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「通言語的観点からみた音声類型論」2023年度第1回研究会（通算第7回目）

日時：2023年6月3日（土）14:00-18:00

場所：オンライン会議室

使用言語：英語

主催：AA研基幹研究「アジア・アフリカの言語動態の記述と記録：アジア・アフリカに生きる人々の言語・文化への深い理解を目指して」（DDDLing）

報告タイトル

1. Priyankoo SARMAH (AA研共同研究員, インド工科大学グワハティ校), Seunghun J. LEE (AA研共同研究員, 国際基督教大学)

“Phonetics of voiceless nasals in Tibeto-Burman languages”

2. Daisuke SHINAGAWA (AA研所員), Seunghun J. LEE (AA研共同研究員, 国際基督教大学)


“Phonetic typology of fricatives in Bantu languages : part 2”

3. 全体討論

各人によるハンドアウトは別添。

PhonTyp Meeting: Year 3 Meeting 1  
June 3, 2023 @ ILCAA Room 304 + hybrid

## Phonetics of voiceless nasals in Tibeto-Burman languages



國際基督教大學  
Expanding Horizons

Priyankoo Sarmah  
Indian Institute of Technology Guwahati

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Indian Institute of Technology Guwahati

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### Outline

1. Background
  1. Articulation of voiceless nasals
  2. Acoustics of voiceless nasals
  3. Analysis of nasometric data
2. Case Studies
  1. Angami
  2. Mizo
  3. Drenjongke

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### Voiceless nasals

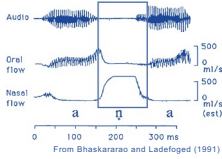
- Voicing contrasts in nasals, attested in several Tibeto-Burman languages.
- Five distinct subgroups of the Tibeto-Burman language family are known to have nasal voicing contrast<sup>1</sup>
  - Lolo-Burmese (*Burmese, Achang*)
  - Qiangic (*Xumi, Pumi, Zhaba*)
  - Bodish (*Chepang, Dhimel, Kham Tibetan*)
  - Nungish (*Anong*)
  - Kuki-chin (*Angami, Chokri, Khezha, Lai, Laizo, Mizo etc.*)
- Apart from the Tibeto-Burman languages, voicing contrasts in nasals are also reported in Ikema Ryukyuan and Welsh.<sup>2, 3</sup>

1. J. A. Matisoff. "Handbook of Proto-Tibeto-Burman: system and philosophy of Sino-Tibetan reconstruction." Univ of California Press, (2003).  
2. C. Ford. "The Status of Voiceless Nasals in Ikema Ryukyuan." Bachelor thesis, Department of Linguistics and East Asian Studies, University of Alberta, Edmonton, (2016).  
3. M. Hammond. "Voiceless Nasals in Welsh." *Journal of Celtic Linguistics*, 20(1): 31-60, (2019)

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### Voiceless nasal articulation: Type 1

*two-step articulation, Burmese, Mizo*



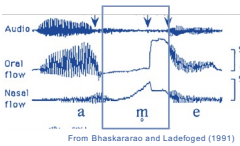
- Open glottis for most of the time during the articulation (distinction vs. voiced ones)
- Voicing in the end (formant transition → place of articulation → distinction between voiceless N)
- Nasal flow is at its maximum during the open glottis phase

From Bhaskararao and Ladefoged (1991)

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### Voiceless nasal articulation: Type 2

*Merged articulation, Angami*



- Continuous nasal airflow, no voicing
- Release of closure (mistakenly perceived as epenthetic plosive)
- Variations in nasal airflow depending on the place alveolar > bilabial > palatal

From Bhaskararao and Ladefoged (1991)

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### Voiceless nasal articulation

- Aerodynamic and electroglottographic (EGG) studies:
  - Xumi and Kham Tibetan: nasal airflow, absence of oral airflow
  - Burmese: Voiced towards the end.
  - Sentence frames: Xumi: devoiced, Tibetan: voiced

1. K. Chirkova, P. Basset, and A. Amelot. "Voiceless nasal sounds in three Tibeto-Burman languages." *Journal of the International Phonetic Association*, (2019)

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### Acoustics of voiceless nasals

**Nasal Consonants**

- Four nasal formants (N1, N2, N3, N4) and their bandwidths (BW1, BW2, BW3, BW4)<sup>1</sup>
- Centre of Gravity (CoG) and Standard Deviation (SD) of the nasal spectrum<sup>2</sup>.

