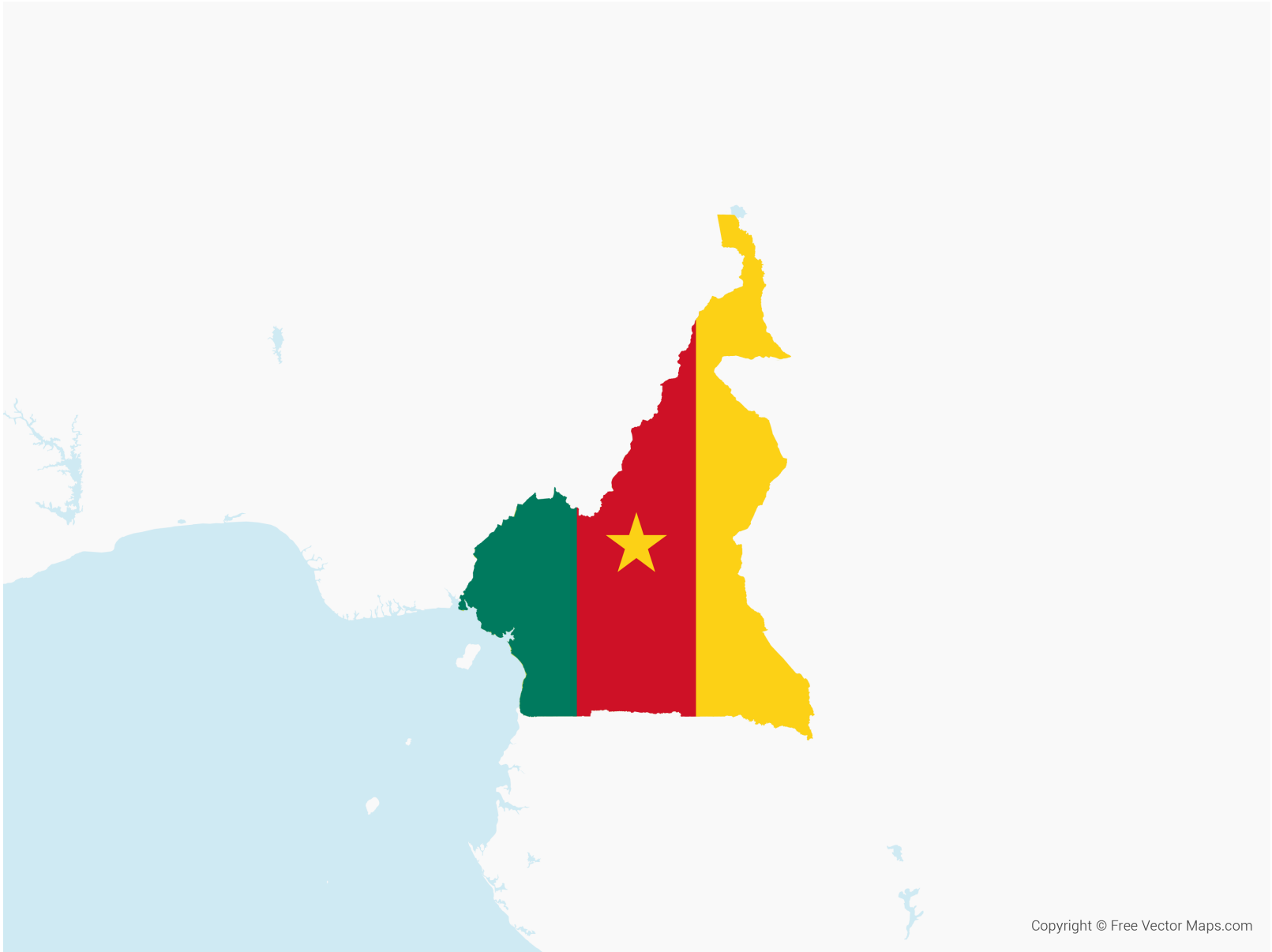
Variation and change in Kom fricativized vowels

Matthew Faytak

ACAL 46 — May 30, 2014

Background: Kom



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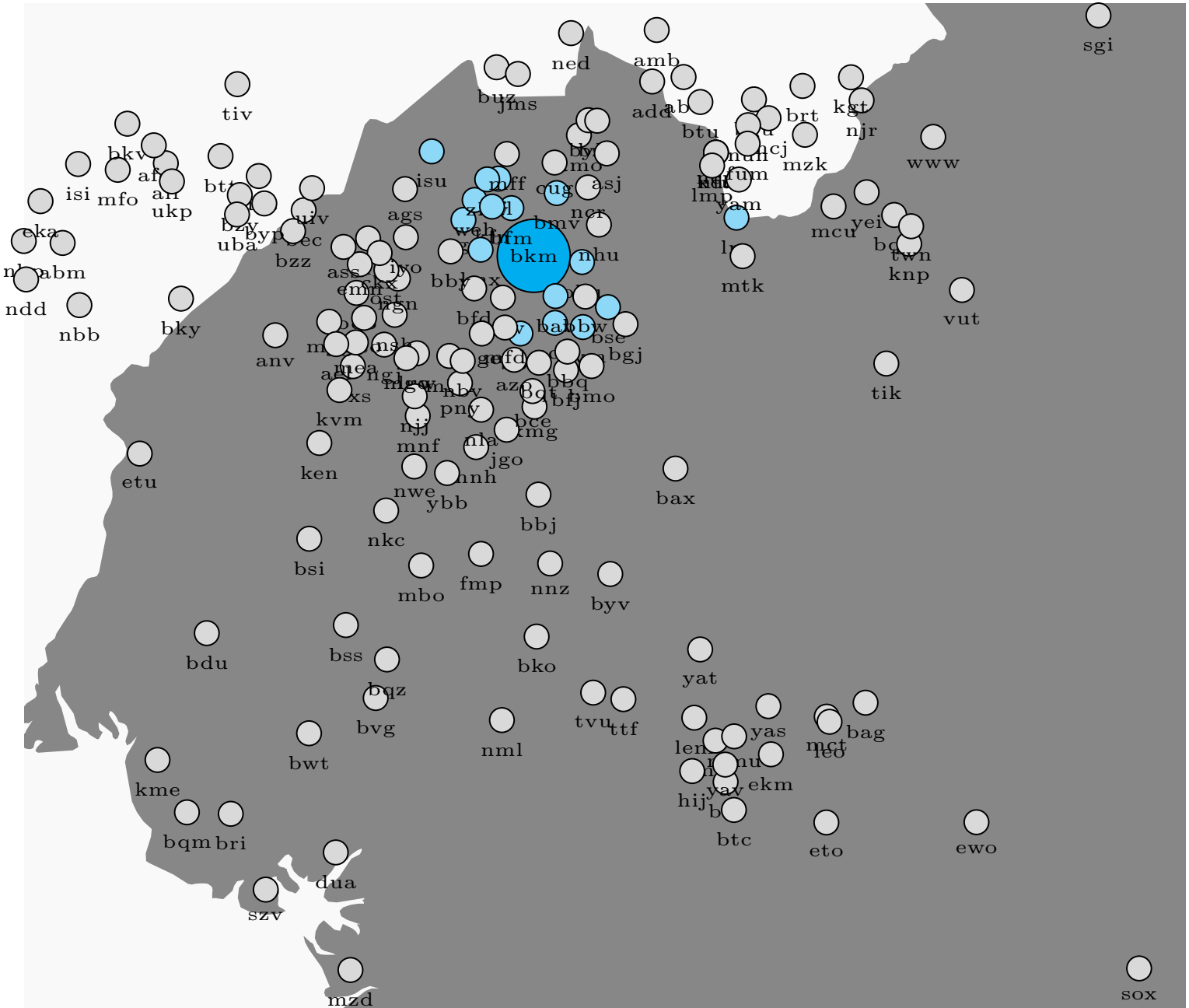


Background: Kom

Demographic information Ethnologue (2009)

- Spoken by 233,000 people, including a large diaspora within Cameroon
- Ethnologue development level 3 - used by speakers of other languages

Orthography in place, taught in primary schools (?) Chia and Kimbi (1984)

Fricativized vowels

Fricativized vowels or **fricative vowels** are known from a handful of languages around the world

- Several languages of the Grassfields area — Connell (2007), Fransen (1995)
- Northern and southwestern China — Dell (1981), Feng (2009)
- Swedish — Schötz et al. (2011), Björsten and Engstrand (1999)

They involve the deliberate formation of a central constriction that produces a fricative noise source

Fricative vowels in Kom

Kom has two fricativized vowels, both of which are high(ish), central, and fully voiced:

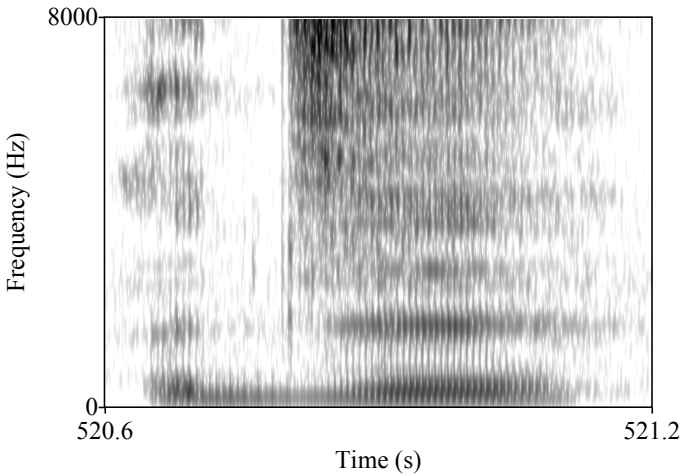
- (Post)alveolar frication, here /z/
- Lip-compressed (after bilabial /b/) or labiodental (elsewhere) frication, here /v/
- The high vowels are sometimes realized with a voiceless "coda" of frication, e.g. [iç], [ux], but they contrast with /z/, /v/:

a˧bv˥ 'ash'	bz˥ 'goat'	i˧bi˥ 'kola nut'	—	bu˥ 'dog'
i˧dv˨˩ 'plenty'	dz˨˩ 'to weep'	ndi˧ 'to insult'	ndu˨˩ 'to leave'	—
ŋkv˨˩ 'rope'	—	a˩˧ŋki˧ 'mirror'	ku˨˩ 'to take'	a˧ku˥ 'mortar'

