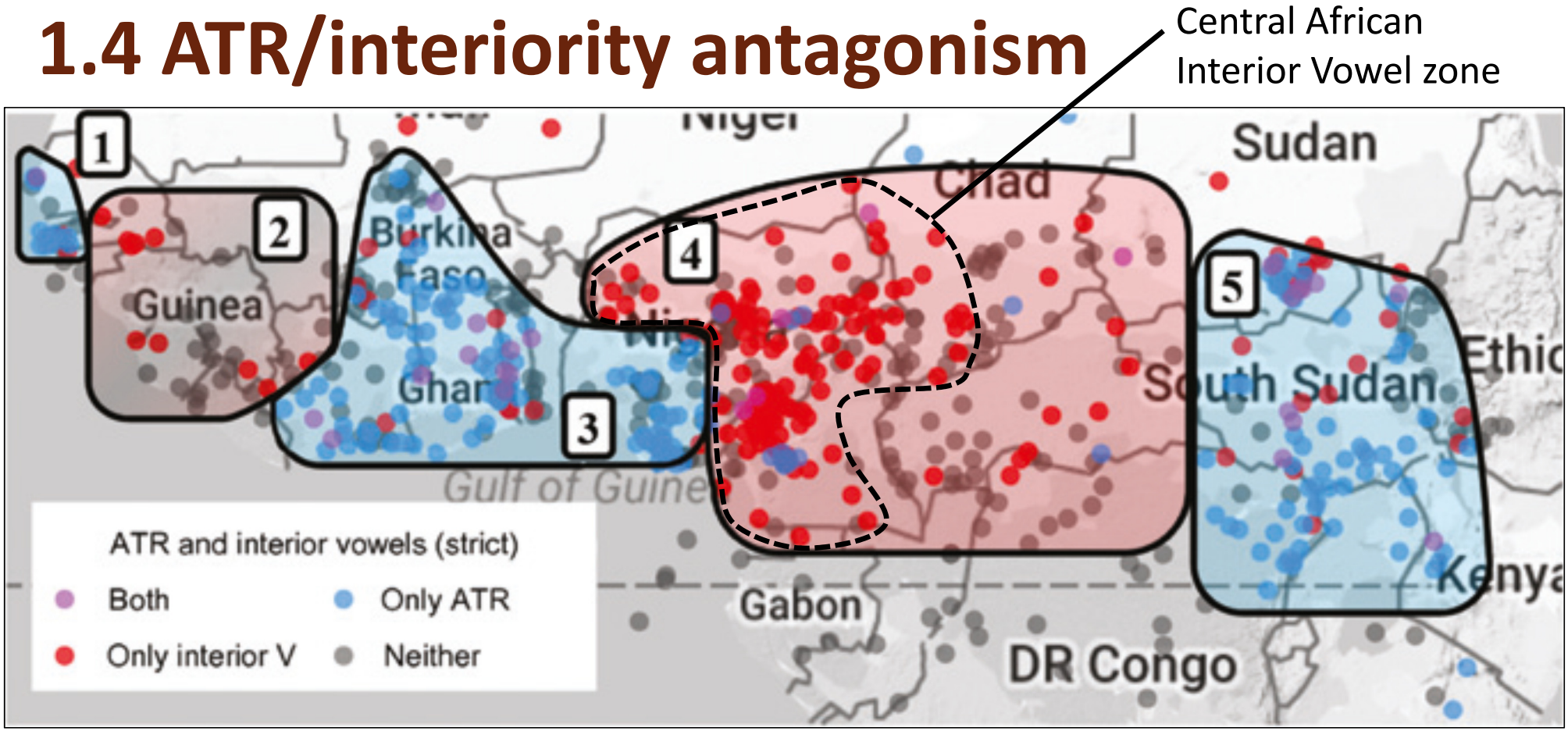
[ATR]	Front	Central	Back
+	i	ɨ	u
–	ɪ	ʉ	ʊ
+	e	ə	o
–	ɛ	ʌ	ɔ
Ø		a	

1.4 ATR/interiority antagonism



Ref: Rolle, Lionnet, & Faytak (2020) – (complete/cross-height) ATR only (blue – n = 188), (phonemic) interior vowels only (red – n = 175), Both (purple – n = 29), Neither (gray – n = 289)

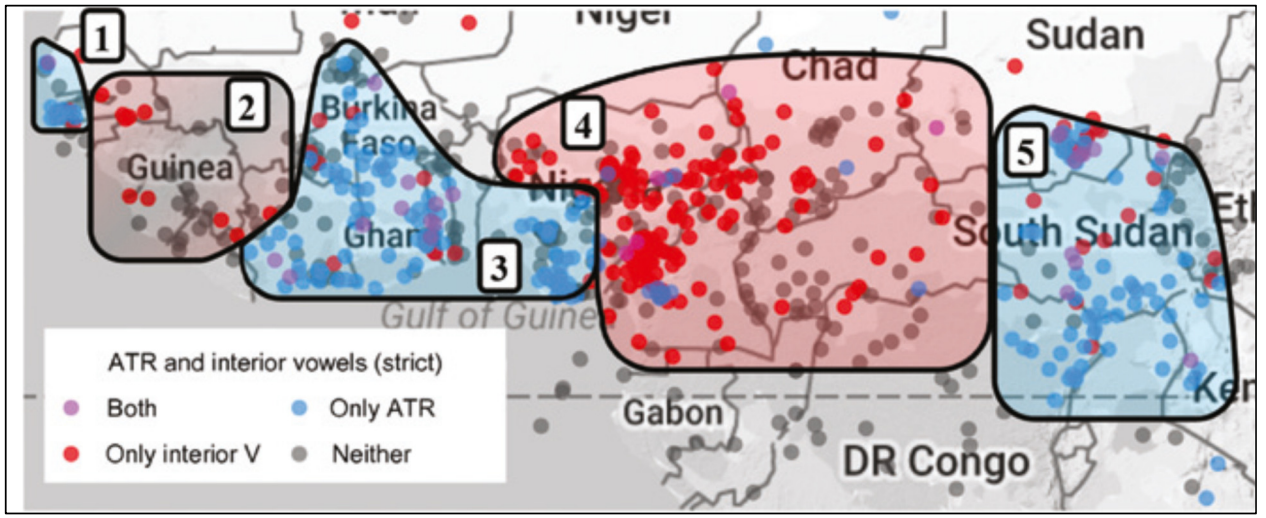
1.4 ATR/interiority antagonism



Ref: Rolle, Lionnet, & Faytak (2020) – Meso-areas in MSB:]1] Atlantic ATR zone, [2] Guinean ATR-deficient zone, [3] West African ATR zone, [4] Central African ATR-deficient zone (*slash* Central African interior vowel zone), [5] East African ATR zone

1.4 ATR/interiority antagonism

- We'll modify this a bit when we turn to Bua in the talk after lunch…



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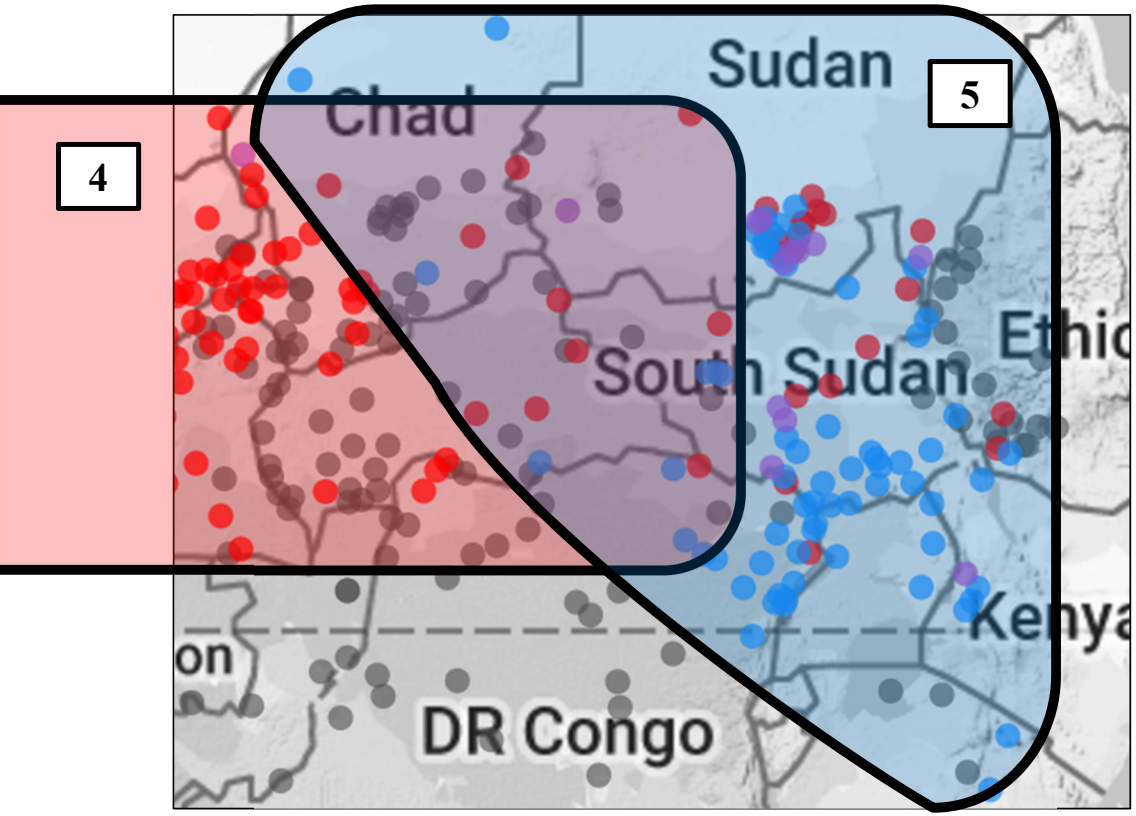

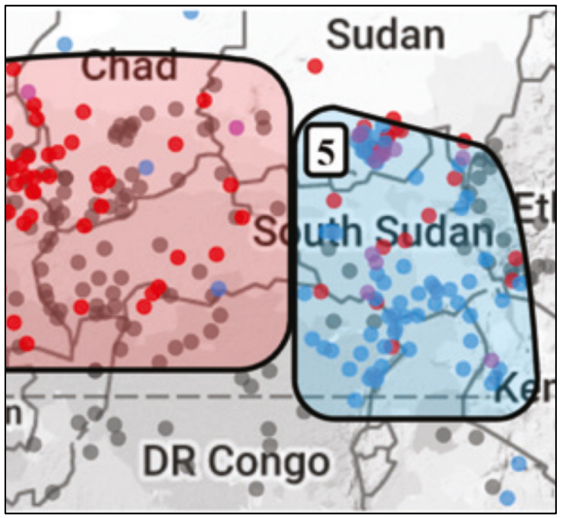

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1.4 ATR/interiority antagonism

- ATR is realized with a distinction along the height dimension (cued by F1) whereas interiority adds additional contrasts along the backness dimension (cued by F2)
- This antagonistic relationship therefore makes sense from a functional perspective on what shapes vowel inventories

2. Changing profiles when changing areas

2. Changing profiles when changing areas

- Question: how strong/robust are these meso-areal signals?
  - Are they stable = resist population/language movements?
  - Are they unstable/shallow = change with population/language movements?
- Related question: how old are these meso-areal signals?
  - If stable → presumably old
  - If unstable → presumably recent (at least in their current location and configuration)

2. Changing profiles when changing areas

- Preliminary findings suggest **high stability** of areal signals
- Languages seem to adapt their phonological profile to the areas where they are or migrate to
  - → strong areal signal survives, “percolates” through layer after layer of population and language movements
- 3 case studies:
  - Delta Cross languages
  - Central Sudanic languages
  - Bantu languages

2.1 Delta Cross languages

- Delta Cross (57) – A major branch of Benue-Congo
  - ►Central Delta (8)
  - ►Lower Cross (23)
  - ►Ogonoid (5)
  - ►Upper Cross (21)

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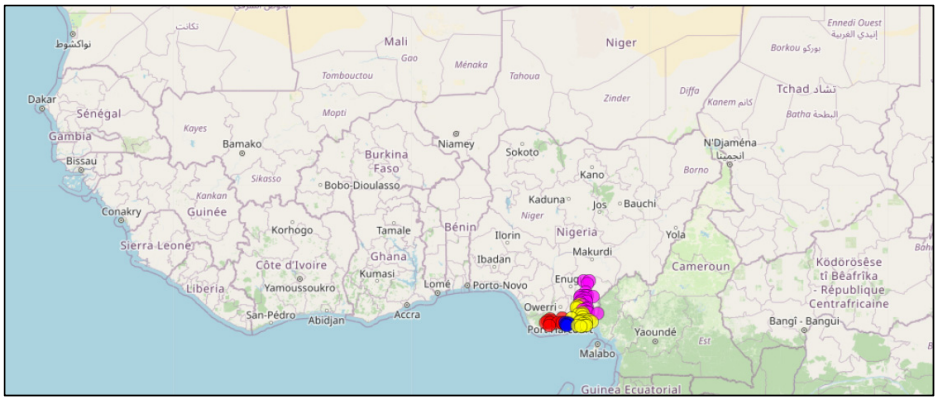