**Nasalization on following vowels**


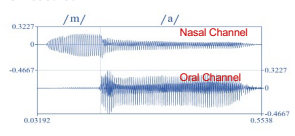
- A1-P0, A1-P1, A3-P0<sup>3</sup>

- M. Dantsuji, "Some acoustic observations on the distinction of place of articulation for voiceless nasals in Burmese," *Studia phonologica*, vol. 20, pp. 1-11, 1986
- M. Tabain, A. Bulcher, G. Green, and R. Beare, "An acoustic study of nasal consonants in three central Australian languages," *The Journal of the Acoustical Society of America*, vol. 139, no. 2, pp. 860-803, 2016.
- M. Y. Chen, "Acoustic correlates of English and French nasalized vowels," *The Journal of the Acoustical Society of America*, vol. 102, no. 4, pp. 2360-2370, 1997.

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### Analysis of nasometric data

KayPENTAX Nasometer II Model 6450 records the nasal and oral channel signals separately. Amplitude is measured.

$$Nasalance = \left( \frac{N}{O+N} \right) \times 100$$

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### Case Studies

Angami, Mizo and Drenjongke

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### Angami

- Angami, primarily found in the Kohima district.
- Also in Chumoukedima and Dimapur districts.
- ~100 small villages
- The Angami group is broadly divided into four sub-groups:
  - Northern Angami : 30+ villages
  - Western Angami : 6+ villages
  - Southern Angami : 13+ villages
  - Chakro Angami : 20+ villages



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### Voiceless nasals in Angami

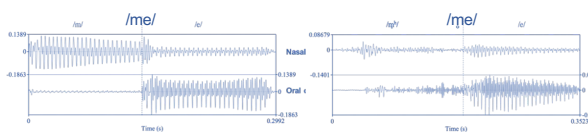
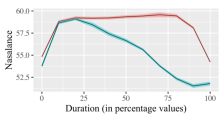
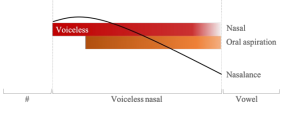
/m/ vs. /m̥/	/n/ vs. /n̥/	/ŋ/ vs. /ŋ̥/
/ma/ 'price'	/na/ 'budding'	/ŋa/ 'crazy'
/m̥a/ 'things'	/n̥a/ 'plant'	/ŋ̥a/ 'messy'

- 4 Angami speakers produced 26 unique tokens
- In isolation and in the sentence frame, /a 'X' puba/ (I said 'X').
- Each token was repeated three times resulting in total of 156 tokens for each speaker.
- In total 624 tokens were elicited out of which 620 were subjected to analysis as 4 tokens were mispronounced<sup>1</sup>.

- V. Terhija and P. Sarmah, "Voiceless nasals in Angami," in *Proceedings of Meetings on Acoustics 179 ASA*, vol. 42(1), Acoustical Society of America, 2020, p. 060008.

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### Voiceless nasals in Angami: Nasometric data






Source: V. Terhija and P. Sarmah, "Voiceless nasals in Angami," in *Proceedings of Meetings on Acoustics 179 ASA*, vol. 42(1), Acoustical Society of America, 2020, p. 060008.

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### Mizo

- Mizo belongs to the Tibeto-Burman language family with 830,846 speakers in Mizoram, NE of India
- It has 4 tones, 5 vowels and 6 nasals which contrast in voicing
- Mizo nasals are found in three POA:
  - Bilabial /m, m̥/
  - Alveolar /n, n̥/
  - Velar /ŋ, ŋ̥/



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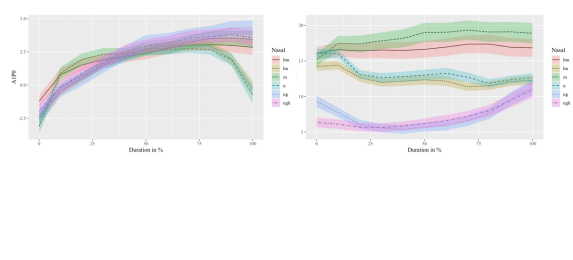
### Voiceless nasals in Mizo

- 3 Mizo speakers produced 30 unique words
- In isolation, repeated 5 times, resulting in 450 tokens<sup>1</sup>.

