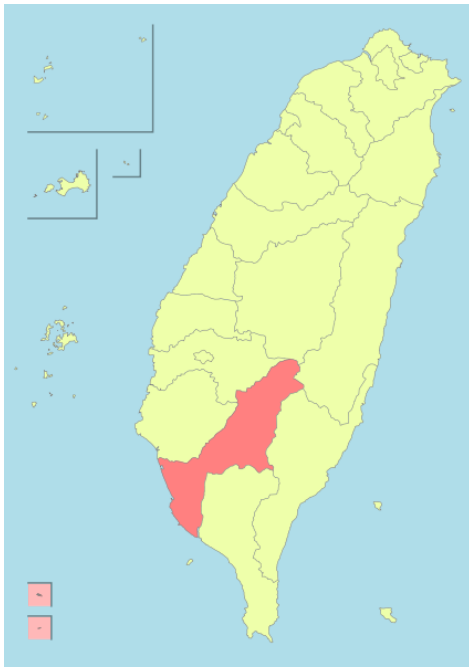
The sociophonetics of gender in three Chinese varieties

Mary E. Beckman Fangfang Li Ya-ting Shih

Columbus, OH, 2018-03-09 — NACCL-30 (Chinese Linguistics: from the field, from the lab, and from the armchair)

Three varieties of Chinese, spoken in these two cities



Map sources: [Songyuan] User Joowwww / Wikipedia commons / Public domain;
[Kaohsiung] User ASDFGHJ (work by Luuva) / Wikipedia commons / CC BY-SA 3.0

The Songyuan (Putonghua) corpus

Researcher Fangfang Li (李芳芳), Psychology, University of Lethbridge

Participants Young adult speakers of Dongbei Mandarin (10 men, 10 women), recorded in 2006-2007 as part of a study of phonological development.

Dissertation Li, Fangfang. 2008. *The Phonetic Development of Voiceless Sibilant Fricatives in English, Japanese and Mandarin Chinese*. Doctoral dissertation, Linguistics. `https://etd.ohiolink.edu`, No. osu1228250787

Materials Initial lingual obstruents before a variety of vowels in words such as /ti^{51} t^{h}u^{25}/ (地图), /se^{55} ja^{35}/ (塞牙), /ta^{51} ʨaŋ^{51}/, /ʨoŋ^{35}/ (熊), and /ʂu^{55} pao^{55}/ (书包)

The Kaohsiung (Taiwanese & Guoyu) corpus

Researcher Ya-ting Shih (施雅婷), Teaching Chinese as a Second Language, Chung Yuan Christian University

Participants Adult speakers of the southern Taiwan varieties of Min Nan and Mandarin (23 young, 21 middle-aged, 20 elderly), recorded in 2011 as part of a study of phonological development in a context of cross-generational language shift.

Dissertation Shih, Ya-ting. 2012. *Taiwanese-Guoyu Bilingual Children and Adults' Sibilant Fricative Production Patterns*. Doctoral dissertation, Teaching and Learning. `https://etd.ohiolink.edu`, No. osu1354603130

Materials Initial fricatives before a variety of vowels, in words such as Taiwanese /sjɔ te/ (熱茶) and Guoyu /ɕoŋ^{35}/ (熊).

Elicitation: picture-prompted word repetition task

target: [ɕoŋ^{35}] 熊

Previous work on gender effects in Chinese (1)

lexical variables

- Farris, Catherine S. 1991. The gender of child discourse: Same-sex peer socialization through language use in a Taiwanese preschool. *Journal of Linguistic Anthropology*, 1(2), 198–224.

morphological variables

- Chan, Marjorie K. M. 1998. Gender-marked speech in Cantonese: The case of sentence-final particles *je* and *jek*. *Studies in the Linguistic Sciences*, 26(1/2), 1–28.

phonological variables

- Hu, Mingyang. 1991. Feminine accent in the Beijing vernacular: A sociolinguistic investigation. *Journal of the Chinese Language Teachers Association*, 26(1), 49–54.

Previous work on gender effects in Chinese (2)

Current study builds on previous acoustic studies of gender effects in several varieties of Chinese.

Fronting of alveolopalatal sibilants in women's speech

- Li, Fangfang. 2005. An acoustic study on feminine accent (女国音) in the Beijing dialect. In Qian Gao (ed.) *Proceedings of NACCL-17*, pp. 219–224.

Lengthening of aspiration in women's /p^h, t^h, k^h/

- Li, Fangfang. 2013. The effect of speakers' sex on voice onset time in Mandarin stops. *Journal of the Acoustical Society of America*, 133(2), EL 142–147.
- Peng, Jui-Feng, Li-mei Chen, & Chia-Cheng Lee. 2014. Voice onset time of initial stops in Mandarin and Hakka: Effect of gender. *Taiwan Journal of Linguistics*, 12(1), 63–80.

Gender effects in phonetics — ubiquitous and yet diverse

Diversity (culture-specificity) due to a multiplicity of bases?

sexual dimorphism effects

lowering of the characteristic frequencies of some sounds in men's speech relative to women's speech (or vice-versa):

- Culture-specific exaggerations of physiological differences?

language socialization effects

enhancement of cues to a phonemic contrast in women's speech relative to men's speech:

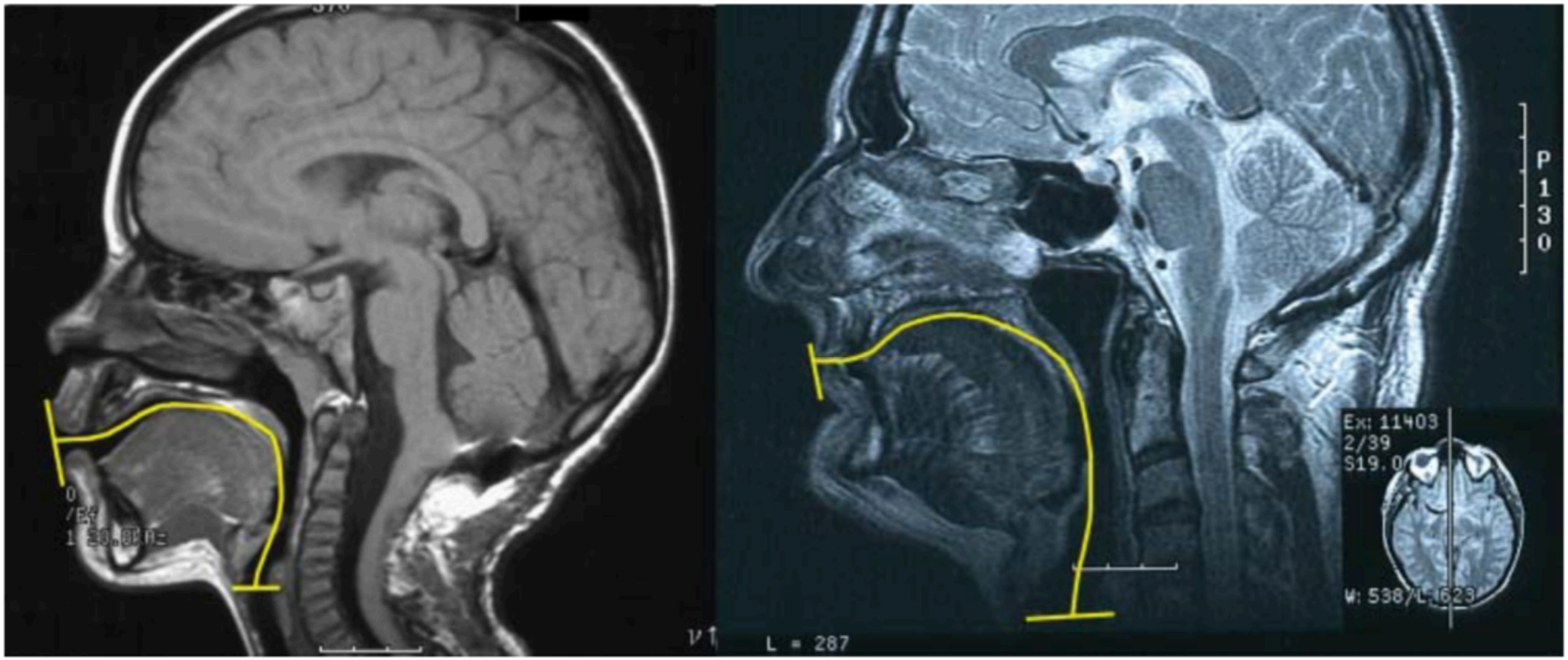
- Typically dominant role of women in language socialization?

sound change effects

differentiation of men and women in only one age group:

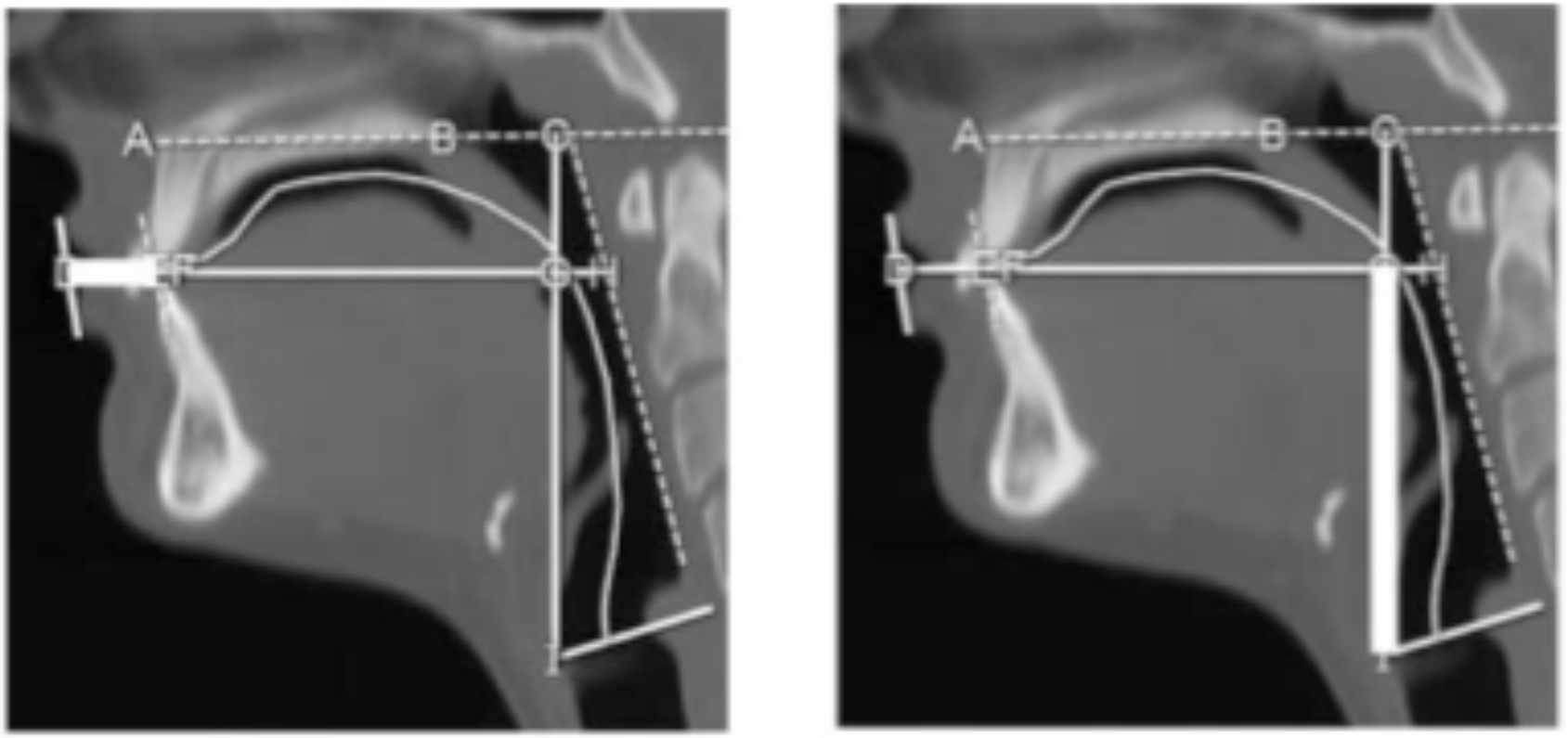
- Role of women as leading agents in sound changes in progress?

The physiological bases of size / power differences



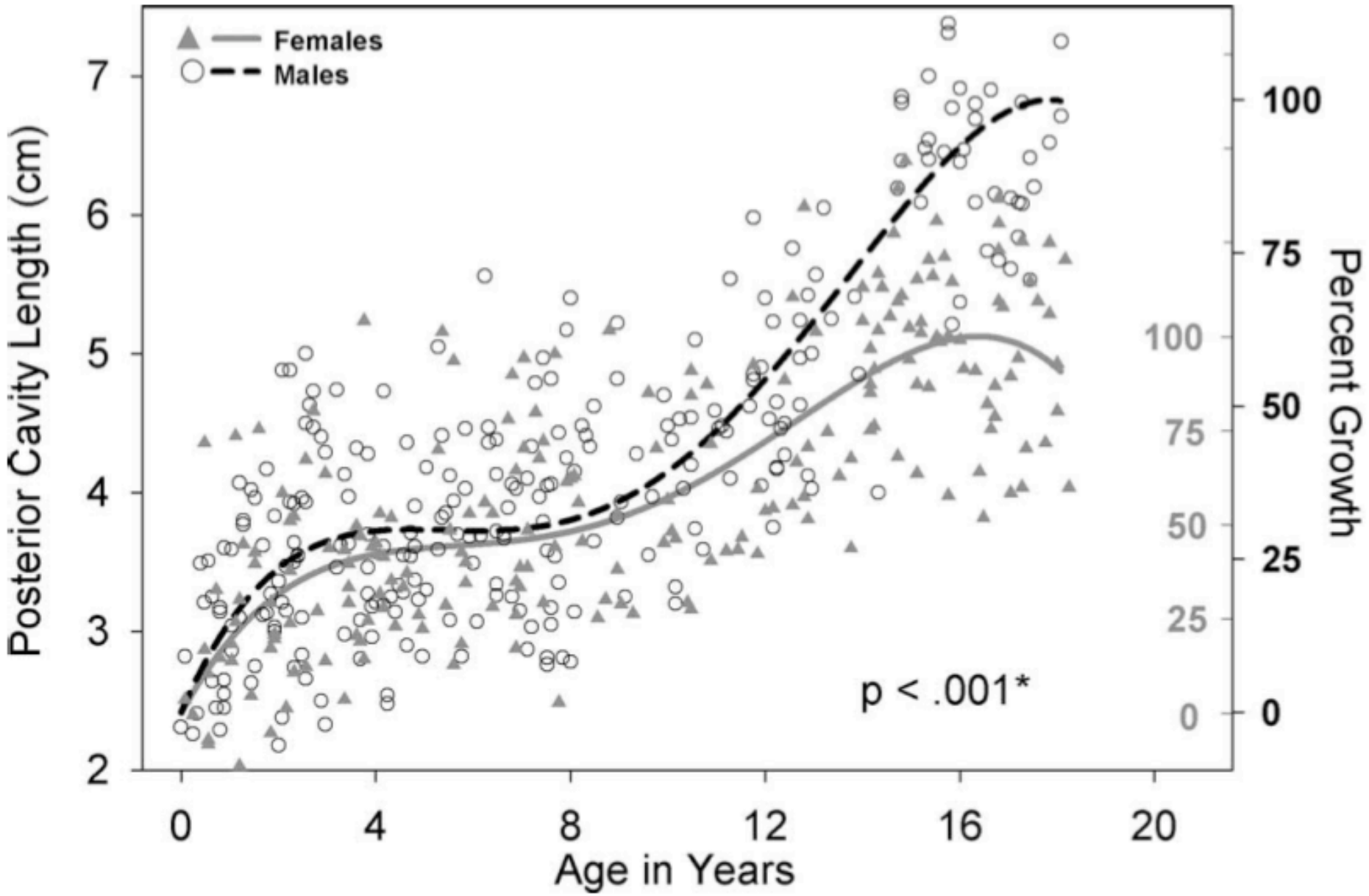
Measuring vocal tract length (VTL) from midsagittal magnetic resonance imaging (MRI) shows a more than 40% increase between (left) MRI for a 4-year-old boy with VTL = 11.28 cm and (right) MRI for a 54-year-old man with VTL = 15.87 cm (Vorperian & Kent, 2007, Fig. 1).

The loci of adult gender differences



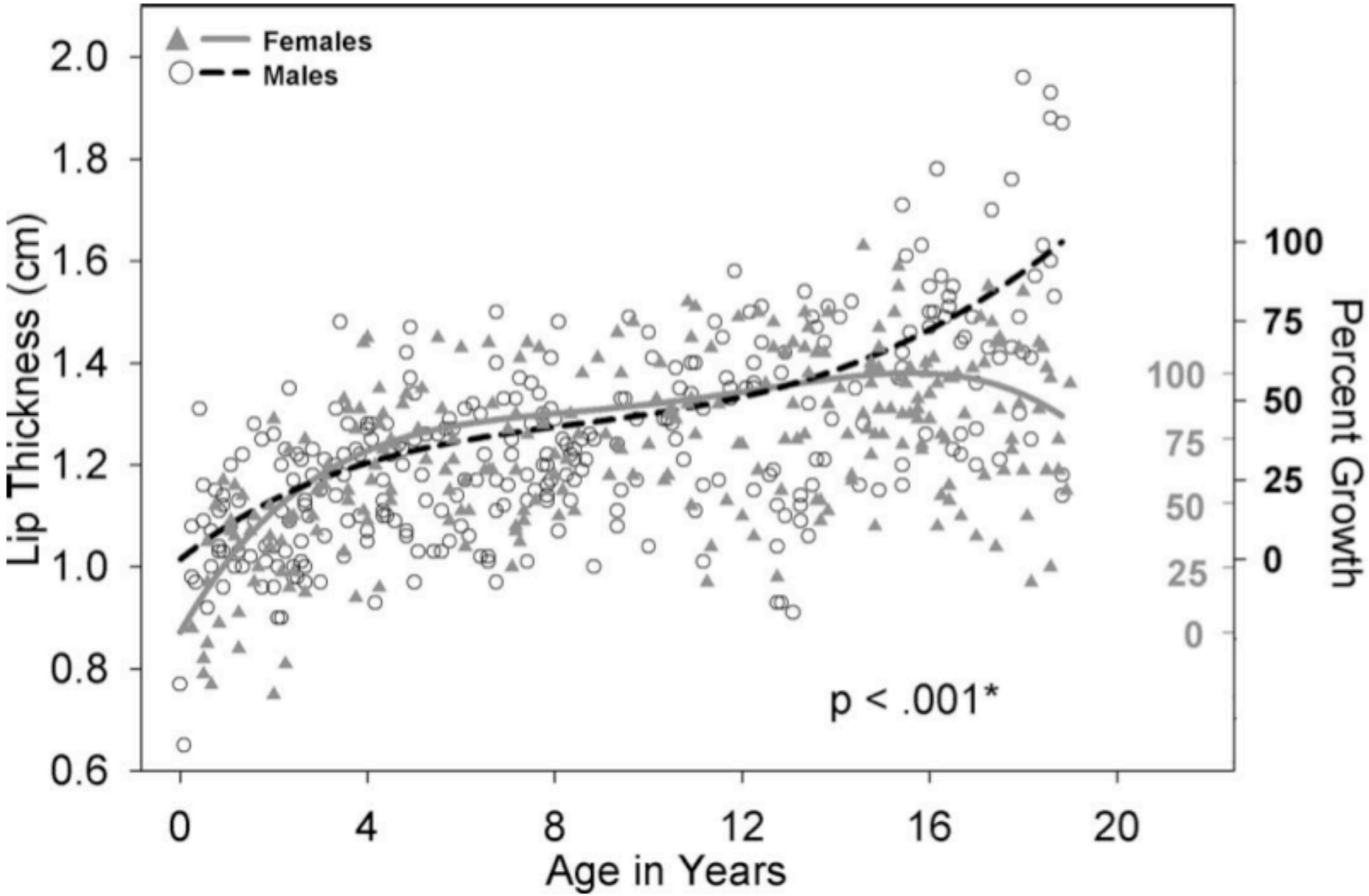
Measuring lip thickness (left) and posterior cavity length (right) as two major components of differences in overall VTL between men and women (Vorperian et al., 2009, Figs. 7 & 4).