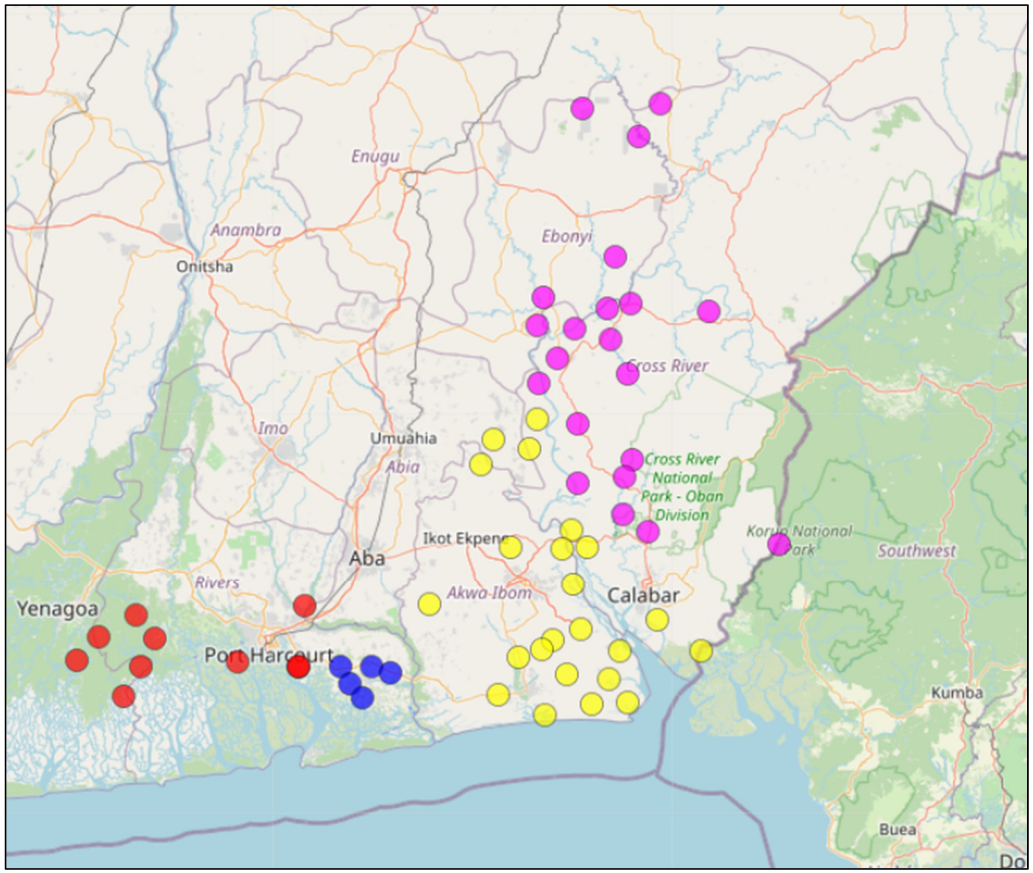

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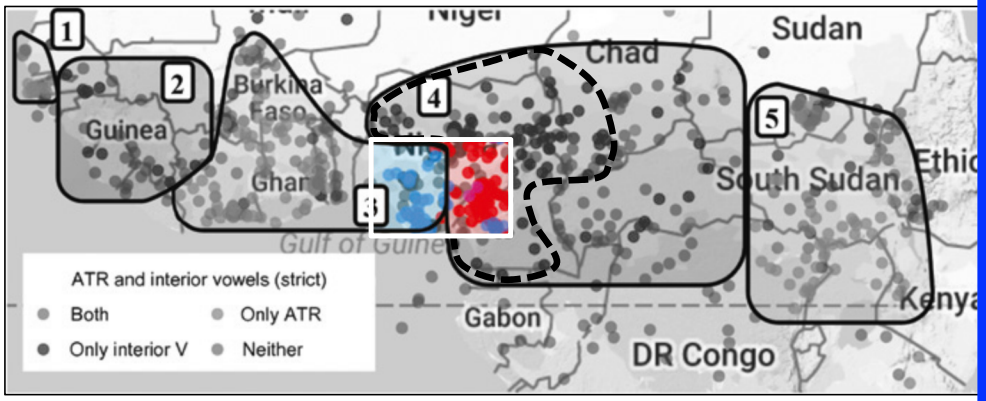
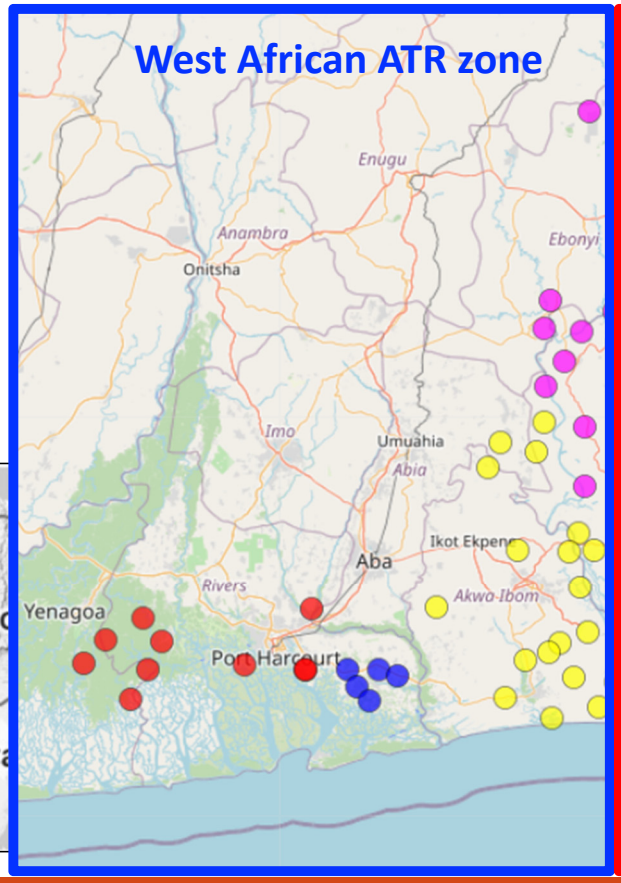
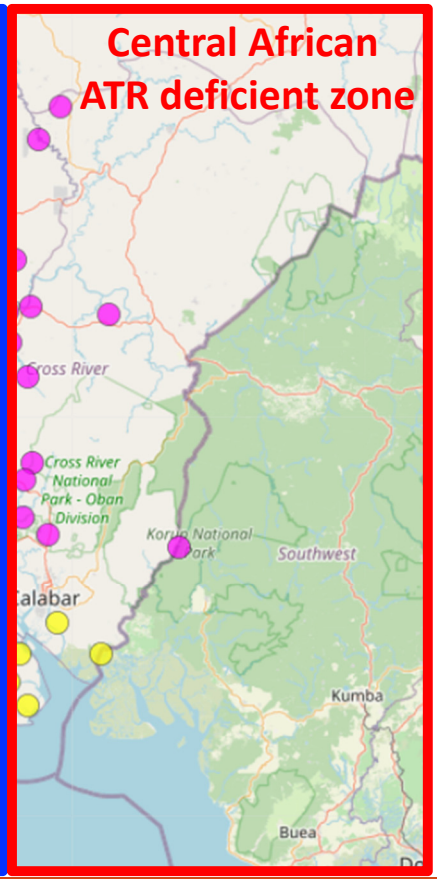


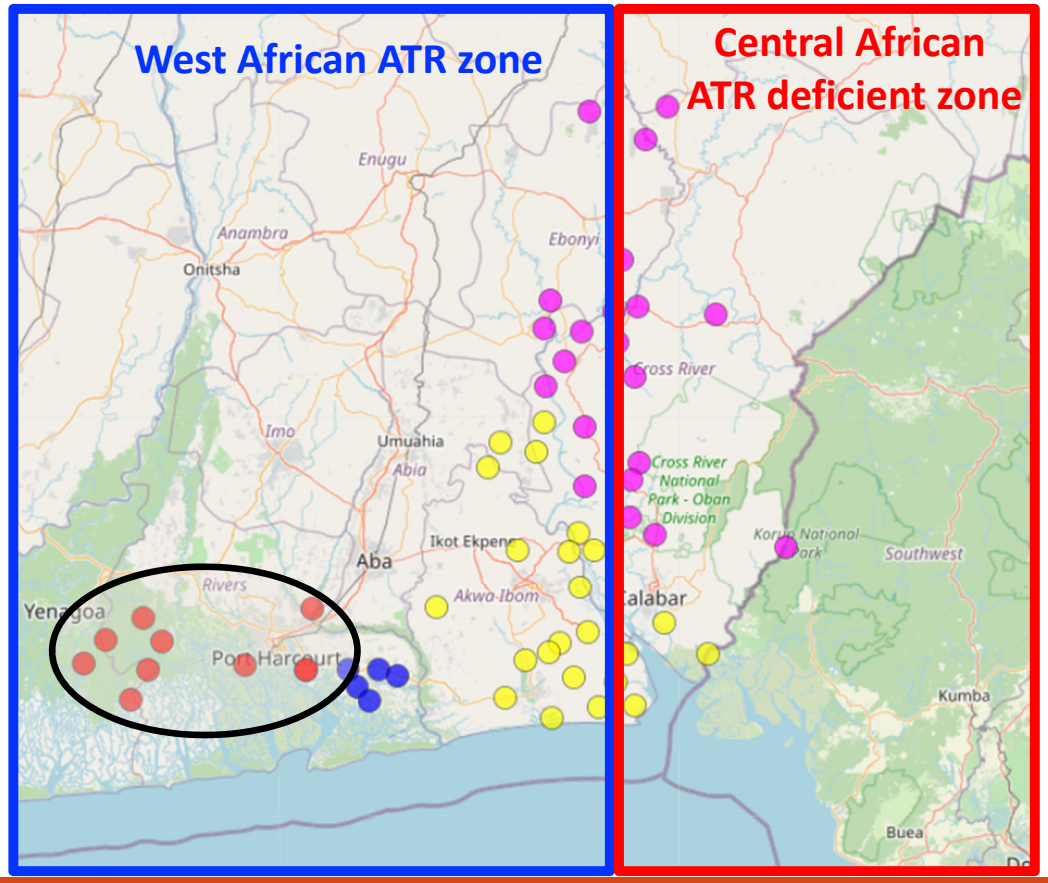




Ref: Glottolog citing Connell (2011)

2.1 Delta Cross languages

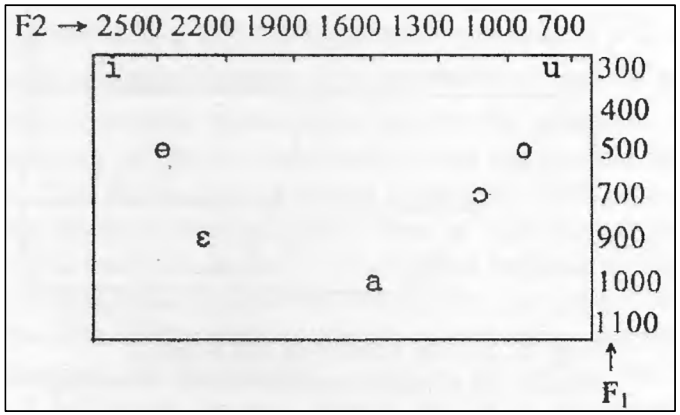
- Central Delta languages uniformly show a complete (cross-height) ATR system
  - /i e ə o u/ vs. /ɪ ɛ a ɔ ʊ/

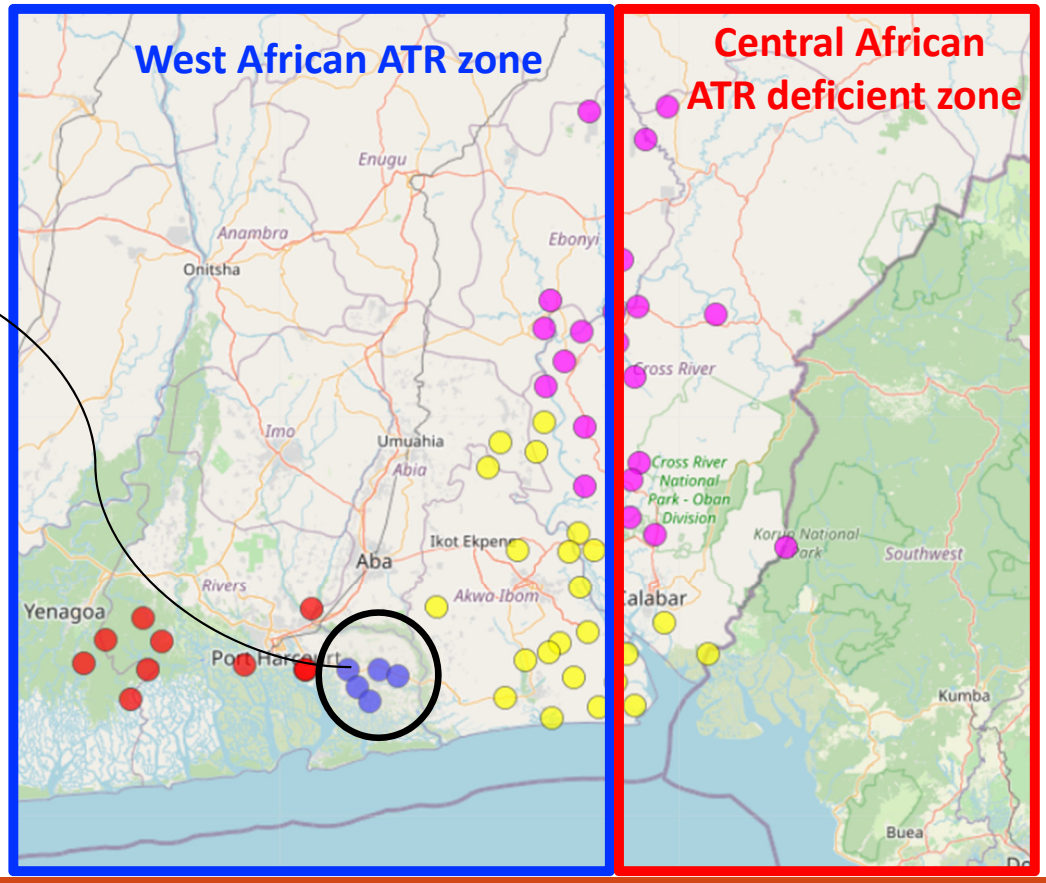


Ref: Kari (2017)

2.1 Delta Cross languages

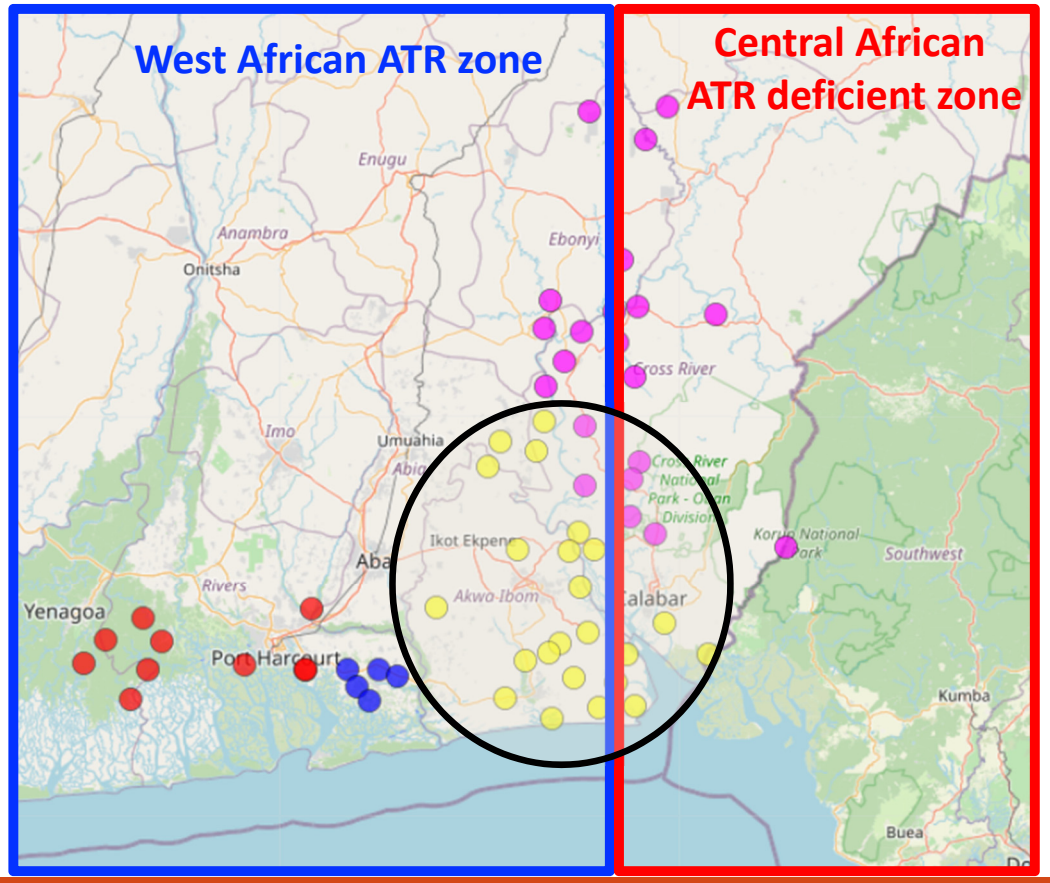
- Ogonoid - incomplete (mid-height) ATR system
  - Eleme [elm]: /i e ɛ a ɔ o u/
  - /e o/ do not co-occur with /ɛ ɔ/
  - no mention of interior allophones





2.1 Delta Cross languages

- Lower Cross languages
  - Often find traces of ATR, such as Incomplete ATR systems
  - But also, “vowels tend to centralize and shorten in closed syllables, sometimes extremely so (i.e., to a brief schwa)”
  - For comparative Lower Cross: “in instances where this has made it difficult, given the data available, to determine the phonemic identity of the vowel, it has simply been left as /ə/”