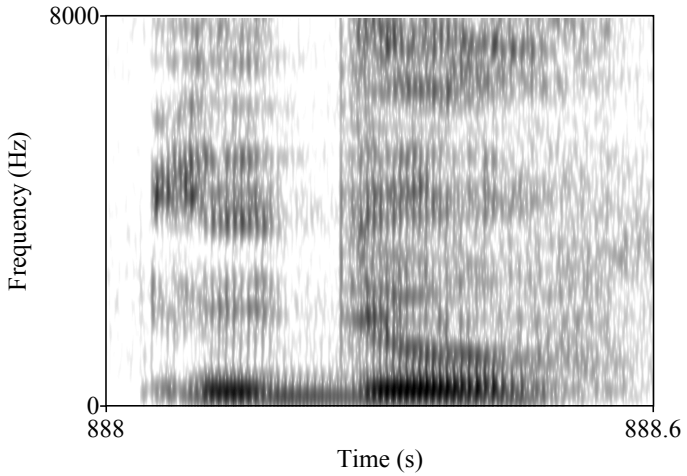
Note that I use **Chao tone letters** throughout Chao (1930)

Fricative vowels in Kom

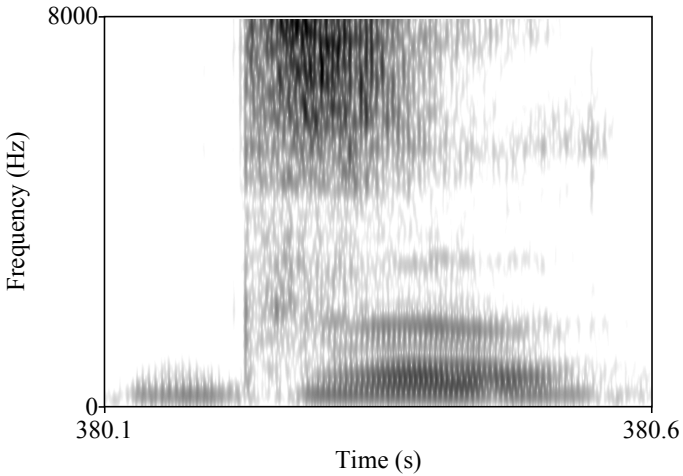
ME, ‘road’



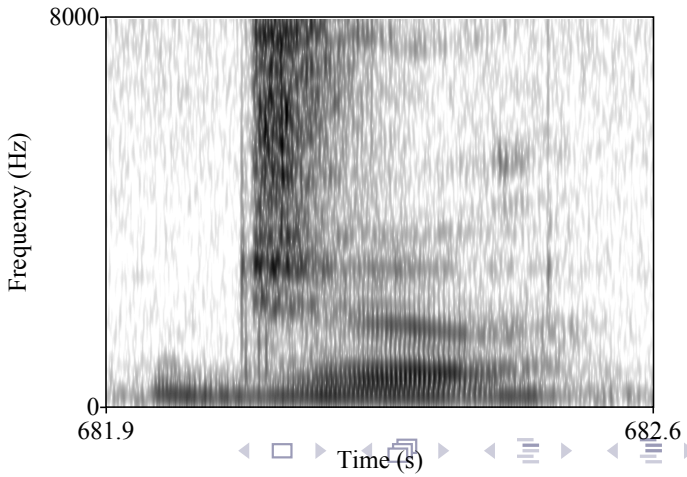
ME, ‘plenty’



EJ, ‘road’

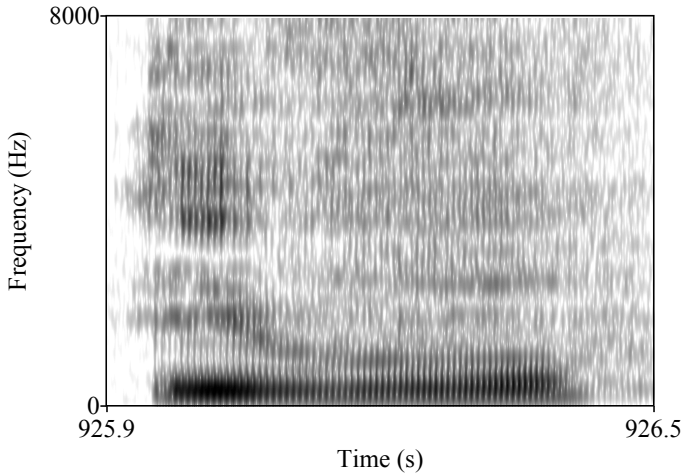


EJ, ‘plenty’

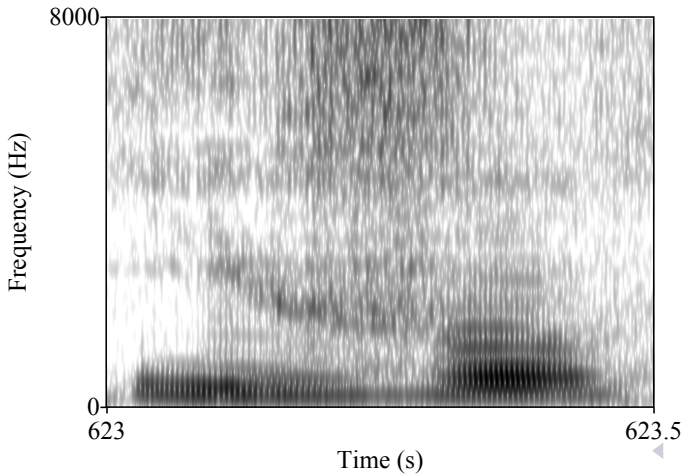


Fricative vowels in Kom

ME, ‘rain’



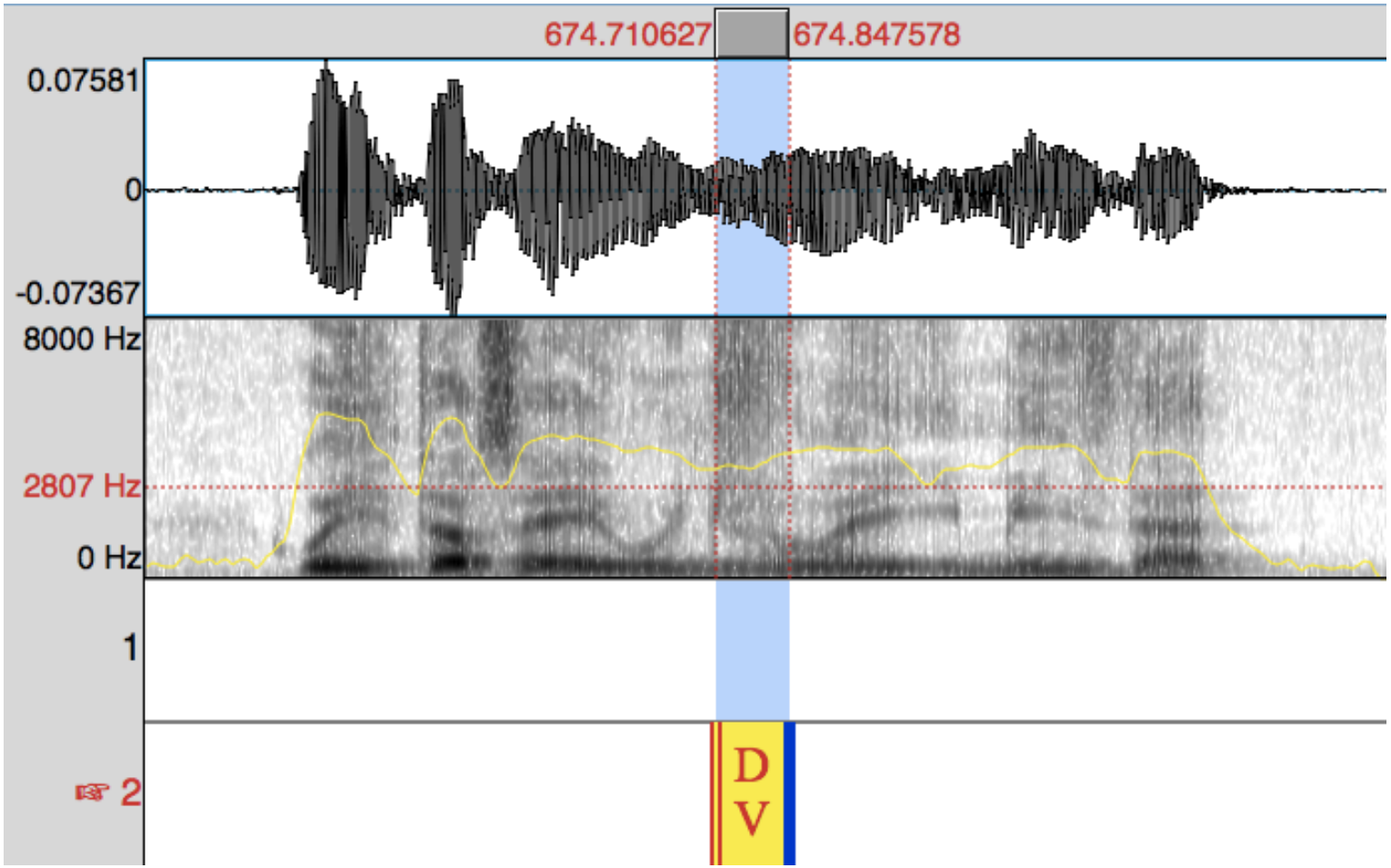
EJ, ‘rain’



Side note: fricative vowels and fricatives

In running speech

u˧ dɣ˥ məjn˧ ‘it’s plenty, it’s enough’



Why fricative vowels?

On the one hand, a descriptive void

- Researchers know how to describe fricatives (spectral moments, peak frequencies)
- Researchers know how to describe vowels (formants, formant trajectories)
- Today, we will deal with a sound that may best be described with aspects of both

Why fricative vowels?

