

‘Central’, or ‘fricative’, vowel in the Ikema dialect of Miyako Ryukyuan: Acoustic and real-time MRI analyses

Shigeko Shinohara, Laboratoire de Phonétique et Phonologie (UMR7018, CNRS – Sorbonne Nouvelle)

Masako Fujimoto, Advanced Research Center for Human Sciences, Waseda Univ.

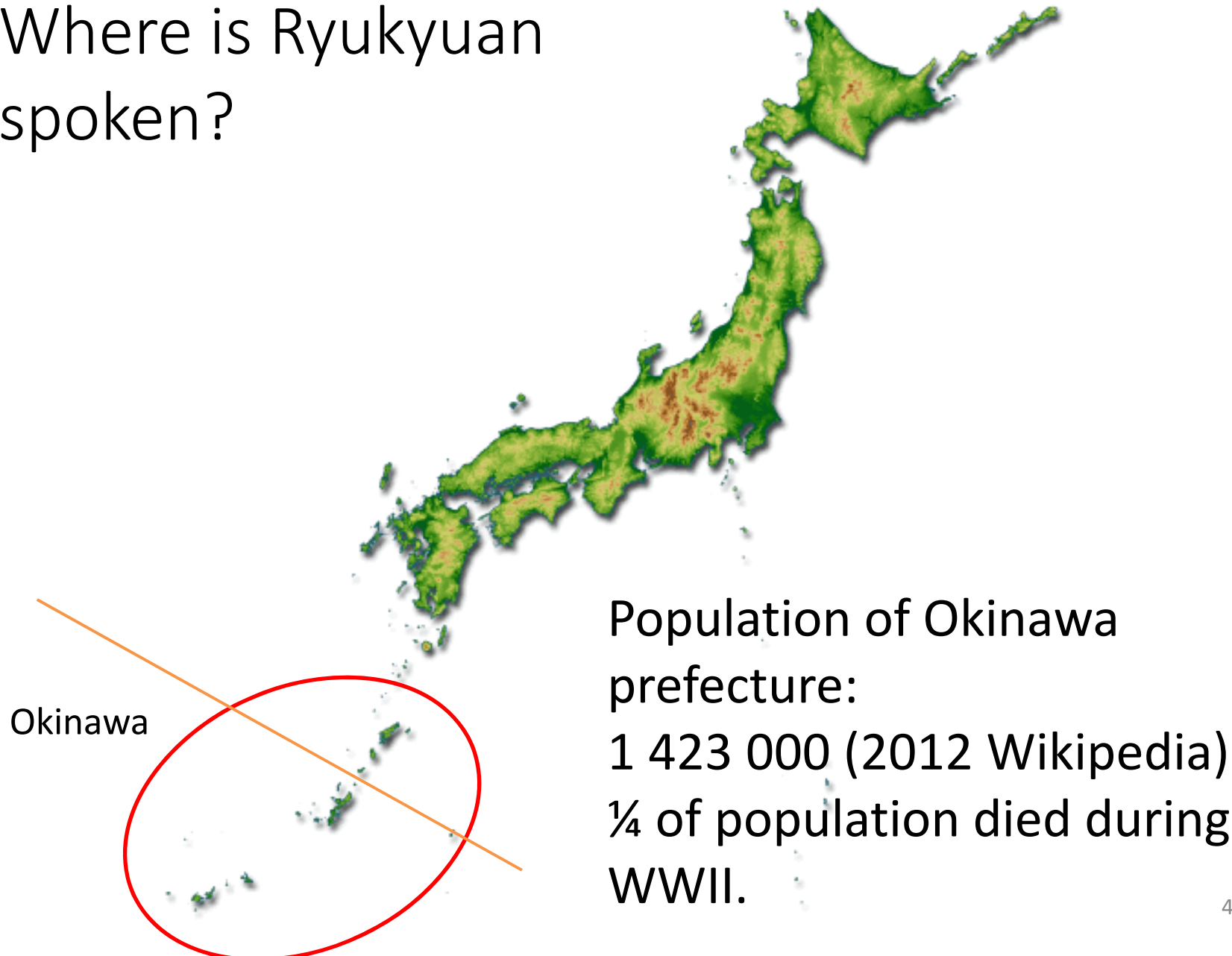
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Outline

- Ryukyuan Language
- The ‘central’ or ‘fricative’ vowel, /l/, in Ikema Miyako Ryukyuan
- Fricative and apical vowels cross-linguistically
- Purpose of study
- Methods
- Results
- Discussion
- Conclusion
- Future work

Ryukyuan Language

Where is Ryukyuan spoken?