2.1 Delta Cross languages

- Ibibio [ibb] dialects vary whether interior vowels are phonemic
  - /kím/ ‘sew’
    [kɨ́m]~[kə́m]
  - /ùkù/ ‘fox-like animal’
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  - /kpók/ ‘cut into pieces’
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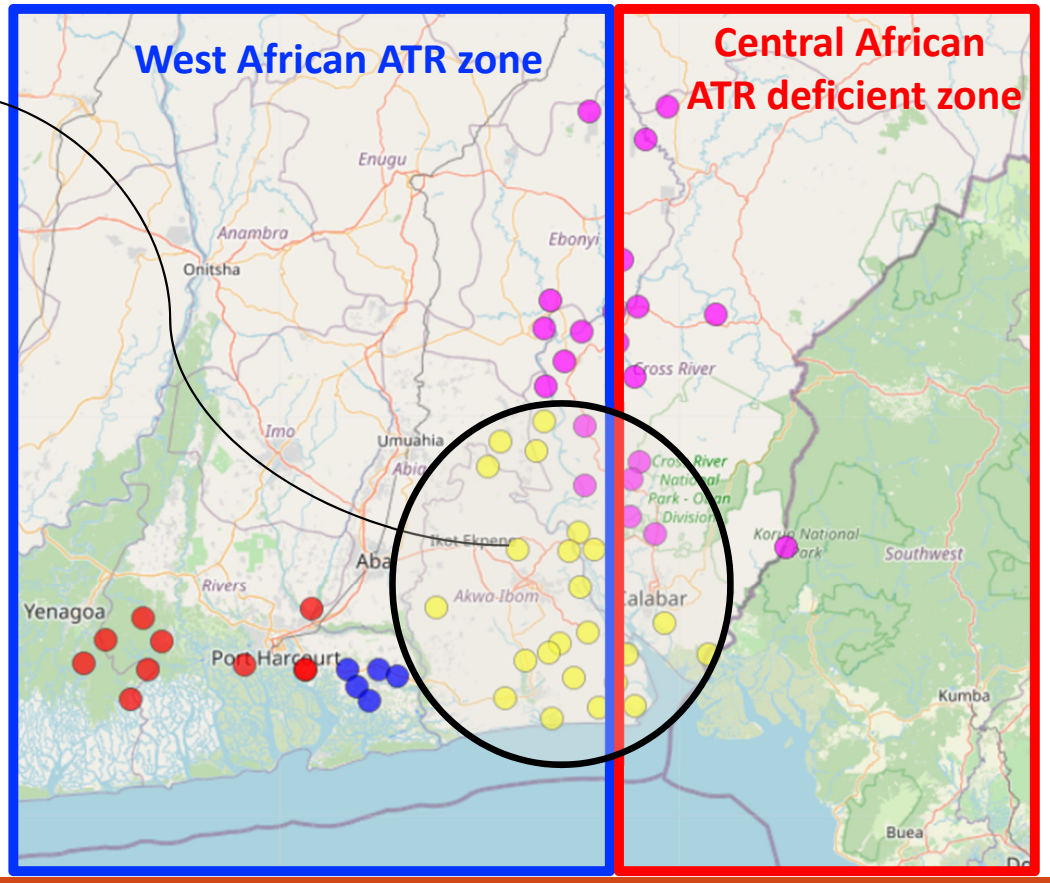
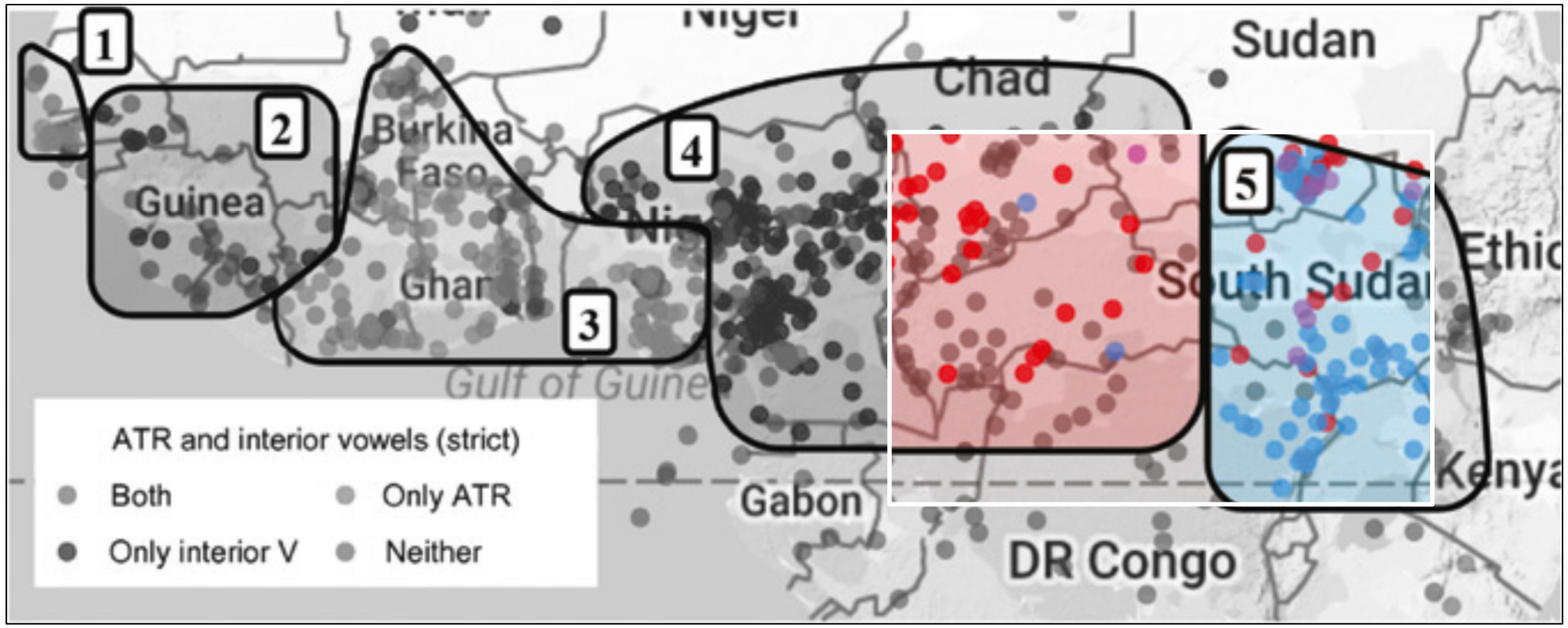


2.2 Central-Sudanic



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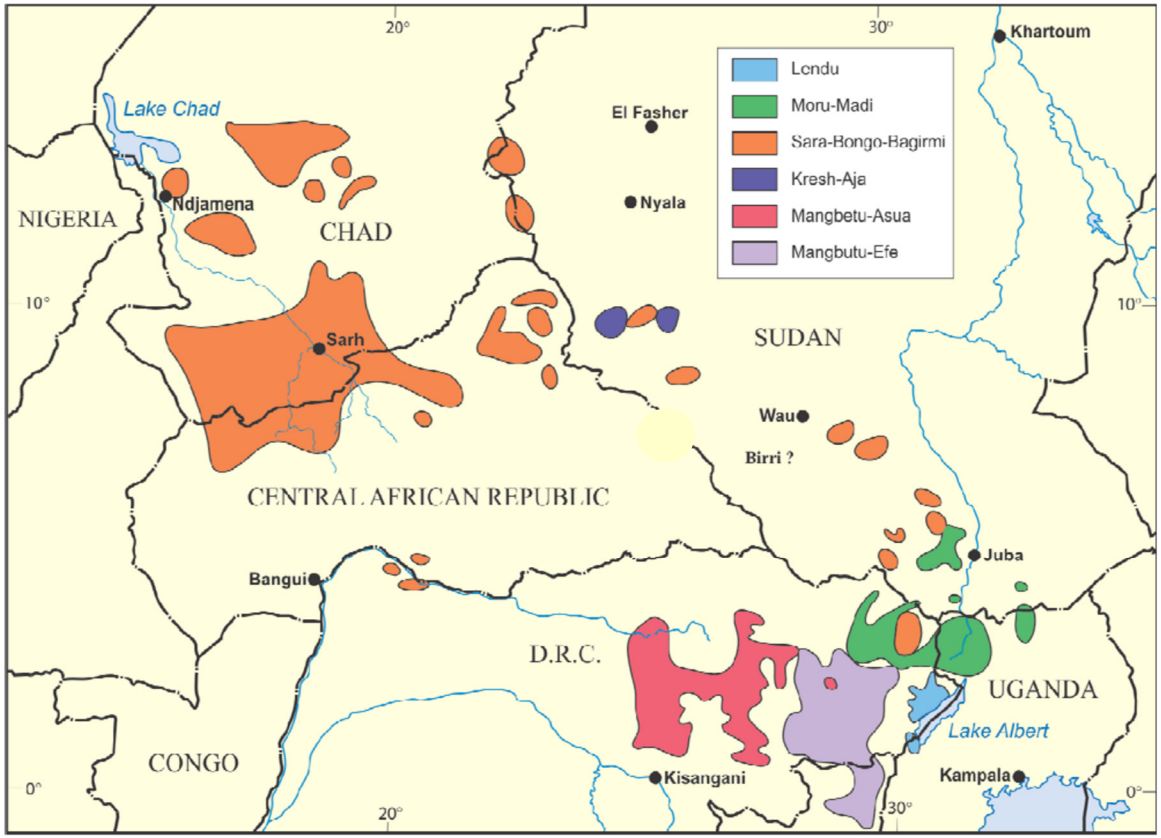

Ref: Blench ms., Boyeldieu 2006, Ehret 1972

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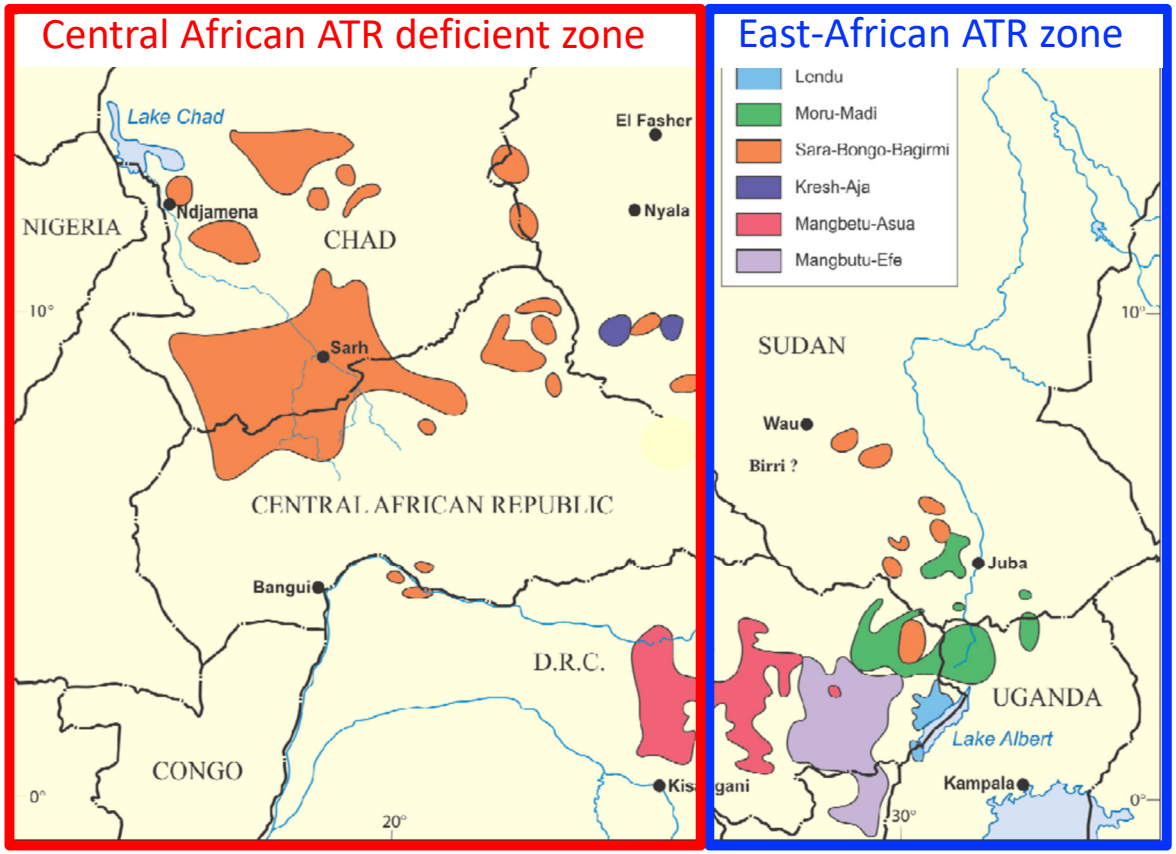

