Vowel assimilation to onset place in Kejom

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ACAL 50, UBC

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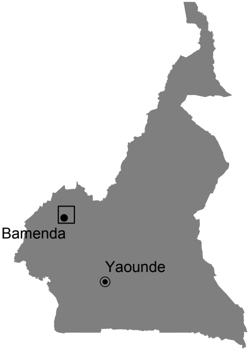
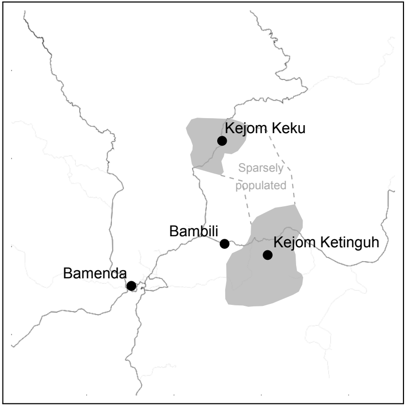
Kejom [kə̀d͡ʒɔ́m]

- More commonly known as Babanki, ISO 693-3 [bbk]
- Roughly 40,000 speakers in two settlements in Cameroon Grassfields[1]





[1] Hyman, 1980; Simons and Fennig, 2017; Hammarström, Bank, Forkel, and Haspelmath, 2017.

The present study

Phonetic details of the Kejom vowels[2] (previously unstudied)

- Kejom Ketinguh variant described here, as spoken by the second author
- Single-speaker study, but author is typical of the larger population
- Acoustic and articulatory records (video and ultrasound)

Evidence for an unusual pattern of **assimilation to onset consonants** for vowels /i/ and /ʉ/

- Both /i/ and /ʉ/ pick up constriction of postalveolar onsets
- /ʉ/ also picks up constriction of labiodental and bilabial onsets

[2] M. Faytak and Akumbu, in press.

Outline

Inventory

Consonant inventory

After Akumbu and Chibaka, 2012

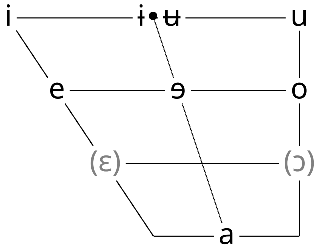
	Bilab.	Labden.	Alv.	Postalv.	Palatal	Velar
Plosive	b		t d			k g
Affricate		p͡f b͡v	t͡s d͡z	t͡ʃ d͡ʒ		
Nasal	m		n		ɲ	ŋ
Fricative		f v	s z	ʃ ʒ		
Approx.	w		l		j	ɰ

- Later, focus will be put on labials, postalveolars

Vowel inventory

Multiple non-peripheral vowel phonemes; common in Grassfields[3]

- Low-mid [ɛ], [ɔ] are marginal (allophones of /e/, /o/; vowel coalescence)
- [ʉ] is often a bit fronter, nearly [y]



[3] Rolle, Lionnet, and Faytak, in press.

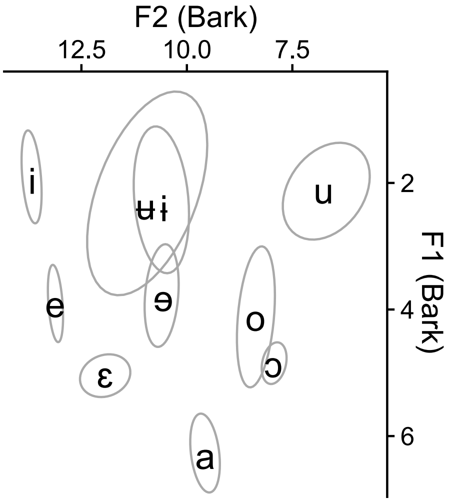
Vowel examples

More will be said about other allophones of /i/, /ʉ/ shortly

	Example	Gloss	
/i/	ə̀bí	‘kola nut’	▷ 1.
/u/	bú	‘more, extra’	▷ 2.
/e/	àbé	‘liver’	
/o/	bó	‘weave’	
/a/	bá	‘dad’	
/ɨ/	gɨ́ꜜsə́	‘voices’	▷ 3.
/ʉ/	gʉ́ꜜsə́	‘skins’	▷ 4.
/ə/	gə́ꜜsə́	‘bundles’	▷ 5.