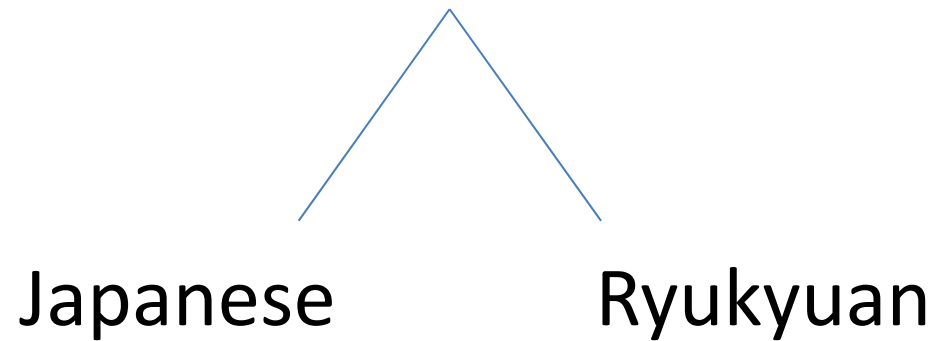
Population of Okinawa prefecture:
1 423 000 (2012 Wikipedia)
 $\frac{1}{4}$ of population died during WWII.

Currently endangered

- The *UNESCO Atlas of the World's Languages in Danger* in 2009 included six Ryukyuan languages
 - *Amamian, Kunigami, Uchinaaguchi, and Miyakoan*: definitely endangered
 - *Yaeyaman and Dunan*: critically endangered
- We refer to them as ‘major dialect groups’ of Ryukyuan

Where does Ryukyuan come from?

Japonic language family



- Separation occurred around A.C. 7 or before.

Different from Japanese?

Basic syntactic structure: roughly similar to Japanese

Phonological system:

- Moraic structure plays a role
- Pitch accent systems exist
- Distinct segment set and segment combinations in each dialect

Typologically rare sounds: Ex. Ikema dialect

Initial geminates: [tta] 'tongue' [vva] 'you' [ffa] 'child'

Voiceless nasal geminates: [ɸna] 'rope', [m̥mu] 'cloud'

Fricative vowel: [zl:] 'soil', [tsl:] breast milk' (Today's topic)