Longer pharynx (larger head & lowered larynx) in men



Source: Vorperian et al. (2009) Figure 4.

Thicker lips (longer lip tube) in men

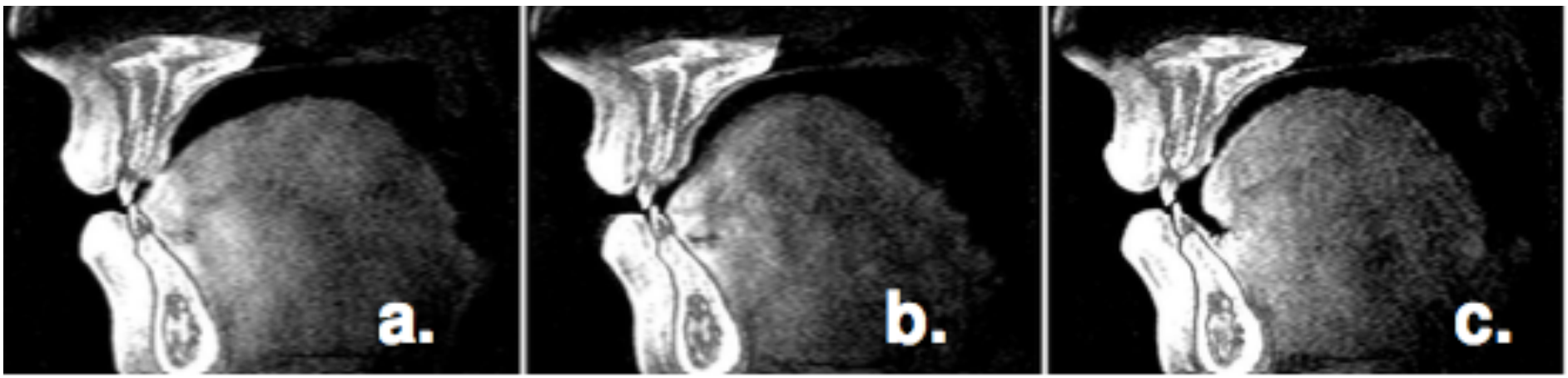


Source: Vorperian et al. (2009) Figure 7.

Articulation of the Mandarin sibilants

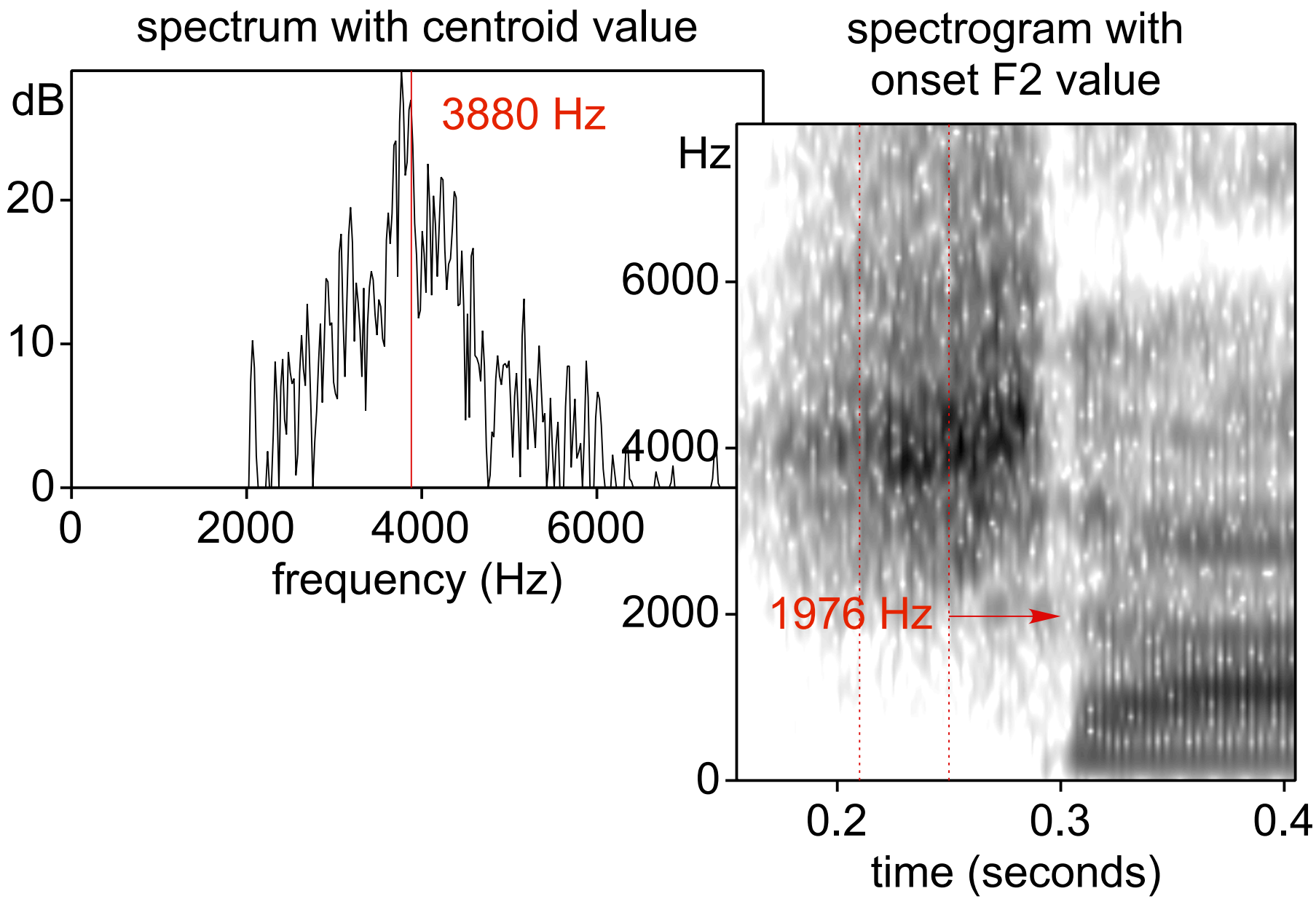
Relevant dimensions and their relationships

- Front cavity size: a. /s/ $<$ b./ɕ/ $<$ c. /ʂ/
- Constriction length: a. /s/ $<$ b./ɕ/ $>$ c. /ʂ/
- Back cavity size: a. /s/ $>$ b./ɕ/ $<$ c. /ʂ/

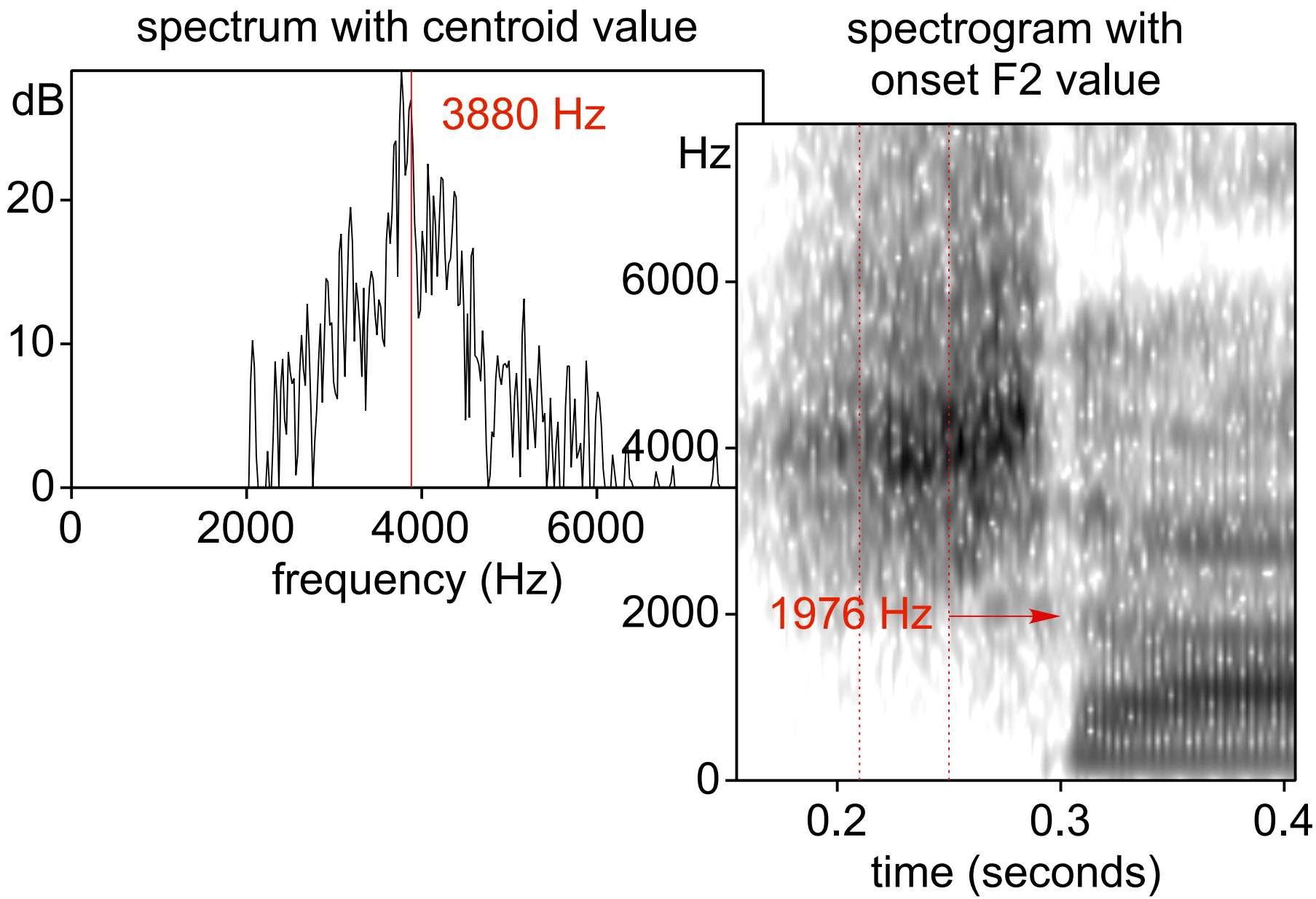


Representative images of (a) dental /s/ vs (b) palatoalveolar [ɕ] vs. (c) retroflex [ʂ] for one of four speakers of "Northern varieties of Chinese" in an MRI study of languages with 1, 2, or 3 sibilant fricatives (Toda & Honda, 2003, Figure 3).

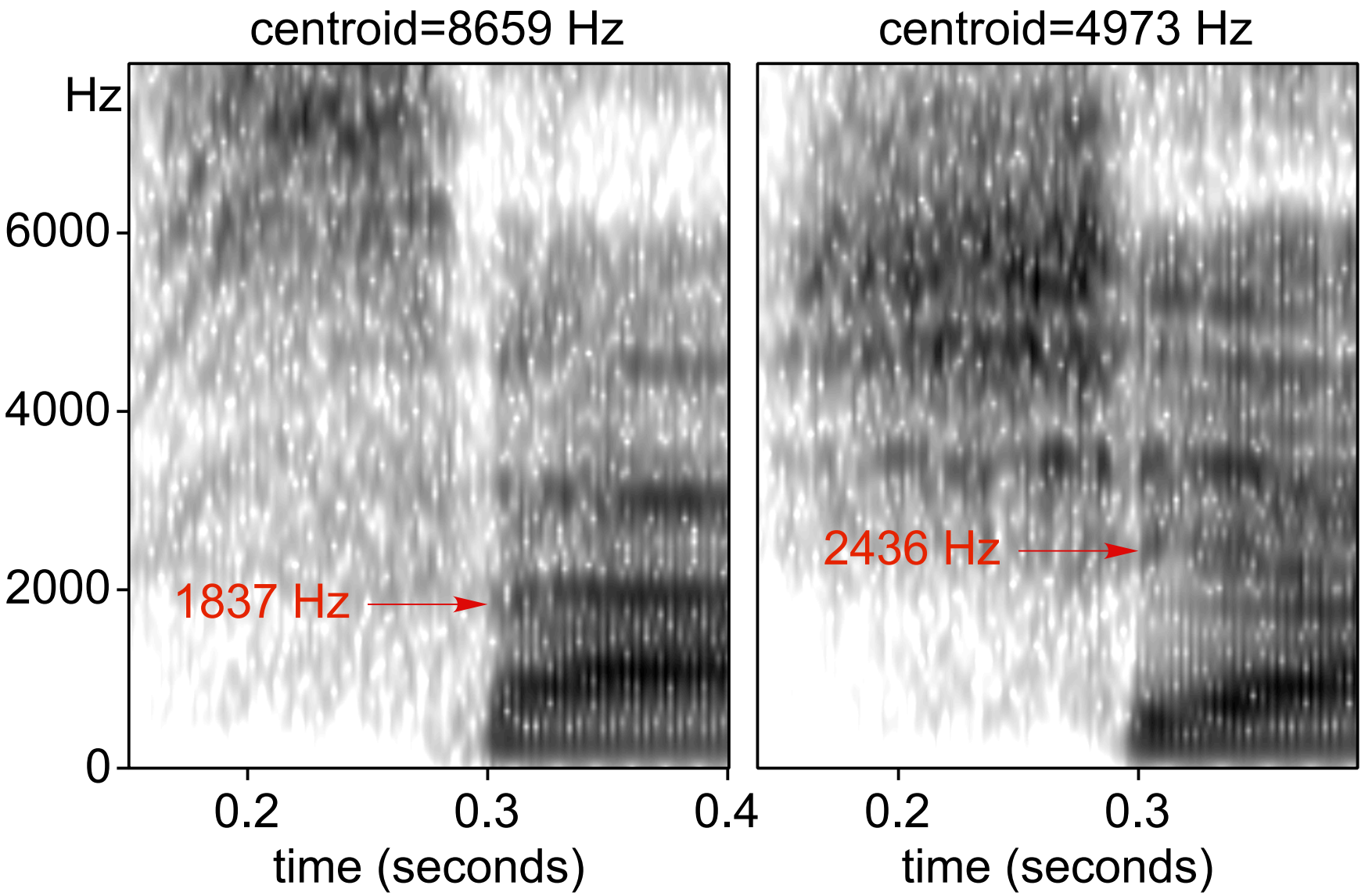
Measures of front and back cavity size in /ʂ/



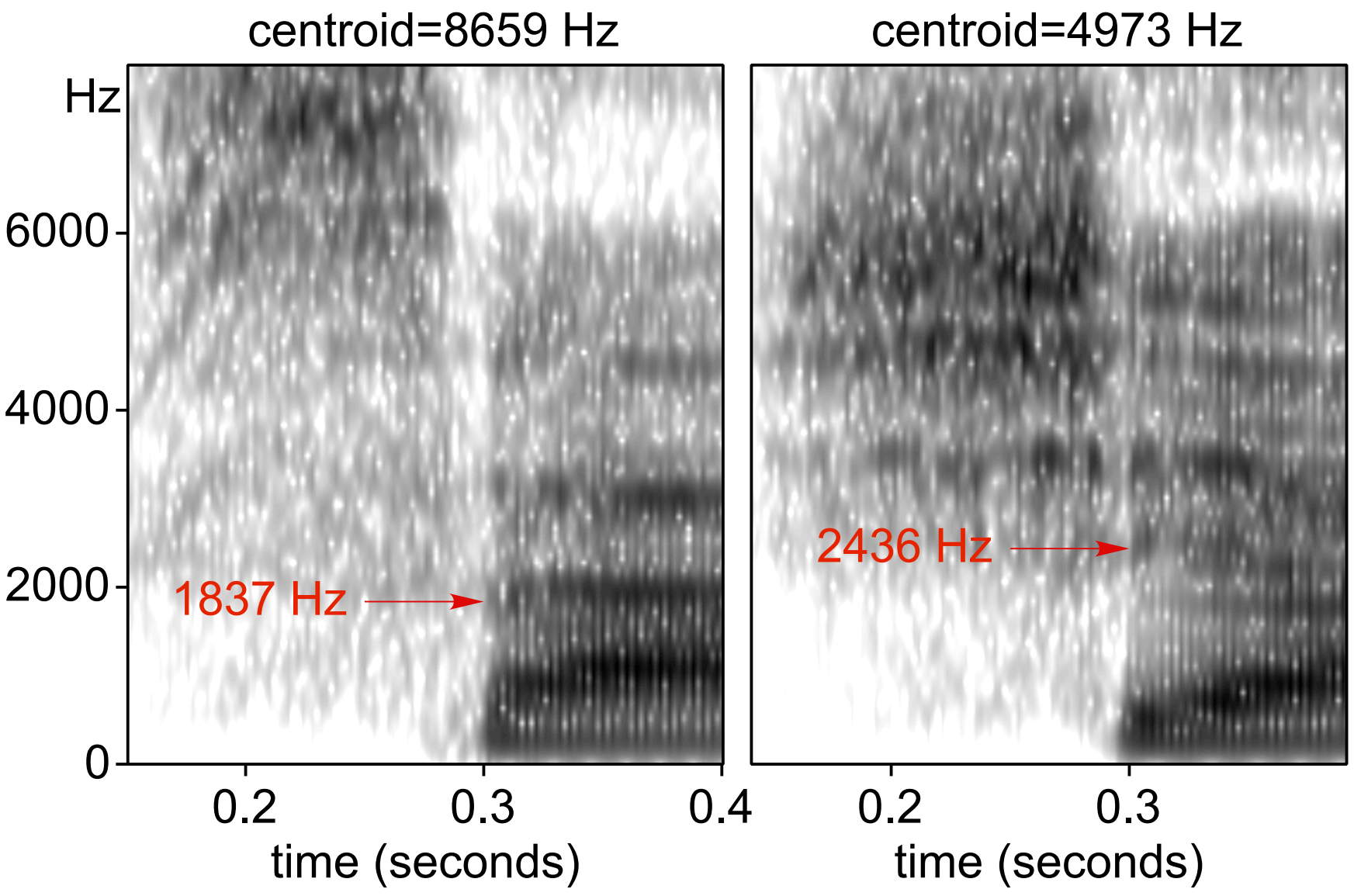
Measures of front and back cavity size in /ʂ/