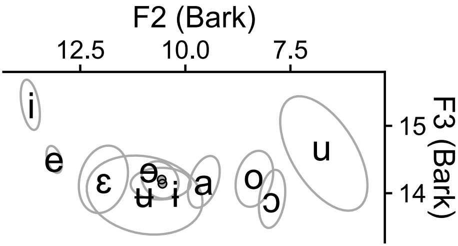
Speaker's vowels on F1–F2 plane

Mean F1, F2 with 95% confidence ellipses



Speaker's vowels on F3–F2 plane

No unexpected differences in F3



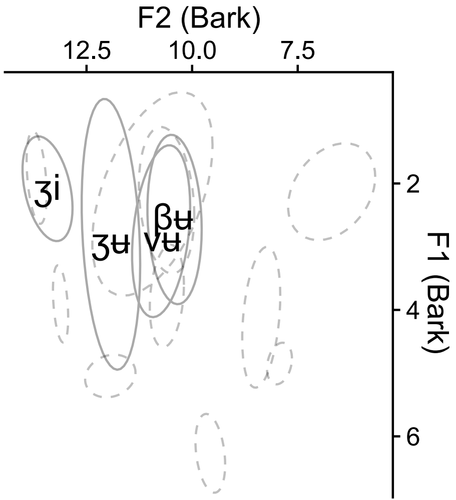
Assimilation of /i/, /ʉ/ to onset

- After postalveolars: [ʉ̻] and [i̻], **postalveolar** constriction made with tongue blade
  - IPA diacritic ◌̻ means “laminal”
- After bilabials: [ʉ$^{\beta}$], **lip-compressed**
- After labiodentals: [ʉ^{v}]; **labiodental** constriction

	Onset type		Example	
/i/	postalveolar	[i̻]	[kə̀^{n}d͡ʒí̻] ‘fool’	▷ 1.
/ʉ/	postalveolar	[ʉ̻]	[t͡ʃʉ̻́] ‘spit’	▷ 2.
/ʉ/	labiodental	[ʉ^{v}]	[p͡fʉ́^{v}] ‘die’	▷ 3.
/ʉ/	bilabial	[ʉ$^{\beta}$]	[bʉ́$^{\beta}$] ~ [bβ̩́] ‘dog’	▷ 4.

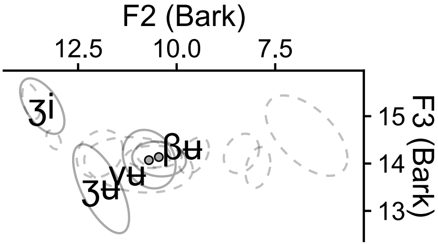
Speaker's allophones on F1–F2 plane

[ʉ̟] has **higher F2** compared to [ʉ], otherwise allophones are similar to “elsewhere” counterparts



Speaker's allophones on F3–F2 plane

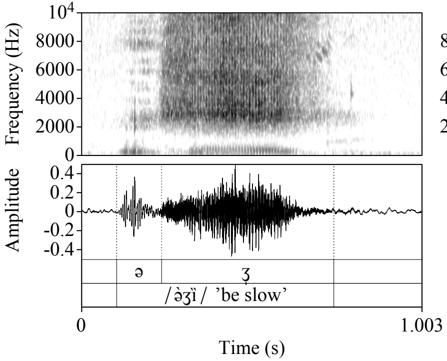
[ʉ̻] has **lower F3** compared to [ʉ], otherwise allophones are similar to "elsewhere" counterparts



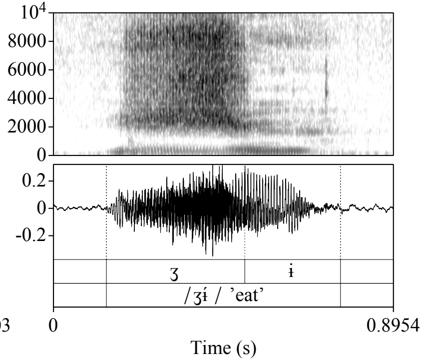
Noise: postalveolar allophones

Postalveolar fricative noise extends from onset straight through [i̺], [ʉ̺], suggesting carryover of constriction location from onset

[ʒi̺] 'be slow' ▷ 1.