However, these are more generally interesting to Africanists, too:

- May be more common than readily acknowledged in a stretch of the northern Grassfields
- Good candidates for proto-Bantu "degree 1" vowels
  (see Merrill and Faytak, tomorrow, this conference)
- Behavior over time has interesting ramifications for typologies of sound change

Overview

Qualitative description:

- Between- and within-speaker variation in vowel choice, /v/ ∼ /z/
- Assimilations of vowel to consonant place and vice-versa
- Associated production of bilabial trills, [ʙ]

Quantitative description:

- HF energy: fricative vowels > regular vowels
- HF energy over the duration of the segment: more dynamicity for fricative vowels

Methods

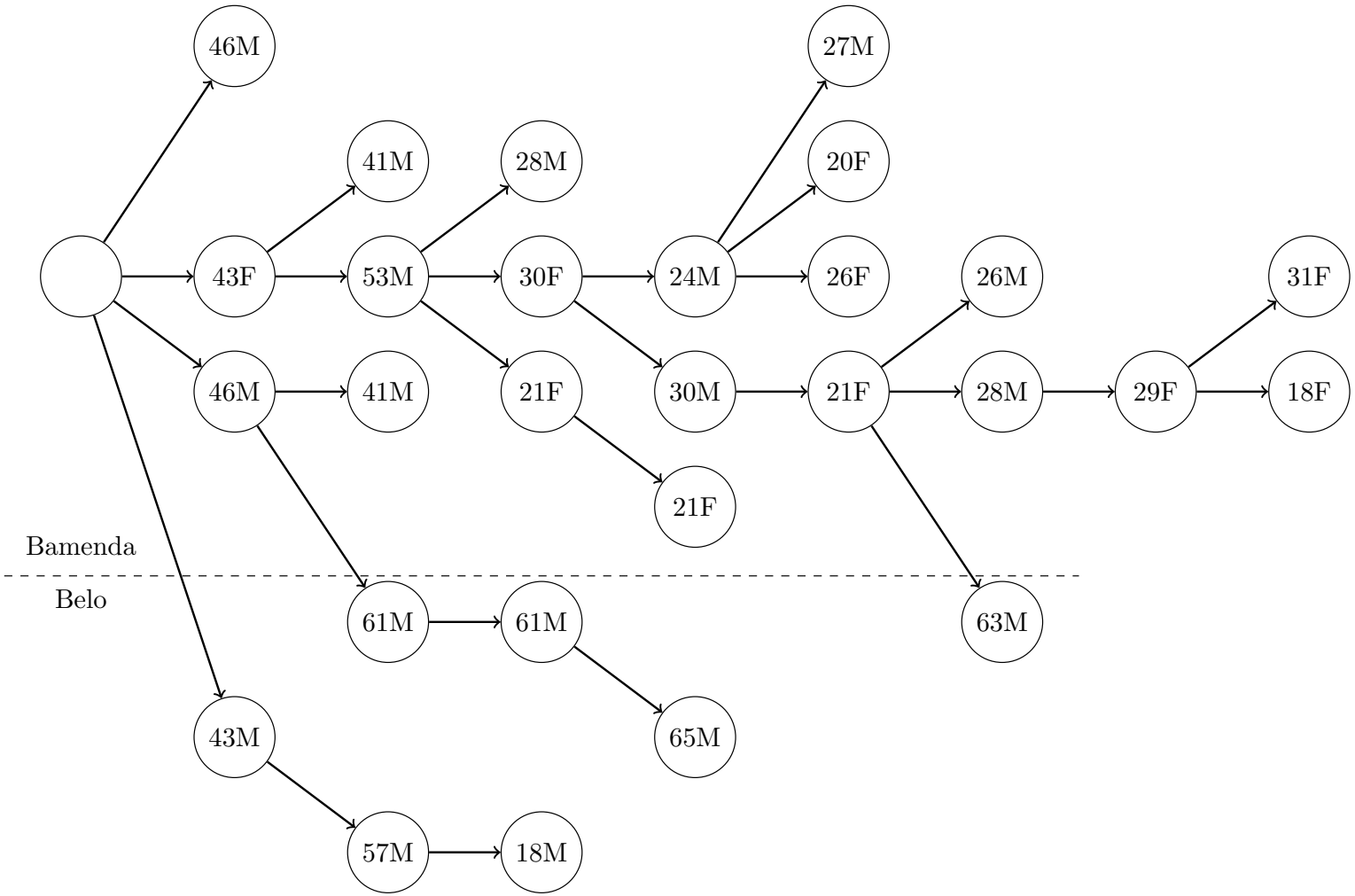
Speaker recruitment

28 first-language speakers of Kom were recruited in Cameroon (18 M, 10 F, ages 18–63)

- 21 speakers of Kom were recruited in and around the city of Bamenda, Cameroon
- An additional 7 were recruited in the town of Belo, north of Bamenda and in Kom country

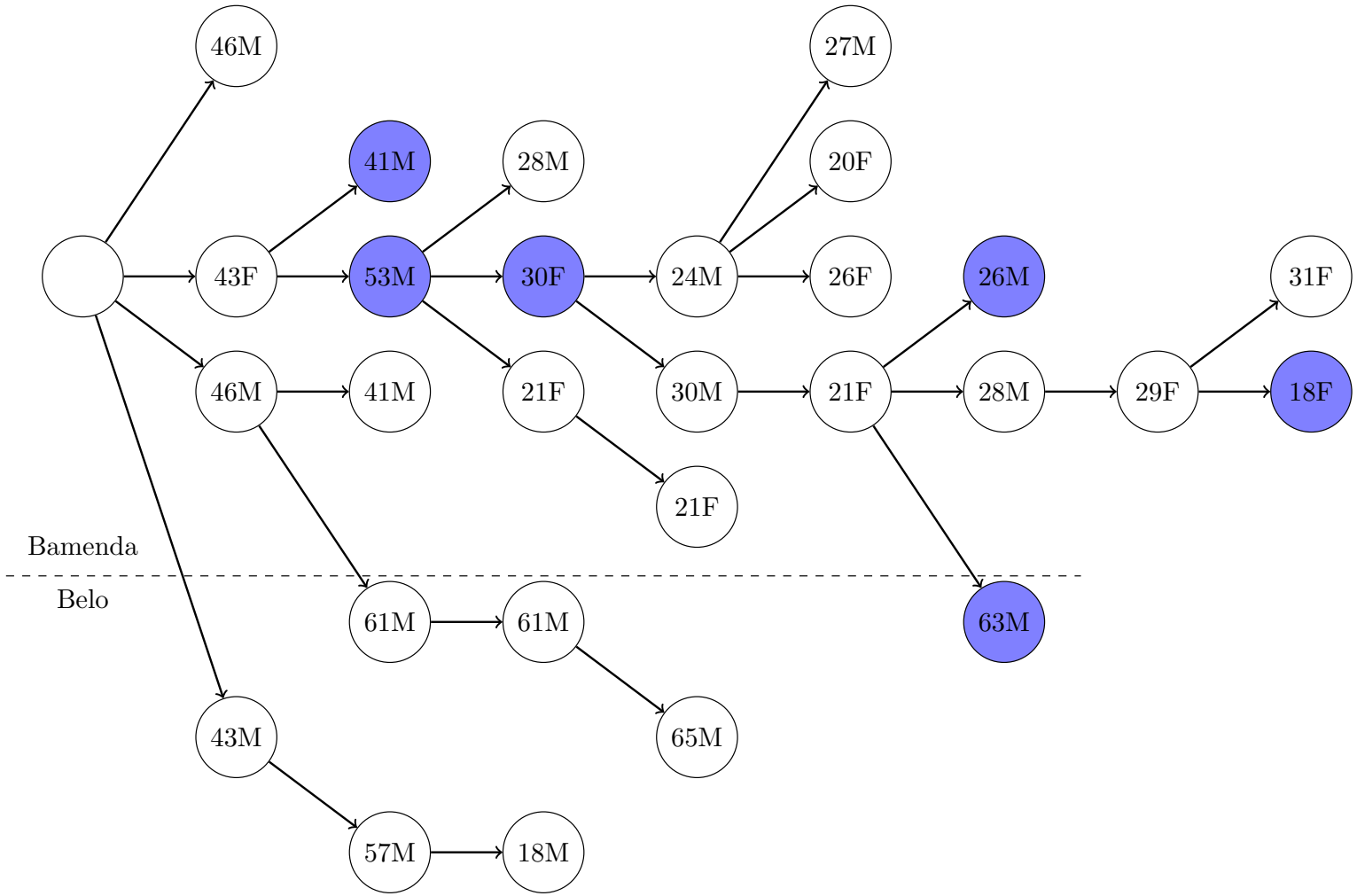
Speaker recruitment

Speakers recruited by way of snowball recruitment Goodman (1961)



Speaker recruitment

Subset examined today: 4M, 2F



Speaker recruitment

Subset examined today: 4M, 2F

	Gender	Age
EJ	F	30
KG	F	18
ME	M	63
VN	M	53
AN	M	41
NV	M	26

Elicitation materials

A set list of lexemes of (C)V shape was elicited

	No lip activity		Lip activity
bz	'goat, birth, thigh'	bv	'goat, birth, thigh, ashes'
dz	'termite, to cry, road'	dv	'to be many'
		gv	'fowl'
z	'to enter'	v	'foot, rain, hundred, sky'
Ci	'kola nut, thigh'	Cu	'hand, to leave'
Ce	'compound, coal, '	Co	'bag, two, house'

Some lexemes vary in vowel from person to person (more later!)