Measures in /s/ (left) vs /ɕ/ (right)

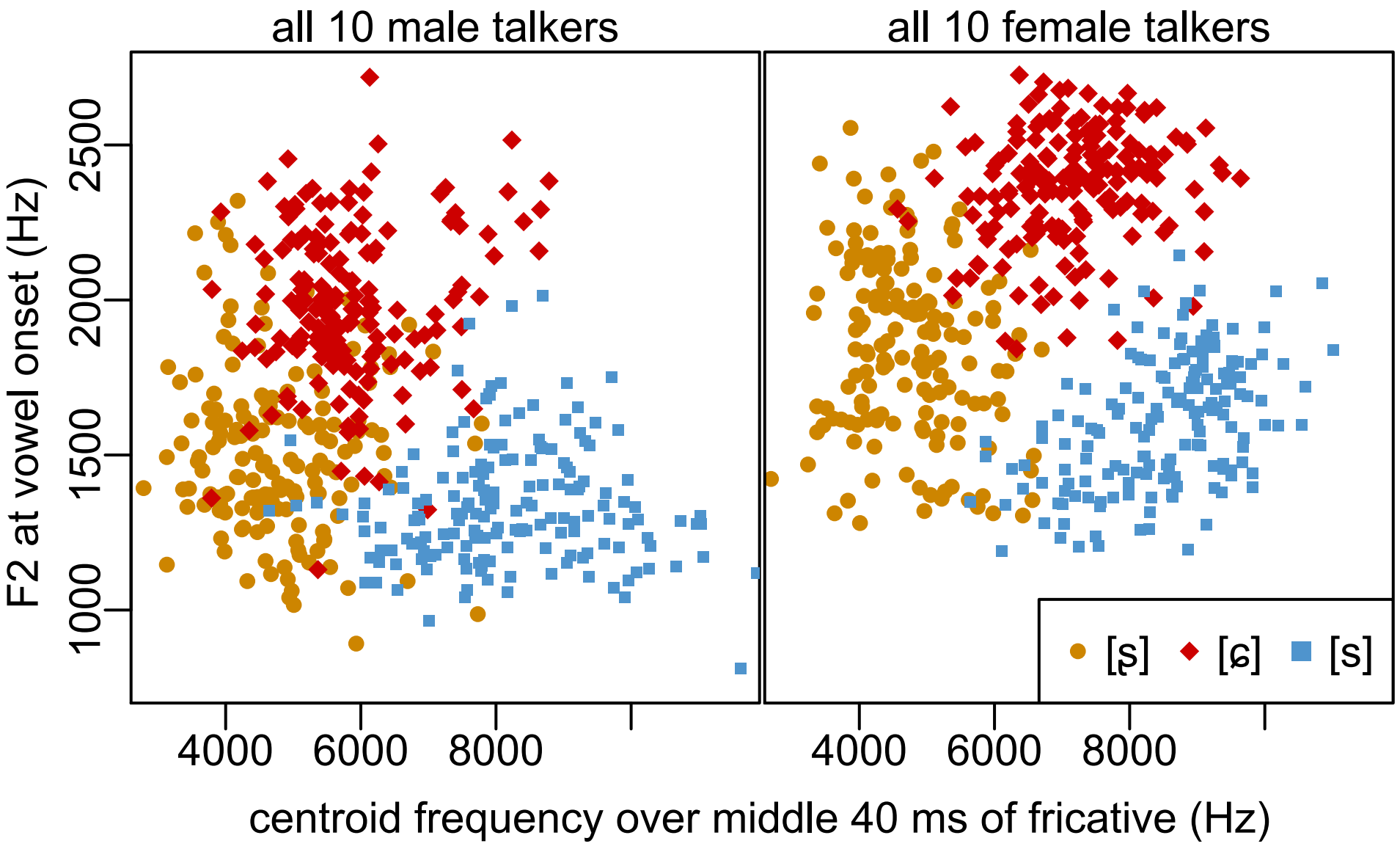


Measures in /s/ (left) vs /ɕ/ (right)

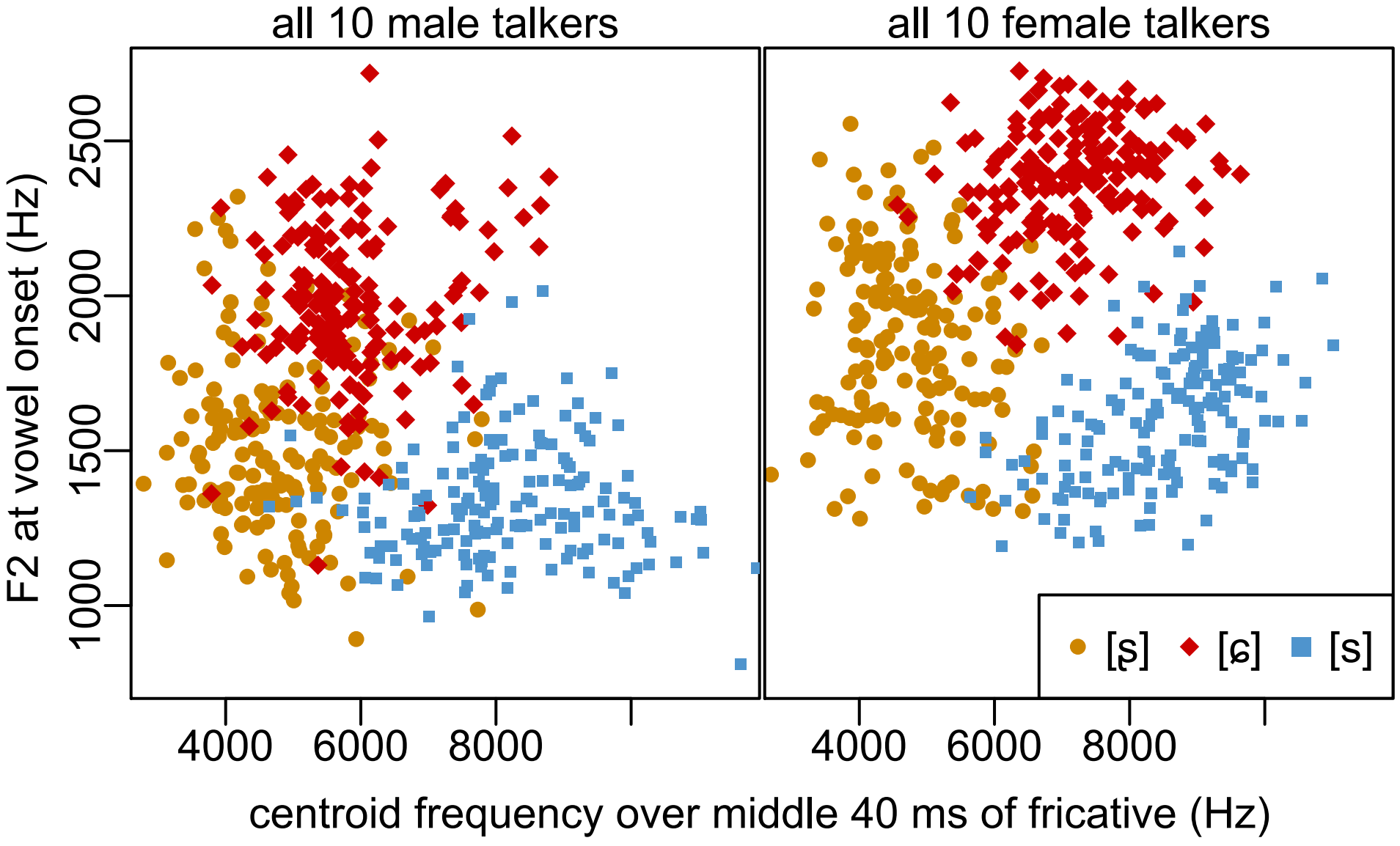


dental /s/ alveolopalatal /ɕ/

The Songyuan (PTH) sibilant fricative space



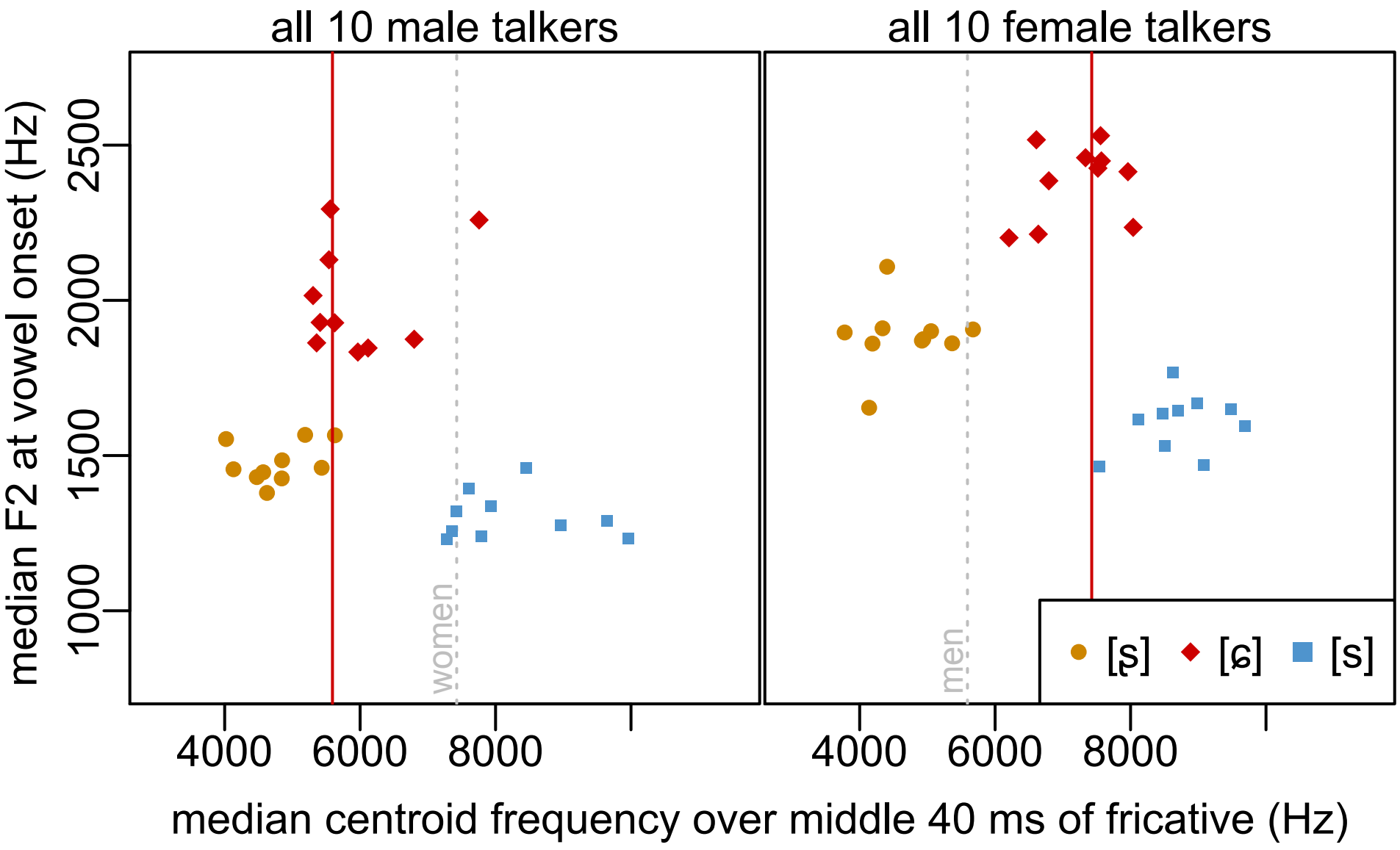
The Songyuan (PTH) sibilant fricative space



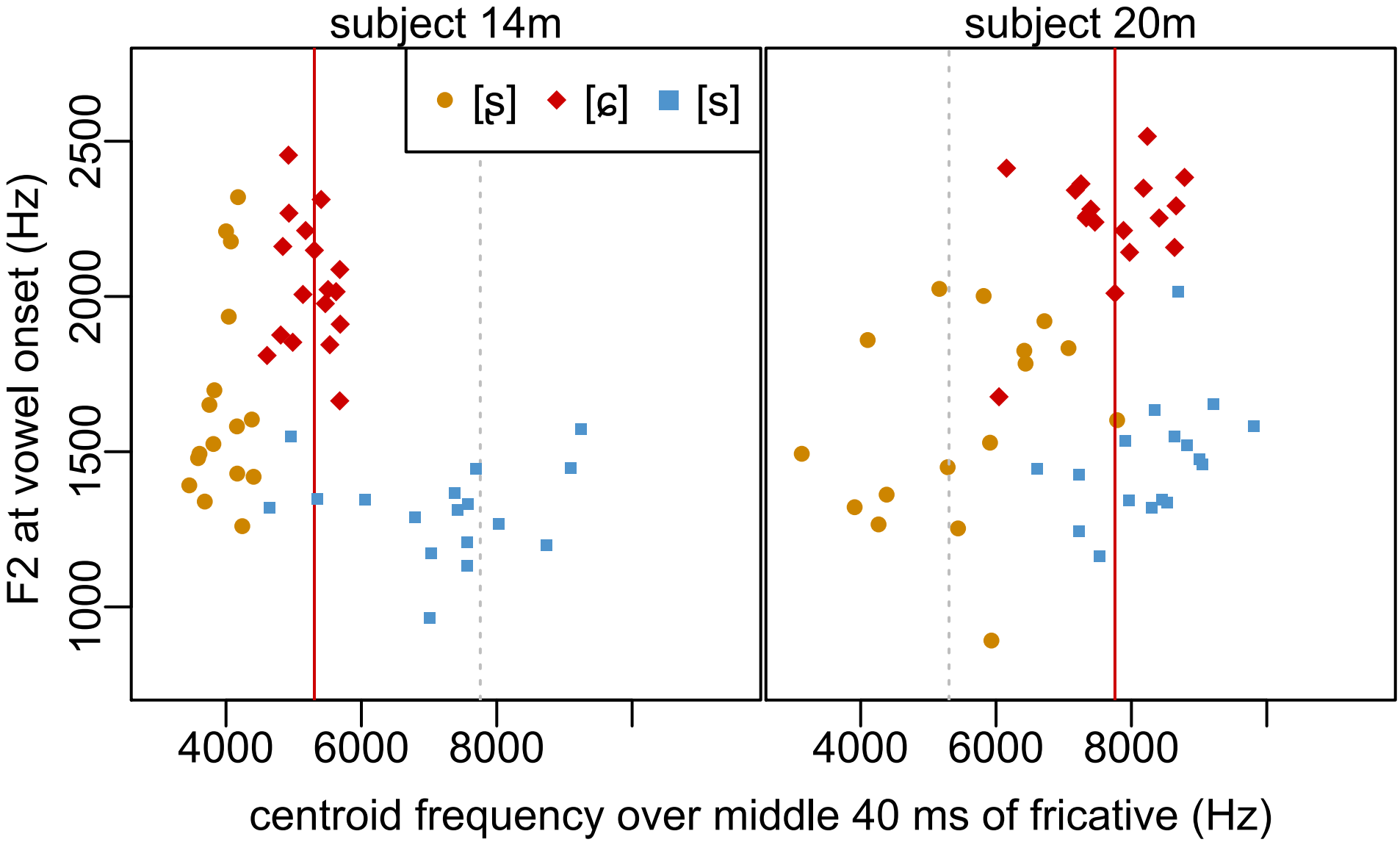
14m : alveolopalatal /ɕ/

03f : "fronted" /ɕ/

Teasing apart between- vs. within-speaker variation



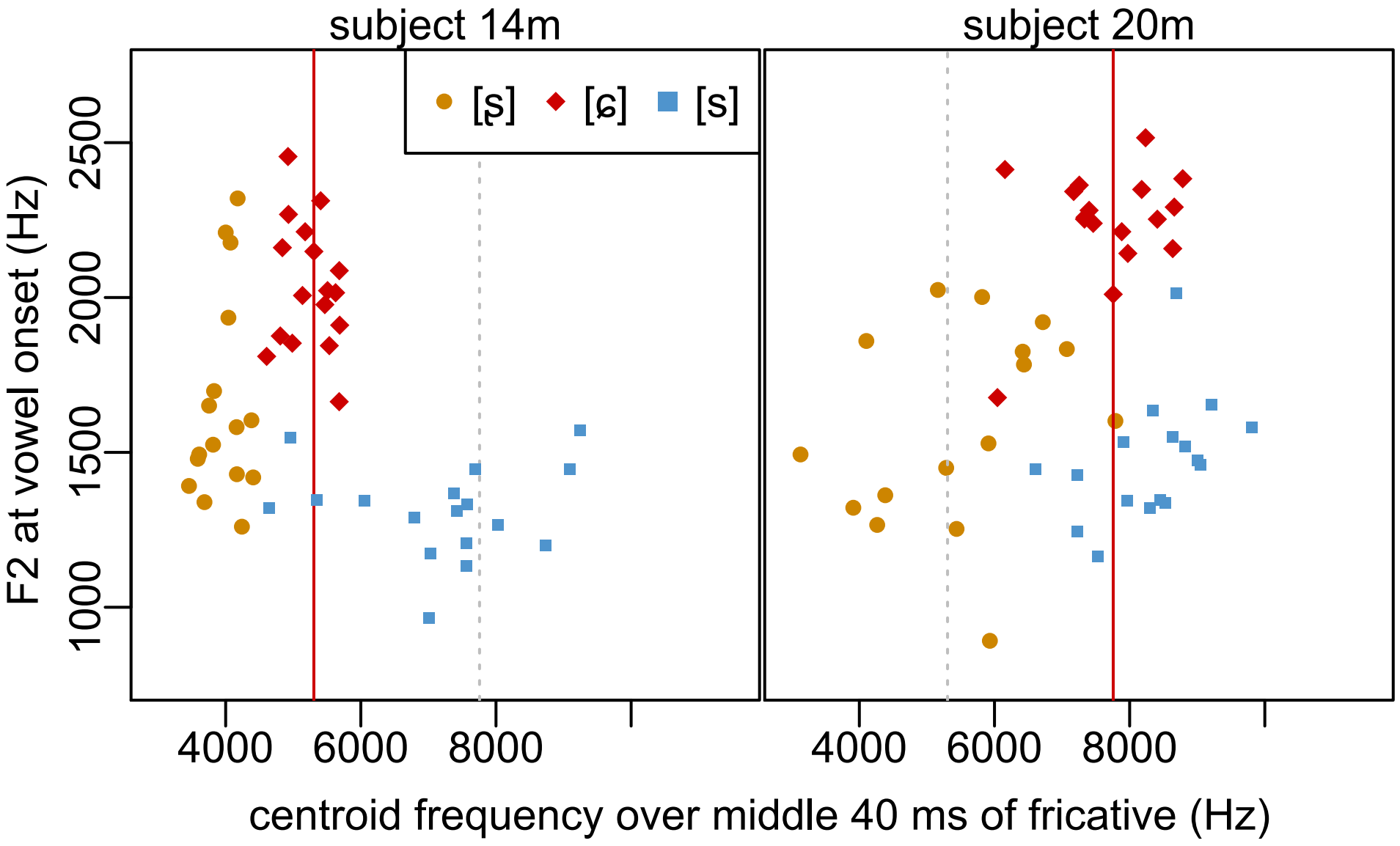
Men with most extreme centroid values in /ɕ/