Relation with Japanese sounds

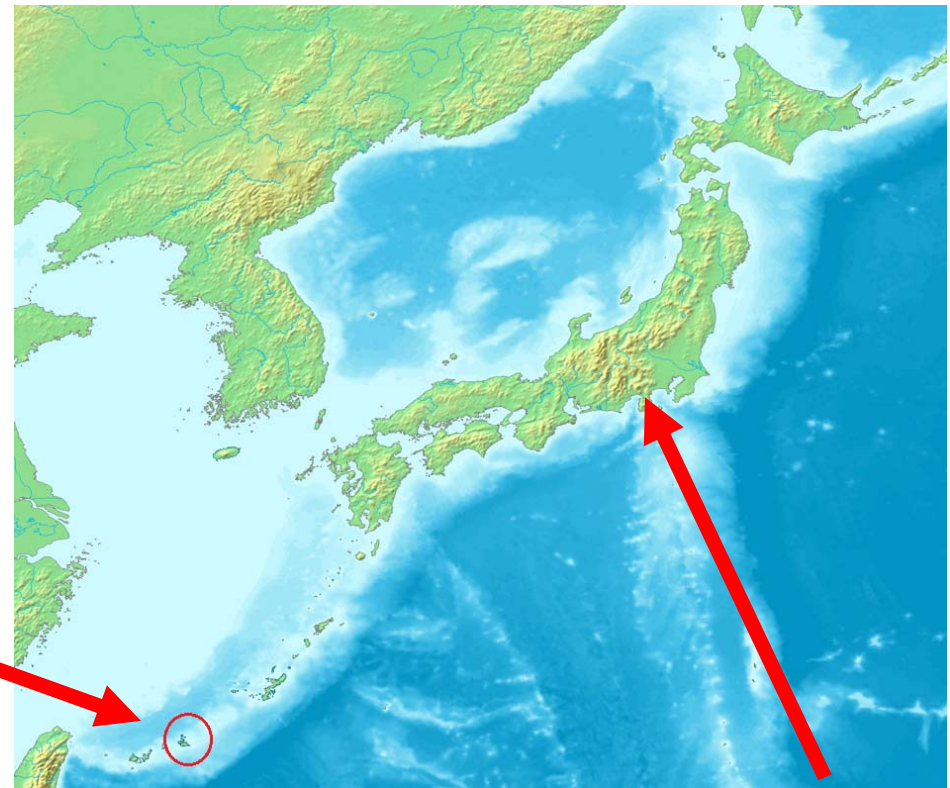
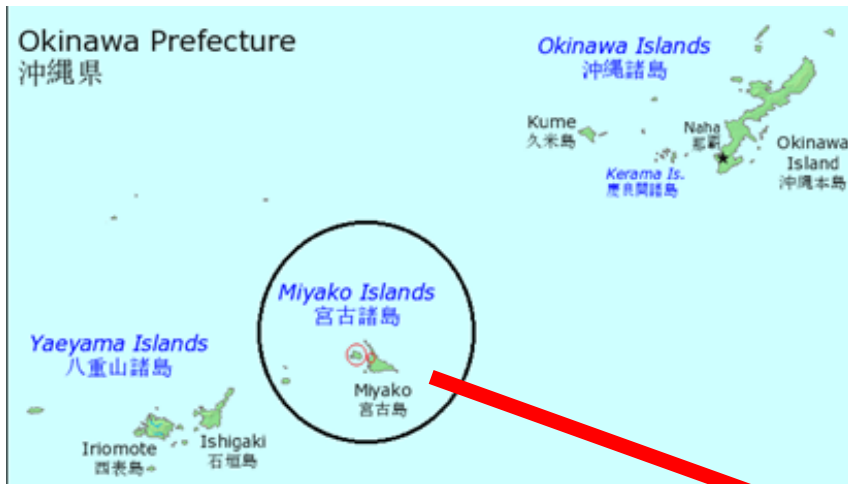
Ex. Correspondence of
5 Japanese vowels -- 4 Miyako Ryukyuan vowels

本土方言		宮古方言
i	—— ɪ	kɪmu (肝), pɪtu (人)
e	—— i	nabi (鱧), mami (豆)
a	—— a	jama (山), pana (花)
o	—— \	kumi (米), butu (夫)
u	—— /	nunu (布), muku (鱒)

表1 本土方言と宮古方言の音韻対応

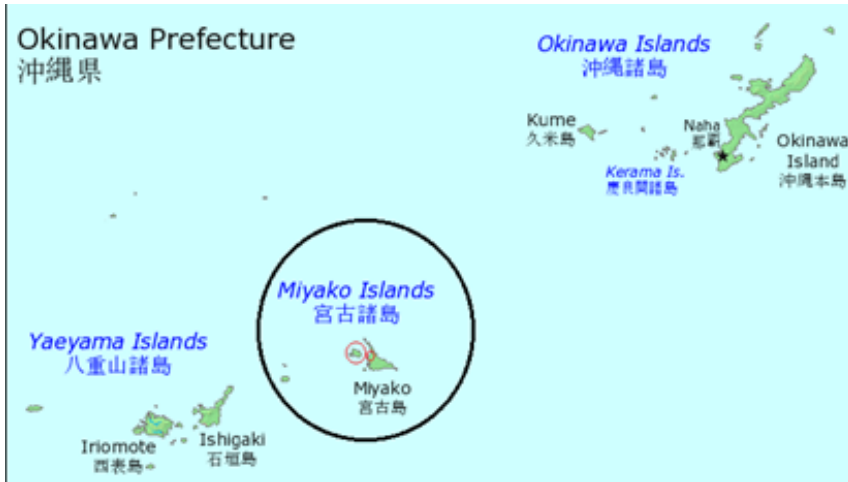
Karimata, S. (1998) *Sohubo no kotoba*, Gekkan Gengo

Where is Miyako
Ryukyuan spoken?