<sup>1</sup>W. Lahminghlui and P. Samrah, "Characterizing voiced and voiceless nasals in Mizo." in Interspeech, 2021, pp. 426-430.

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### Voiceless nasals in Mizo: Vowel Nasality




<sup>1</sup> W. Lahminghlui and P. Samrah, "Voiceless Nasals in Mizo," in preparation, 2023.

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### Drenjongke

- Tibeto-Burman language spoken in Sikkim, India
  - a.k.a. "Bhutia", "Lhoke" or "Sikkimese"
- Spoken by about 80 000 speakers in Sikkim
- Drenjongke voiceless nasals are innovative (i.e. not found in Dzongkha or Tibetan, adjacent languages in the same language family)
- Data Collection
  - 6 speakers in March 2019, Sikkim, India
  - Participants were recorded reading five times a randomized list of words in a carrier sentence comprising words with an initial voiceless nasal.



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### Voiceless nasals in Drenjongke

- Previous impressionistic descriptions of the Drenjongke phonological inventory report that the language has **eight nasal phonemes** that contrast in terms of voicing (Yiniemi 2019, Georǵe van Driem p.c.)
- [+voice] /m, n, ŋ, / and [-voice] /m̥, n̥, ŋ̥/

/m/ vs. /m̥/	/n/ vs. /n̥/	/ŋ/ vs. /ŋ̥/
/m̄/ 𑄎: 'mother'	/n̄/ 𑄎: 'here'	/ŋ̄/ 𑄎: 'sun, day' <sup>57</sup>
/m̄/ 𑄎: 'wound'	/n̄/ 𑄎: 'ear'	/ŋ̄/ 𑄎: 'sister-in-law'
/m̄/ 𑄎: 'down, low(er)'	/n̄/ 𑄎: 'nose'	/ŋ̄/ vs. /ŋ̄/
		/ŋ̄/ [ŋ̄aʔ] 𑄎: 'speech'
		/ŋ̄aʔ/ [ŋ̄aʔ] 𑄎: 'invocation'

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### Drenjongke

- The data obtained from our recordings suggests that there is no unique phonetic realization of the voiceless nasal but at least four different patterns.
- The patterns we observed for the realization of voiceless nasals are as follows:
  - (1) a voiceless nasal (type 1, Bhaskararao & Ladefoged)
  - (2) a nasal without voicelessness (i.e. [n, m, ŋ, ŋ]).
  - (3) glottal frication but nasality only on the preceding vowel (i.e. [h]).
  - (4) a metathesis in the consonant portion: voiced nasal consonant followed by glottal frication (i.e. [nh]).

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Summary: Drenjongke

- There is no unique phonetic realization of the voiceless nasal in Drenjongke.
  - 4 different patterns, with inter and intra speaker variations
- What all these patterns have in common is that **nasality is maintained**
  - Phonologically there is a target ([nasal] and [spread glottis]), but phonetically the target is not uniformly realized.

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Emergence of voiceless nasals

- Diachronically, /s/, /g/ and /k/ are reconstructed as a source of voiceless nasals
- Burmese:
  - **s+nasal** sequence → voiceless nasal (Ohala and Ohala 1993)
- Burmese:
  - consonant clusters **Cn** (/s/, /g/) → voiceless nasal (Nishida 1975)
- Icelandic:
  - consonant clusters **Cn** (/k/) → voiceless nasal
  - [ni:vvr] 'knife' [nje:] knee (Jessen & Pétursson 1998: 44)

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Phonetic Typology of Voiceless nasals

- Voiceless nasals are accompanied by weak frication
  - Is this type of frication comparable to the ones found in aspirated plosives (the signal during a long vot).
- Does the presence of voiceless nasals in the consonant inventory have any relationship with aspirated plosives?

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Typology of voiceless nasals in known languages

- Presence of voiceless nasals ~ Aspirated plosives

Lg family	Ig	VN	Asp	Lg family	Ig	VN	Asp
Burmese	Burmese	x	x	Bodish	Kham Tibetan	x	x
Burmese	Achang	x	x	Nungish	Anong	x	x
Qiangic	Xumi	x	x	Kuki-chin	Angami	x	x
Qiangic	Pumi	x	x	Kuki-chin	Chokri	x	x
Qiangic	Zhaba	x	x	Kuki-chin	Mizo	x	x
Bodish	Chepang	(?)		Okinawan	Ikema	x	(?)
Bodish	Dhimal	x	x	Gaelic	Welsh	x	(pre-asp)

- Nearly all languages with (contrastive) voiceless nasals have a contrastive aspirated plosive.