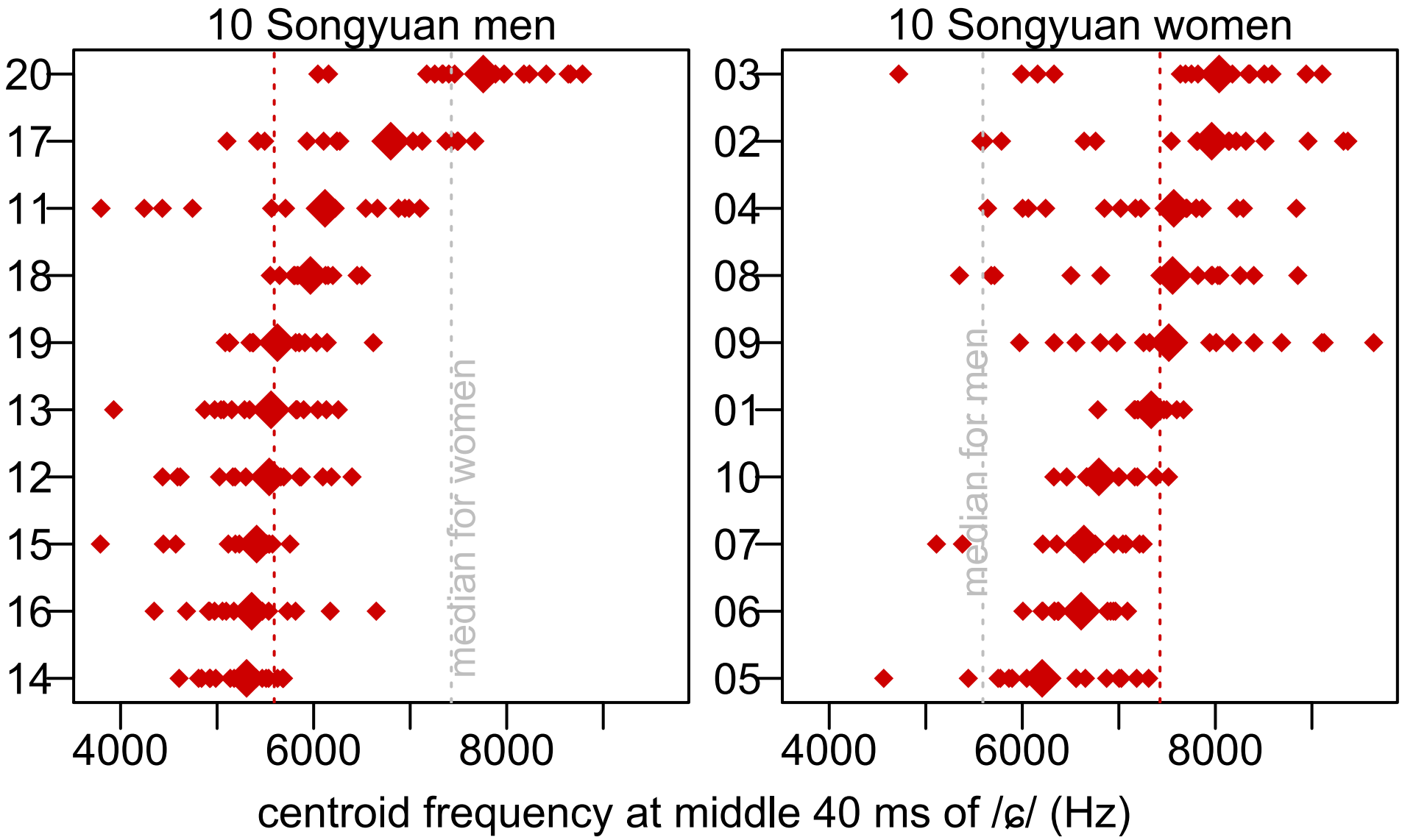
14m : alveolopalatal /ɕ/

20m : "fronted" /ɕ/

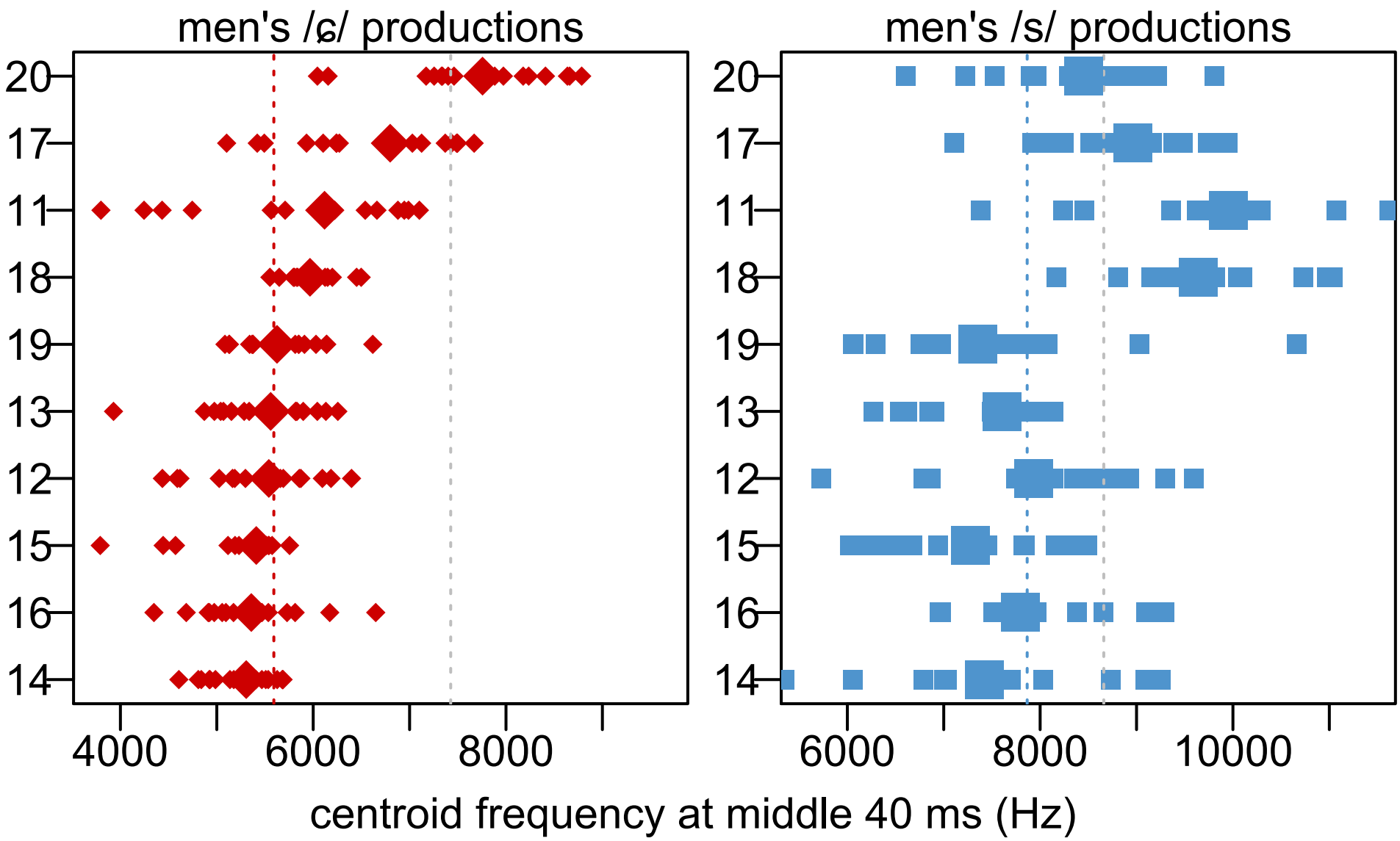
Men with most extreme centroid values in /ɕ/



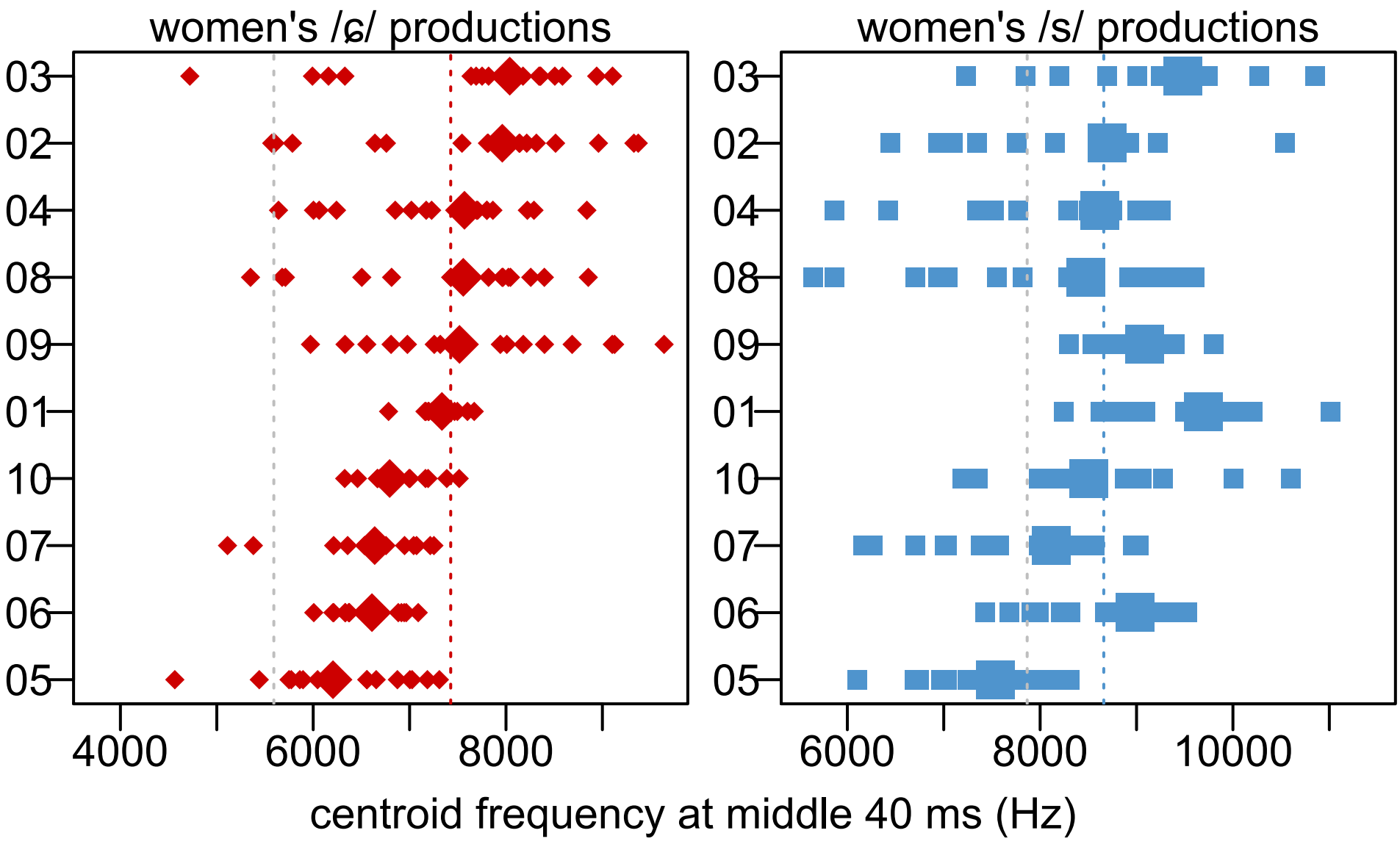
All of the centroid values in /ɕ/



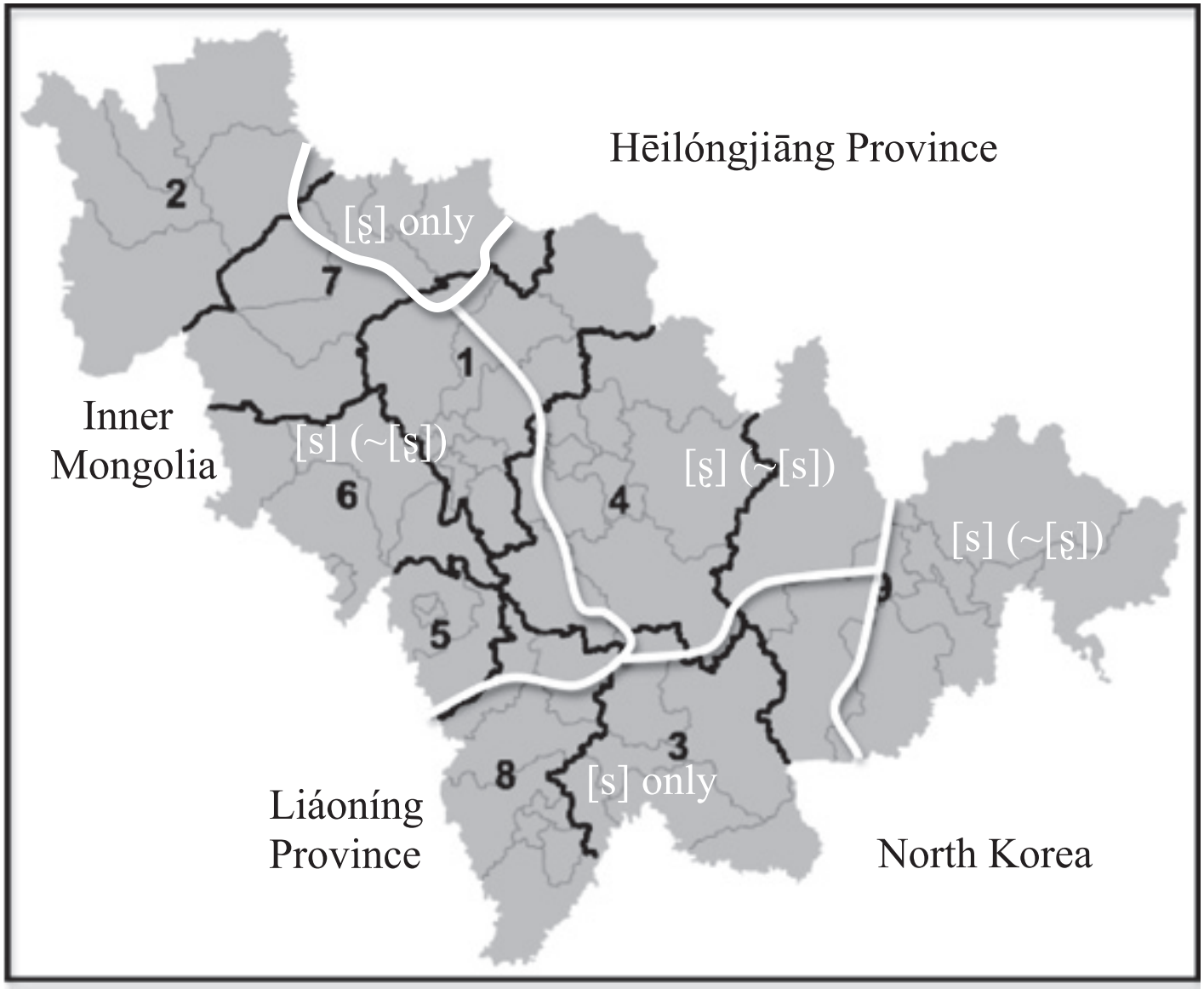
Comparing centroid values in /ɕ/ and /s/ (men)



Comparing centroid values in /ɕ/ and /s/ (women)



Earlier distribution of values for merged /s/-/ʂ/



source: Sūn, Lù, & Lǐ (1986, p. 45).

The Songyuan sibilant space

- Young women (at least university-educated women) have fronted /ɕ/ relative to men.
- What is the relationship to the long-standing"feminine accent" of the Beijing vernacular?
- Larger sociolinguistic context: (1) Influx of ethnic Han began only in early 1900s. (2) In the generation born after 1976, the standard Putonghua contrast between /s/ and /ʂ/ has been solidified and there are no longer the hypercorrections of [s] for /ʂ/ observed among men of the previous generation (who came of age between 1966 and 1976).
- Some young men are also exaggerating the dental quality of the standard /s/, perhaps to enhance the contrast with /ʂ/ (or perhaps to conform to a more traditionally northern and less southern-oriented "yuppie" norm — cf. Zhang, 2005)?