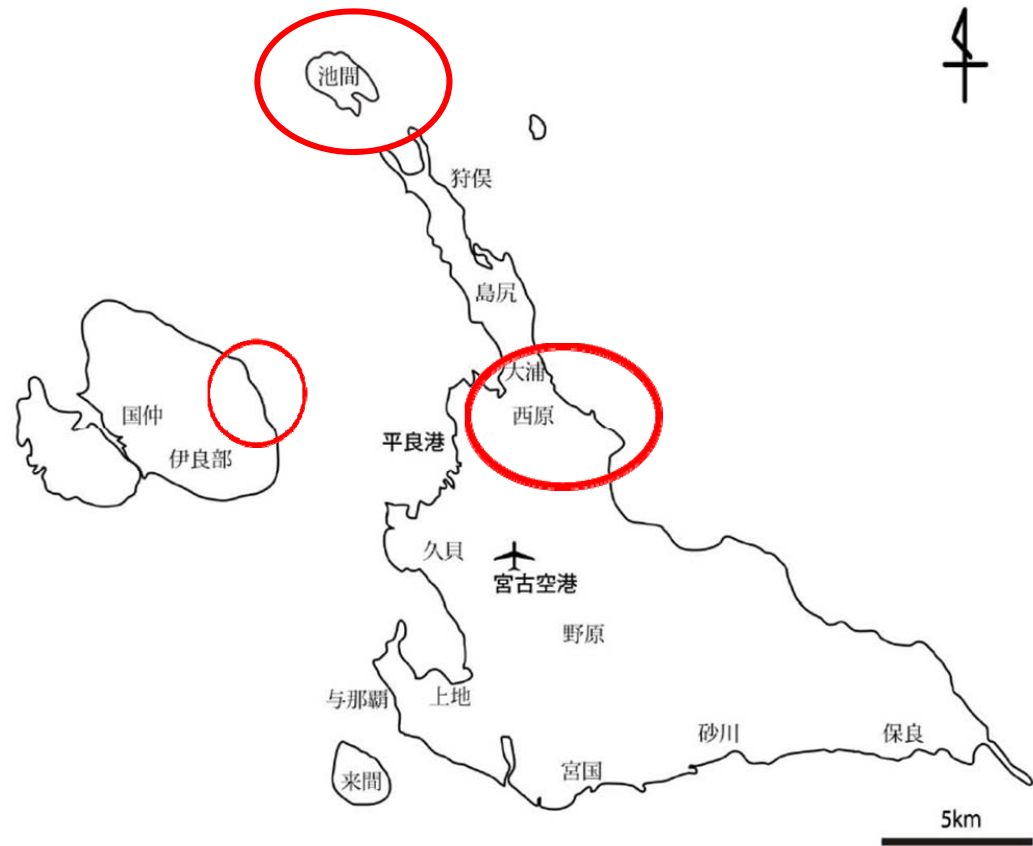
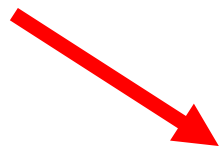
Miyakojima in
Okinawa

Tokyo



Miyakojima is composed of several islands

Ikema dialect: Ikema Island,
Nishihara in Miyako Island,
Sarahama in Irabu Island



Picture from Kibe 2012

地図3 宮古方言調査地点

The Ikema bridge



from HP of Miyakojima City

The 'central' or 'fricative' vowel, /l/, in the
Ikema dialect of Miyako Ryukyuan

Vowel system in Ikema dialect

/a, i, u, l/

Some limited lexical items are pronounced with
/e/ (/ee/ 'yes') and /o/ (/gakkoo/ 'school')

/l/ - a central, apical or fricative vowel?

- /l/ in Miyako and southern Ryukyuan has been called
 - ‘central’ vowel, /i/ (Uchima 1984), /i/ (Hayashi 2010)
 - ‘apical’ vowel, /ɿ/ (Sakiyama 1963, cited in Ohno et al. 2000; Pellard and Hayashi 2012)
- Its place of articulation has been an issue of debate
- It accompanies some friction noise of [z] or [s], may be called ‘fricative’ vowel

Quality of /l/ in Ikema Ryukyuan

- The vowel /l/ in Ikema dialect is reported to be losing its friction

- Frication noise is heard in certain speakers

• /zl/ ‘soil’ by M1  /tsl/ ‘breast milk’ 

• /zl/ by M2  /tsl/ 

• /zl, hazl, mizl/ ‘soil’, ‘leg’, ‘water’ by M2 

Asymmetric distribution of /l/ in Ikema

Ikema consonants :

/(p) b t d k g ts s z f v h m n r j w N ŋ/

/l/ occurs only after /ts, s, z/: [tsl, sl, (d)zl]

No other vowels occur after these consonants

(adapted from Pellard & Hayashi, 2012)

*/fl/ Hayashi (2010)