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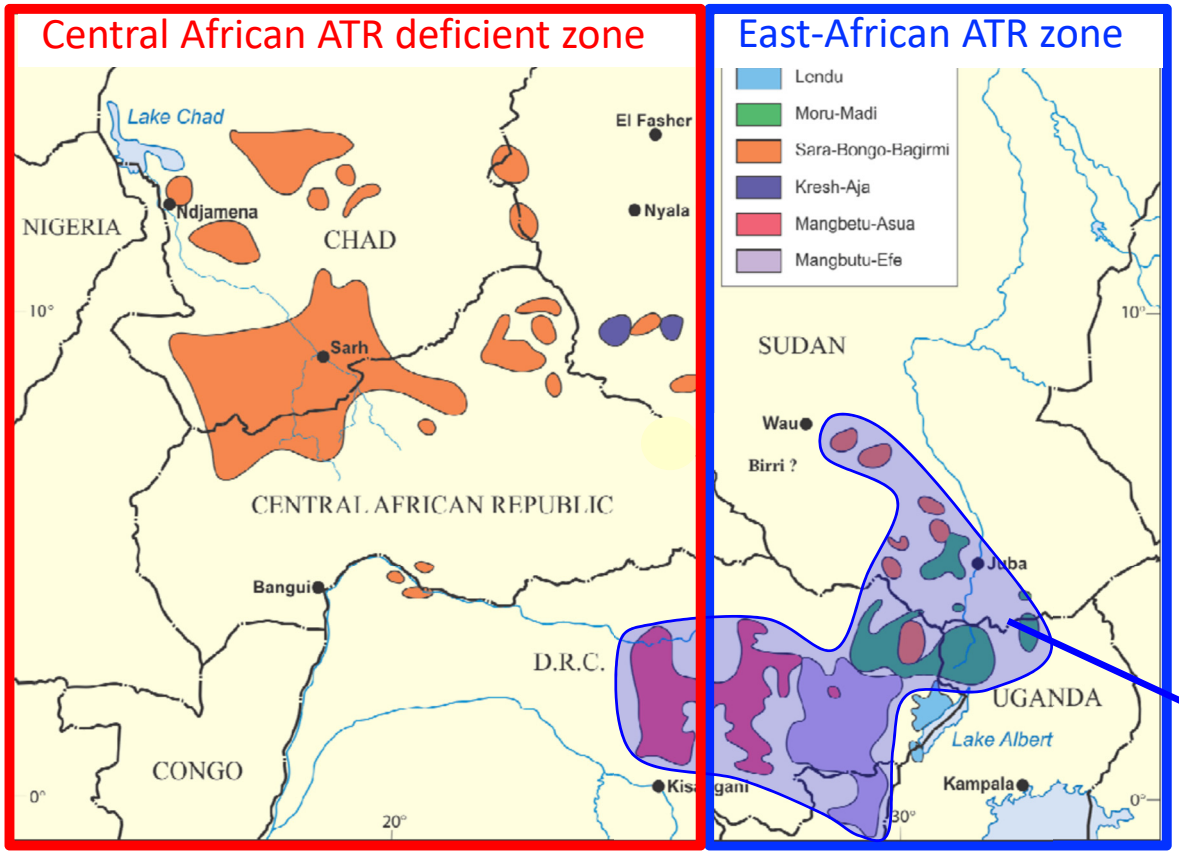
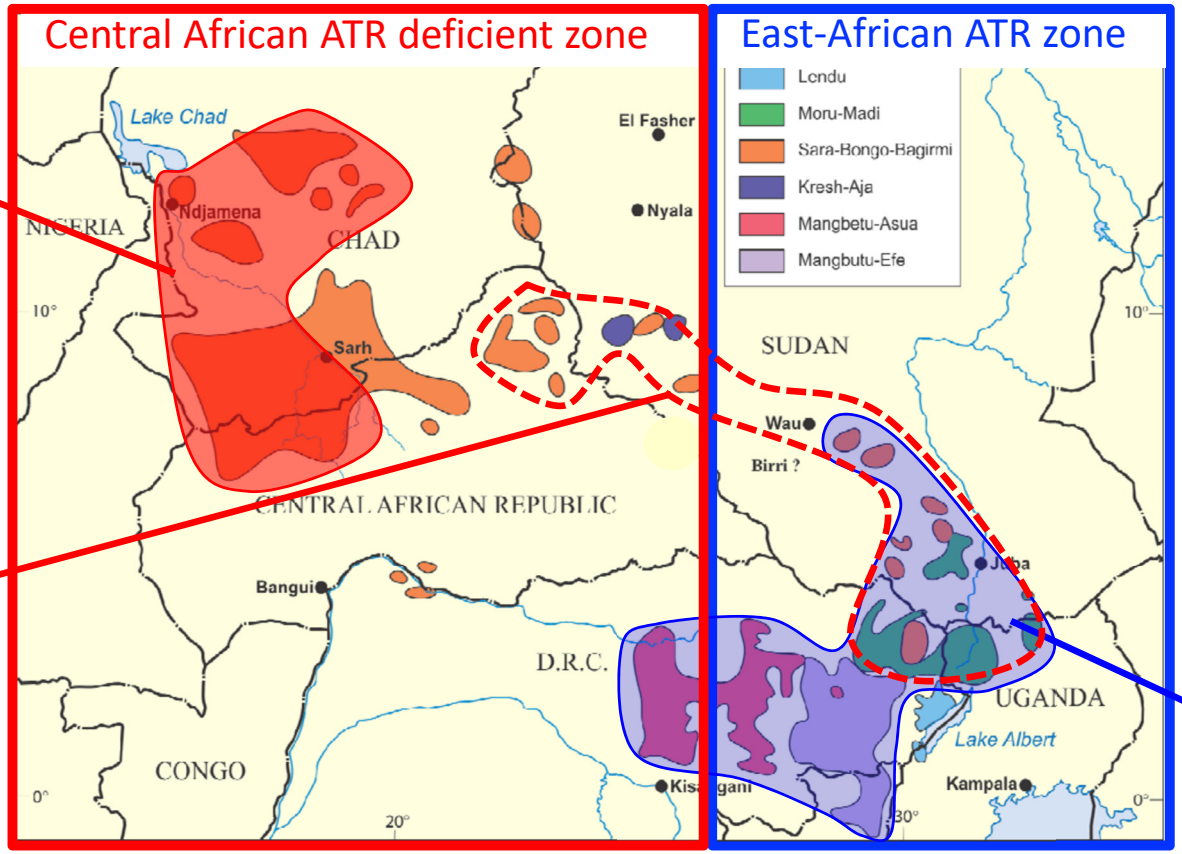


ATR harmony
(only 3 exceptions)

2.2 Central-Sudanic

?



Interior vowels (high frequency)

Interior vowels (low frequency)

ATR harmony (only 3 exceptions)

2.2 Central-Sudanic

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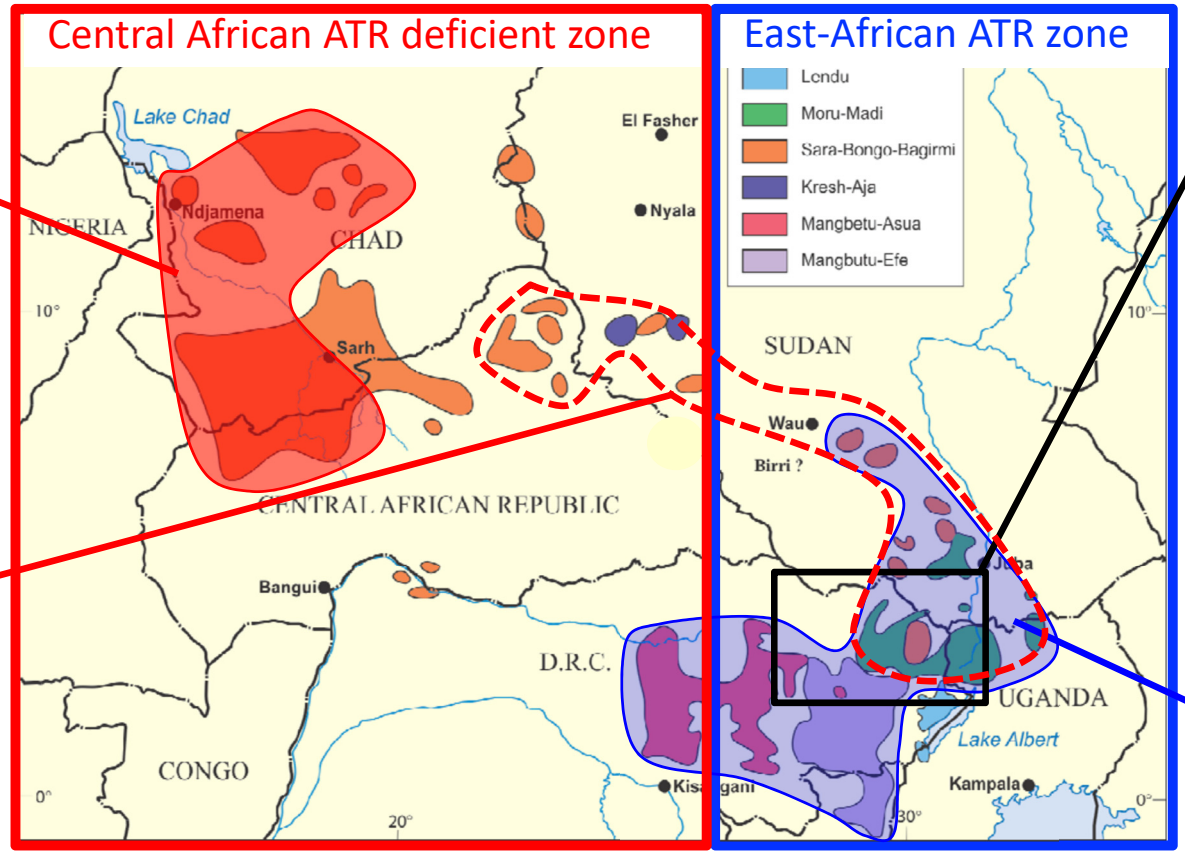

Interior vowels (high frequency)

Interior vowels (low frequency)

Proto-Central-Sudanic (Ehret 1974)

ATR harmony (only 3 exceptions)

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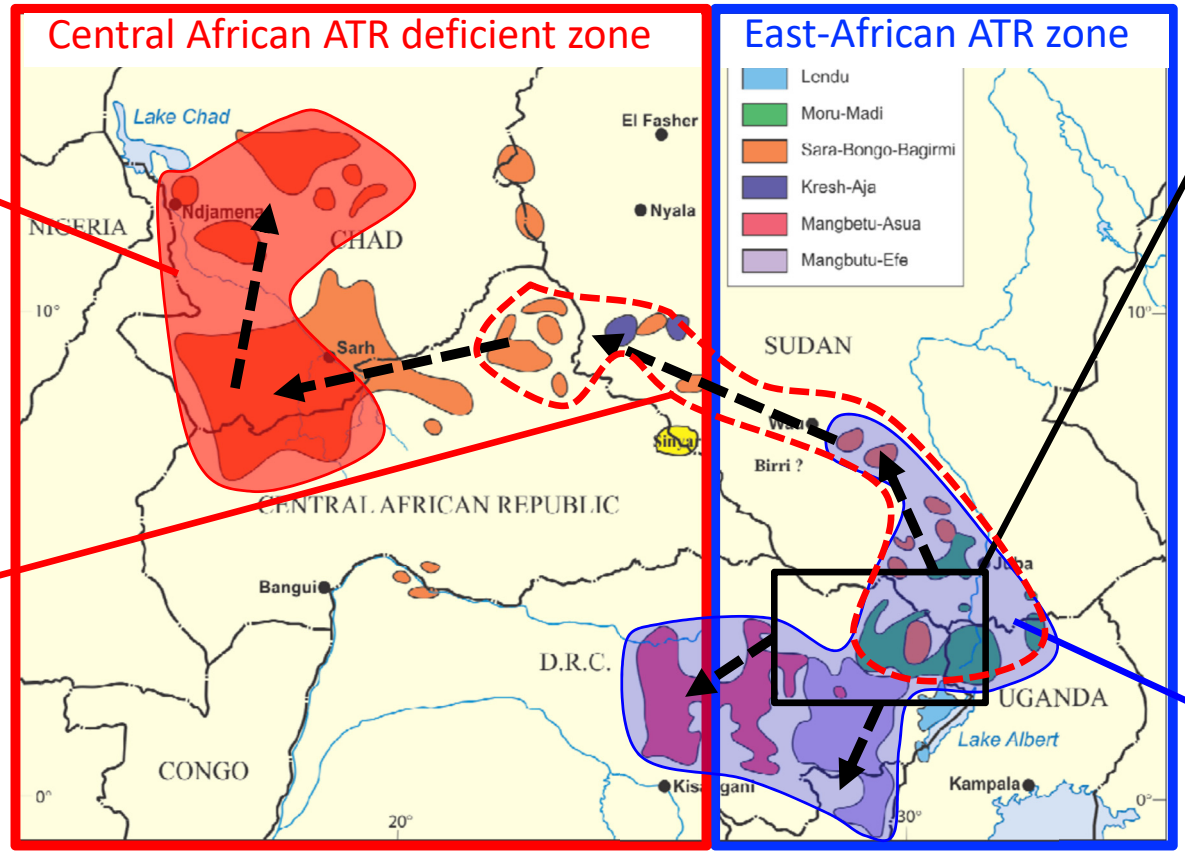


Interior vowels (high frequency)

Interior vowels (low frequency)

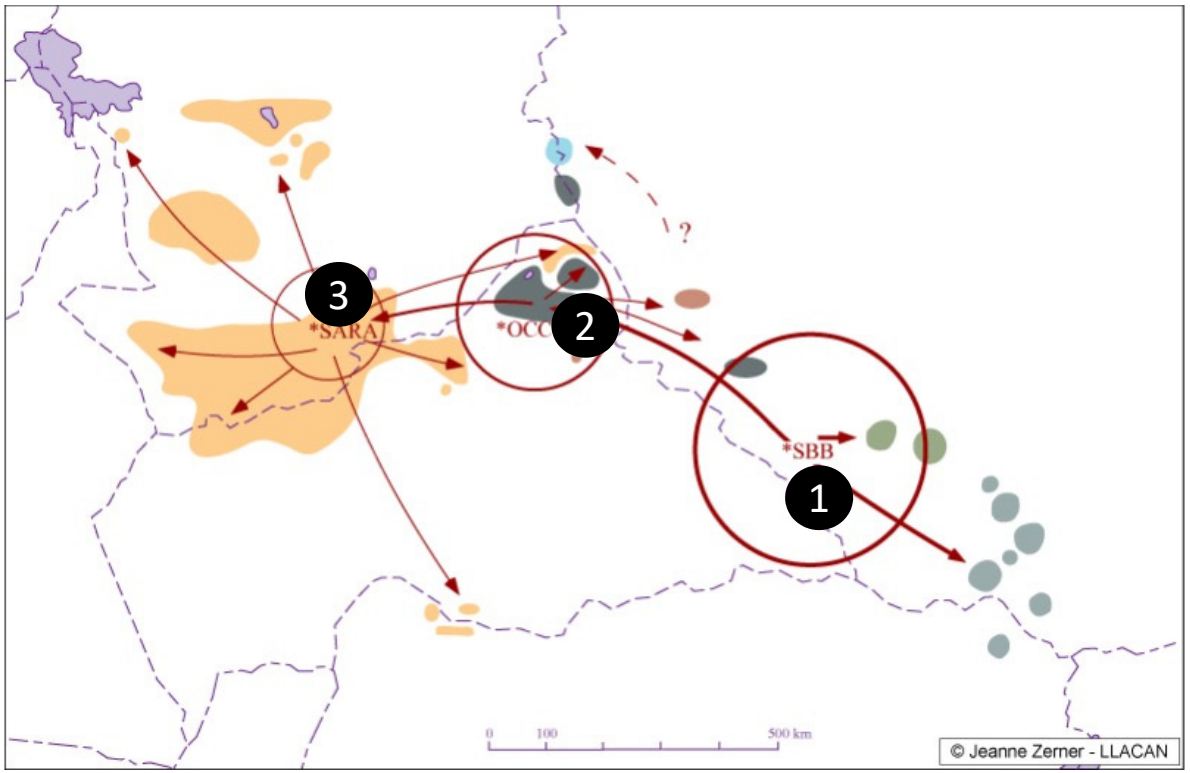
Proto-Central-Sudanic (Ehret 1974)

Hypothesis:

- Proto-CS had ATR
- <u>ATR lost in SBB</u> when moving out of ATR zone
- <u>Interior V gained</u> (or kept and reinforced?) in SBB when moving into Interior vowel zone

ATR harmony (only 3 exceptions)