Glottal physiology (Grays [1918 ed.], Titze [1989])

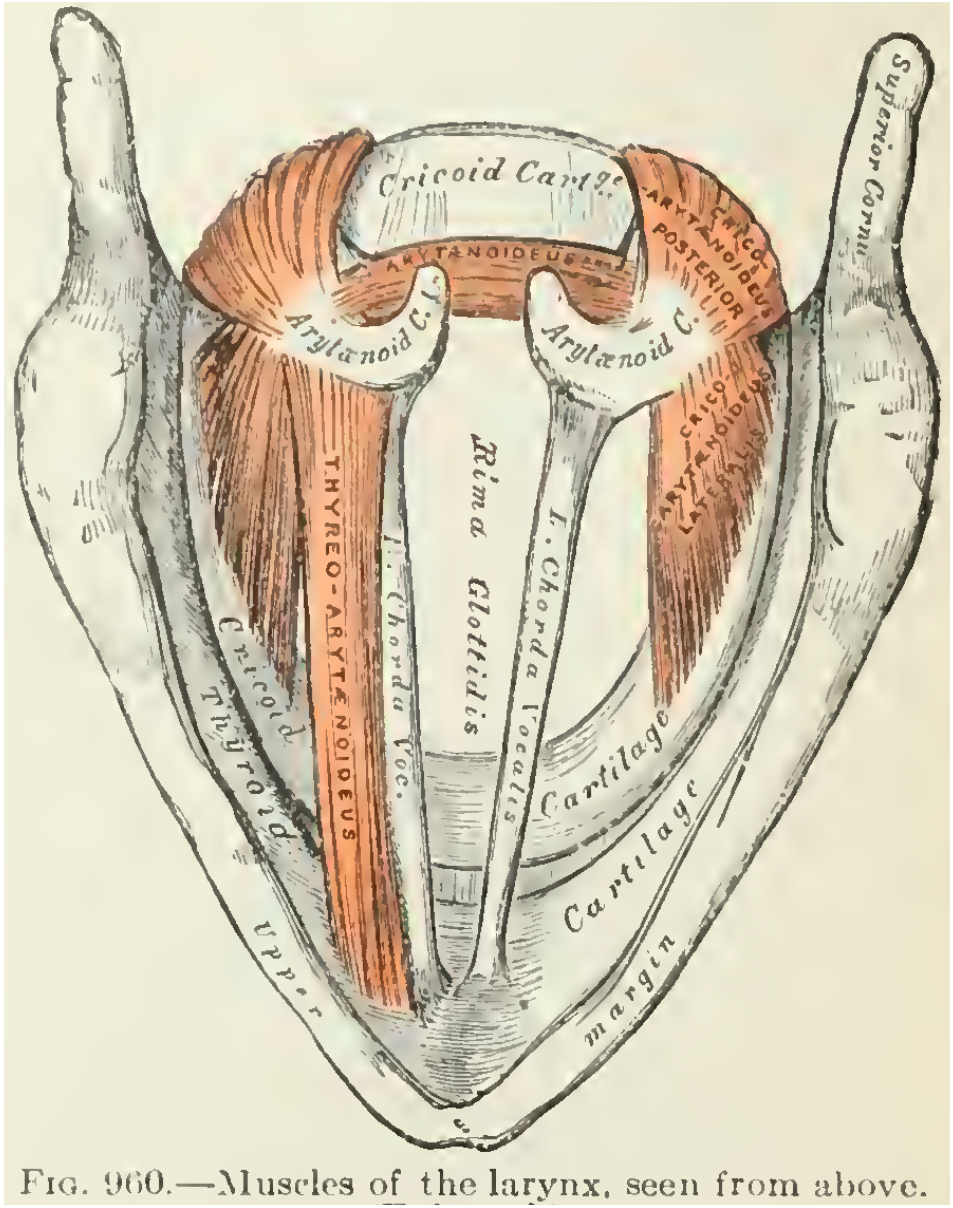
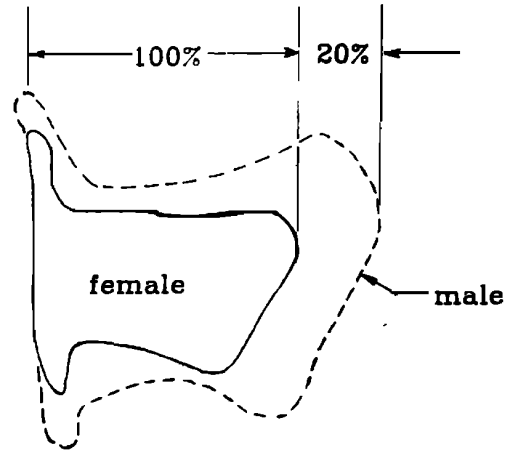
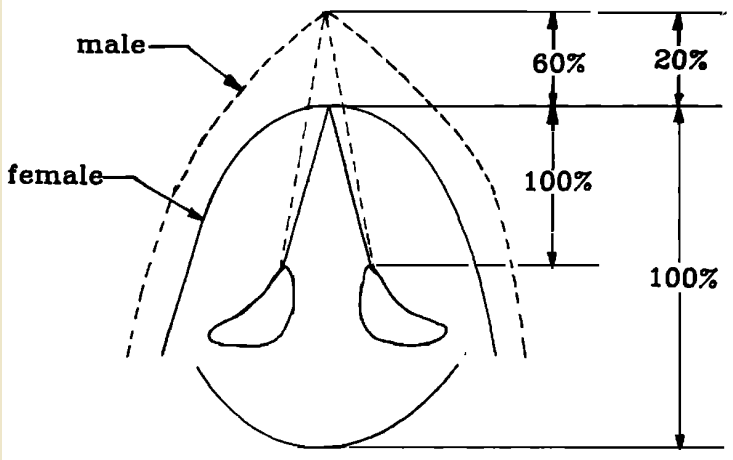


FIG. 960.—Muscles of the larynx, seen from above.

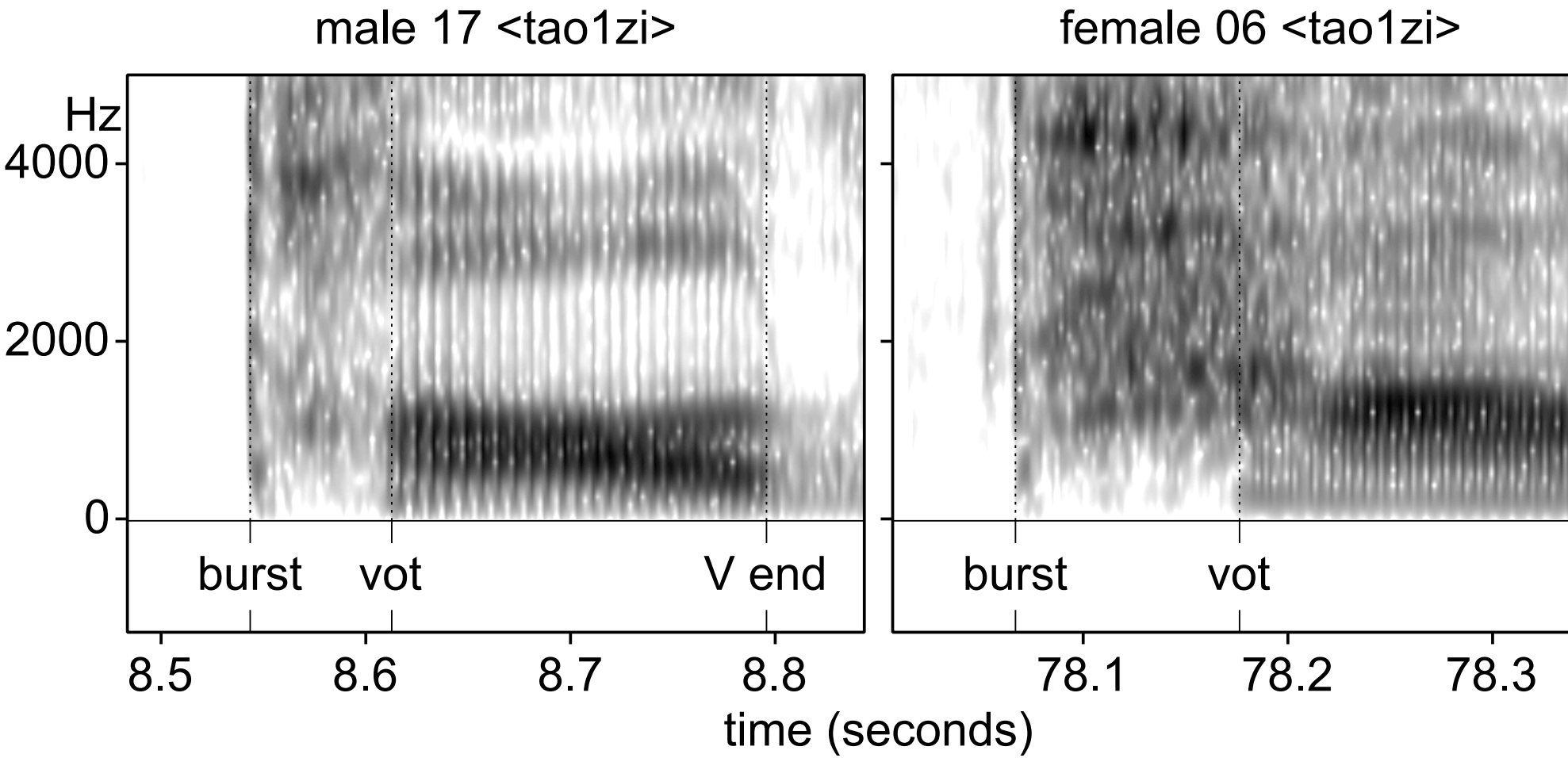


(a) Sagittal View



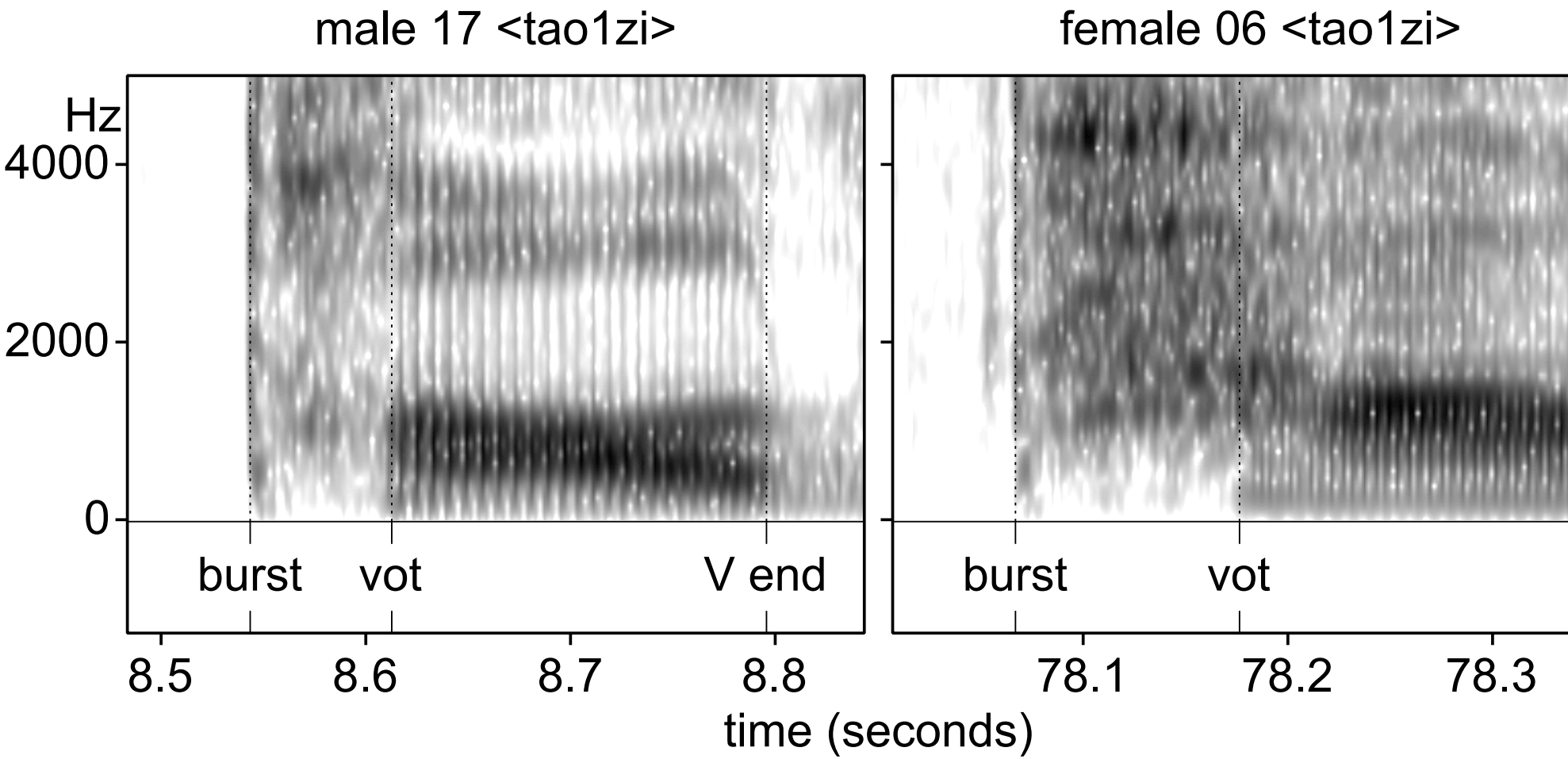
(b) Horizontal Section

Glottal size differences affect voice quality (and VOT)



Spectrograms of initial 400 ms of 2 talkers' productions of the word /t^hao^{55} tsɨ/ (桃子), showing tag points for burst, voice onset, and end of following vowel (V end), with VOT = 69 ms vs 109 ms.

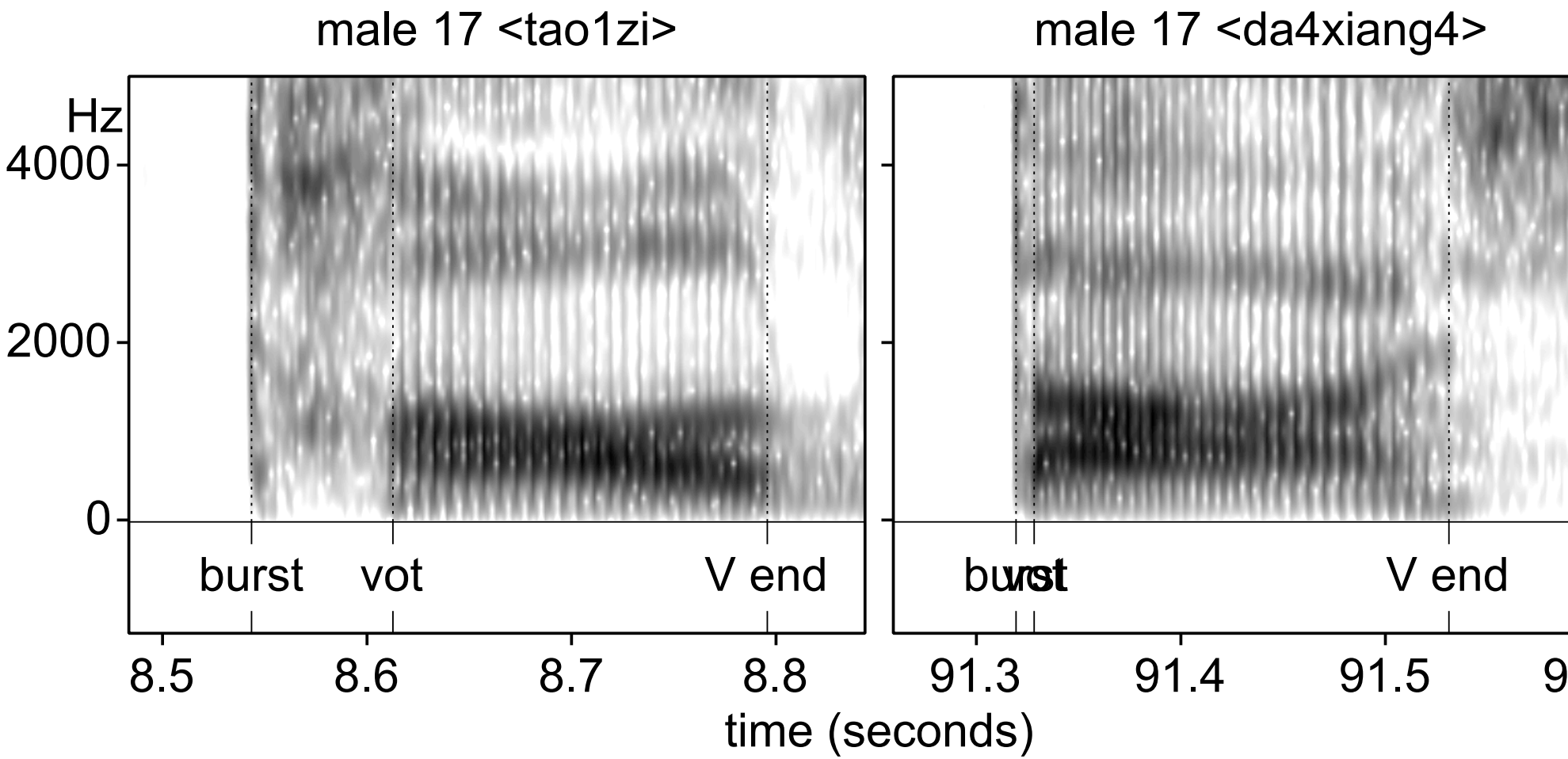
Glottal size differences affect voice quality (and VOT)



17m : pressed voice /t^h ao^{55}/

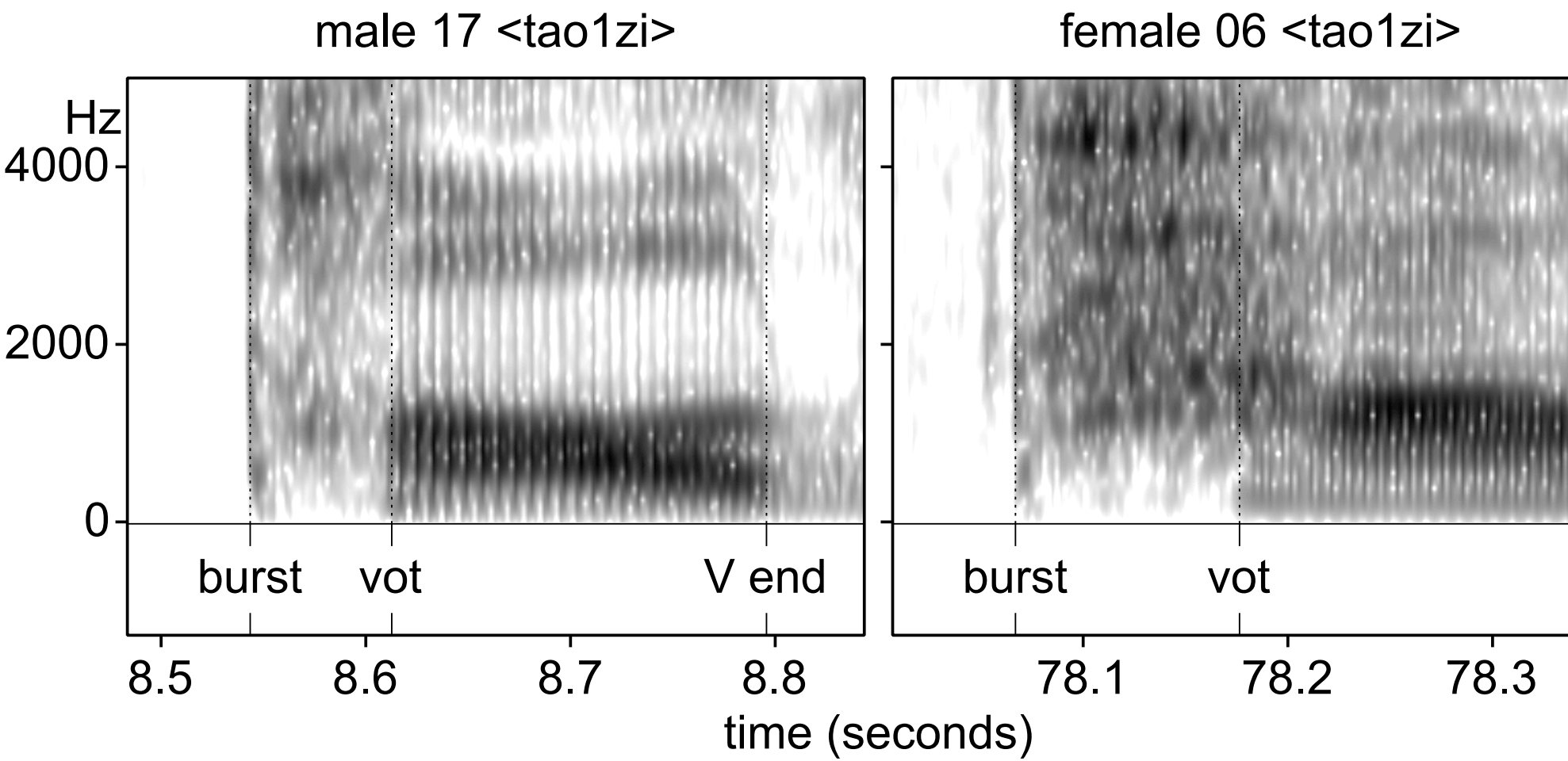
06f : breathy voice /t^h ao^{55}/

Measuring the aspiration contrast



Spectrograms of one talker's productions of the words /$t^{h}ao^{55}$ $tsɨ$/ (桃子), with 69 ms VOT, vs /ta^{51} $ɕaŋ^{51}$/ (大象), with 9 ms VOT.