Recording procedure

Recording was carried out on a Marantz PMD 661 solid-state recorder (22 kHz sampling rate) using an AudioTechnica omnidirectional lapel microphone

- Each category above was elicited at least five times
- Effort made to record indoors and minimize echo
- Token counts are not usually equal, due to environmental variation and certain common words appearing repeatedly
- Lowest token counts are generally for /e/ and /u/

Qualitative

Vowel choice and trilling

Within and between speaker: /v/ ∼ /z/ in stems with labial initials /b m f/

Gloss	Kom	Oku	
‘birth’	bz̩˥ ∼ bv̩˥	bi	*bi
‘goat ’	bz̩˦ ∼ bv̩˦	bvəj	*b(u)i
‘thigh’	a˧˥bz̩˨˦ ∼ a˧˥bv̩˨˦	kəbij	*kəbi
‘avocado’	bzɛ˨˦ ∼ bvɛ˨˦	bia	*bia
‘nosebleed’	bzɛ˧˥ ∼ bvɛ˧˥	—	*bia (?)
‘to swallow’	mz̩˩˦ ∼ mv̩˩˦	mi	*mi
‘to take’	fz̩˥ ∼ fv̩˥	—	*fi
‘DIST.DEM.CL19’	fz̩˥-fə˧˥ ∼ fv̩˥-fə˧˥	—	*fi

Oku data from Davis (1992)

Vowel choice and trilling

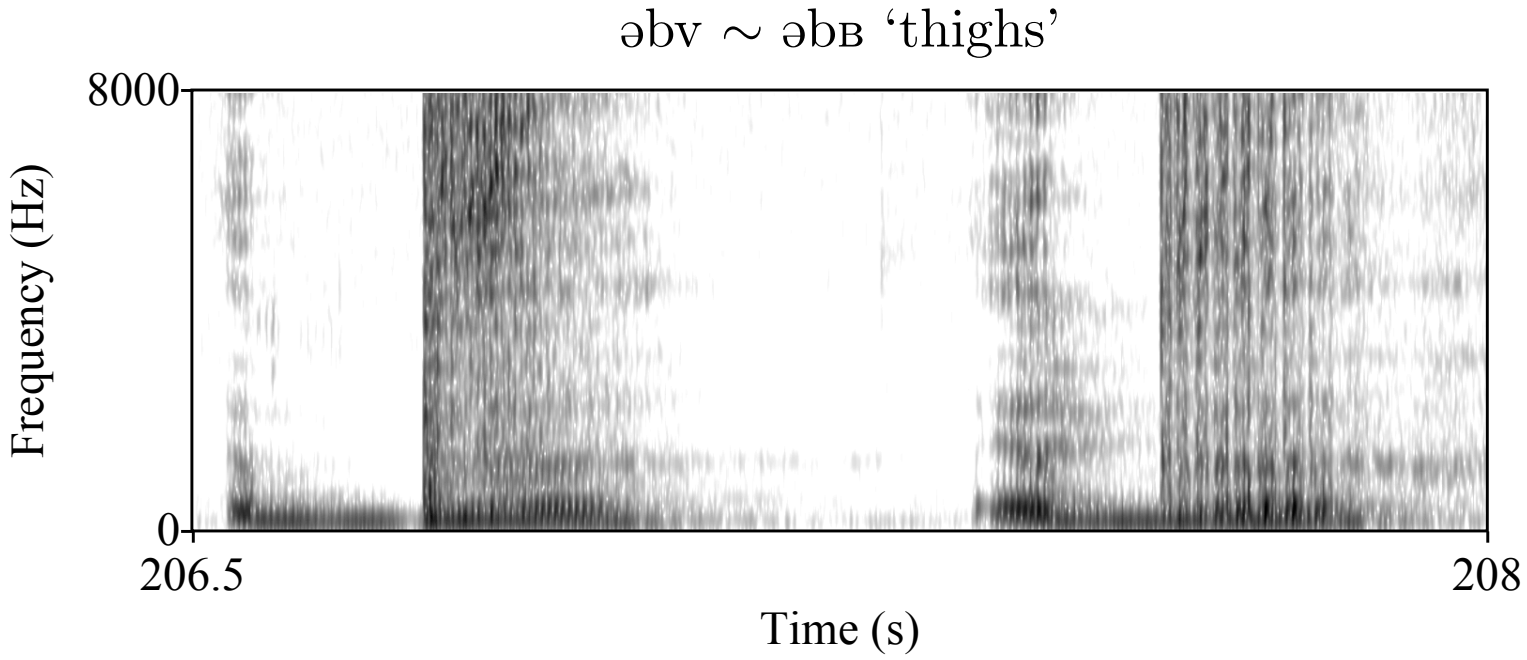
Exceptions: two words in which *u → ɣ̩

Gloss	Kom	Oku	
‘anthill’	mbɣ̩k⊣ ∼ mbz̩k⊣	mbvək	*mbuk
‘ashes’	a⊣bɣ̩⌉, *a⊣bz̩⌉	—	*bu

- Otherwise, the comparative data suggest *i → z̩ (→ ɣ̩)
- Much more difficult to imagine how *i directly to ɣ̩ would work

Trilling

If the initial is /b/, speakers sporadically produce a pre-stopped bilabial trill ([bʙ̩] and [bʙ̩] both attested)



The trilling may have “seeded” the /v/ ∼ /z/ variation, or may be a symptom of the coarticulatory tendencies that make both possible

Quantitative

H(igh)/T(otal) energy metric

Fricatives have characteristic high-frequency energy; measuring spectral intensity above a cutoff point should capture a distinction between fricativized and non-fricativized vowels

- Similar metric has been used to distinguish among types of fricatives Utman and Blumstein (1994)

After segmenting vowel tokens using Praat TextGrids, a custom Python script was used to:

- Downsample all audio to 16 kHz sampling rate and measure intensity (dB) at 60 points in each spectrum
- Mel-transform the audio's spectra to more accurately weigh the contributions of lower frequencies
- Normalize intensity to a minimum of 0 dB (lowest point $\rightarrow$ 0; no negative dB values)

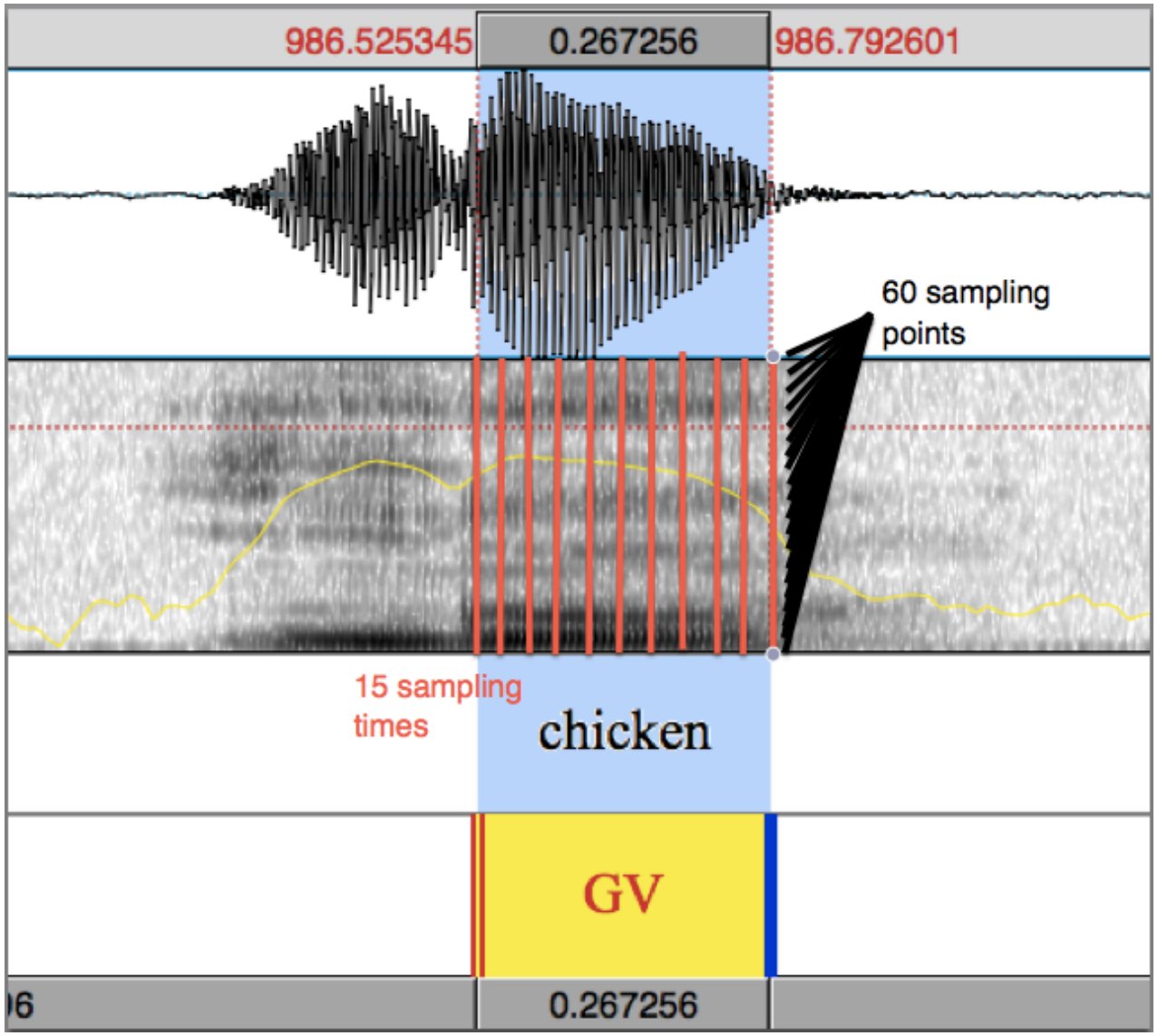
H/T energy metric

Once the spectra are normalized and transformed:

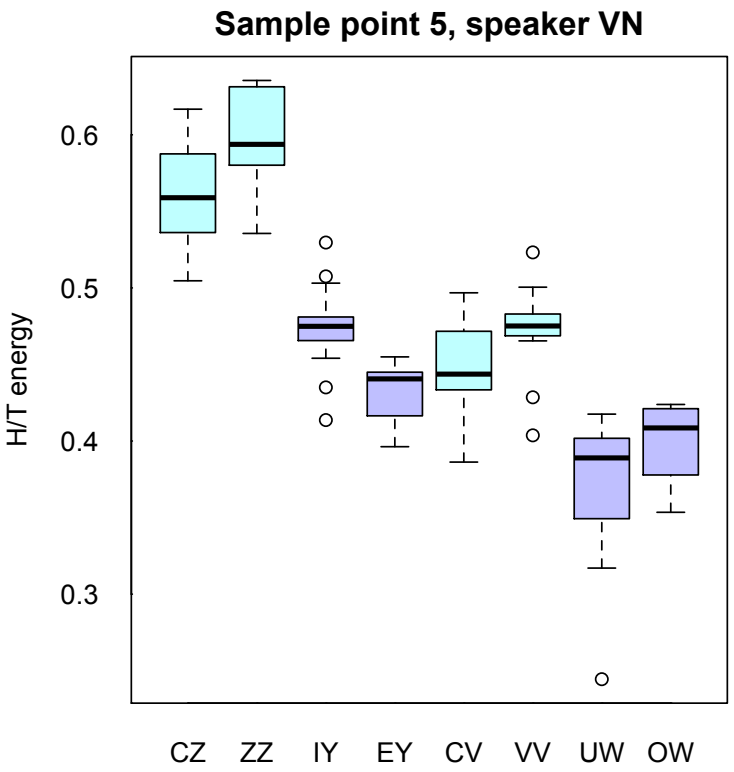
- H (high-frequency energy) is calculated by summing the intensity of the 25 highest-frequency points in the spectrum (3–8 kHz)
- T (total energy) is calculated by summing the intensity of all 60 points in the spectrum (300 Hz – 8 kHz)
- Sampling of spectra starts at 300 Hz to remove voicing from spectrum
- H/T is calculated; will always be a number between 0 and 1 (share of total intensity contributed by the portion of the spectrum above 3 kHz)