2.2 Central-Sudanic: Sara-Bongo-Bagirmi



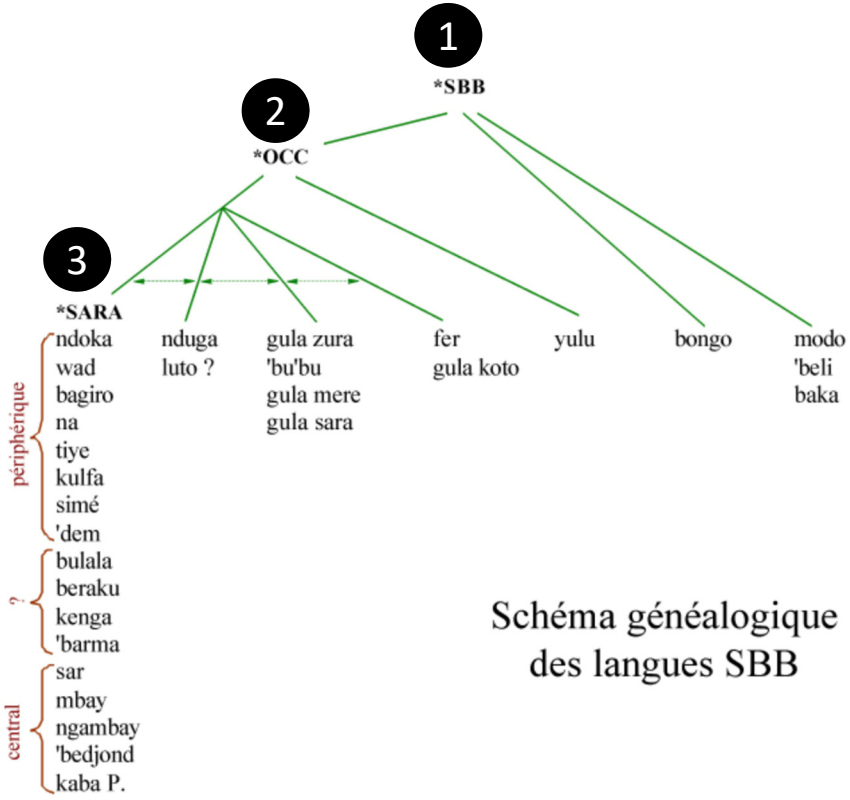
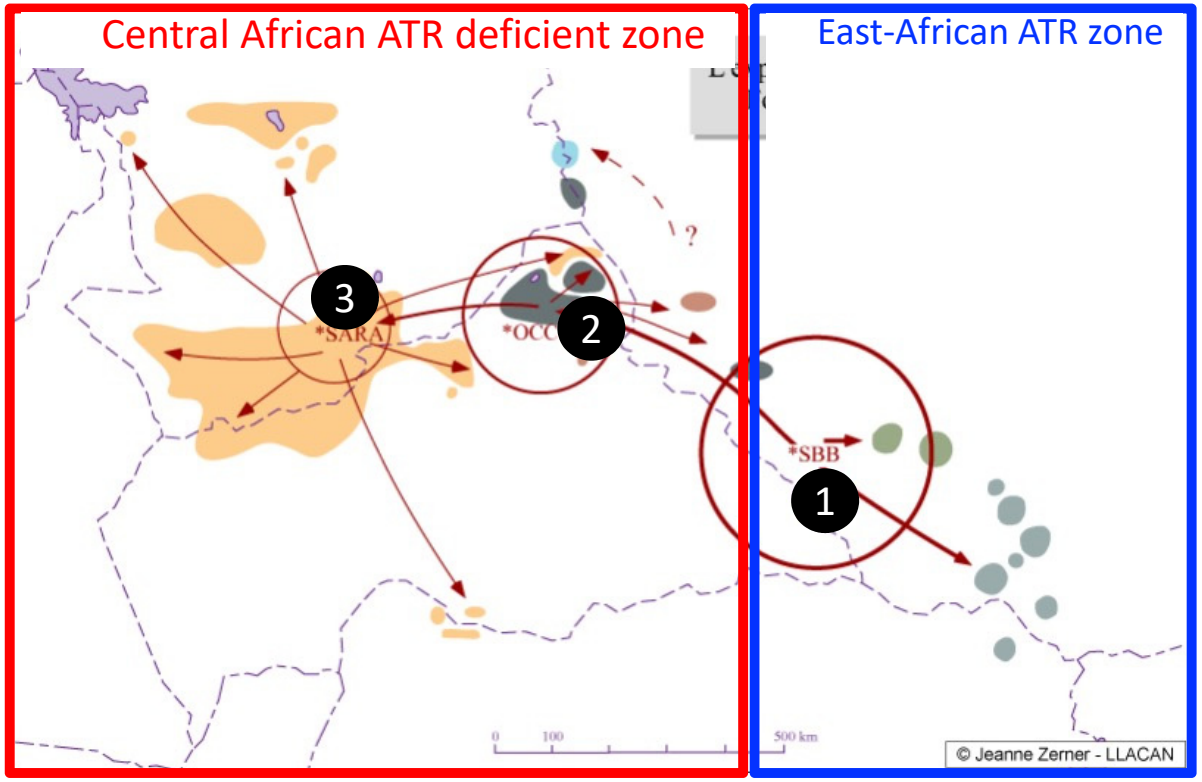
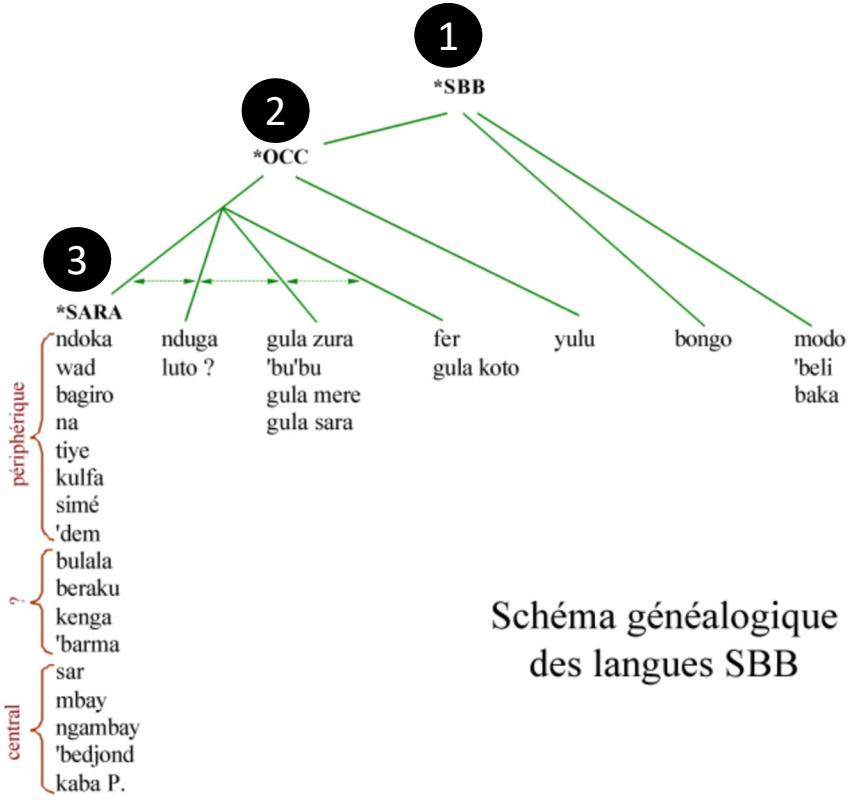


Schéma généalogique des langues SBB

2.2 Central-Sudanic: Sara-Bongo-Bagirmi





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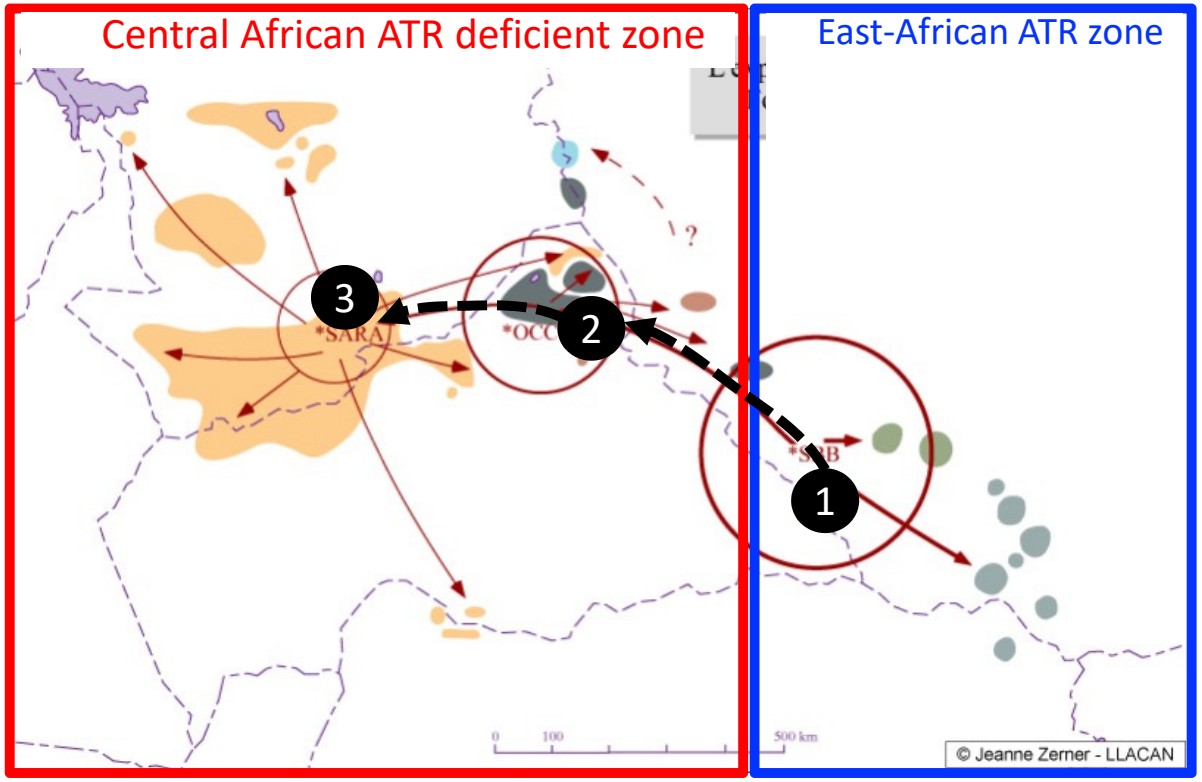

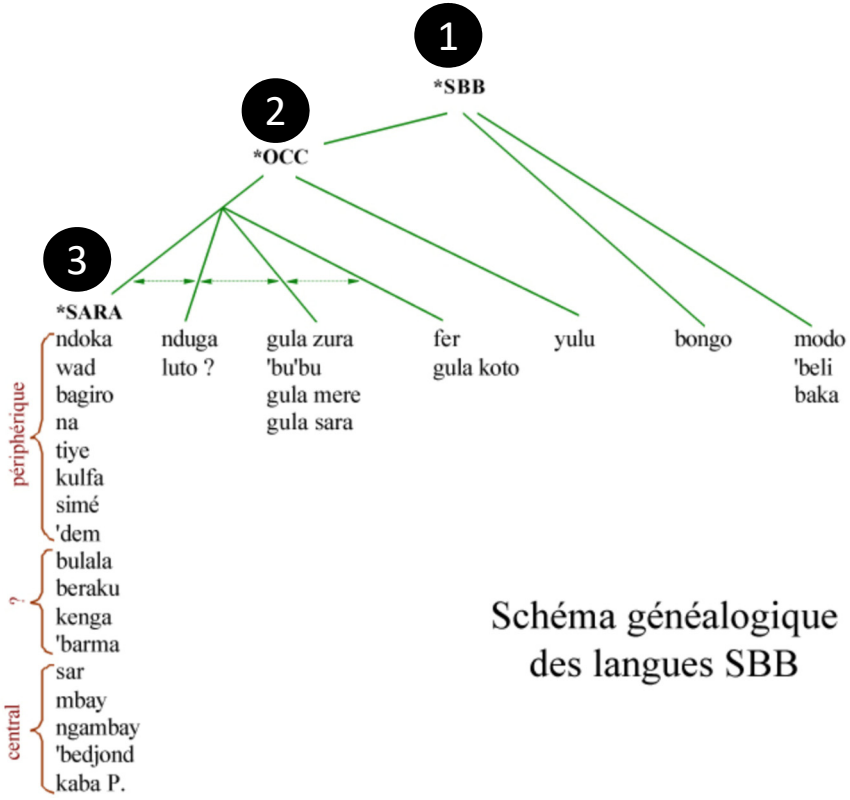

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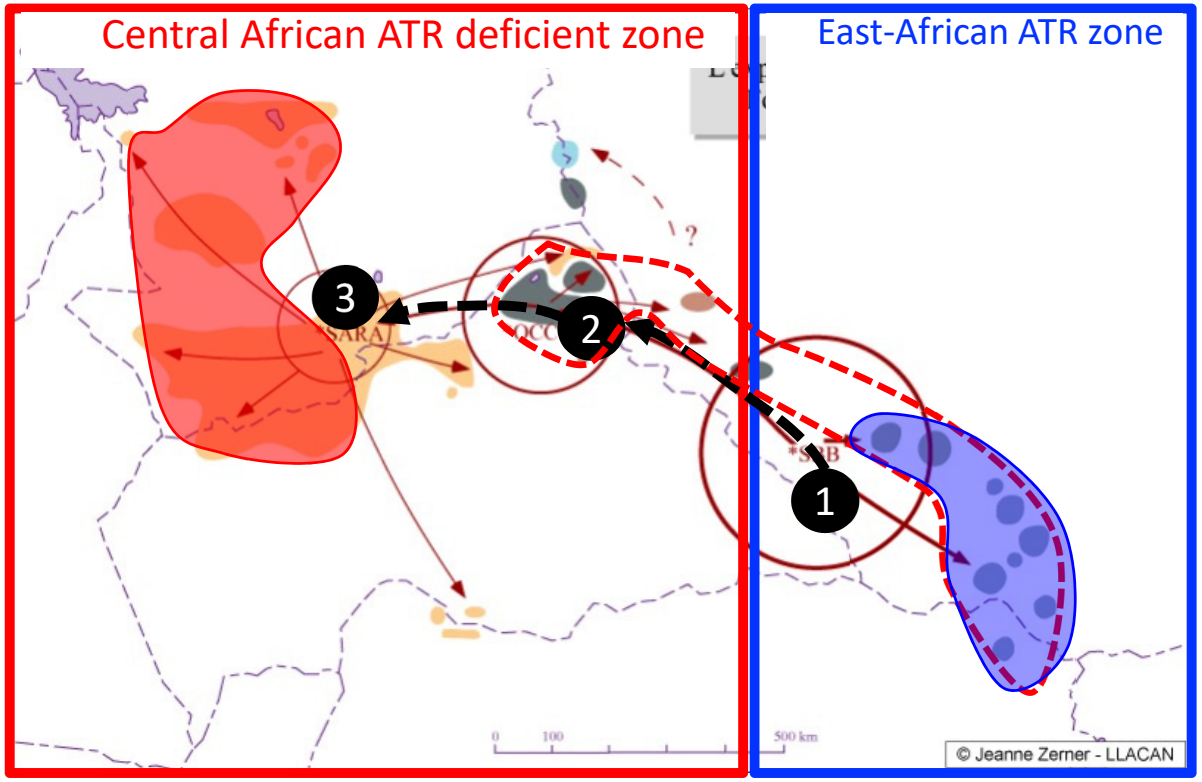