Glottal size differences affect voice quality (and VOT)



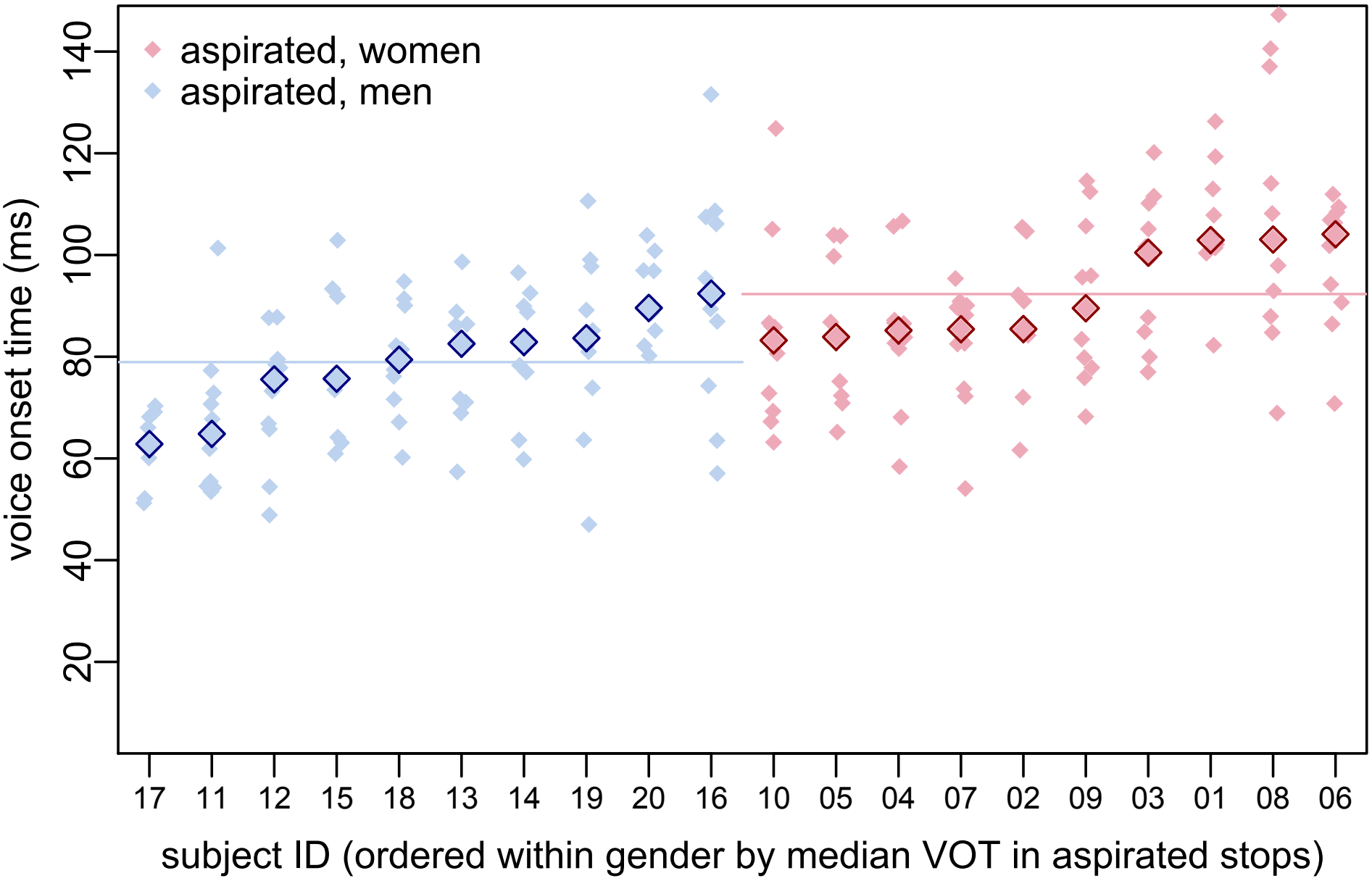
17m : pressed voice /t^h ao^{55}/

cf. 17m : pressed voice /ta^{51}/

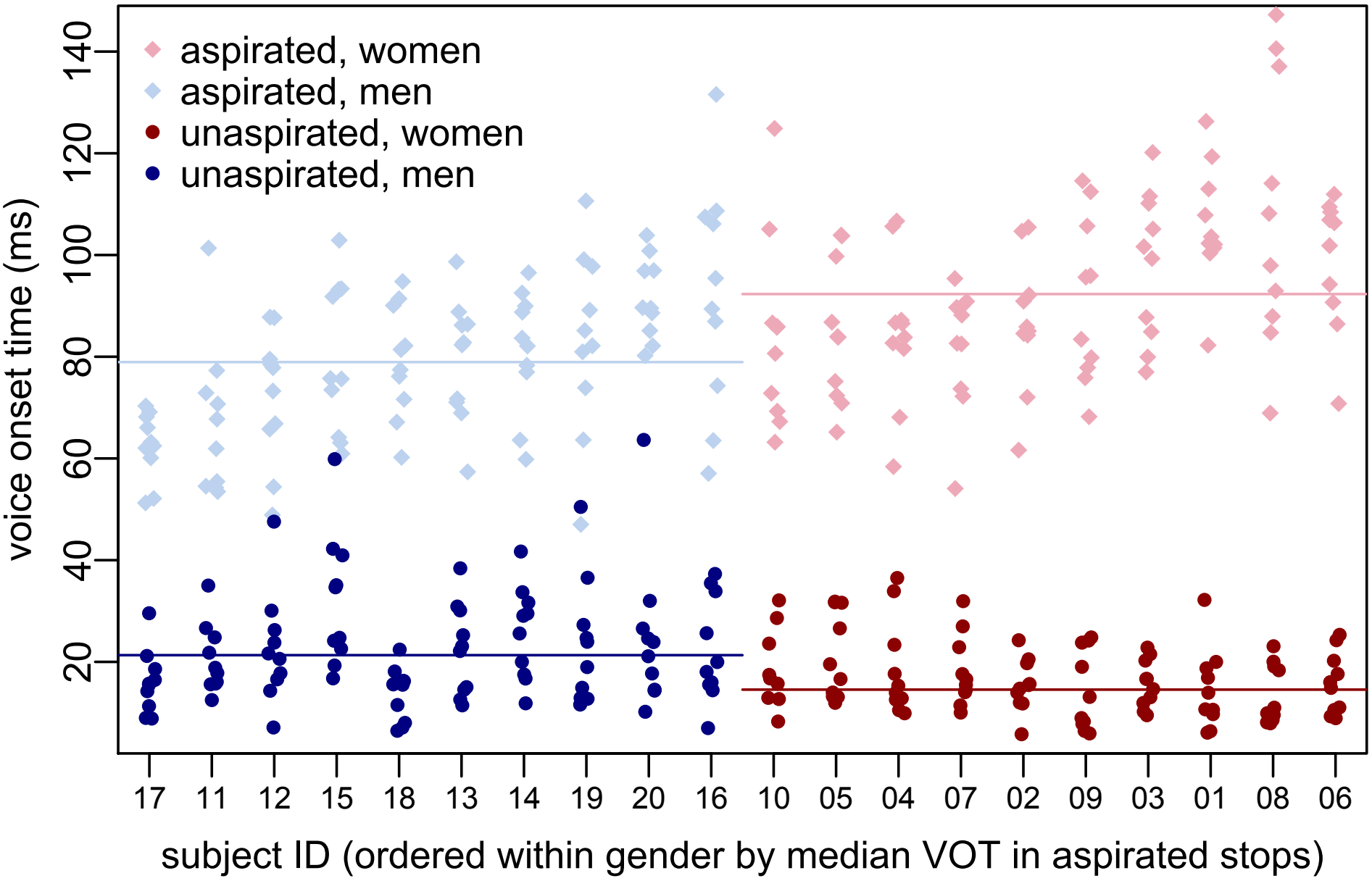
06f : breathy voice /t^h ao^{55}/

06f : pressed voice /ta^{51}/

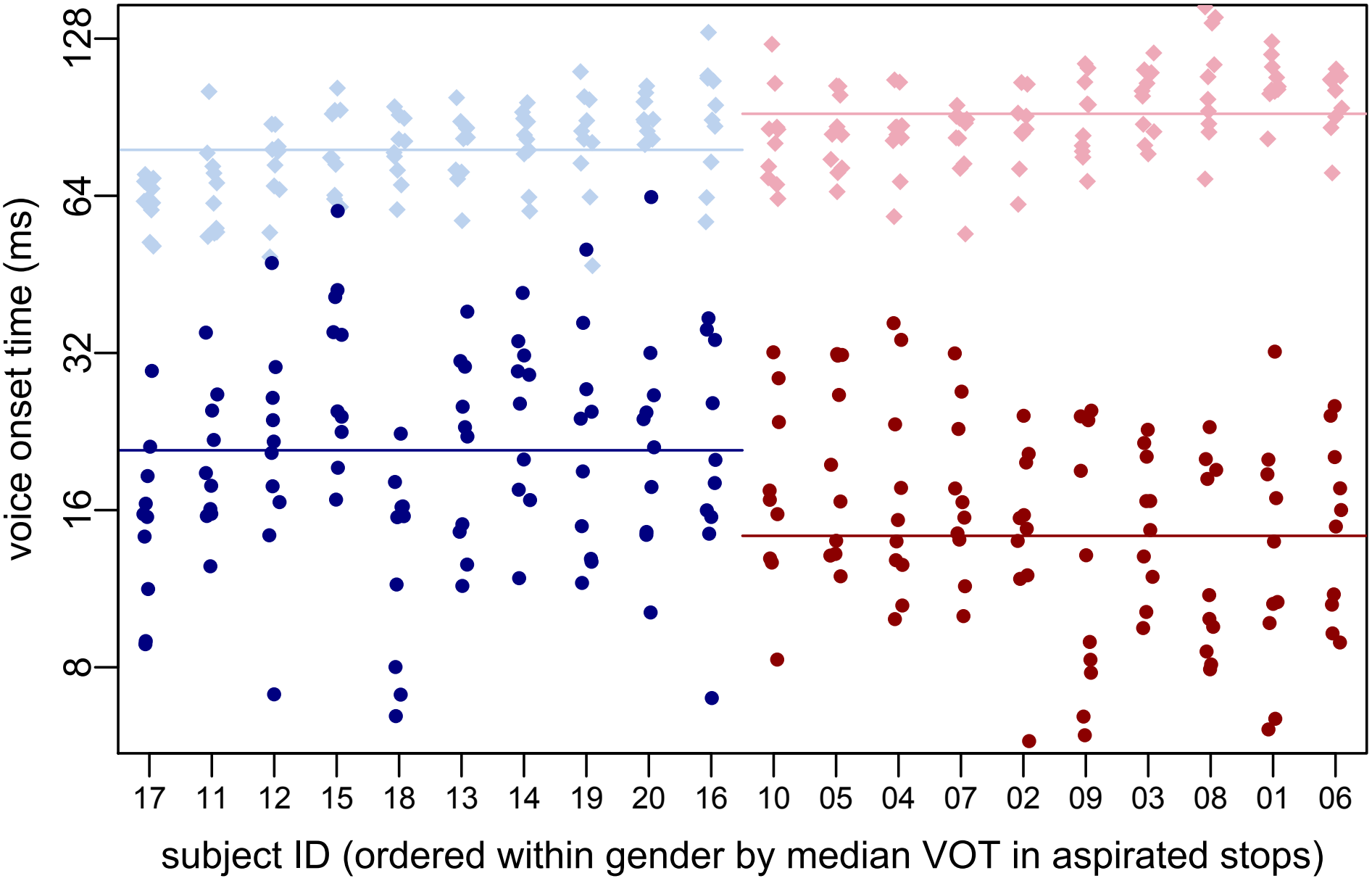
Voice onset time (VOT) in Songyuan (PTH) talkers



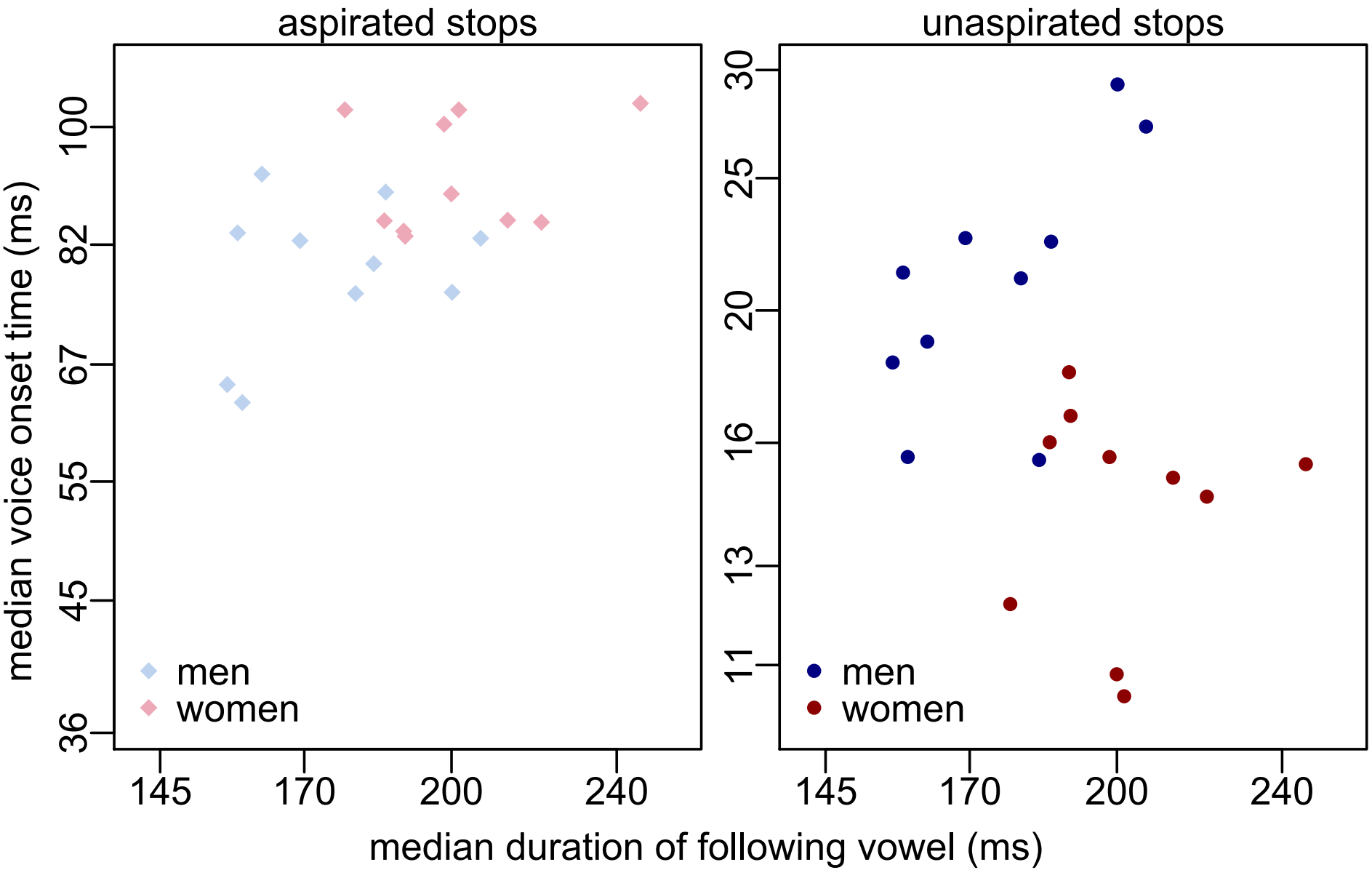
Voice onset time (VOT) in Songyuan (PTH) talkers



Voice onset time (VOT) in Songyuan (PTH) talkers



VOT in relationship to a speaking rate measure



The Songyuan aspiration contrast

- Women have longer VOT values in aspirated stops relative to men.
- They also have slower average speaking rates, as gauged by the following vowel durations.
- However, the correlation between speaking rate and VOT in aspirated stops cannot be a direct, causal relationship, because ...
- Women have **shorter** VOT values in unaspirated stops, suggesting that ...
- Women enhance the contrast between aspirated and unaspirated stops relative to men as part of a larger ensemble of "clear speech" effects that include a slower speech rate.

Larger versus smaller fricative inventories

The two main Chinese varieties in contact in Taiwan have different tone, vowel, and consonant inventories.