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Acknowledgements

- This project is supported by Strategic Japanese-Swiss Science and Technology Programme of JSPS and SNSF.
- We thank Michinori Suzuki for annotating the voiceless nasal data.
- We thank Shigeto Kawahara, Tomoko Monou, Jeremy Perkins, George van Driem, Selin Grollman, Pascal Gerber and Julián Villegas for comments.

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# Phonetic typology of [complex] fricatives in [southern] Bantu languages

preliminary observations and a typological overview

Daisuke Shinagawa (ILCAA) & Seunghun J. Lee (ICU & U of Venda)

2023-06-03 @ the first Phontyp meeting in 2023

# Summary of the last talk

		GFB	A43	A44	A53	A83	B30	C101	D25	D32	E60	JE17	JE25	P13	P21	P23	P31	R11	R22	R41	K43	K34b	K33	K31	K14	R31	S61	S41			
labial	bilabial						β			ϕ												β	β	β						6	25
	labiodental	f, (v)		f	f, v	f, v	f		(f, v)		f, (v)	f, v	f		(f)		v	f, v	f, v	f, v	f, v	f, v	f, v	f	f, v	v	f	f, v	24	25	
coronal	dental																		θ, ð		θ, ð					θ, ð			3		
	alveolar	s, (z)	s	s	s, z	s, z	s	s	s, z	s	s, (z)	s, z	s	(s)	s	s	s	s	s	s, z	s, z		s	s, z	s, z		s, s̄w, r	s, z	24	26	
	palatoalveolar	(ʃ, ʒ)				ʃ, ʒ			(ʃ)		ʃ		(ʃ)		(ʃ)	ʃ	ʃ	ʃ	ʃ	(ʃ)	ʃ, ʒ	ʃ	ʃ	ʃ	ʃ	ʃ, ʒ	(ʃ)	ʃ	17		
	lateral																								(l)	l, ɮ		2			
dorsal	velar	(ɣ)		x			ɣ												x, ɣ		ɣ	ɣ					x, ɣ	7	7		
glottal	glottal		h	h		h		h			h					h	h		h	h	h	h	h		h	ɦ	h, ɦ	15	15		

NW&WW: Various  
(Simple~Moderate)

CW& E: Simple

SW&SE: Complex

- ★ Most of the Bantu languages (esp. Central and Western) have a rather simple system of fricatives, typically including **labial and coronal fricatives** with or without voice contrast
- ★ From a geographical viewpoint, **Southern languages tend to develop a rich system** of fricatives

# (relatively) complex fricatives in Southern Bantu

Maddieson and Sands (2019: 90)

- ★ Most of the languages have relatively limited sets of fricatives of the cross-linguistically common types, although **lateral fricatives** (and **affricates**) have developed in or been borrowed into a number of the southern languages, such as Sotho-Tswana S30, Xhosa S41 and Zulu S42. Particularly striking in this connection is the velar ejective lateral affricate [k<sub>l</sub>'] of Zulu S42 (cf. Naidoo 2007), which is auditorily reminiscent of a lateral click.



# (relatively) complex fricatives in Southern Bantu

Ladefoged and Maddieson (1996: 330–331)

- ★ **Doubly-articulated fricatives** [...] are hard to produce and poorly distinctive. Nonetheless, in a small number of languages it has been claimed that such segments do occur. We have examined some of these cases and found them to be instances of either fricative segments with a secondary articulation, or **instances of a sequence of two fricatives** that has been interpreted as a single segment for phonological reasons.