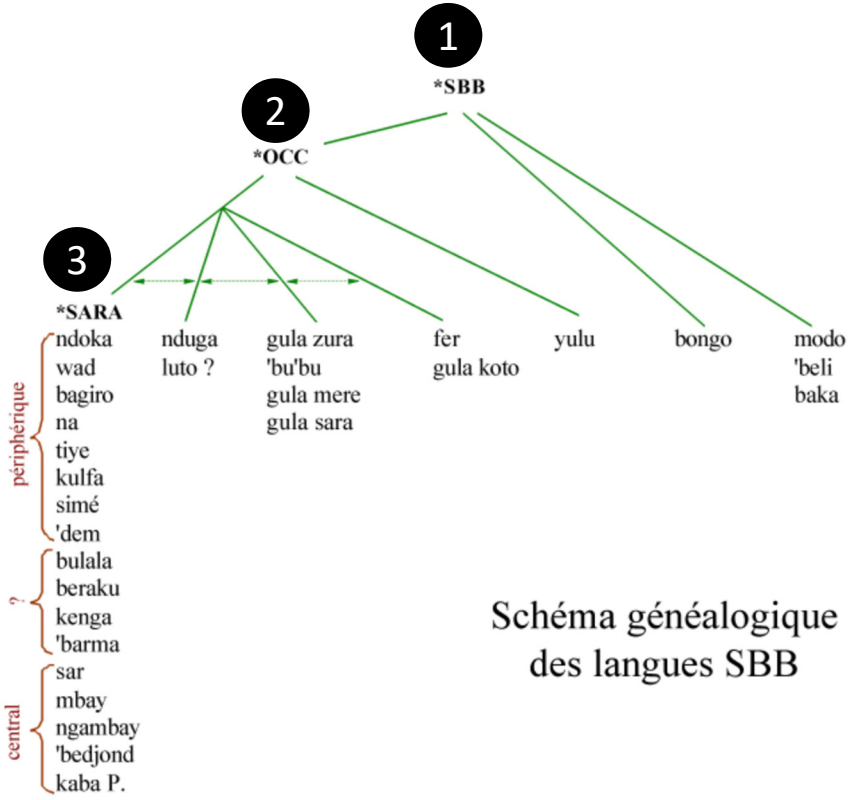

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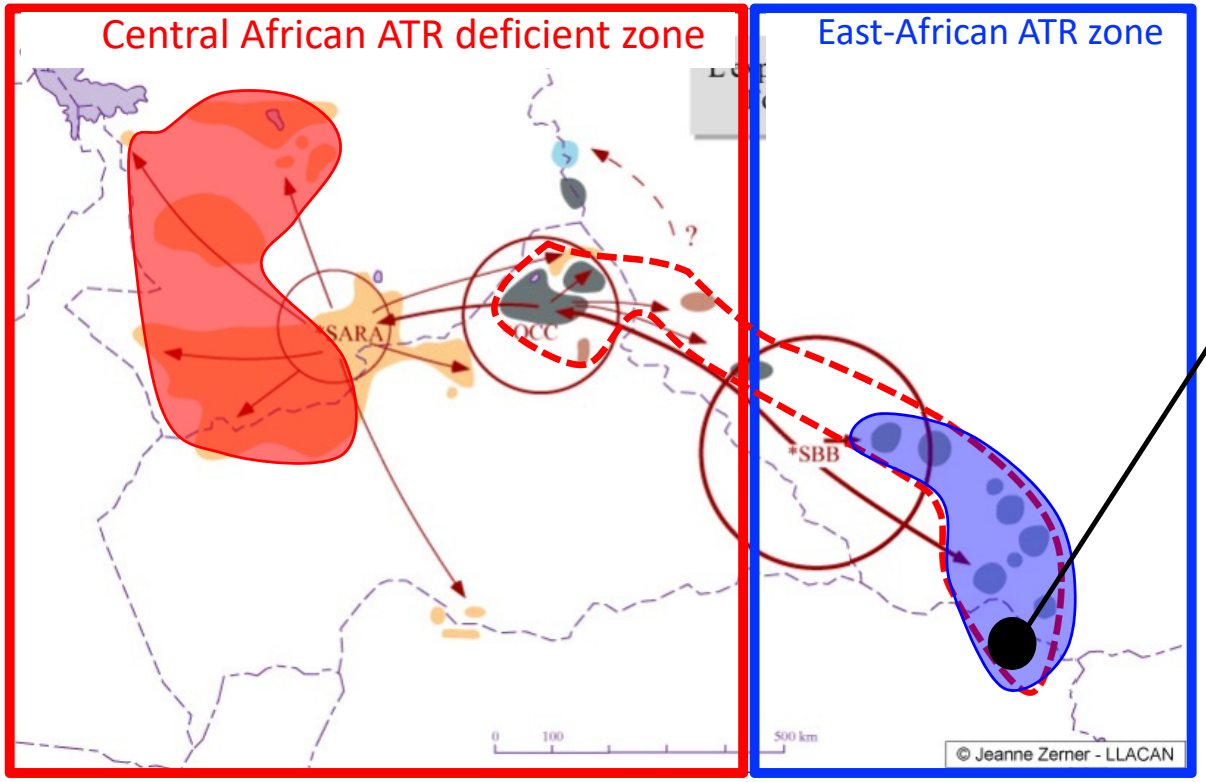
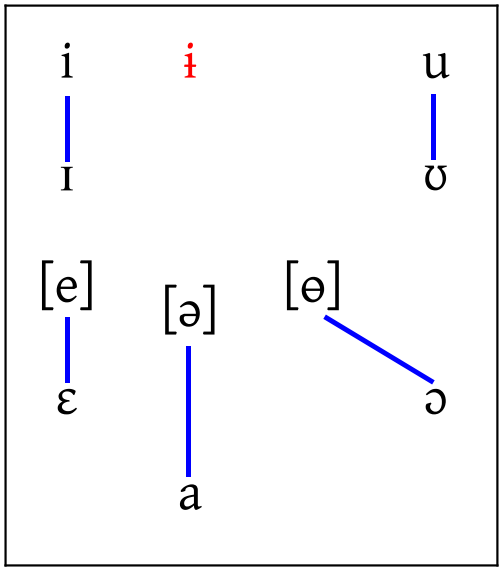


Baka [bdh]



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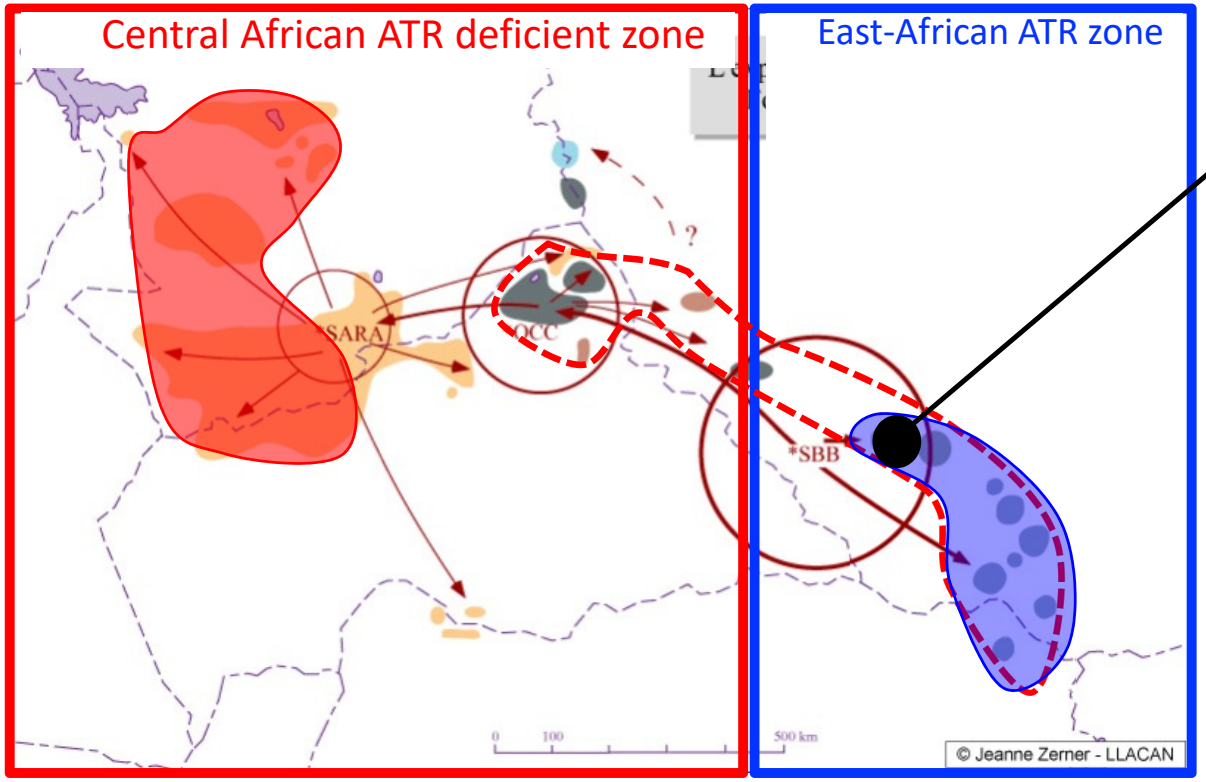
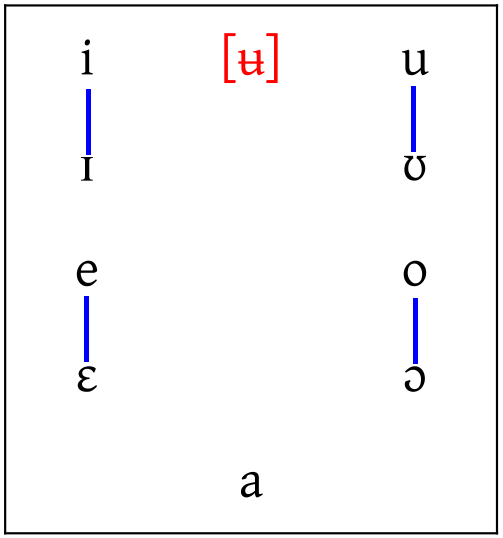
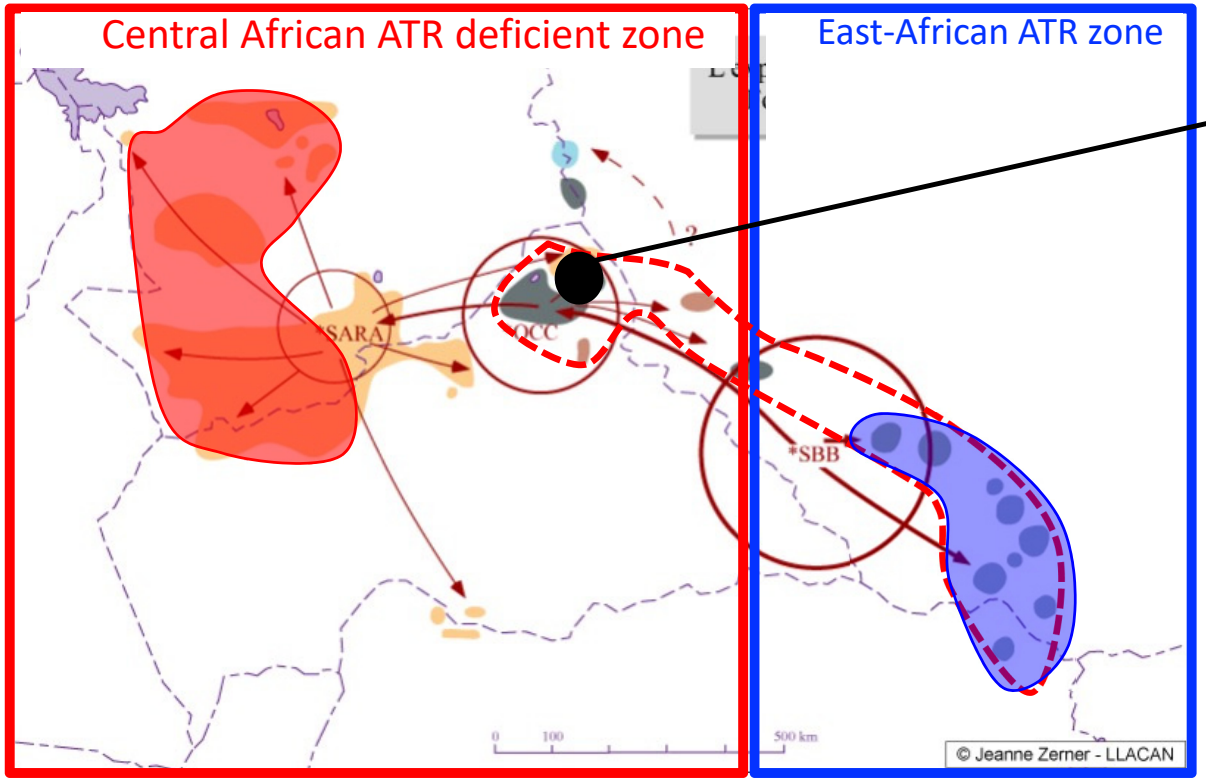


Bongo [bot]



[ʉ] = allophone of /u/

2.2 Central-Sudanic: Sara-Bongo-Bagirmi

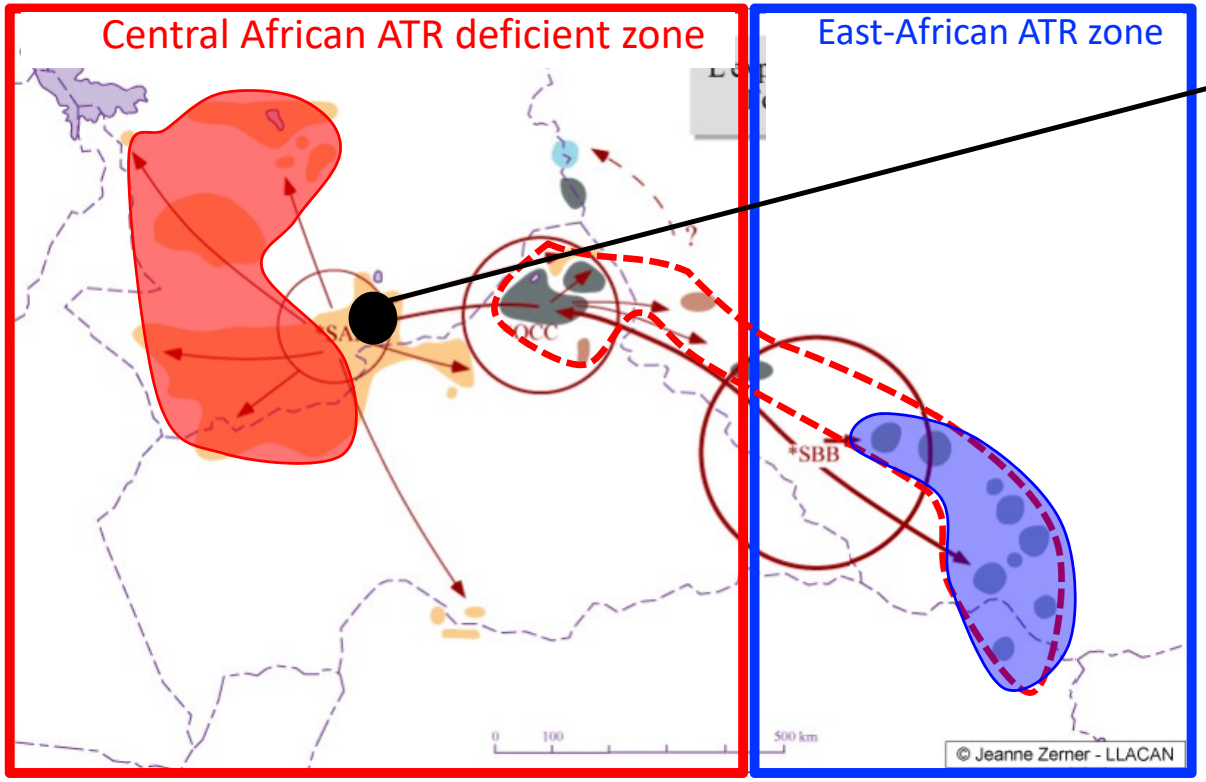


Fer [kah]

i		u
e		o
ɛ	[ə]	ɔ
	a	

[ə] is epenthetic

2.2 Central-Sudanic: Sara-Bongo-Bagirmi

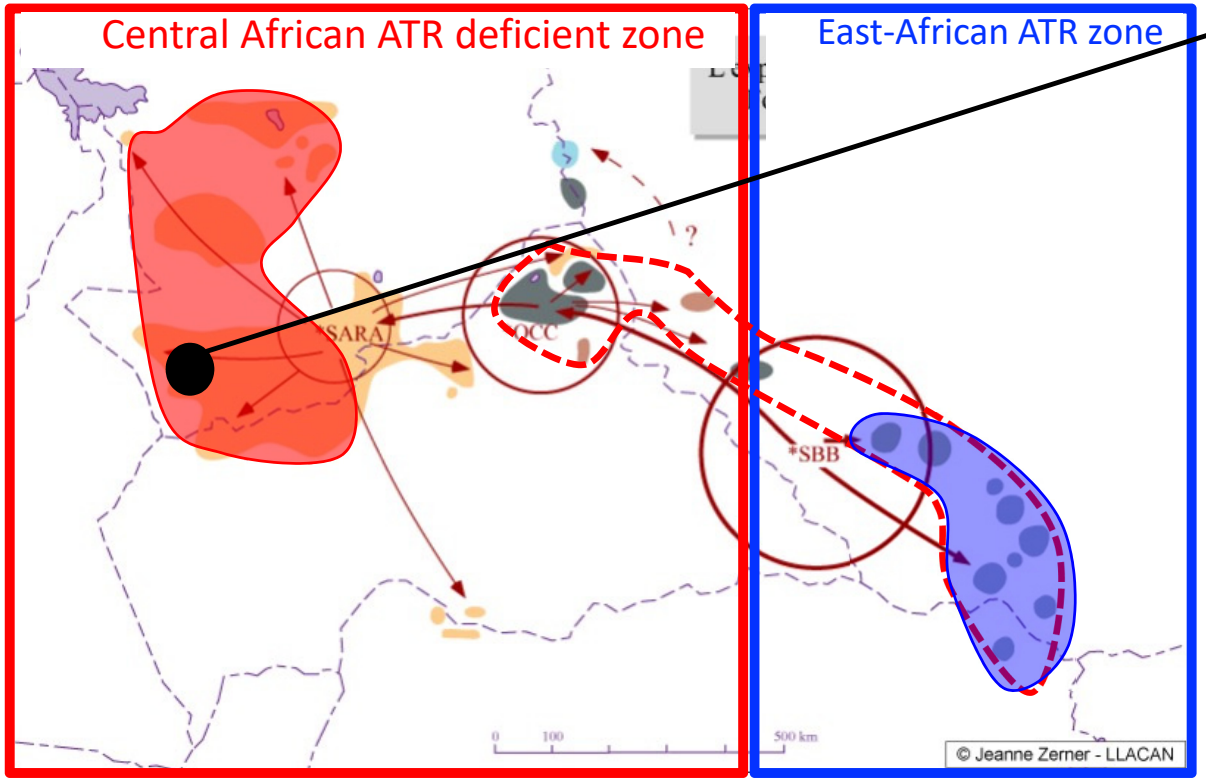


Deme [kwg] / **Na** [kwv] / **Kulfa** [kxj]

i	u
e	o
ɛ	ɔ
a	

(No interior vowels)