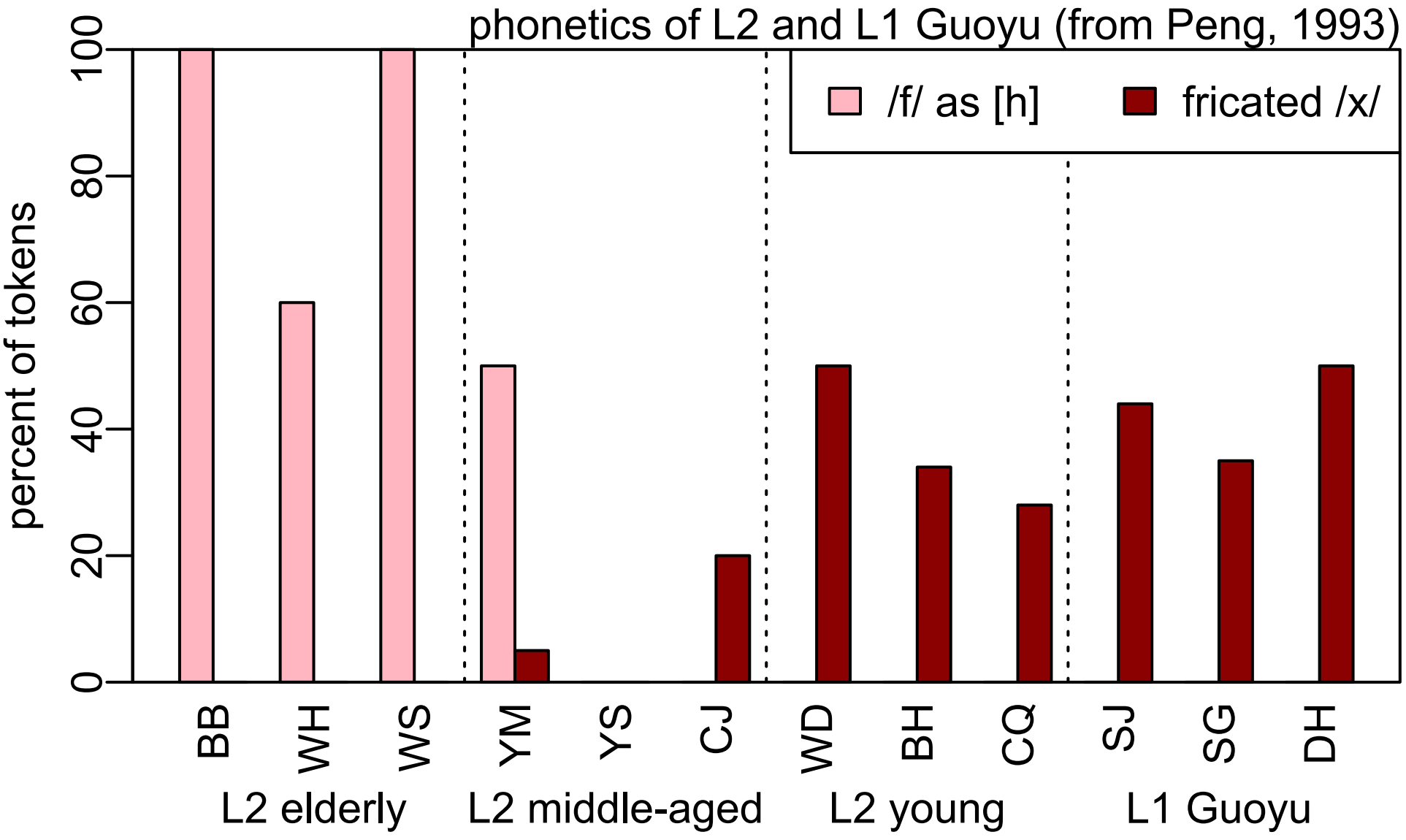
The Guoyu fricative inventory

place	IPA	example word	phonotactics
labiodental	/f/	/fan^{51}/ (飯)	
dental	/s/	/san^{55} kə/ (三個)	not before /i, y/
alveolopalatal	/ɕ/	/ɕa^{55} tsɨ/ (蝦子)	not before /u/
retroflex	/ʂ/	/ʂa^{55} fa^{56}/ (沙發)	not before /i, y/
velar	/x/	/xai^{35} tsɨ/ (孩子)	not before /i, y/

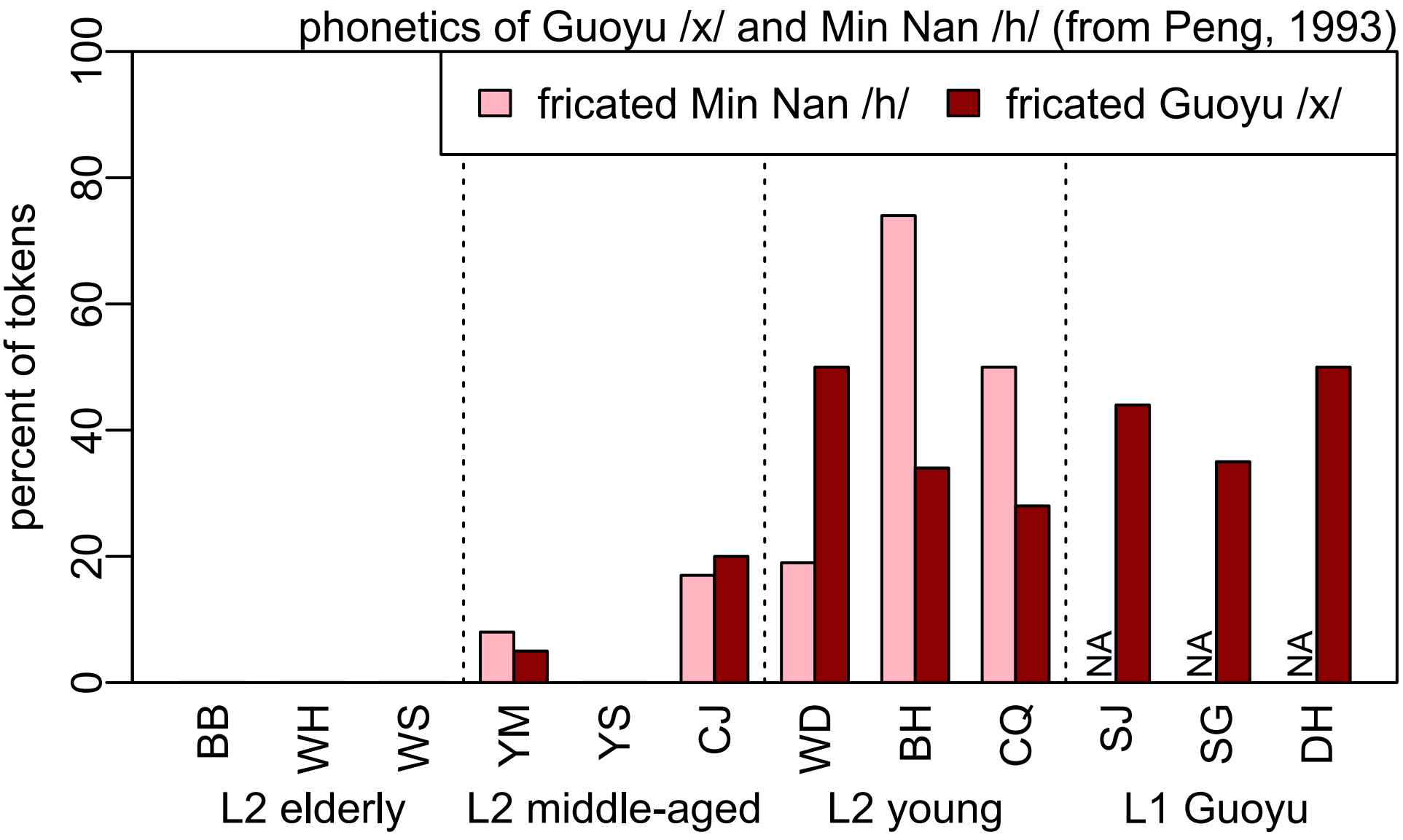
The Taiwanese Min Nan fricative inventory

place	IPA	example word	allophony
alveolar	/s/	/se^{55} sã^{55}/ (洗衣)	
		/si^{33} tsiəŋ^{55}/ (時鐘)	"palatalizes" to [ɕ] before /i, j/
glottal	/h/	/hei^{13} a^{53}/ (蝦子)	

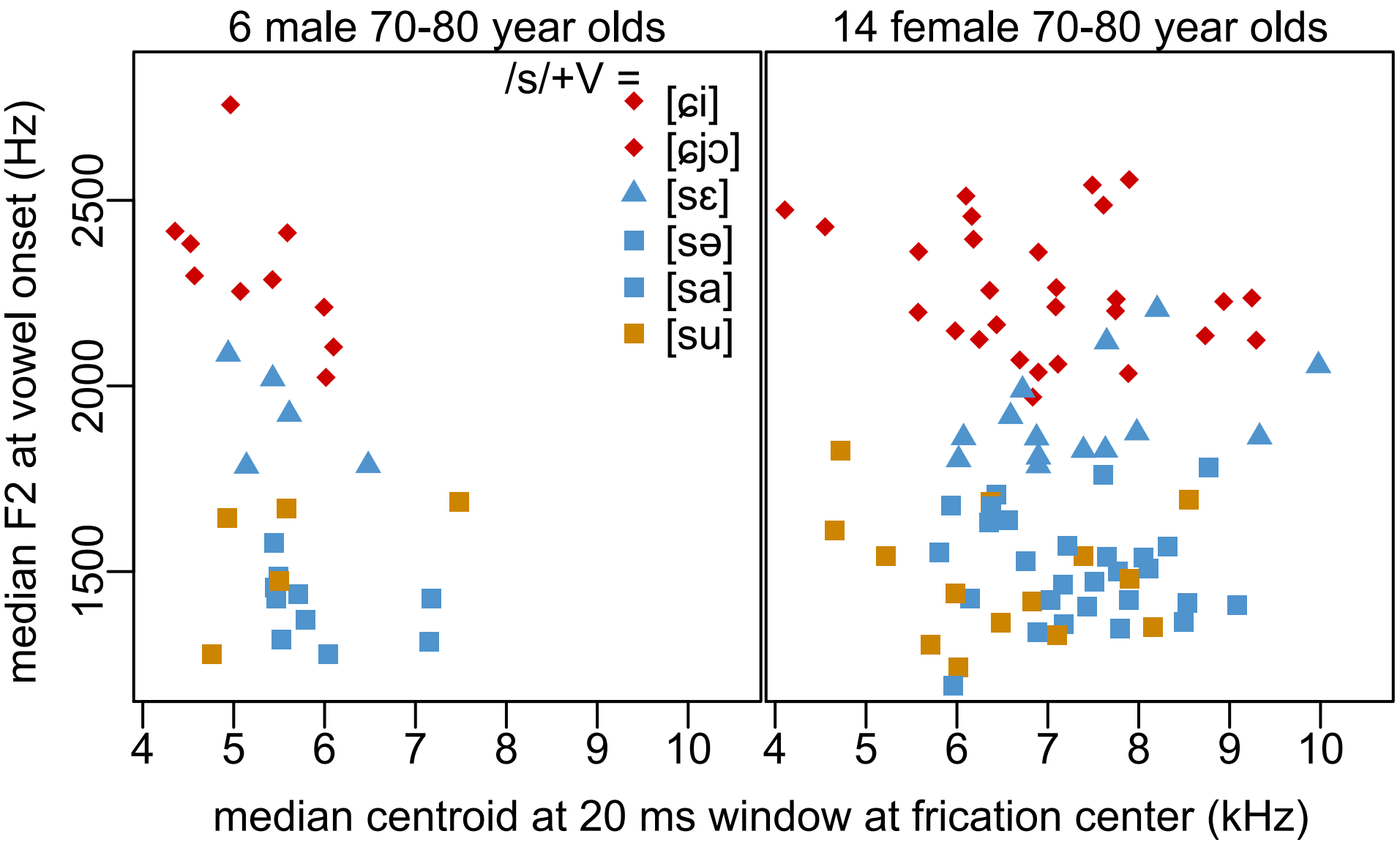
Previous work on the phonetics of Guoyu fricatives



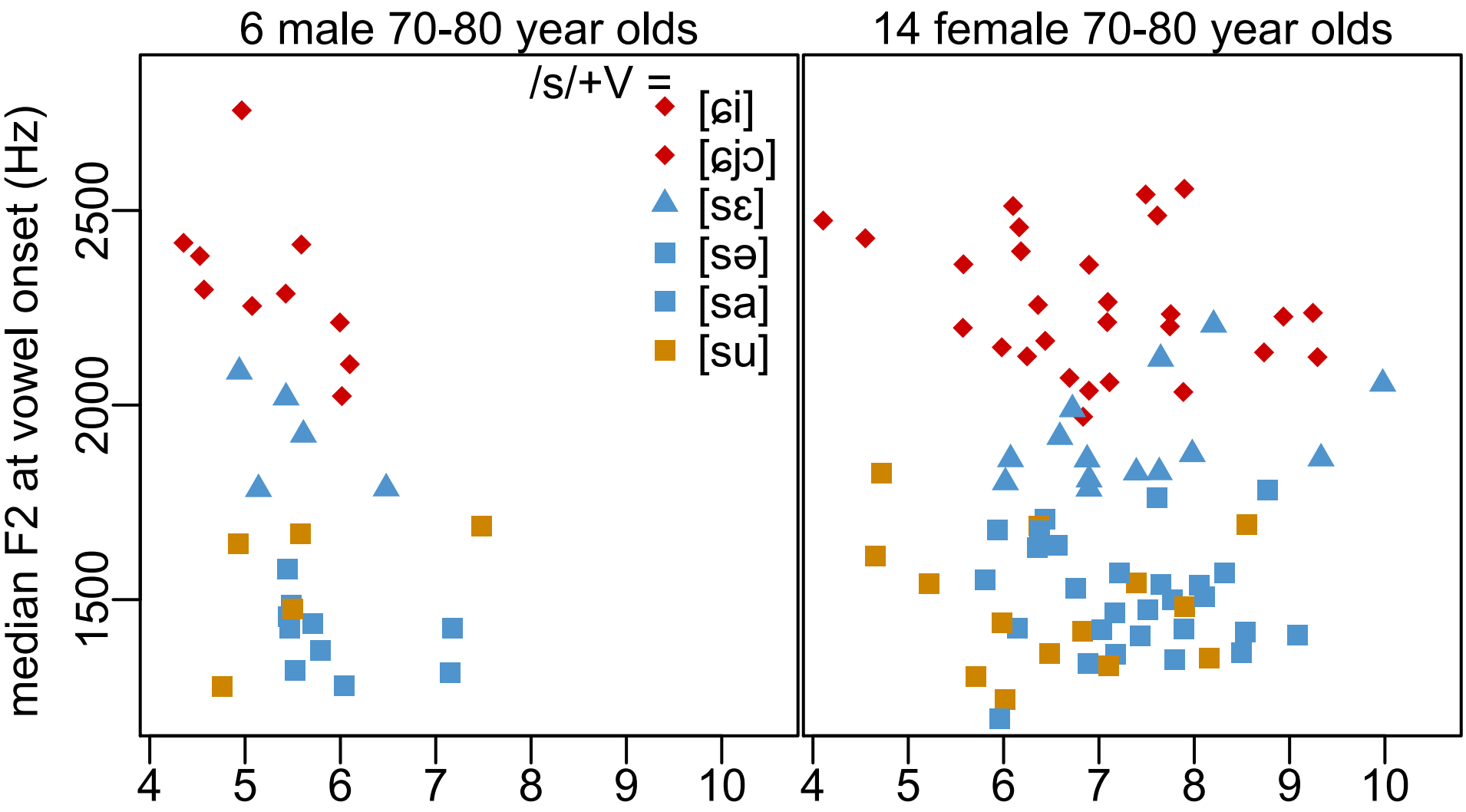
Effect of language contact on Min Nan /h/