# (relatively) complex fricatives in Southern Bantu

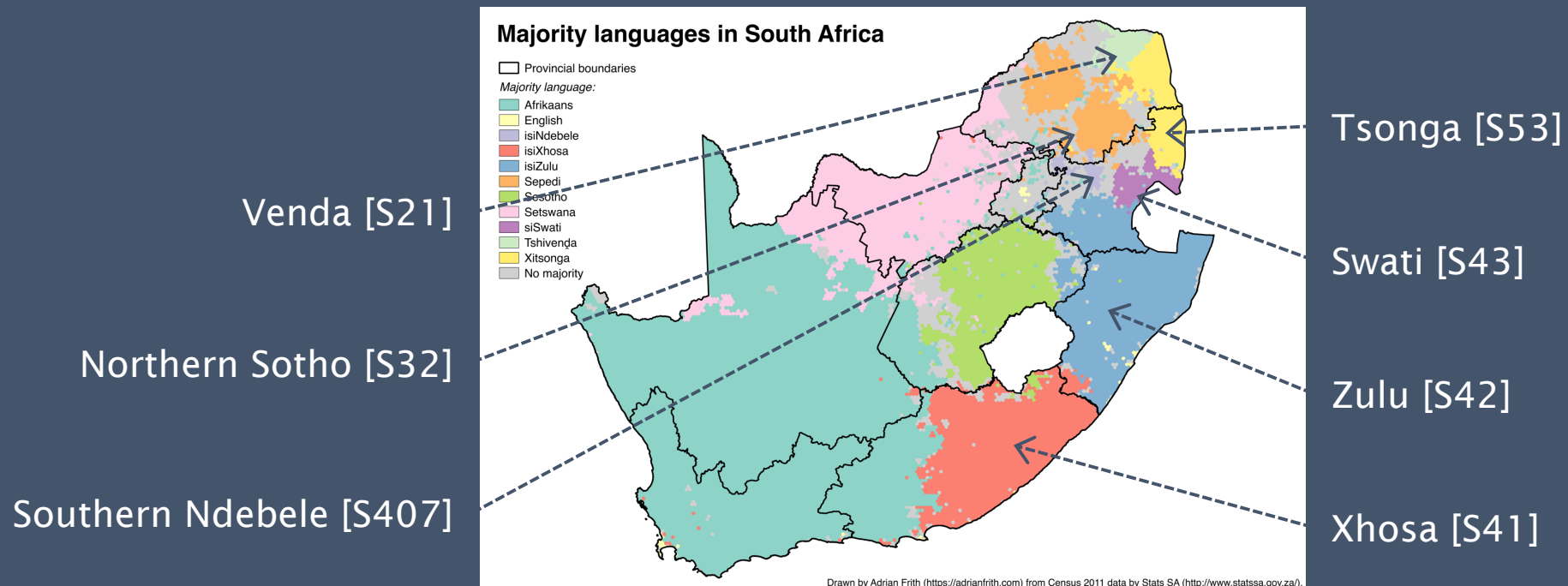
Ladefoged and Maddieson (1996: 330–331)

- ★ A case where there are clearly **two separate sources of frication** is found in SePedi (Northern Sotho). Lombard (1985) transcribes the segments  $f\widehat{s}$ ,  $f\widehat{j}$ ,  $\beta\widehat{z}$  in words such as  $\beta\text{ofsa}$  ‘youth’,  $\text{lefje:ra}$  ‘coward’ and  $\beta\text{zalwa}$  ‘beer’ and describe them as labiodental-alveolar, labiodental-prepalatal and bilabial-prepalatal fricatives respectively. [...] However, [...] **these are phonetic sequence**. One articulation follows the other, [...] The phonetic description given, namely, **that they have two simultaneous fricative articulations, is incorrect**.

# Main topics of this talk

- i) Preliminary observations on **hetero-organic affricates/ fricatives**
- ii) Typological overview of **lateral fricatives**

across six Southern Bantu languages



Map source: <https://adrian.frith.dev/linguistic-diversity/>

# Aspects of fricatives in S languages

- ★ Preliminary observation: genesis of hetero-organic affricate as ‘incomplete BS’

Lemma:

‘Zimbab**w**e’

Etymology:

\*-bùè  
[MAIN 285; all but A, B, H]

\*-bùjè  
[VAR 4701; J, S]

Pronunciation:

[b̥z̥ie ~ b̥z̥e]