* /p/ dia-, ideo-lectal

Fricative and apical vowel cross-linguistically

Apical or fricative vowel cross-linguistically

Assimilative context (same place and manner)

- **Mandarin:** /s, ts, ts^h/ followed by apical vowel (Lin 2008) described as [an alveolar approximant articulation, and transcribed with IPA symbols [z] with, subscript, the lowering diacritic [̣], and a following superscript [ʷ] to show the accompanying close back unrounded coloration] (Wells 2007)
- **Lanzhou and Loufan Chinese:** /u/ realized as [v] after labiodental fricatives and affricates, creating a prolongation of friction noise (Dell 1994)

Apical or fricative vowel cross-linguistically. cont'd

Dissimilar context

- **Karimata dialect of Miyako Ryukyuan:** Strong friction noise occurs in /l/ after /p, b, t, d, k, g/, but not after /s, ts, z/ (Ohno et al. 2000), (contra p.c. Pellard, p.c. Karimata – frication also after /s, ts, z/)

Apical or fricative vowel cross-linguistically. cont'd

Mixed contexts?

- **Len in Mambila language** group spoken in Cameroon has two phonetic fricative vowels contrasting with /i/ or /u/ (Connell 2007)
 - Alveolopalatal fricative vowel [ʒi̯] occurring after [b, ʃ],
 - Labiodental fricative vowel [vw̥] after [t, d, k, f]
- **Jixi dialect of Huizhou Chinese:** Fricative vowel [z] after /p, p^h, m, n, s, ts, ts^h/ This vowel contrasts with other high vowels after the same set of consonants (Shao 2018)

Purpose of study

Research questions on /l/ in Ikema

- How is it articulated?
- What are its acoustic correlates?
- Is there any reason for synchronic occurrence of /l/ only after alveolar sibilants?

Methods

Rt-MRI filming

- Mid-sagittal head and neck area
- Two speakers
- 10 frames per sec.
- 16 word lists
- Speakers uttered test words in a list repeatedly
- Each session took 50 seconds

- 6 - 12 repetitions depending on the words

Rt-MRI analysis

- Images/frames corresponding to the target phones identified
- Shapes of the articulators observed
- Premier Elements, Photoshop Elements (by Adobe) and Praat were used

Audio recording and analysis

The speakers uttered words in the dialect when shown by the experimenter the corresponding words in standard Japanese

3-4 times each in isolation

Sony PCM-D50 integrated microphone

48 Hz sampling, digitized at 16 bit

F1, F2 at midpoints of the target vowels measured by Praat 6.0.21 (Boersma and Weenink 2016) and mean values calculated

Test words and numbers of utterance

	/ɪ/	/i/	/u/	/a/
Audio	tsɪ [tsɪ:] 'breast milk' M1: 3 M2: 4	ti [ti:] 'hand' M1: 3 M2: 4	tu [tu:] 'ten' M1: 4 M2: 4	ta [ta:] 'rice field' M1: 3 M2: 4
rt-MRI	nttsɪɪ [nttsɪ:] 'soup' M1: 10 M2: 8	ti [ti:] 'hand' M1: 10 M2: 8	tu [tu:] 'ten' M1: 10 M2: 8	ta [ta:] 'rice field' M1: 10 M2: 8

Result rt-MRI

nttsll 'soup' M1

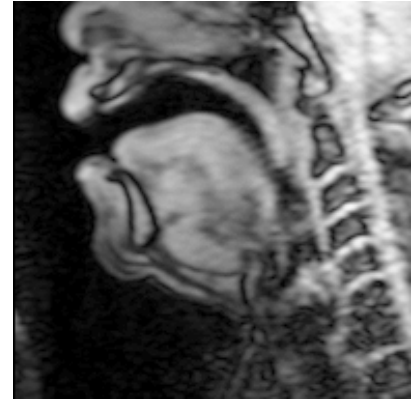
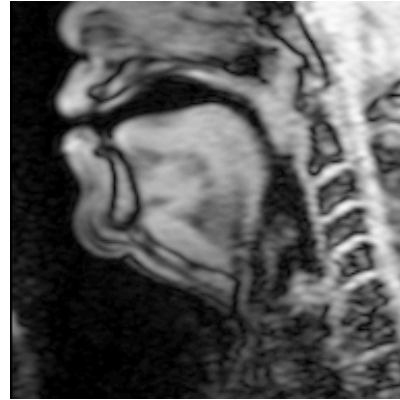
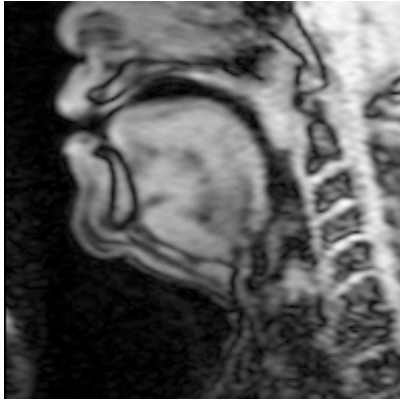