H/T energy metric, visualized

Each vowel token: H, T, and H/T at 15 evenly spaced times



H/T energy ratio at fifth sampling point, Kom

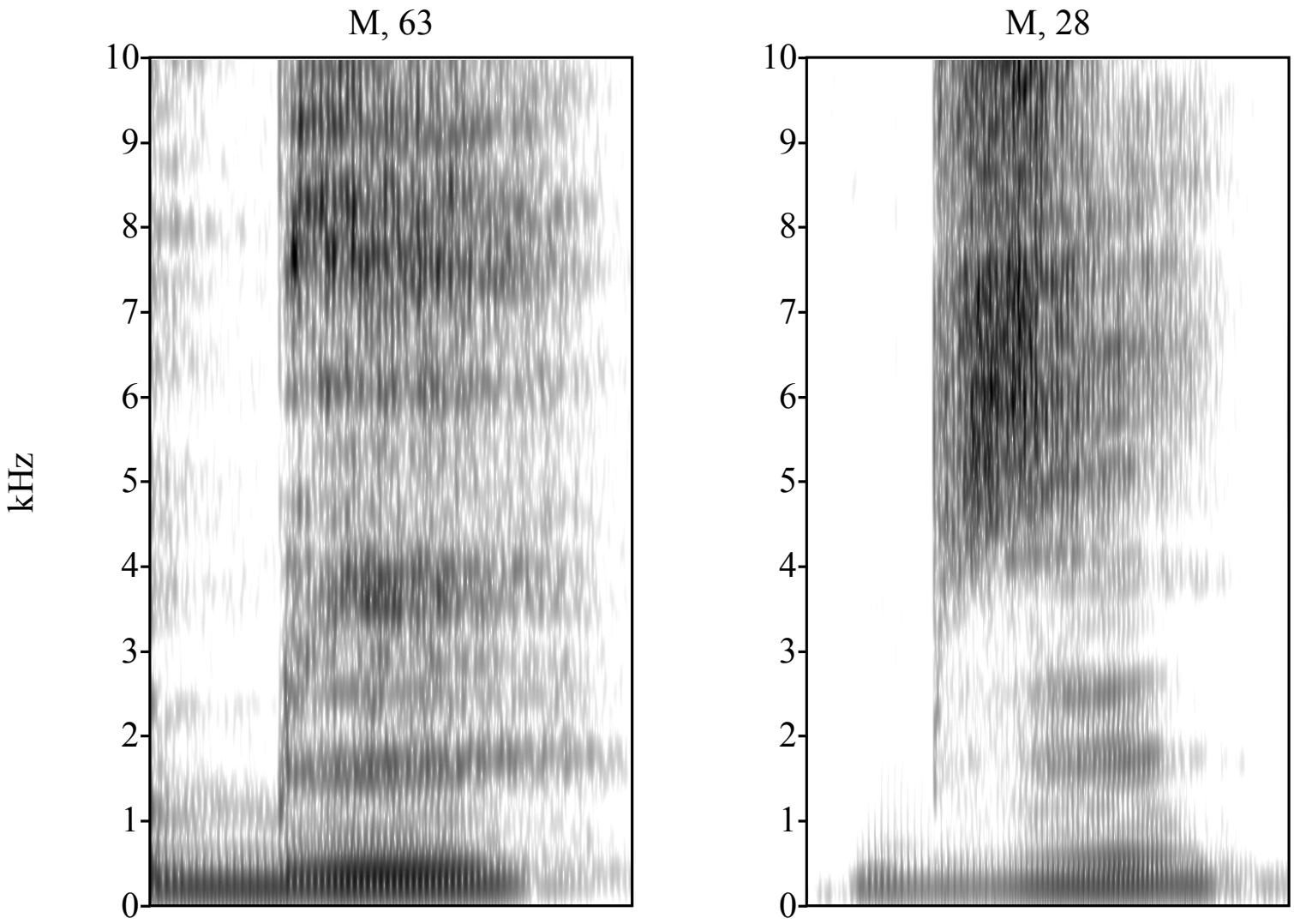


Across all tokens of:

- CZ = {b,d} + /z/
- CV = {b,d,g} + /v/
- ZZ = /z/, no onset
- VV = /v/, no onset
- IY = C or ∅ + /i/
- UW = C or ∅ + /u/
- EY = C or ∅ + /e/
- OW = C or ∅ + /o/

Vowels with lip activity (VV, UW, etc) are broken out from those without it (ZZ, IY, etc) because of known spectral differences between the two groups: a lower H should result for lip activity, all else held equal

A look at dynamicity



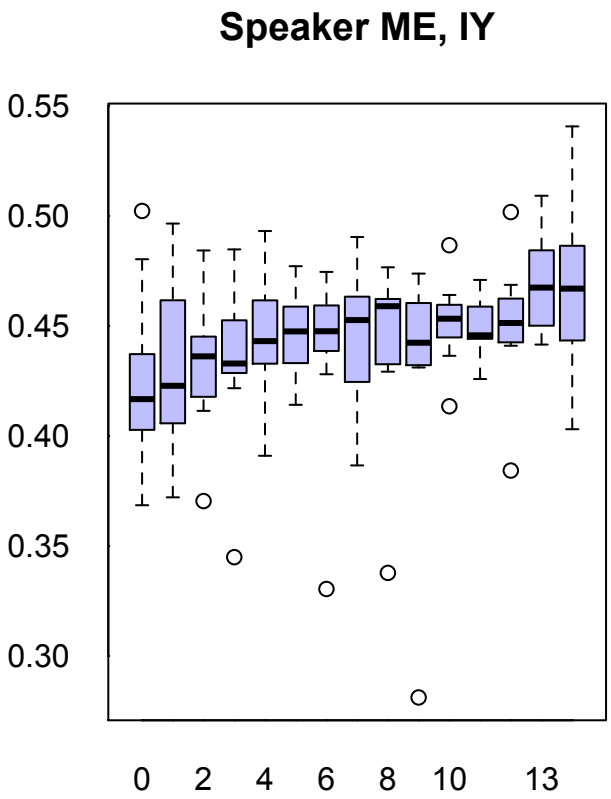
A look at dynamicity: SSANOVA

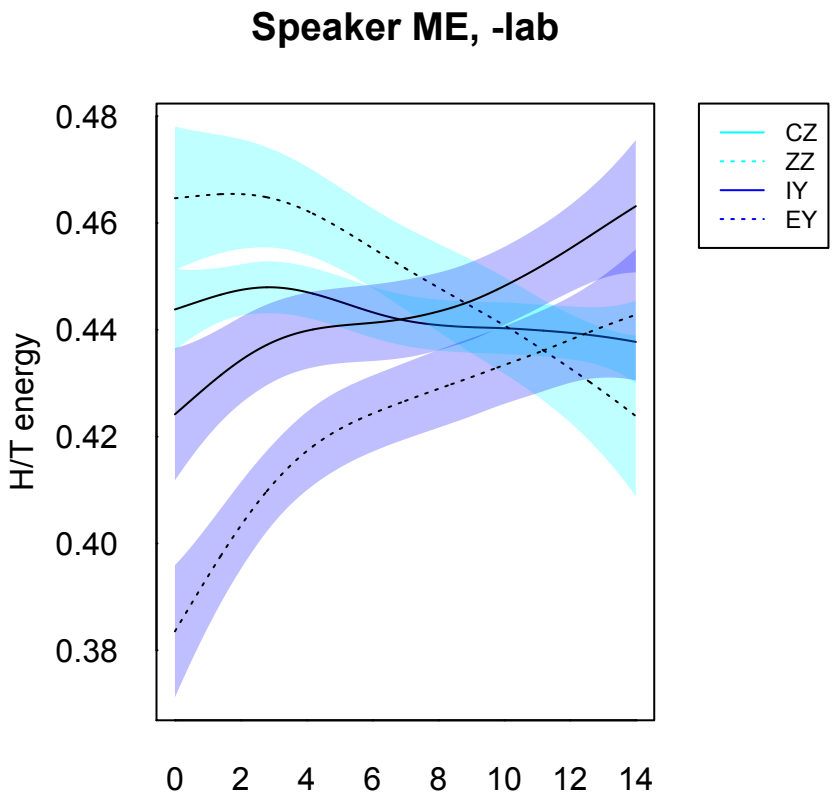
To get a better sense of dynamicity: Smoothing Spline ANOVA (SSANOVA)

Davidson (2006)
Nycz and De Decker (2006)

- A spline is generated to best fit collections of sampled points ('knots'), here the H/T values for each of many vowel tokens at 15 time points
- A smoothing term makes the spline less wavy
- 95% Bayesian confidence intervals are given around each spline
- If the confidence intervals overlap at some point along the spline, the difference between the curves is not significant