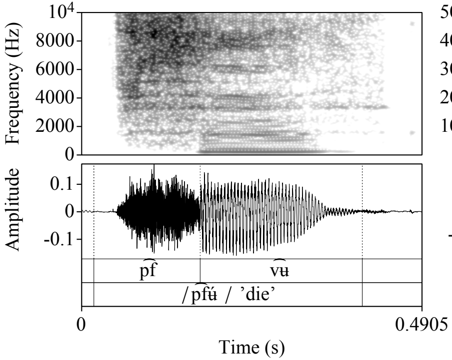
[ʒɨ] 'eat' ▷ 2.



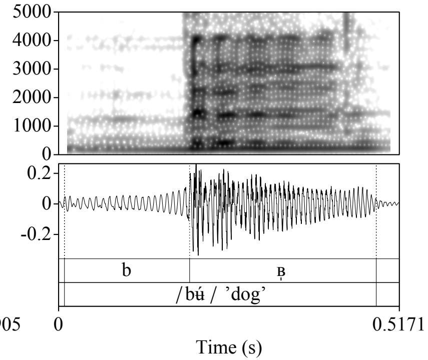
Noise: labial allophones

[ʉ^{v}] shows similar continuation of frication from labiodental onsets; lip-compressed [ʉ^{ß}] is frequently trilled

[p͡fʉ́^{v}] ‘die’ ▷ 1.



[bʙ̣́] ‘dog’ ▷ 2.



Interim summary

These allophones could be construed as the result of processes of **assimilation** of some vowels to some onsets

- Assimilation to postalveolar onsets in terms of tongue position
- Assimilation to bilabial, labiodental onsets in terms of lip position (only of [$+$round] vowel)

Articulatory study

Are /i/ and /ʉ/ *really* produced with constriction locations used by an articulator active in some onset consonants?

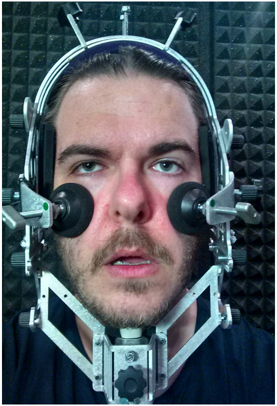
Materials

Recordings were taken of the second author

- **Ultrasound** recordings and **video of lips** collected in separate sessions
- Collected in Berkeley PhonLab, 2016
- Words containing target vowels [i̻], [ʉ̻], [ʉ^{ß}] [ʉ^{v}]
- Also words containing comparison vowels [i], [u], [ʉ]

Ultrasound tongue imaging

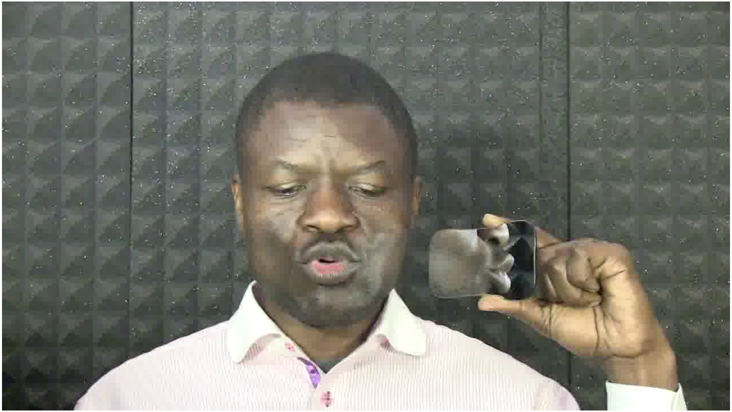
- Provides information on **tongue shape** and **position**
- Ultrasound probe is stabilized with respect to the lower jaw using a headset[4]



[4]Scobbie, Wrench, and van der Linden, 2008.

Video recording

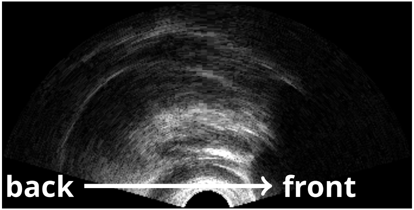
- View of face to capture **labial articulation**
- Collected in separate session from ultrasound
- Frontal recording; mirror held at 45° angle to capture side view of lips



Example ultrasound data

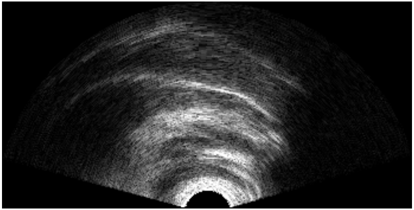
Palate is not normally visible at same time as tongue, but has been added in for reference

[u]



[i]

[a]



Analysis

Ultrasound data is noisy; undergoes further processing

- **Tongue surface contours extracted** using EdgeTrak[5]
- Contours submitted to smoothing-spline ANOVA[6], calculated using polar coordinates[7]
- Resulting models are of **typical tongue surface position** for each segment type
- If confidence intervals do not overlap, the models differ at that point along the curve

[5] Li, Kambhamettu, and Stone, 2005.