2.2 Central-Sudanic: Sara-Bongo-Bagirmi



Ngambay [sba] (and most Central Sara)

i	[ɨ]	u
e	[ə]	o
		ɔ
	a	

- [ɨ] = reduced /i e a ɔ o u/, very frequent in lexicon and speech
- [ə] = allophone of /e/
  - in C__L and
  - in C_Cɨ

2.2 Central-Sudanic: Sara-Bongo-Bagirmi

- Proto-SBB
  - Likely spoken in East African ATR zone
  - Likely had ATR harmony (Boyeldieu p.c.)
  - (Might have had interior vowels as well, but limited?)
- Migration into the Interior Vowel zone led to **profile change:**
  - **ATR lost** in all Western SBB
  - **high-frequency Interior vowels gained** (or further elaborated) in westernmost Sara languages

2.3 Northeast Bantu: Gain of ATR

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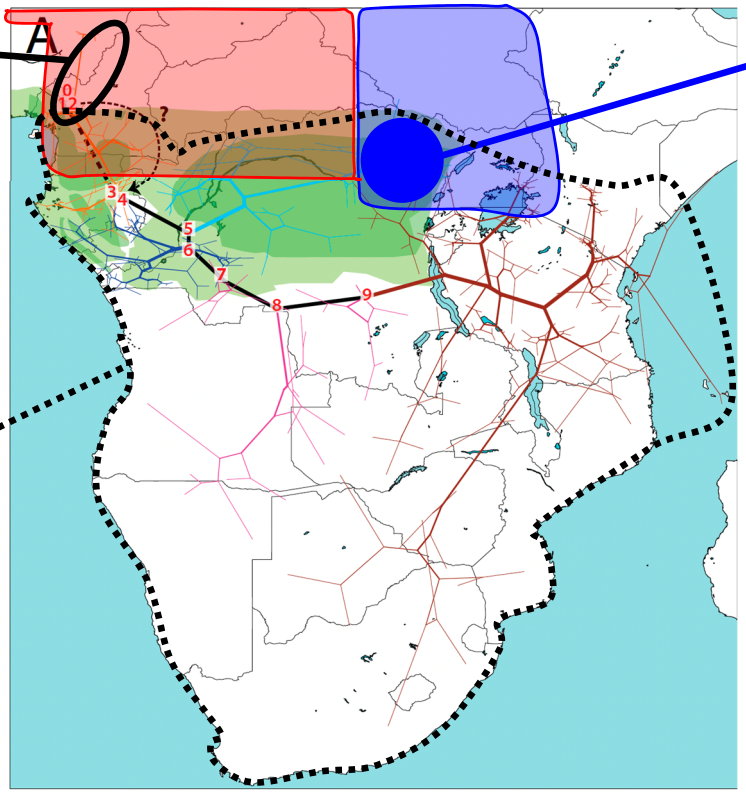
Proto-Bantu
No ATR harmony
reconstructed

Bantu languages
No ATR harmony
(Except Northeast DRC)



Bantu languages with ATR contrast & harmony

- Kinande
- Lika
- Budu
- etc.

2.3 Northeast Bantu: Gain of ATR

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No ATR harmony
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Bantu languages
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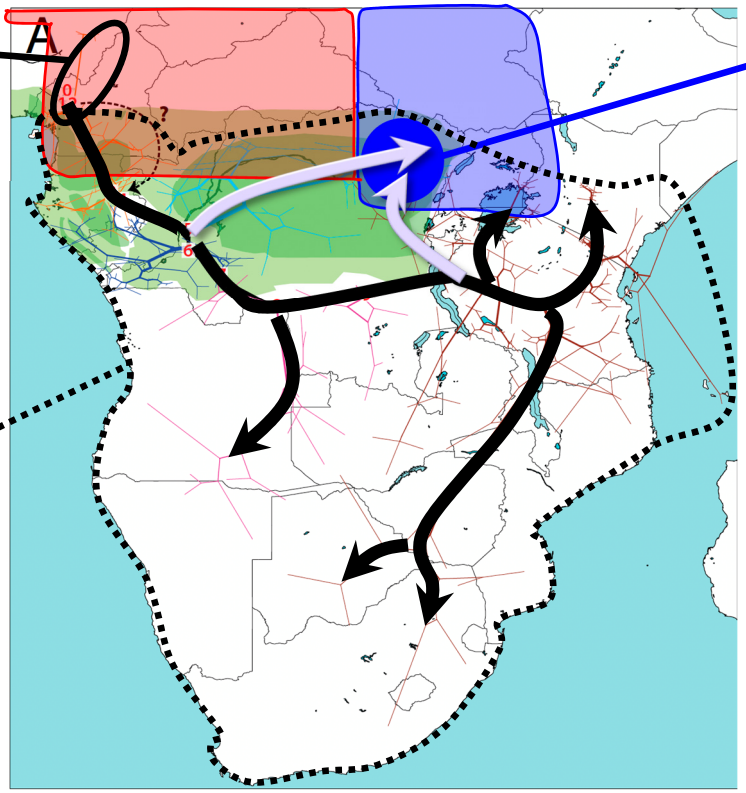


Bantu languages with ATR contrast & harmony

Hypothesis:

- **gained ATR** when moving into East African ATR zone
- **Contact** with Central-Sudanic, Zande, etc.

→ Similar to acquisition of Labial-Velars by Bantu languages in Northern DRC (Bostoen and Donzo 2013, Idiatov and Van de Velde 2021)

2.3 Proto-Bantu: ATR or not?

Proto-Bantu vowel system: 2 reconstructions

A. (Meeussen, 1967, a.o.)

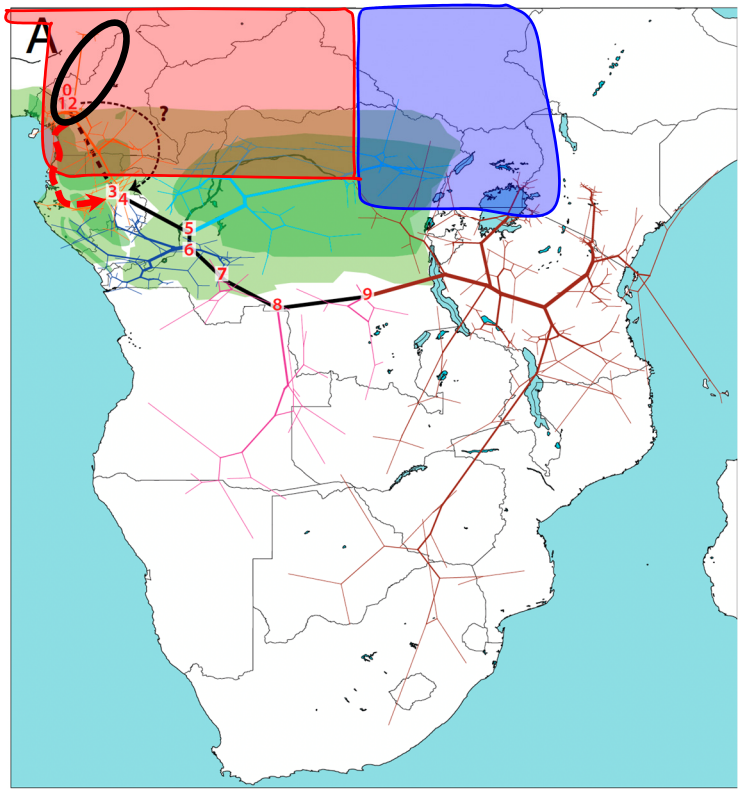
*į	*ų	super-high
*i	*u	high
*e	*o	mid
*a		low

- 4-height system
- no ATR contrast
- no ATR harmony

B. (Bastin et al 2002, a.o.)

*i	*u	high [+ATR]
*ɪ	*ʊ	high [-ATR]
*e	*o	mid
*a		low

- 3-height system
- ATR contrast in high V
- no ATR harmony



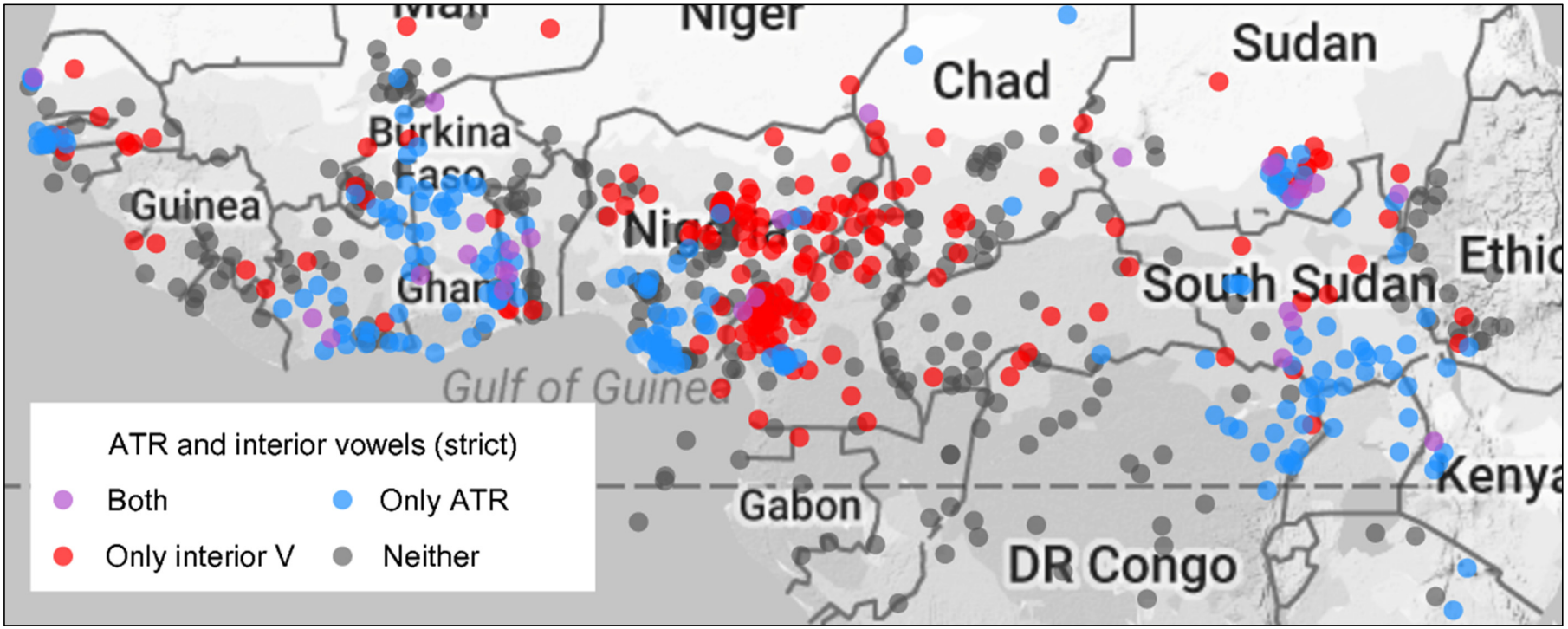
If Proto-Bantu was spoken in Central-African ATR-deficient zone
→ Argument in favor of reconstruction A = without ATR (?)

Ref: Grollemund et al 2015, Idiatov & Van de Velde 2021, Meinhof & van Warmelo 1932: 33, Guthrie 1967: 52, Meeussen 1967: 83, Bastin et al. 2002, Bostoen 2019 and refs therein

3. ATR/interiority antagonism

3.1 Antagonism: Where is there overlap?

- **Where** precisely does ATR and (phonemic) interiority **overlap**?



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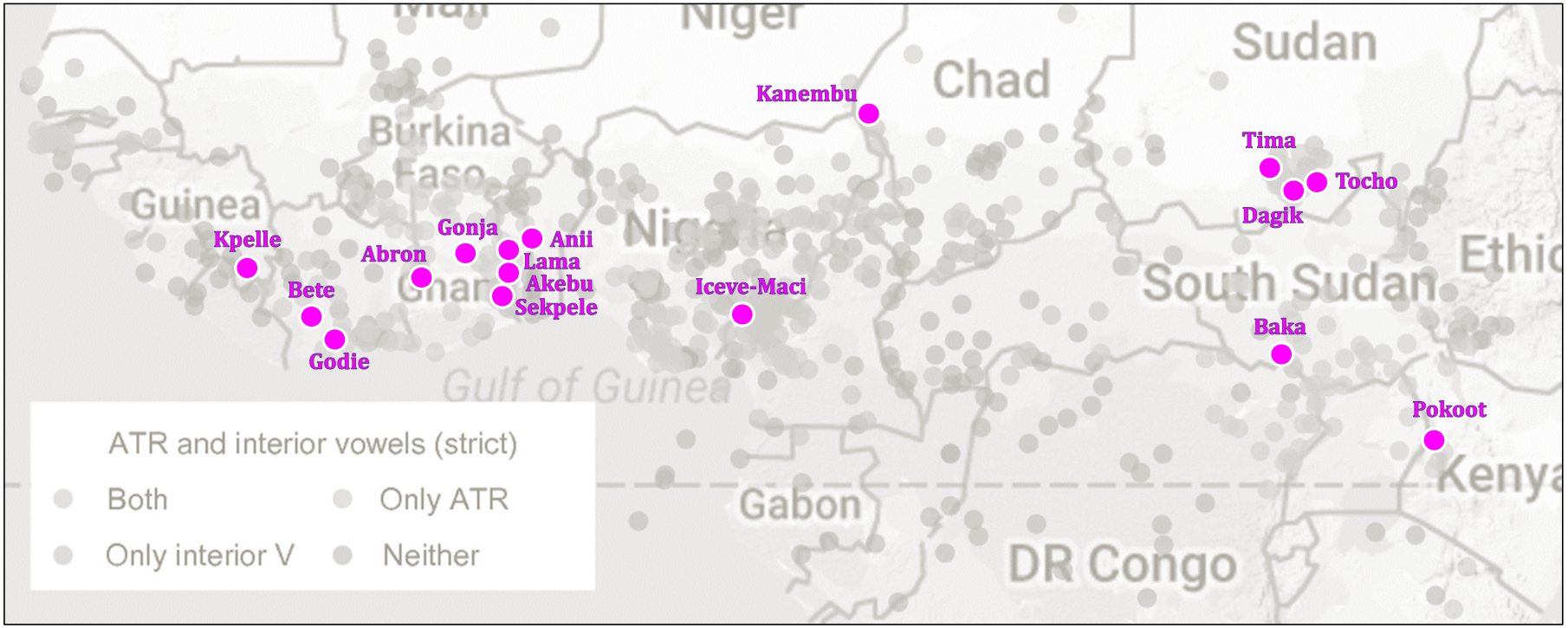