nttsll 'soup' M2

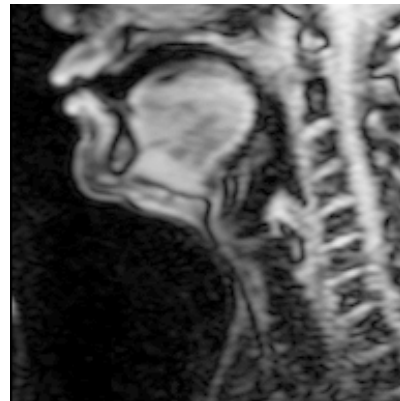


4 vowels

M1



M2



/i/

/i/

/u/

/a/

Comparison among 4 vowels

- Position of constriction

/l/: tongue front and the front part of hard palate

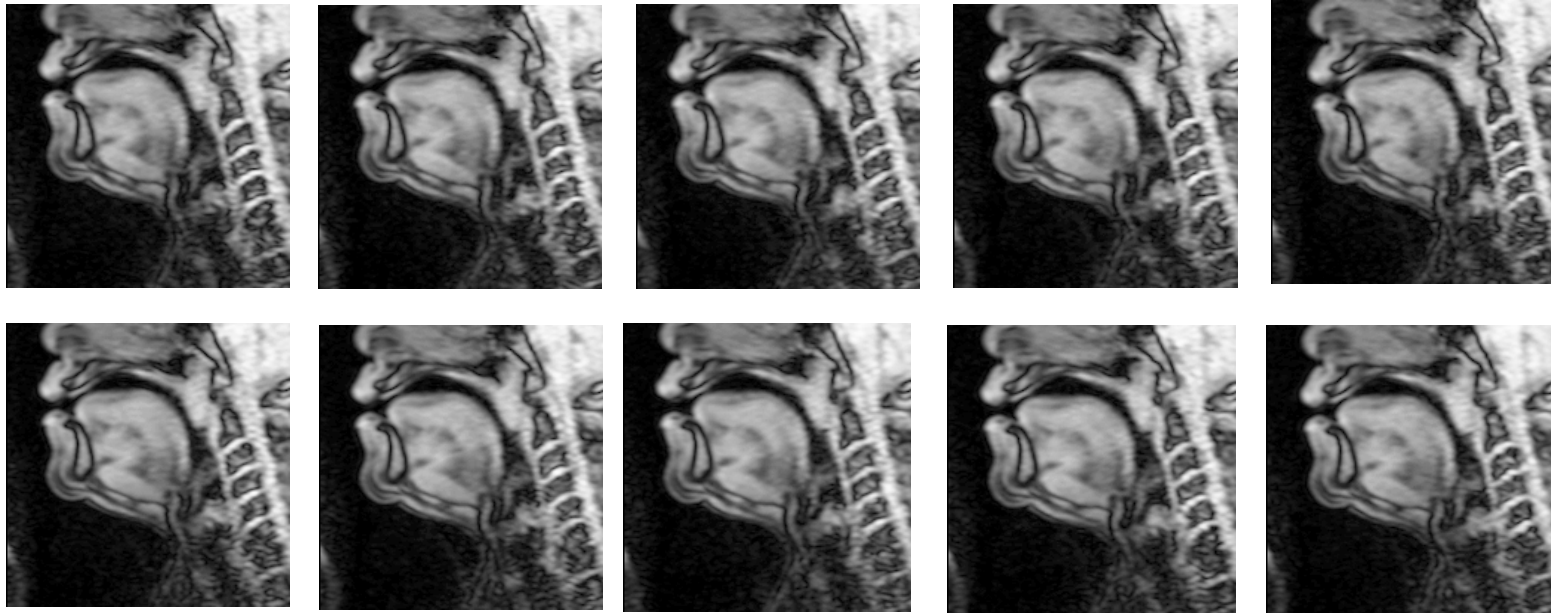
/i/: tongue blade and the back part of hard palate