[6] Davidson, 2006.

[7] Mielke, 2015.

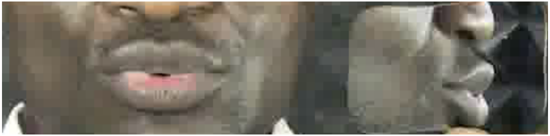
Results

Labial articulation of [ʉ^{v}], [ʉ^{ß}]

Lip posture of both allophones is quite distinct from [u]

[u]: [bú] ‘more, extra’

[ʉ^{ß}]: [bʉ́^{ß}] ‘dog’



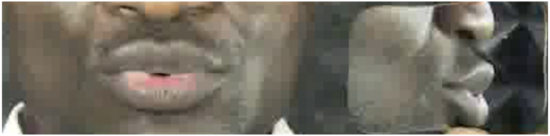
[ʉ^{v}]: [^{n}b͡vʉ́^{v}] ‘chicken’ ▷

Labial articulation of [ʉ^{v}], [ʉ^{ß}]

Also distinct from [ʉ]; [ʉ^{ß}] subtly protruded compared to [ʉ]

[ʉ]: [gʉ̀] 'skin' ▷

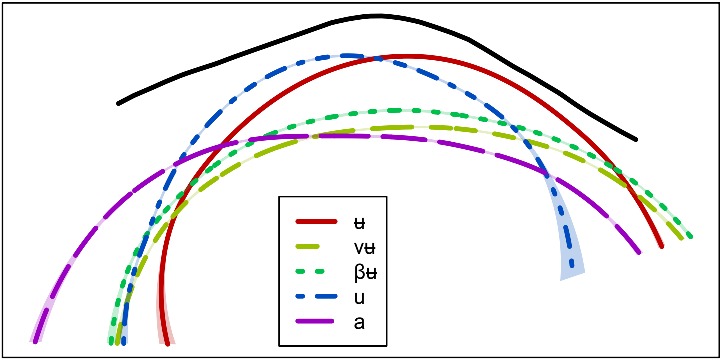
[ʉ^{ß}]: [bʉ́^{ß}] 'dog'



[ʉ^{v}]: [^{n}b͡vʉ́^{v}] 'chicken'

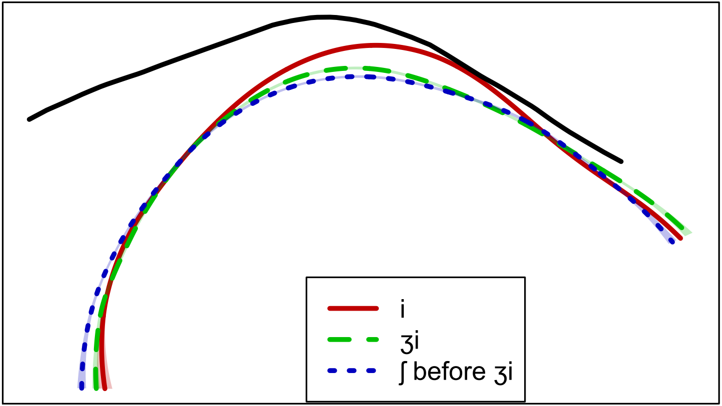
Lingual articulation of [ʉ^{v}], [ʉ^{ß}]

- Tongue position of [ʉ^{v}], [ʉ^{ß}] (yellow, green) is surprisingly **low** and **front**
- Compare [a] (purple)
- Very distant from any high vowel, even [ʉ]
- n.b. palate trace is provided in black