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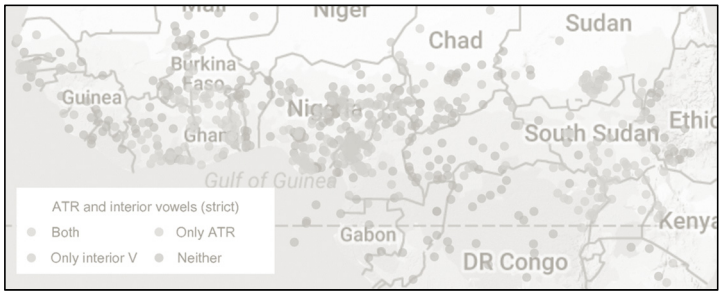
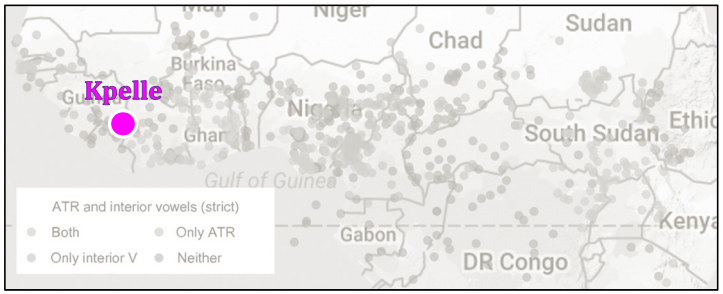


	index	language	iso	ATR+interiority system
1	id_0523	Kpelle	gkp	mid-harmony
2	id_0228	Gonja	gjn	interiority is allophonic
	id_0733	Pokoot	pko	interiority is allophonic
3	id_0098	Abron	abr	interiority has no counterpart
	id_0402	Sekpele	lip	interiority has no counterpart
	id_0081	Anii	blo	interiority has no counterpart
4	id_0268	Akebu	keu	interiority is neutral
	id_0656	Baka	bdh	interiority is neutral
5	id_0142	Bete	bet	full interior series
	id_0227	Godie	god	full interior series
	id_0297	Lama	las	full interior series
	id_0644	Iceve-Maci	bec	full interior series
	id_0531	Kanembu	kbl	full interior series
	id_0511	Dagik	dec	full interior series
	id_0585	Tima	tms	full interior series
	id_0586	Tocho	taz	full interior series

3.1 Antagonism: Where is there overlap?

- Guinean Kpelle [gkp]
  - Common Mande restriction that mid vowels of different heights do not co-occur (i.e. *e…ɛ, *ɔ…o, etc.)
  - /i/ is realized [i̱] but /ii/ is [ii]
  - /e/ is realized [ə] but /ee/ is [ee]



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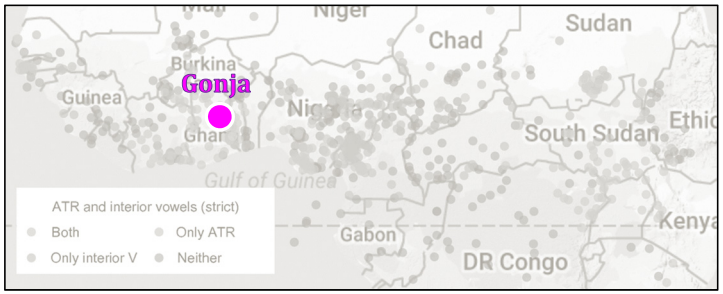
3.1 Antagonism: Where is there overlap?

- Gonja [gjn] – Has ATR harmony
  - "Short front vowels occurring between consonants often sound rather short and centralized in Gonja"
  - [kìʃí] 'to hate'
  - [gìsí] 'to belch'



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Ref: Nelson et al. 2016

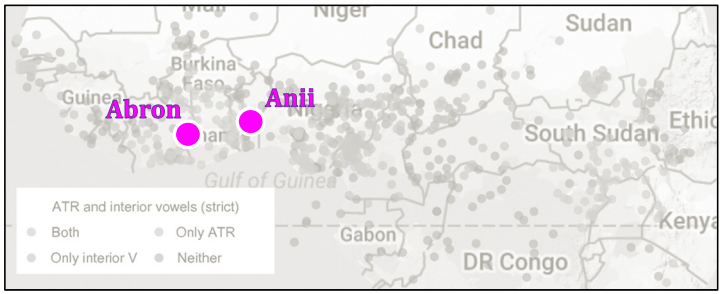
3.1 Antagonism: Where is there overlap?

- Abron [abr]

+ATR	i	ĩ	**y**	e			u	ũ	o
-ATR	ɪ	ĩ		ɛ	a	ã	ʊ	ʊ̃	ɔ

- Anii [blo]

+ATR	i	e	ə			u	o
-ATR	ɪ	ɛ	a	**ɨ**		ʊ	ɔ



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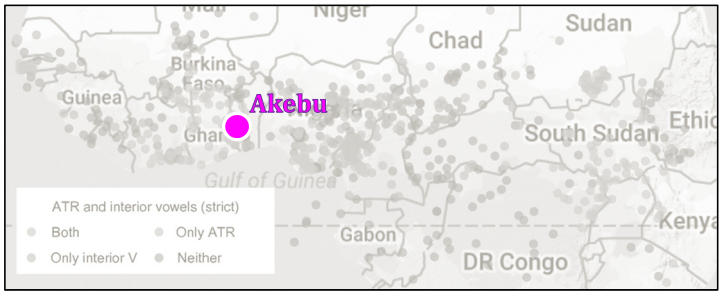
Ref: Timyan-Ravenhill 1983; Morton 2012

3.1 Antagonism: Where is there overlap?

- Akebu [keu]

+ATR	i	ĩ	e	ẽ	u	ũ	o	õ
-ATR	ɪ	ɪ̃	ɛ	ɛ̃	ʊ	ʊ̃	ɔ	ɔ̃

- However, both /ə/ and /a/ are neutral, i.e. **not** an ATR pairing



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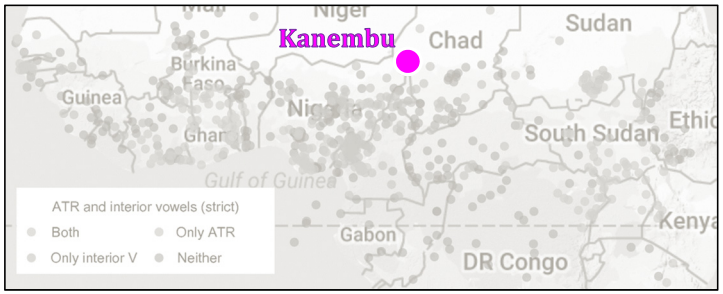
	id_0585	Tima	tms	full interior series
	id_0586	Tocho	taz	full interior series

Ref: Williamson 1973 [Heine 1968]; Koffi 1981; Storch & Yao Koffi 2000

3.1 Antagonism: Where is there overlap?

- Kanembu [kbl]

[ATR]	Front	Central	Back
+	i	ɨ	u
−	ɪ	ʉ	ʊ
+	e	ə	o
−	ɛ	ʌ	ɔ
Ø		a	



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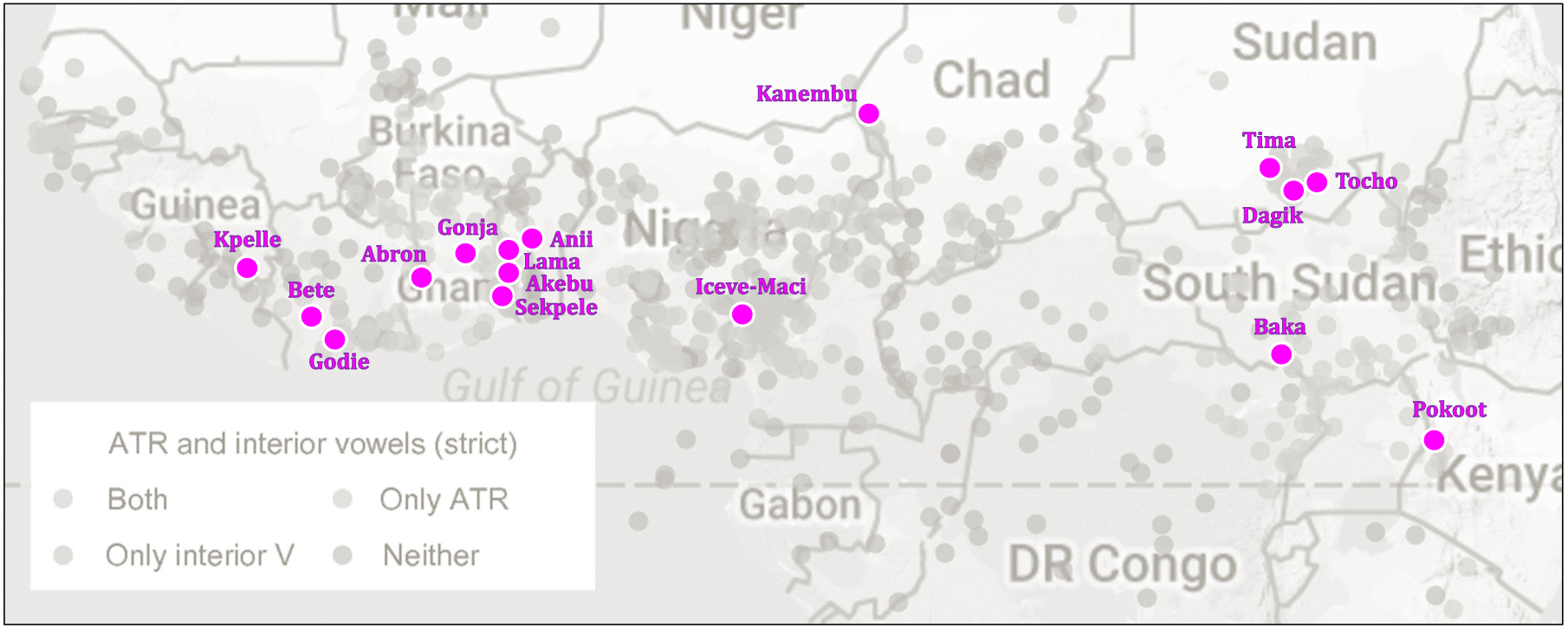
Ref: Jouannet (1982)

3.1 Antagonism: Where is there overlap?

- **ATR+Interior systems**: Surprisingly few at Central African boundaries



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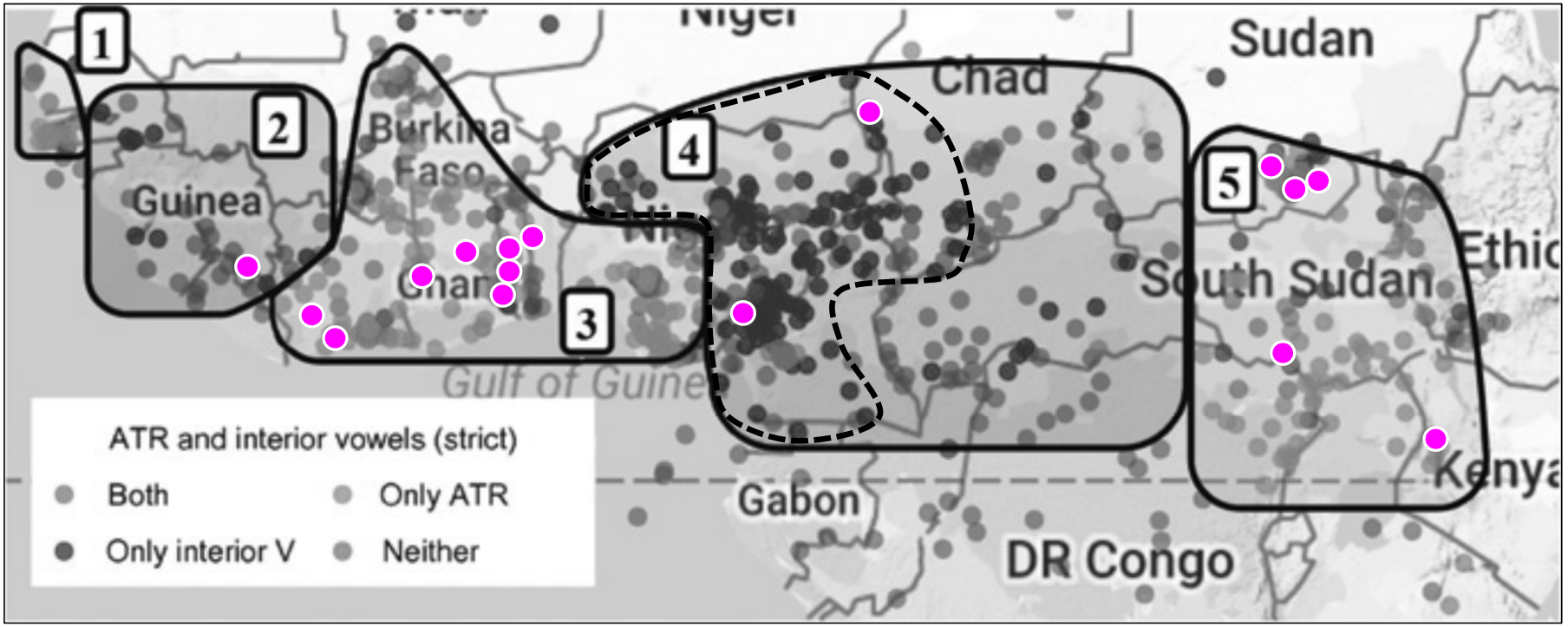

Ref: Rolle, Lionnet, & Faytak (2020) – Meso-areas in MSB:]1] Atlantic ATR zone, [2] Guinean ATR-deficient zone, [3] West African ATR zone, [4] Central African ATR-deficient zone (*slash* Central African interior vowel zone), [5] East African ATR zone

3.2 Antagonism: Why so few in C. Africa?

- Why are there so few ATR+Interiority systems within Central Africa, specifically at the transition boundaries with the West African ATR zone and the East African ATR zone?
- Loss of Harmony **before** Gain of Interiority?
  - Cross-Height ATR Harmony breaks down before interior vowels are acquired
  - We saw this already with the Delta Cross languages
- **Just chance**?
  - Such ‘saturated’ vowel systems are rare cross-linguistically

3.2 Antagonism: Why so few in C. Africa?

- Regardless of the precise reason, this (again) clearly demonstrates the **antagonism** between **ATR** and **interiority**

Conclusion

- Vowel systems within the MSB have a **clear meso-areal distribution**
  - In particular, the West and East ATR zones are separated by a wide ATR deficient zone in Central Africa
- **ATR** (harmony) and **Interior** vowels are areally **antagonistic**
  - The Central African ATR-deficient zone includes a wide and dense area where languages predominantly have interior vowels.
- Presence of **interior vowels** is one more feature **defining Central Africa** as a meso-area (with, e.g. clause-final negation, *inter alia*)
- **Languages change their phonological profiles** when changing areas
  - Areal signals are strong and stable: they resist migration and language shift (percolate up through layers of population movements)

Acknowledgments: Thank you to our colleagues at Princeton, Leibniz-ZAS, and UC Berkeley
References: Please email us for specific references. Many are found within Rolle, Lionnet, & Faytak (2020).

Appendix:
Comparing the distribution of vowels vs. KP-sounds (labial-velar stops)