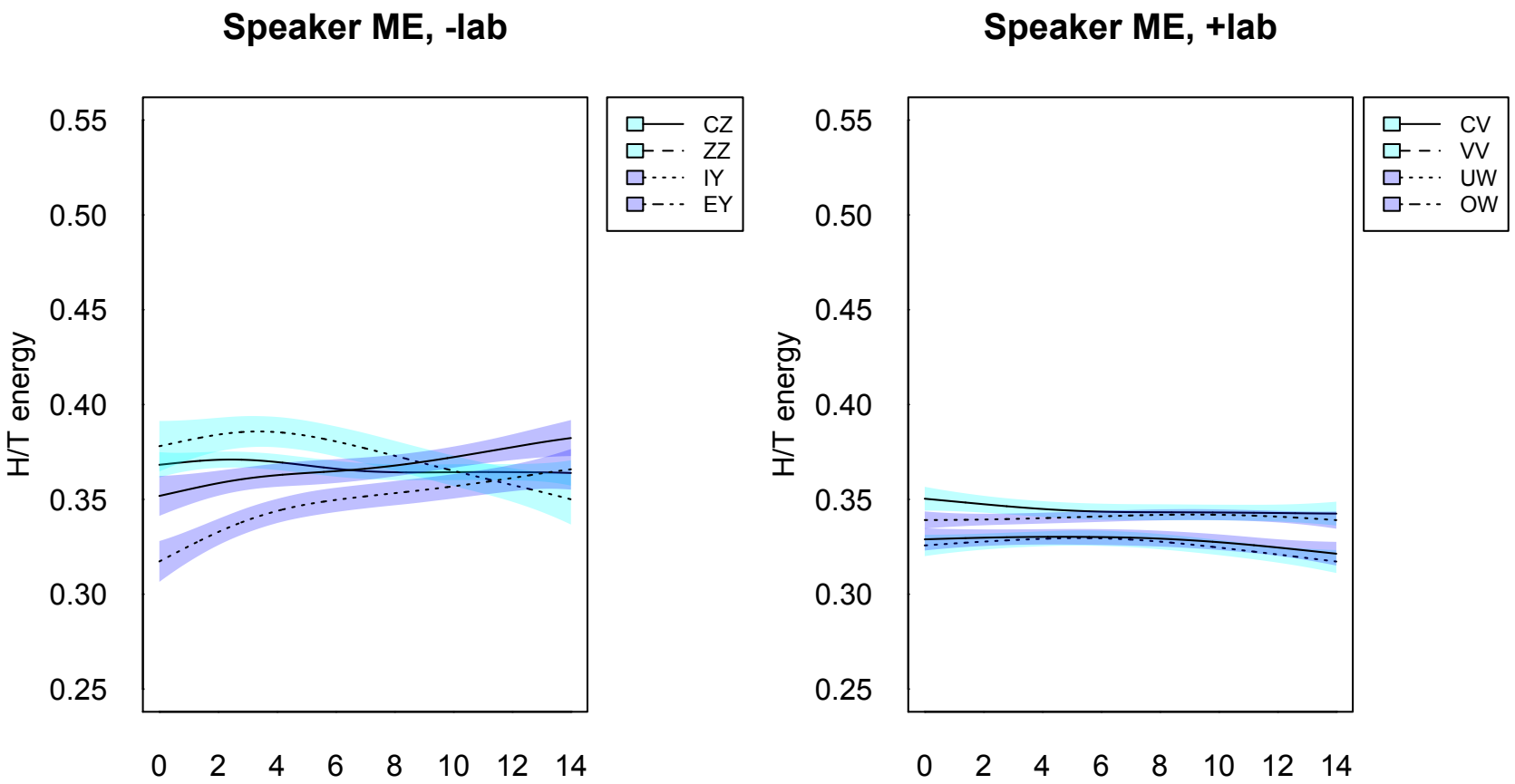
Boxplot vs. SSANOVA





- As a nice bonus, we can overlay multiple splines

SSANOVA by subject and ±lab



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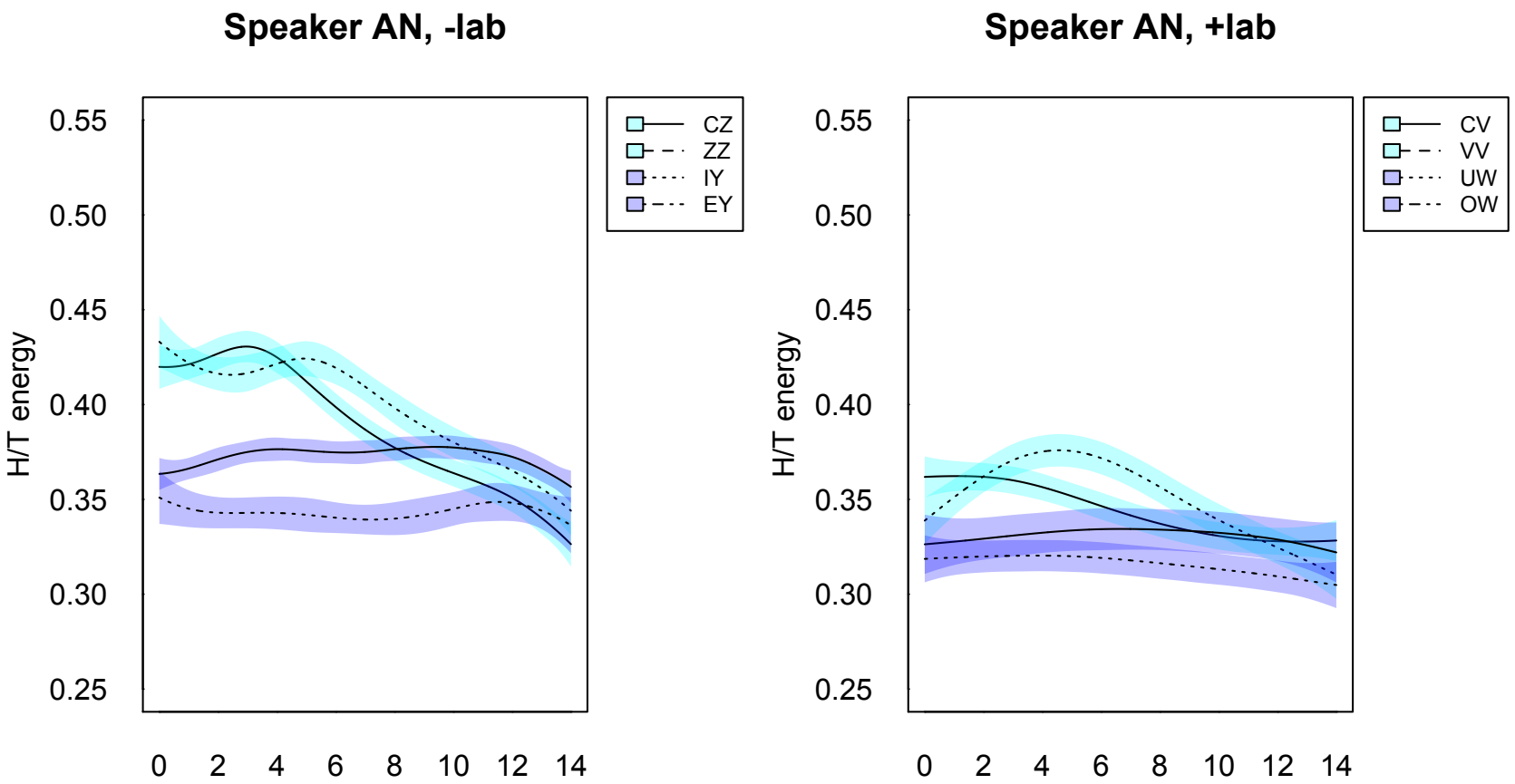

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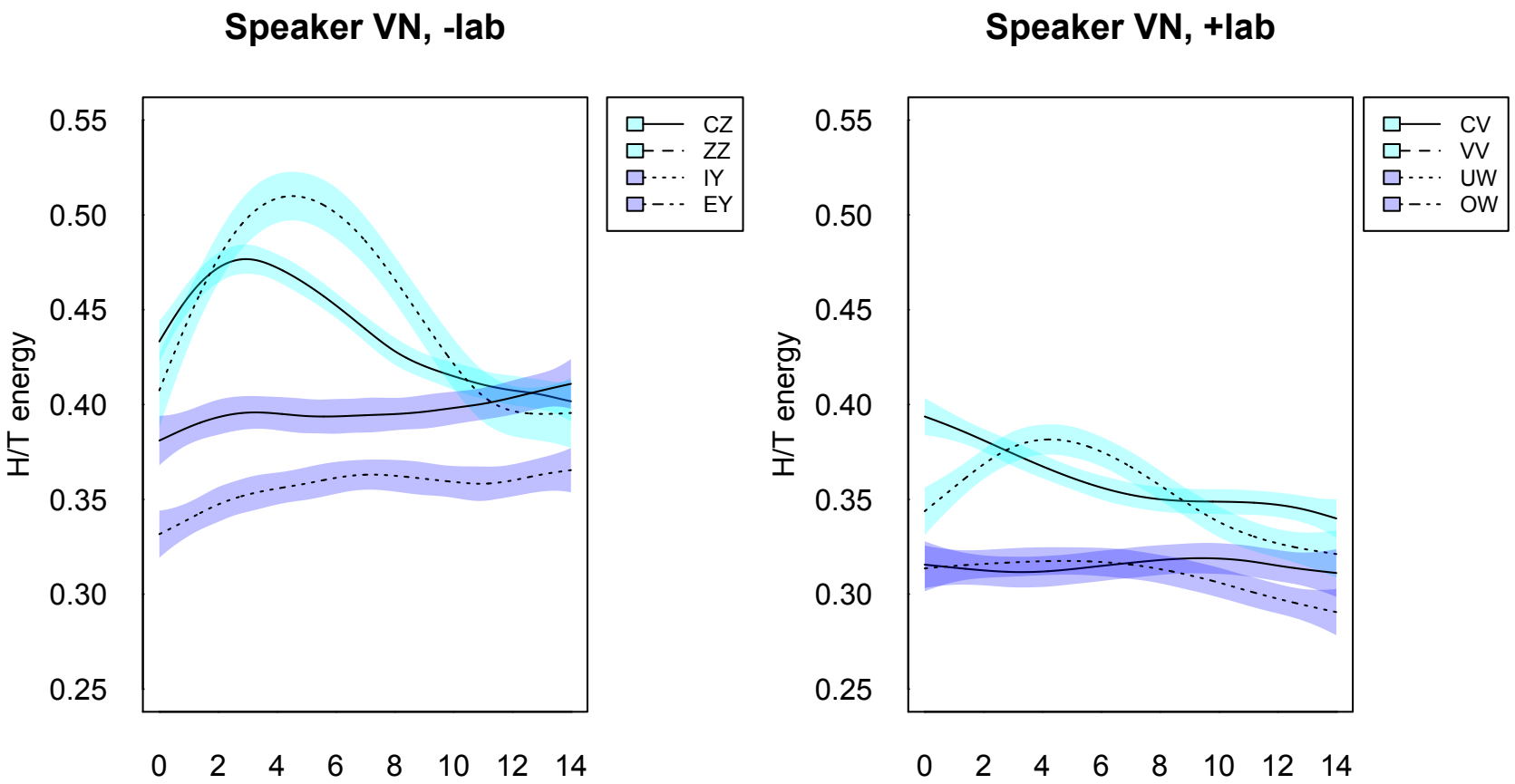