/u/: back of the tongue and soft palate

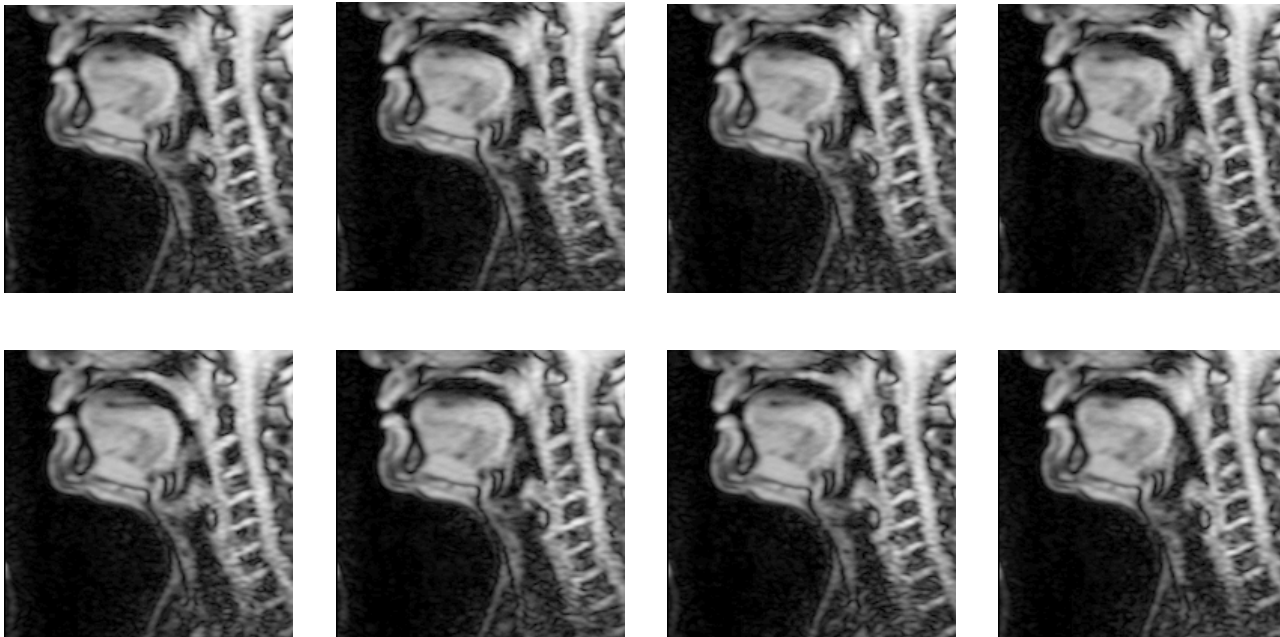
/a/: upper part of pharynx

- /l/: constriction is farther **front** than that for /i/, **not between /i/ and /u/**