Stage 1: F2 onset differs in [ɕ] vs [s] allophones of MN /s/

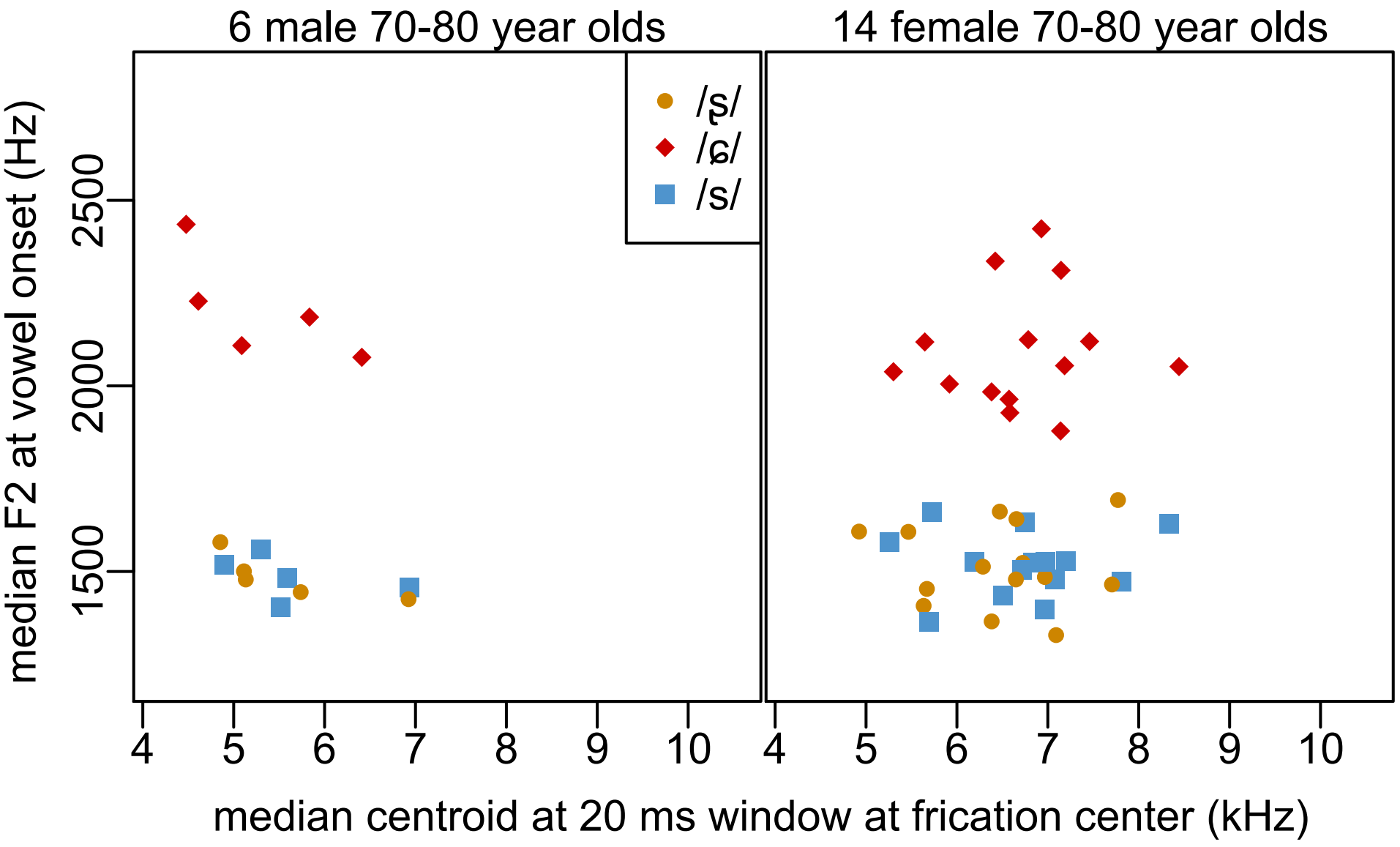


Stage 1: F2 onset differs in [ɕ] vs [s] allophones of MN /s/

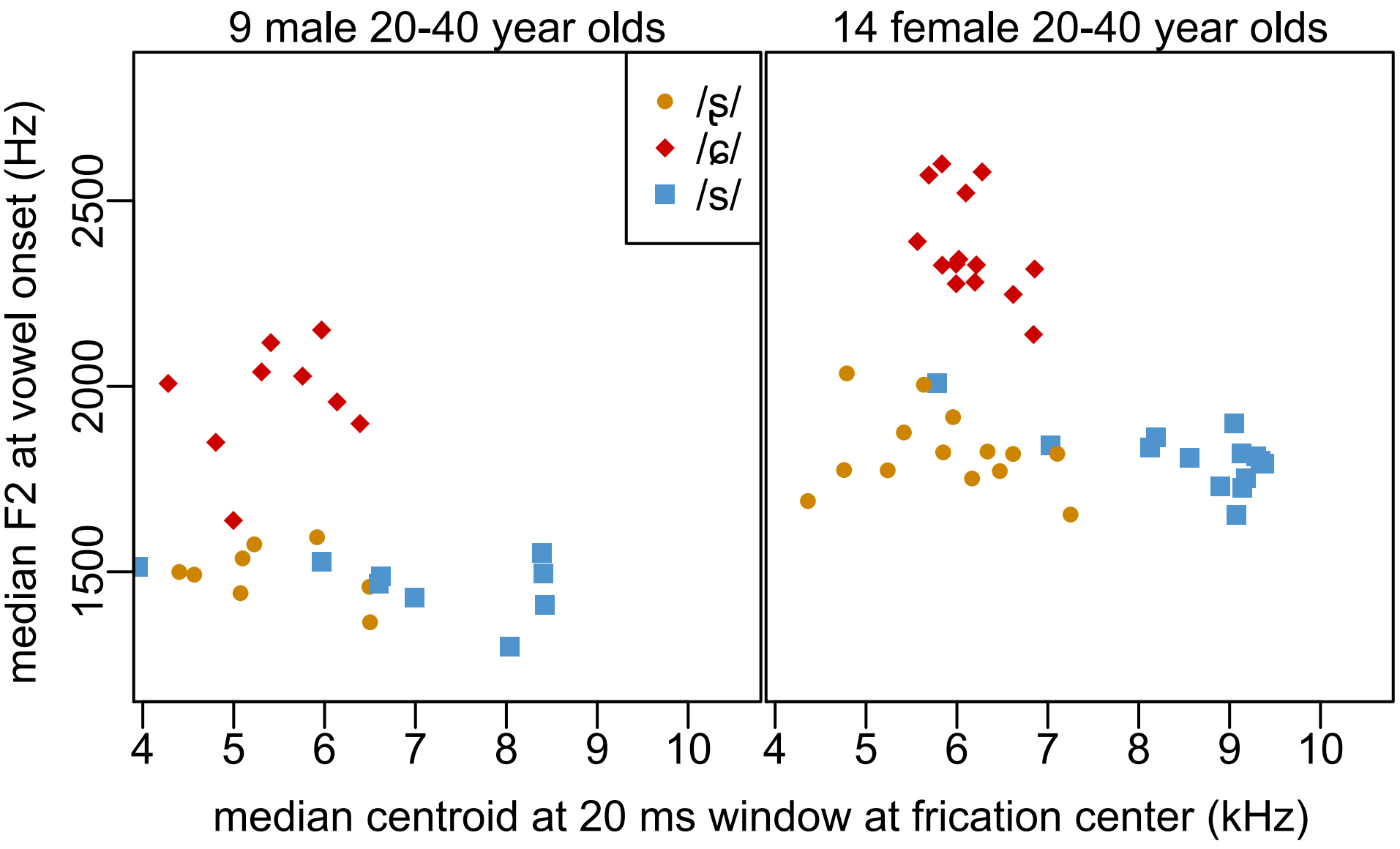


allphones of /s/ : [s] in /se^{55} sã^{55}/ vs. [ɕ] in /si^{33} tsiəŋ^{55}/

Stage 1: GY /ɕ/ vs. /s/ differentiated only at vowel onset

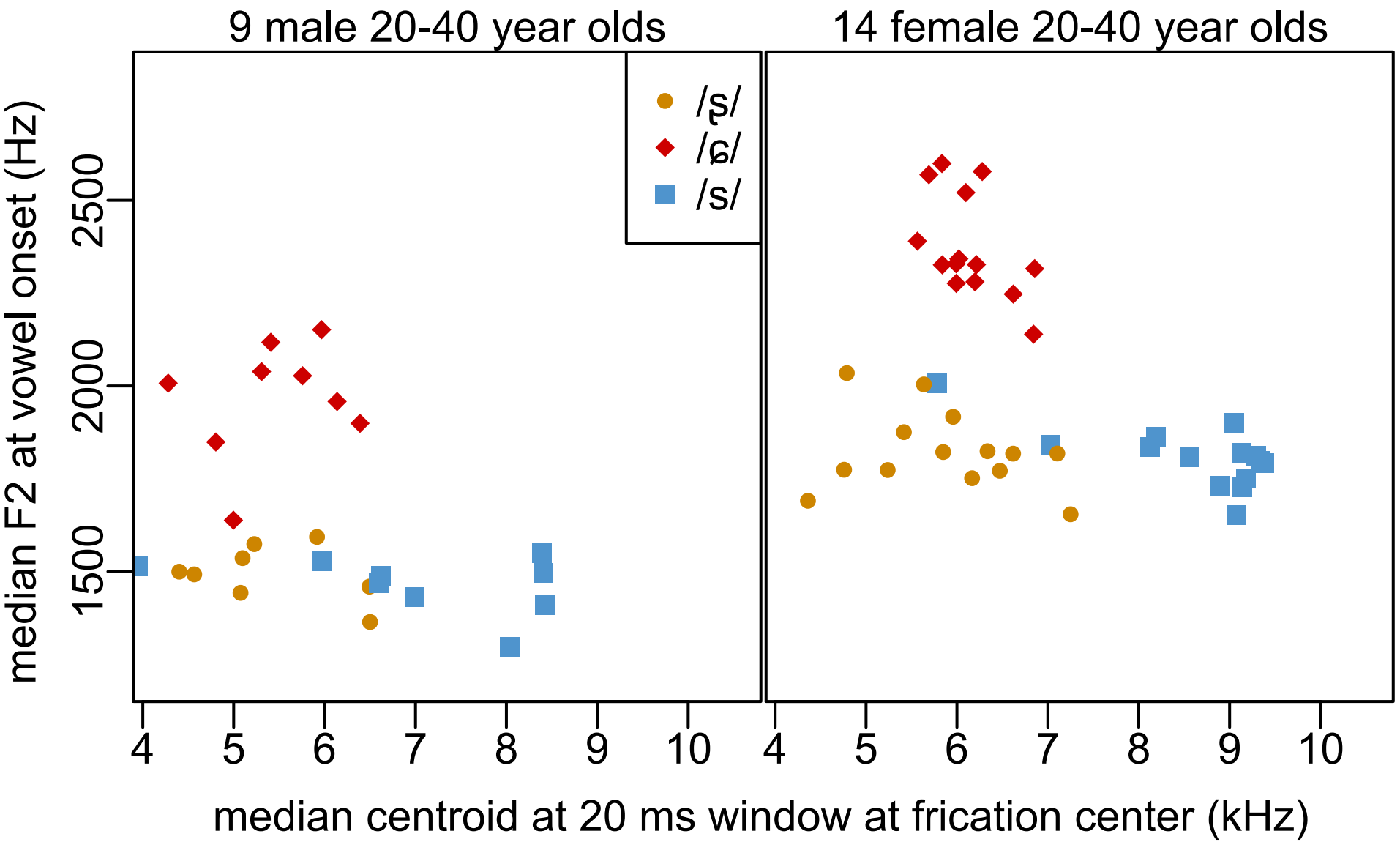


Stage 3: GY /ɕ/ vs. /s/ differentiated at fricative center

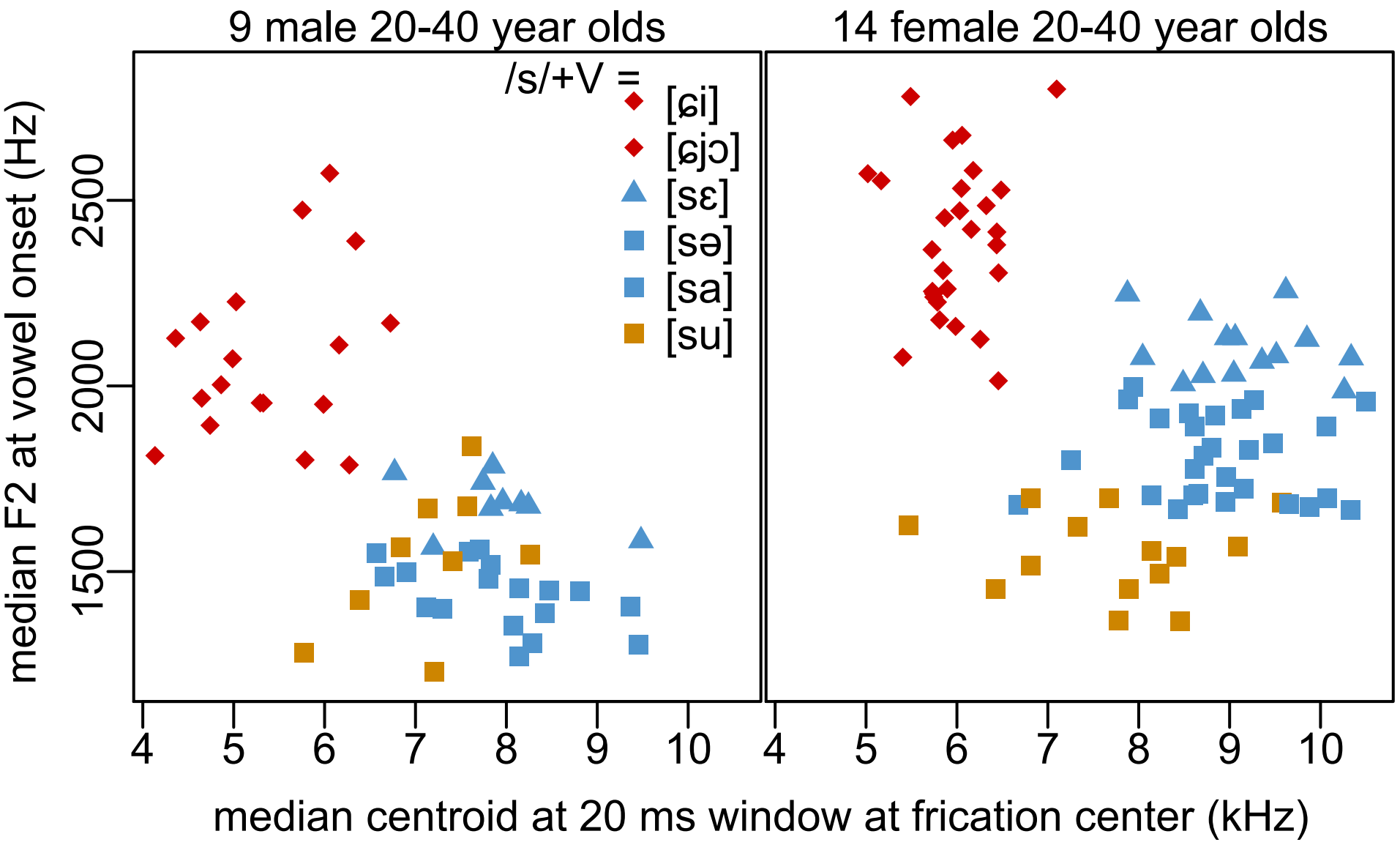


assimilation of Guoyu /s/ to Taiwanese /s/ in /ɕe^{51} ɕe/

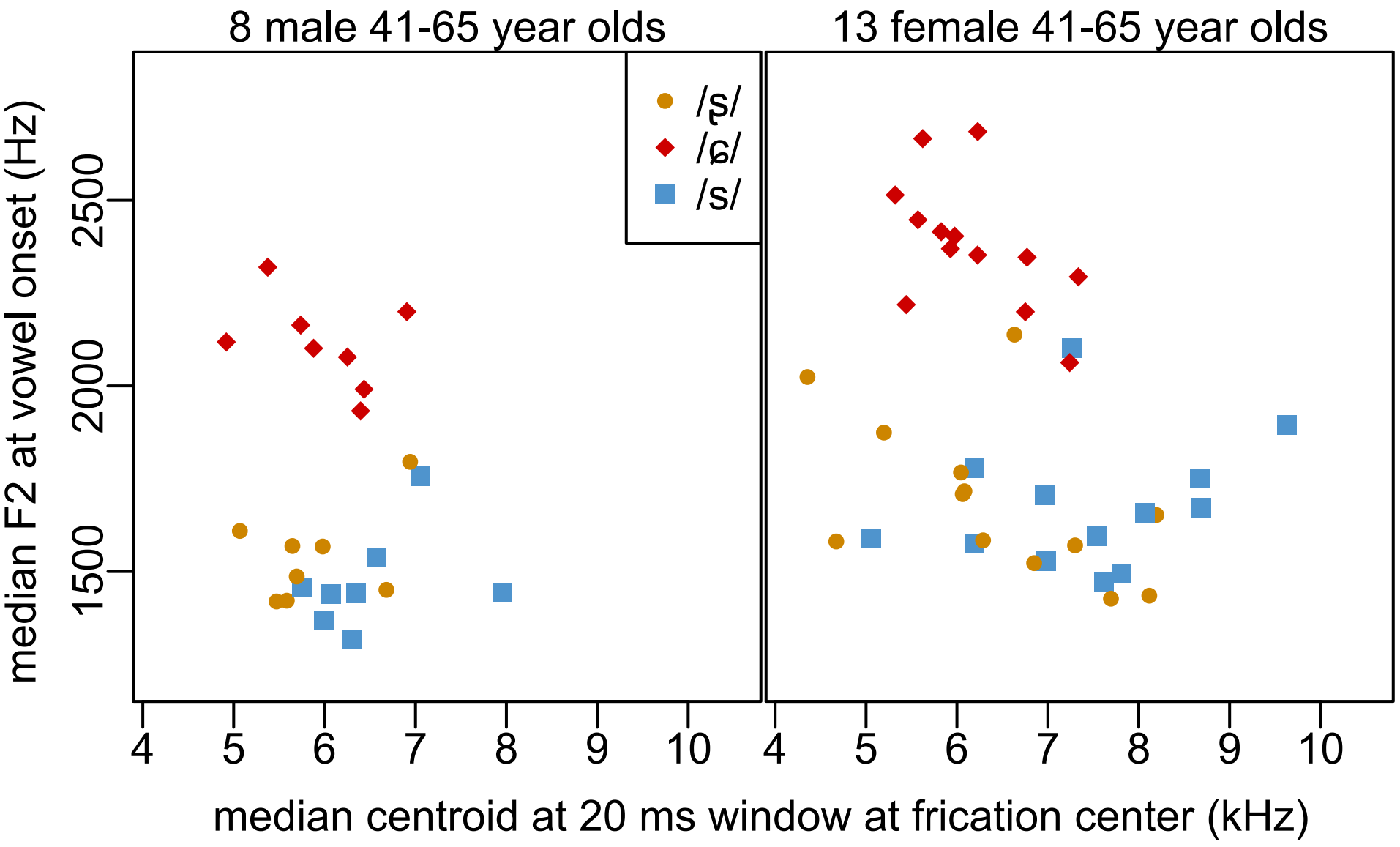
Stage 3: GY /ɕ/ vs. /s/ differentiated at fricative center



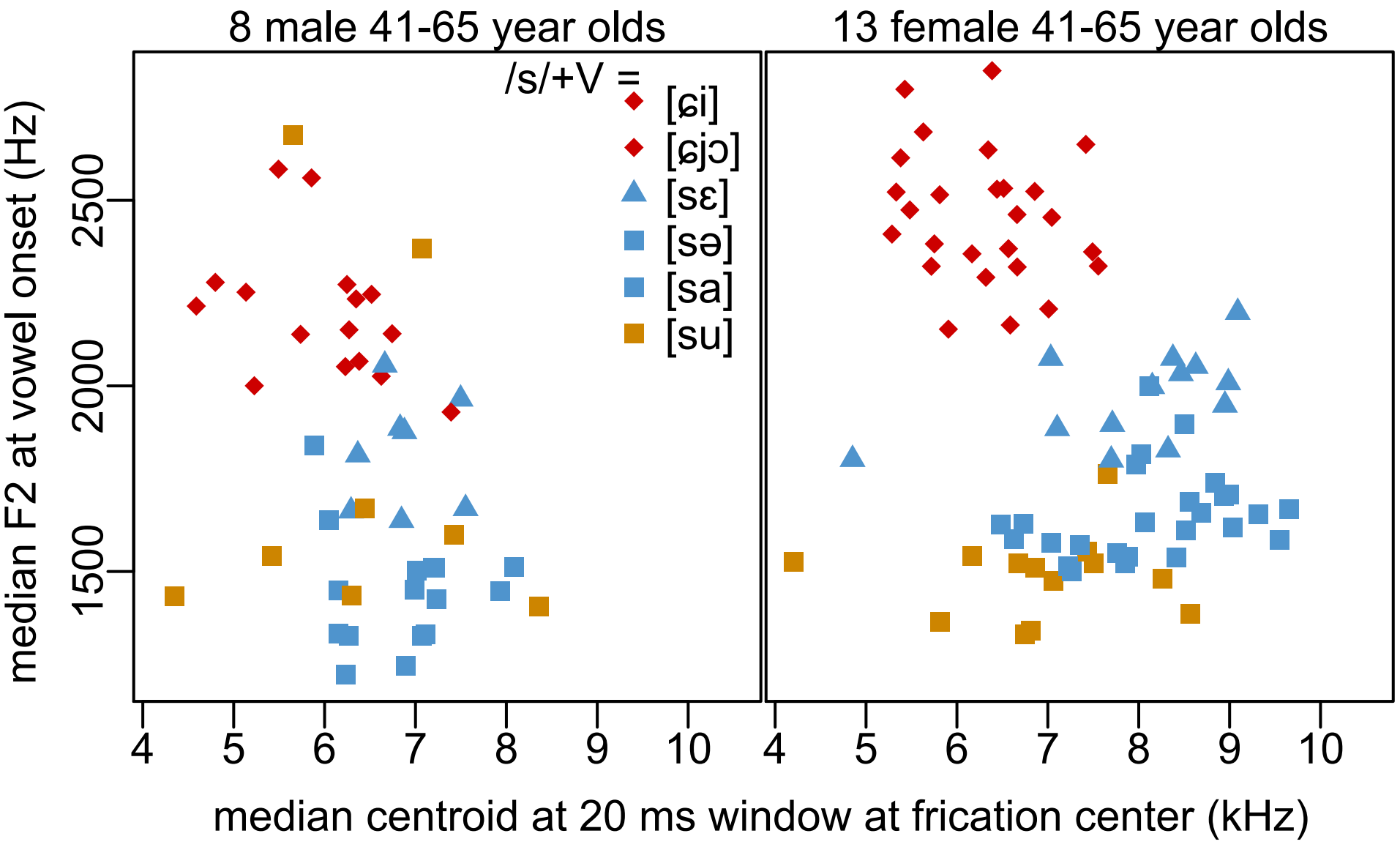
Stage 3: [ɕ] vs [s] allophones look like Guoyu /ɕ/ vs /s/



Stage 2: GY production patterns differentiated by gender



Stage 2: MN allophones also differentiated by gender



The Kaohsiung sibilant space(s)

- As in the Peng (1993) study of non-sibilant fricatives in the northern dialects, the Shih (2012) study of Kaohsiung sibilant fricatives shows 3 stages of acquisition of Guoyu phonetics.
- Stage 1: The oldest speakers assimilate the GY contrast between dental /s/ vs alveolopalatal /ɕ/ to the L1 allophonic variation between an alveolar [s] and a "palatalized" [ɕ].
- Stage 3: Most of the youngest speakers have acquired the phonetics of the GY /s/ vs /ɕ/ contrast, which has influenced their L1 phonetics, to differentiate a more dental [s] allophone from a robustly alveolopalatal [ɕ] allophone for MN /s/.
- Stage 2: In the middle generation, men tend to produce the older assimilation patterns of their parents and women tend to produce the younger allophonic patterns of their children.

The Songyuan Putonghua sibilant space

Many young women have a fronted ([sʲ]-like) /ɕ/, much like the long-standing "feminine accent" variant of Beijing.

The Songyuan Putonghua aspiration contrast

These young women have longer VOT values in /t^h, k^h/ and shorter VOT values in /t, k/, enhancing the aspiration contrast relative to most men's productions, a "clear speech" effect?

The Kaohsiung Guoyu sibilant space

Middle-aged women are more advanced in the shift from heavily accented Guoyu sibilants to a Putonghua-like differentiation between /ɕ/ and /s/ (and even /ʂ/).

The Kaohsiung Southern Min sibilant allophones

Middle-aged women are more influenced by Guoyu contrasts in their differentiation of allophones of /s/ in Southern Min.

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