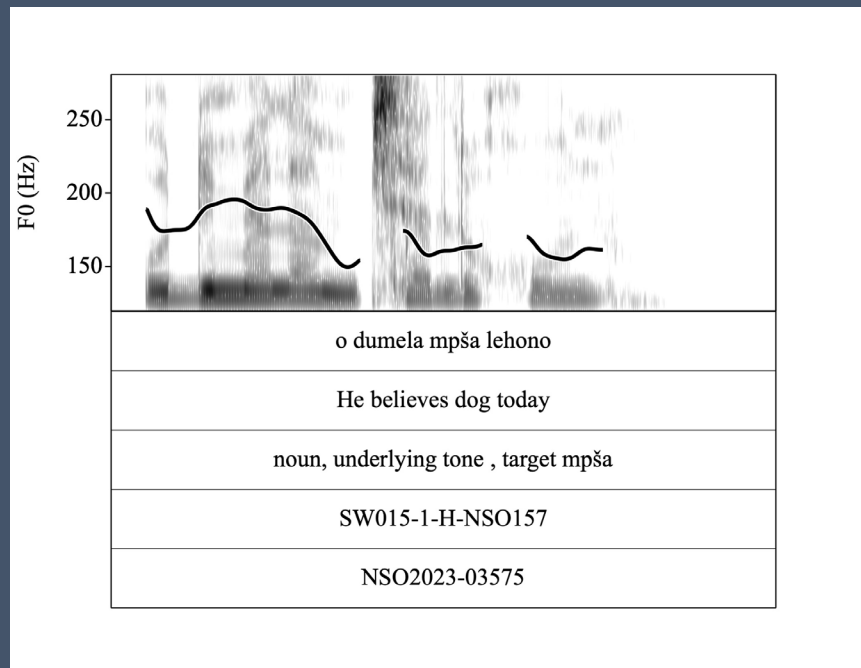
Process:

\*-bùjè > bje  
ɨ → ∅  
Vowel dropping

bje > bz̥je  
b → bz/ \_j  
S-type ‘incomplete’ BS?

# Aspects of fricatives in S languages

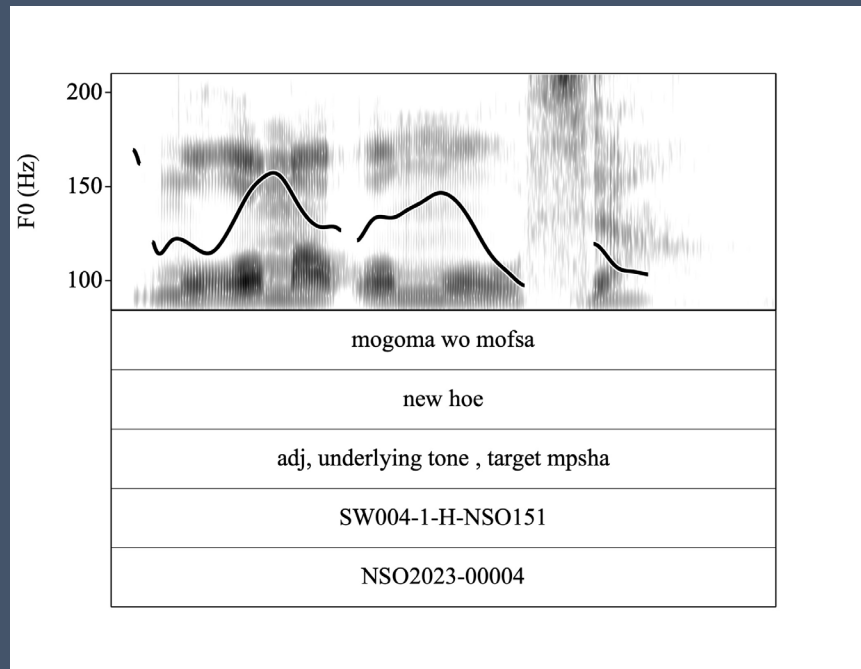
- ★ hetero-organic (labial-dorsal) affricate: N. Sotho