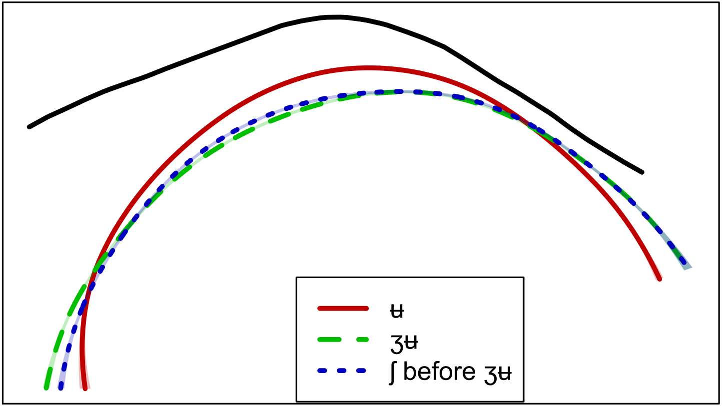
Lingual articulation of [i̺]

- Shape of [i̺] is overall nearly identical to [ʃ]
- Lowered tongue dorsum relative to [i]
- Blade somewhat raised, suggesting support of raised tip



Lingual articulation of [ʉ̺]

- Shape of [ʉ̺] is overall nearly identical to [ʃ]
- Lowered tongue dorsum relative to [ʉ]
- Blade very much raised in support of [ʃ]-like constriction



Conclusion:

Yes: Kejom /i/, /ʉ/ do take on the major constriction location of certain onsets

Discussion

Summary: phonetics

Phonetically interesting: assimilation results in unusual vowel-like sounds

- Constriction types not typically associated with vowels (postalveolar, labiodental, etc.)
- Some occlusion of vocal tract is usually apparent: light noise, trilling, etc.
- At odds with description of vowels as having **unimpeded airflow**[8]
- If not vowels, then they are also not quite voiced fricatives (too many formants!)

[8] Catford, 1977.

Summary: phonology

Interesting classes of undergoers and triggers, even if treated as two distinct processes

- Only *some* high vowels affected
- Why no assimilation to velars like /k/, or alveolars like /s/?
- Why only assimilation to the obstruent continuants (no plosives except /b/)?

Typological parallels

Pattern of assimilation to onset resembles that of **"fricative vowels"** in languages of the **Sinosphere** (China and surrounds)[9]

- Coronal types, AKA "apical vowels": /i/ takes on the constriction location of a sibilant fricative or affricate preceding it, similar to Kejom [i̻][10]
- Labial types: /u/ takes on the constriction location of a bilabial or labiodental obstruent preceding it, similar to Kejom [ʉᵛ] and [ʉᵝ]
- Labial segments also have lowered tongue body, as in Kejom[11]

Asymmetries in perception and resistance to coarticulation likely explain these recurring patterns

[9] Dell, 1994; Zhu, 2004.

[10] Lee-Kim, 2014; Matthew Faytak and Lin, 2015.

[11] Matthew Faytak, Kuo, and Wang, 2019.

Closer to home

More of these vowels can be found in Grassfields Bantu: very often reflexes of a reconstructible ***u**

- [i̻] and [ʉᵛ] occur in Oku, closely related
  - Allophones of a single phoneme /ə/, which is a reflex of ***u**[12]
- [ʉᵝ] occurs in Medʉmba, further afield[13]
- Kom, also closely related[14]
- Further afield: Limbum[15], Len Mambila[16]

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[12] Davis, 1992.

[13] Olson and Meynadier, 2015.

[14] Matthew Faytak, 2017.

[15] Matthew Faytak, 2017.

[16] Connell, 2007.

Concluding notes

Vowels of the sort investigated here are probably **undercounted**

- Auditory impression is often of a central vowel such as [ɨ] or [ə]
- More careful phonetic record-keeping may spare us further descriptive inaccuracies
- Include simple articulatory methods in the fieldworker's arsenal
    - Photography or videography
    - Static palatography, if possible given phonotactics

Concluding notes

Also cautions against painting linguistic areas with too broad a brush

- Kejom's part of the Grassfields is not very prototypically West African phonologically
- In fact, greater typological similarity to the Sinosphere in some senses

Thanks

For questions or comments, please contact faytak@ucla.edu

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Ultrasound specs

Hardware

- Ultrasonix SonixTablet equipped with C5/9–10 microconvex probe
- Probe stabilized with Articulate Instruments headset[17]

Software

- Raw scanline data converted to real-world proportions using Python utilities
- All image modifications turned off (data is unfiltered)
- No other imaging parameters changed
- Frame rate of approximately 57 Hz

[17] Scobbie et al., 2008.