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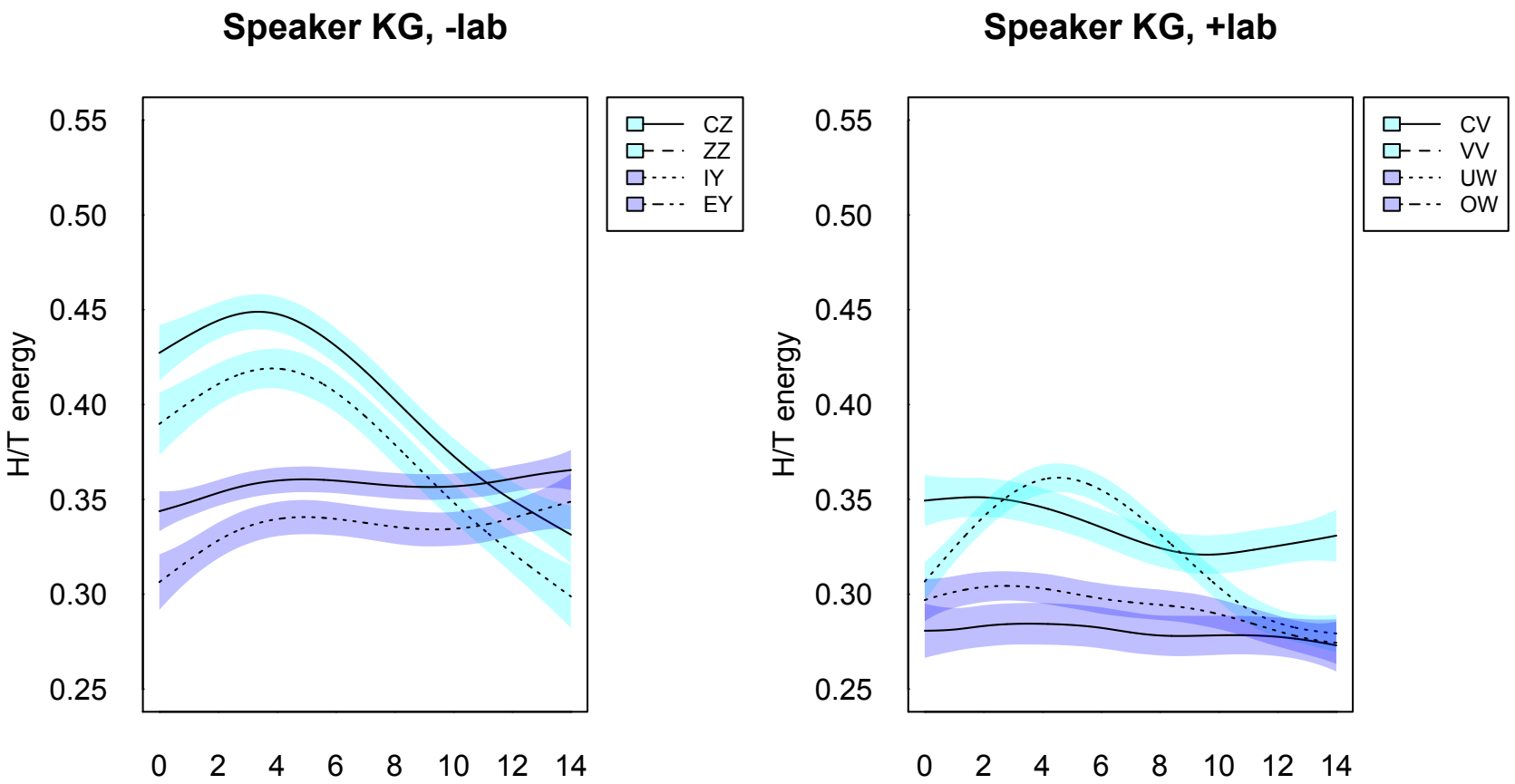

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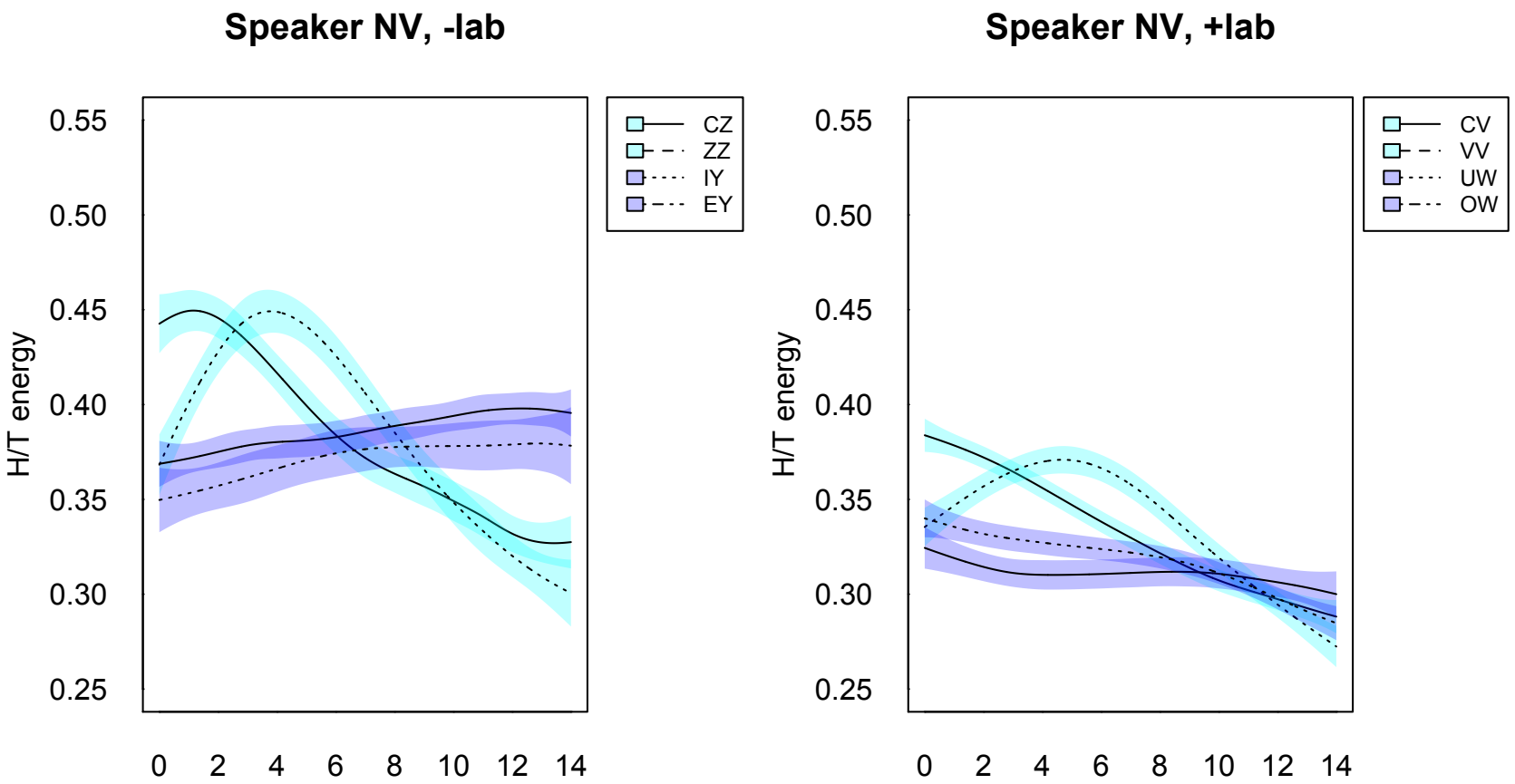