SW015-1-H-NSO157

# Aspects of fricatives in S languages

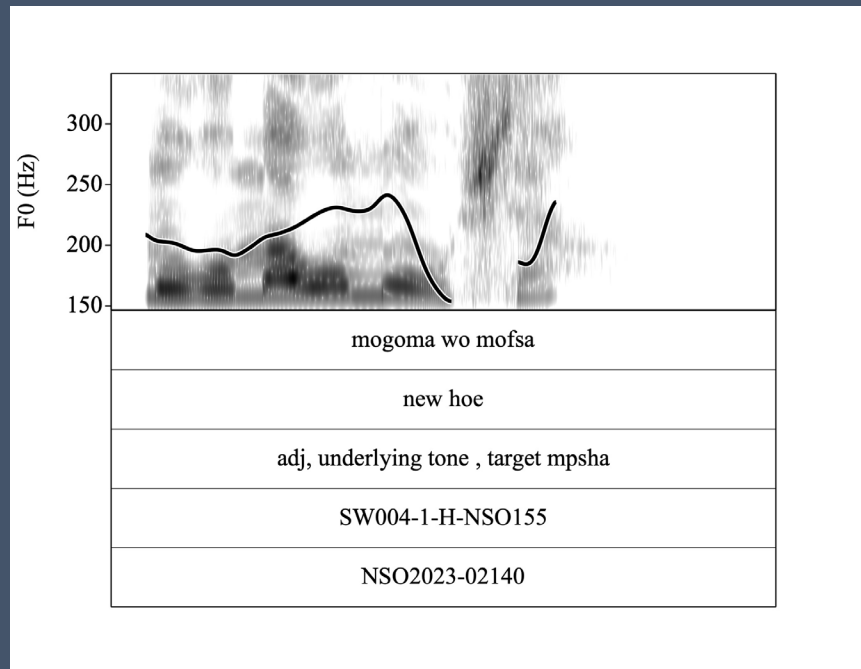
- ★ hetero-organic (labial-dental) fricative: N. Sotho



SW004-1-H-NSO151

# Aspects of fricatives in S languages

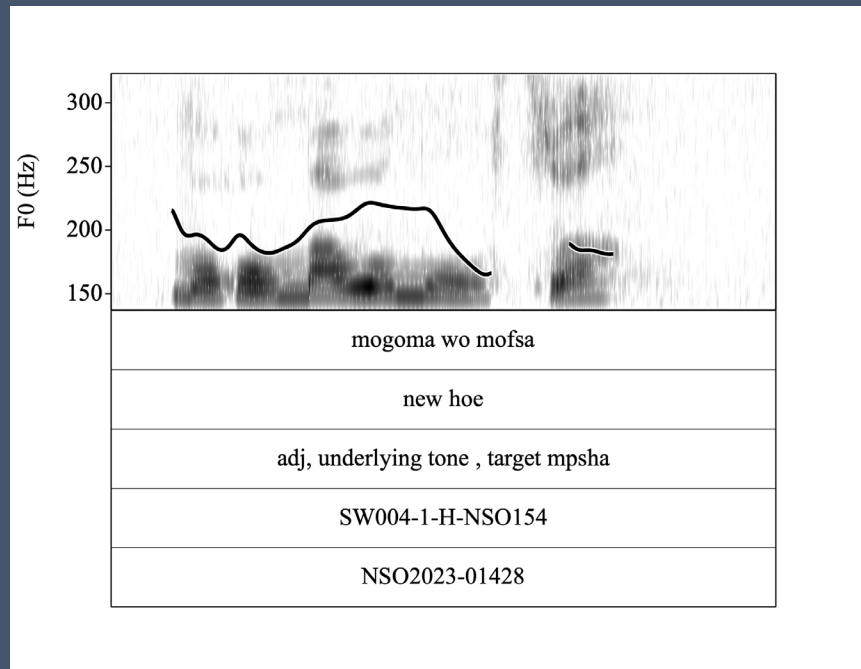
- ★ hetero-organic (labial-colonial) fricative: N. Sotho



SW004-1-H-NSO155

# Aspects of fricatives in S languages

- ★ hetero-organic (labial-colonial) fricative: N. Sotho



SW004-1-H-NSO154



# Typological overview

## Cross-linguistic variation

	[ɬ]			[ɮ]		
	#_	V_V	N_	#_	V_V	N_
Venda [S21]	0.00	0.00	0.00	0.00	0.00	0.00
N. Sotho [S32]	0.53	0.47	0.00	0.00	0.00	0.00
S. Ndebele [S407]	0.46	0.18	0.00	0.04	0.14	0.18
Xhosa [S41]	0.20	0.40	0.00	0.07	0.07	0.27
Tsonga [S53]	0.44	0.28	0.17	0.06	0.00	0.11
Swati [S43]	0.28	0.17	0.17	0.11	0.06	0.22
Zulu [S42]	0.22	0.33	0.11	0.11	0.06	0.17

# Typological overview

Restricted occurrence of voiced LF: [ɸ] > [ɓ]