10 utterances of /l/ in nttsl 'soup' by M1



8 utterances of /l/ in nttsl 'soup' by M2



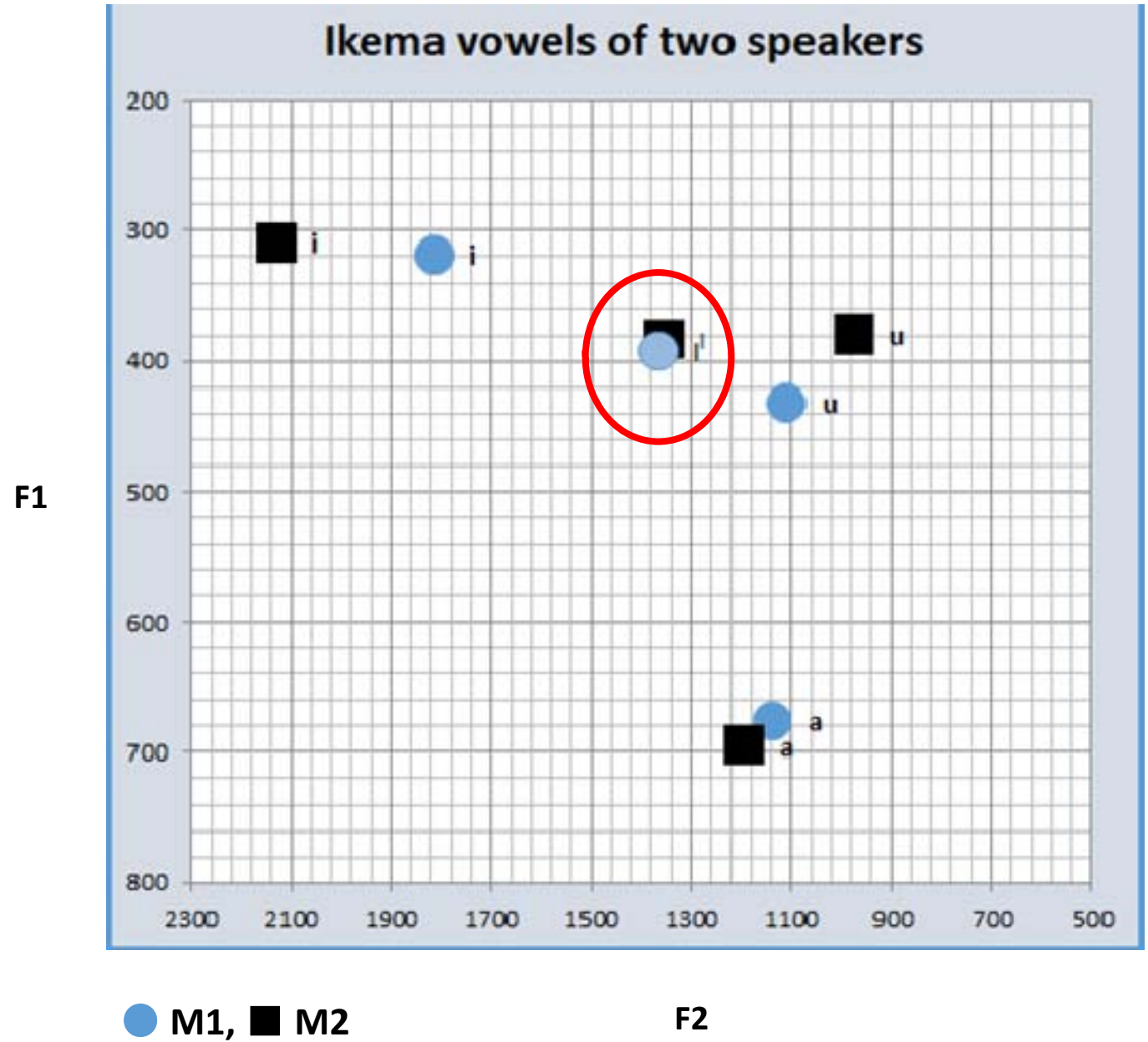
Result 2 Formants

Articulation and formants

- Jaw opening: close – low F1
open – high F1 [a]
- Tongue position: front – high F2 [i]
back/round – low F2 [u]

Ladefoged (2001)

F1 F2 Chart



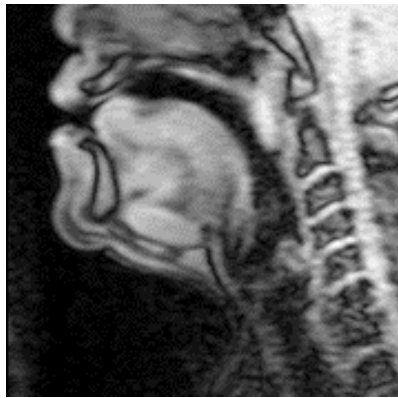
Discussion

- MRI: /l/ is articulated at the front part of hard palate with front of the tongue by the two speakers
 - **apical vowel** (cf. Sakiyama 1963, 1965)
- F2: /l/ is between /i/ and /u/, indicating
 - **central quality** (cf. Ohno et al 2000)

MRI: Compatibility with sibilant consonants

[s]ata 'sugar' [z]ll 'soil'

ntts[ll] 'soup'



Conclusion

- Articulation & acoustic correlates:
Very front articulation even though it sounds central when without frication noise
- Phonological distribution
Preceding alveolar sibilant consonants /ts, s, z/ and /l/ are articulated at the similar position in mid-sagittal observation
Thus, the vowel /l/ occurs in assimilative context in Ikema

Future work

- Examine the observed difference quantitatively
- For [z]-like frication noise in /l/, some grooved tongue shape may be necessary
→ Coronal plane to observe horizontal contact dimension and groovedness
- /l/ in other Miyako dialects

Acknowledgement

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