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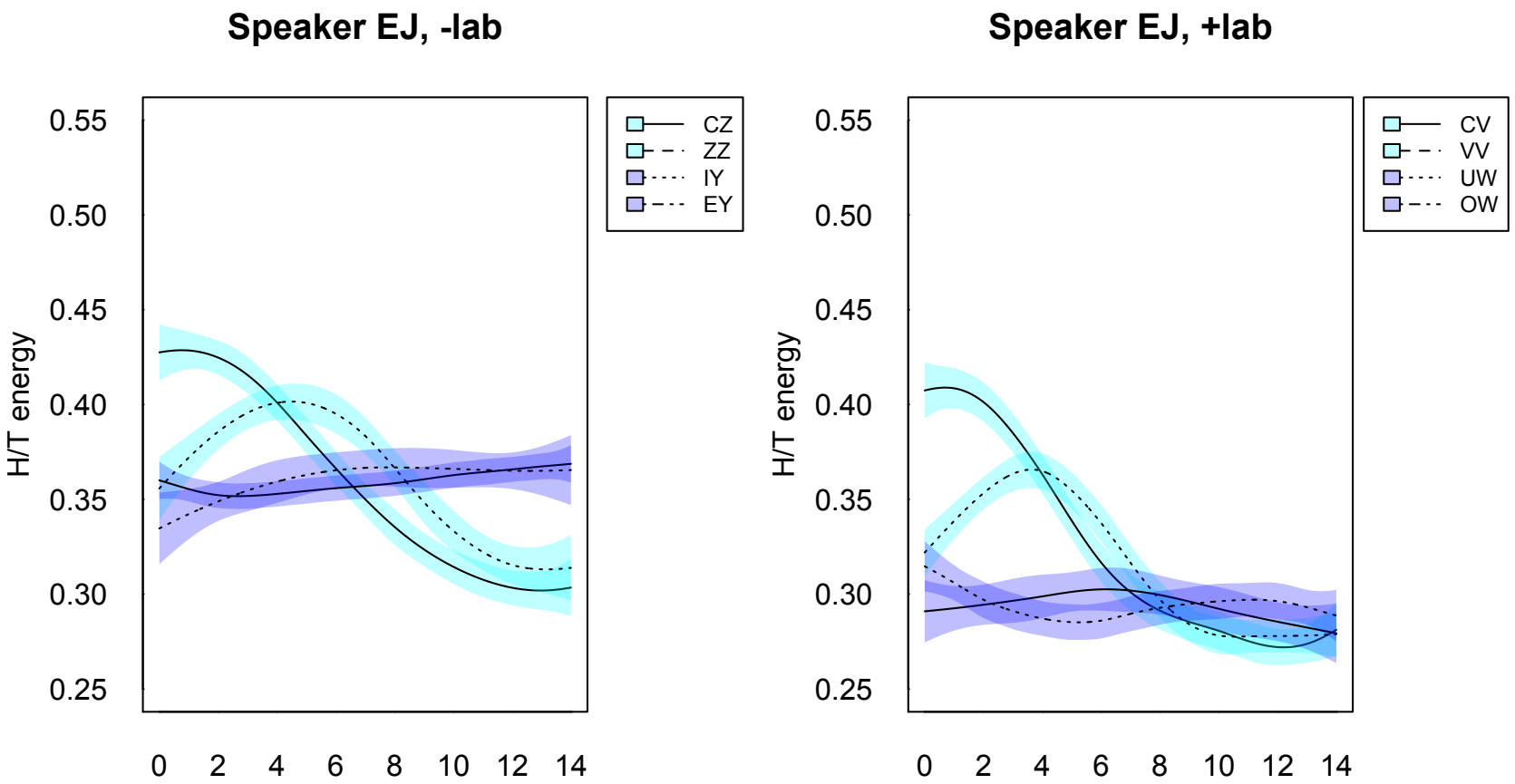
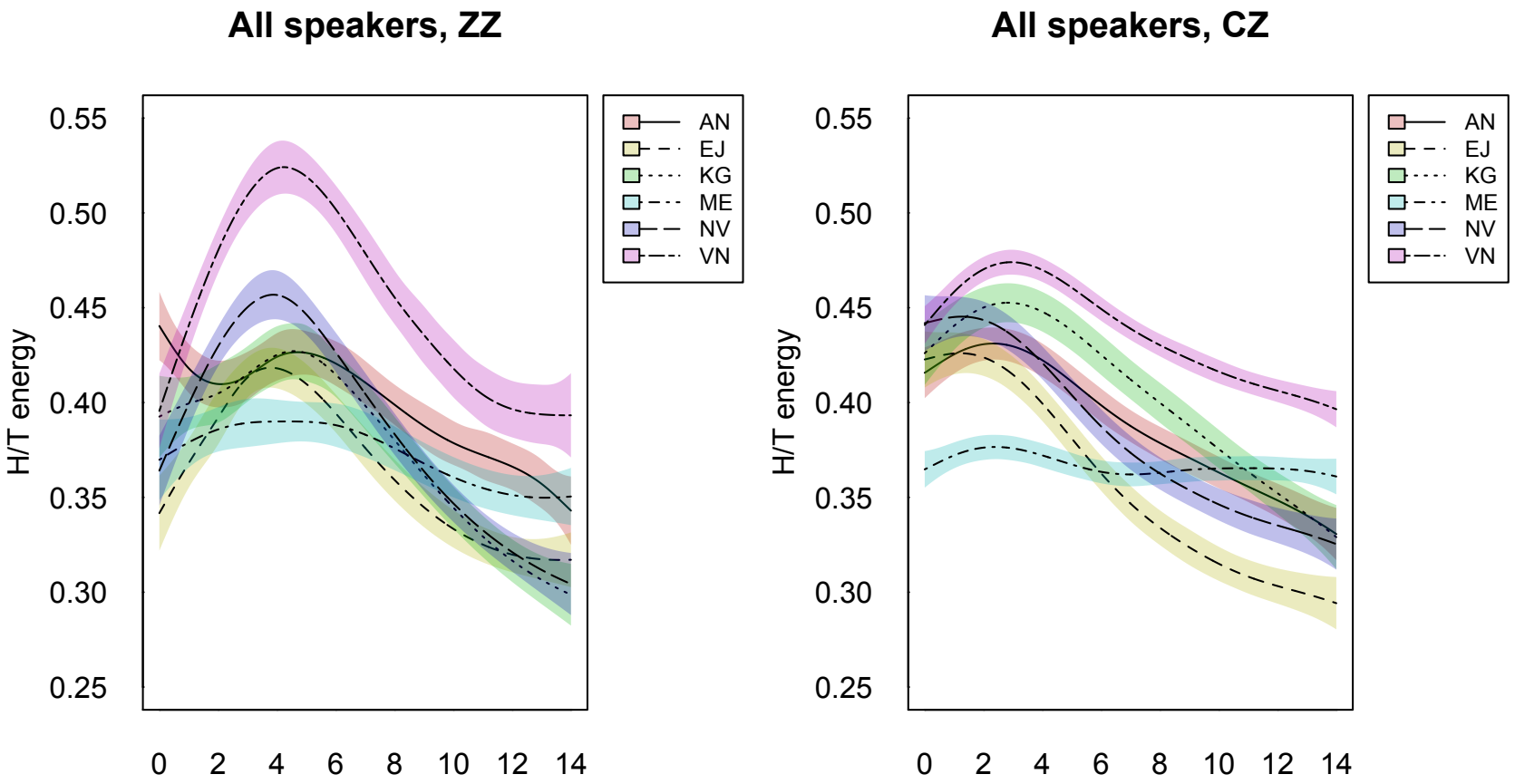


SSANOVA by phone

Speakers vary in peak H/T and trajectory of H/T



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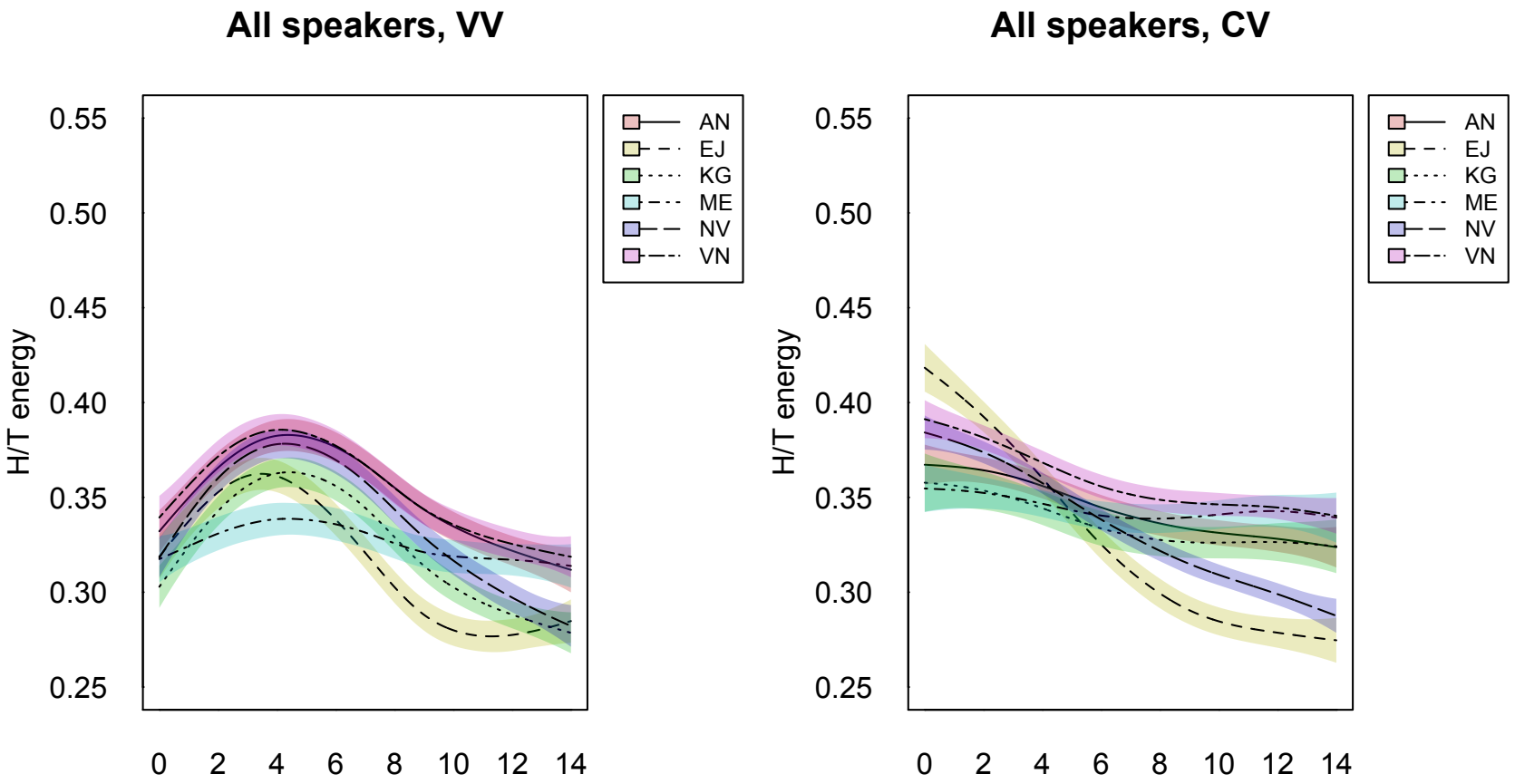

Summary

For fricativized vowels:

- Speakers vary in size of peak H/T, which can be interpreted as relative intensity of frication
- Speakers do not vary much in timing of peak H/T
- Speakers vary in trajectory of H/T over the vowel, which can be interpreted as relative 'level-ness' of frication intensity
- In particular, some speakers exhibit a more rapid fall in H/T to a lower endpoint; these more dynamic speakers tend to be younger

Most of these characteristics do not apply to the high vowels /i/, /u/

Conclusions

- Fricativized vowels in Kom have more HF energy and more internal dynamicity than other high vowels
- Younger speakers appear to have a tendency to "release" fricativized vowels into a (relatively) frictionless portion
- Vowels appear to be able to pass through a fricativized stage, as in Oku: all speakers have the frictionless portion for /v/

	Bum	Kom	Oku
*-ŋgu 'fowl'	-ŋgu	-ŋgv(ə)	-ŋgvəə
*-kul 'to chew'	kut	kv(ə)l	kfəl
*-ju 'to breathe'	ju	ʒv(ə)	zəə
*-su 'fish'	—	-ʃv(ə)	-səə

Significance

- Relevant to Bantuists due to their potential as analogues to developments of the Proto-Bantu first-degree high vowels
- Various proposals on the "consonantal," "noisy", or "fortis" nature of these sounds

  Zoll (1995)
  Maddieson (2003)

- if the latter were fricativized, then "splitting" into fricative-vowel sequences and vowel "place" changes provide some additional explanatory power for the diverse sound changes comprising Bantu Spirantization

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Side note: fricative vowels and fricatives

Distinctions between fricativized vowels and voiced fricatives are less clear, but appear to mainly involve the presence of strong low-frequency formant structure (to be examined in future research)

- Fricative consonants have less formant structure
- Fricative vowels generally have some, often plainly visible

ə˧chɣ˥ ndo˧ ɣa˧za˨ʐ˩ ‘the door is ajar’