	[ɸ]			[ɓ]		
	#_	V_V	N_	#_	V_V	N_
Venda [S21]	0.00	0.00	0.00	0.00	0.00	0.00
N. Sotho [S32]	0.53	0.47	0.00	0.00	0.00	0.00
S. Ndebele [S407]	0.46	0.18	0.00	0.04	0.14	0.18
Xhosa [S41]	0.20	0.40	0.00	0.07	0.07	0.27
Tsonga [S53]	0.44	0.28	0.17	0.06	0.00	0.11
Swati [S43]	0.28	0.17	0.17	0.11	0.06	0.22
Zulu [S42]	0.22	0.33	0.11	0.11	0.06	0.17

# Typological overview

Post-nasal restriction on [-v] LF

	[ɸ]			[ɬ]		
	#_	V_V	N_	#_	V_V	N_
Venda [S21]	0.00	0.00	0.00	0.00	0.00	0.00
N. Sotho [S32]	0.53	0.47	0.00	0.00	0.00	0.00
S. Ndebele [S407]	0.46	0.18	0.00	0.04	0.14	0.18
Xhosa [S41]	0.20	0.40	0.00	0.07	0.07	0.27
Tsonga [S53]	0.44	0.28	0.17	0.06	0.00	0.11
Swati [S43]	0.28	0.17	0.17	0.11	0.06	0.22
Zulu [S42]	0.22	0.33	0.11	0.11	0.06	0.17

# Typological overview

Post-nasal preference for [+v] LF

	[ɬ]			[ɮ]		
	#_	V_V	N_	#_	V_V	N_
Venda [S21]	0.00	0.00	0.00	0.00	0.00	0.00
N. Sotho [S32]	0.53	0.47	0.00	0.00	0.00	0.00
S. Ndebele [S407]	0.46	0.18	0.00	0.04	0.14	0.18
Xhosa [S41]	0.20	0.40	0.00	0.07	0.07	0.27
Tsonga [S53]	0.44	0.28	0.17	0.06	0.00	0.11
Swati [S43]	0.28	0.17	0.17	0.11	0.06	0.22
Zulu [S42]	0.22	0.33	0.11	0.11	0.06	0.17

# Further discussion: process of development

		GFB	A43	A44	A53	A83	B30	C101	D25	D32	E60	JE17	JE25	P13	P21	P23	P31	R11	R22	R41	K43	K34b	K33	K31	K14	R31	S61	S41		
labial	bilabial						β			ϕ												β	β	β					6	25
	labiodental	f, (v)		f	f, v	f, v	f		(f, v)		f, (v)	f, v	f		(f)		v	f, v	f, v	f, v	f, v	f, v	f, v	f	f, v	v	f	f, v	24	25
coronal	dental																		θ, ð		θ, ð					θ, ð			3	
	alveolar	s, (z)	s	s	s, z	s, z	s	s	s, z	s	s, (z)	s, z	s	(s)	s	s	s	s	s, z	s, z			s	s, z	s, z		s, s̰, r	s, z	24	26
	palatoalveolar	(ʃ, ʒ)				ʃ, ʒ			(ʃ)		ʃ		(ʃ)			(ʃ)	ʃ	ʃ	ʃ, (ʒ)	ʃ, ʒ	ʃ	ʃ	ʃ	ʃ	ʃ, ʒ		(ʃ)	ʃ	17	
	lateral																									(l)	l, ɬ	2		
dorsal	velar	(ɣ)		x			ɣ												x, ɣ		ɣ	ɣ						x, ɣ	7	7
glottal	glottal		h	h		h		h			h					h	h		h	h	h	h	h		h		ɦ	h, ɦ	15	15

★ From a geographical viewpoint, Southern languages tend to develop a rich system including **lateral fricatives**.

⇒ due to **contact?** (cf. M&S 2019: 90) or **local innovation?**

“Most of the languages have relatively limited sets of fricatives of the cross-linguistically common types, although **lateral fricatives** (and affricates) have developed in or **been borrowed** into a number of the southern languages...”  
(M&S 2019: 90)

“Lateral fricatives are only found in Nguni languages [...] and appear to have some association with Khoisan, **general opinion is that they are a local independent development**... Indeed they appear to show regular correspondences with other Bantu languages, for example, Swahili” [e.g. *hlawula* vs. *chaguz* ‘choose’; *hleka* vs. *cheka* ‘laugh’ ]  
“Lateral fricatives in Niger-Congo appear to always be recent and of local evolution, **internally generated**.” (Blench 2006: 3, 8)

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