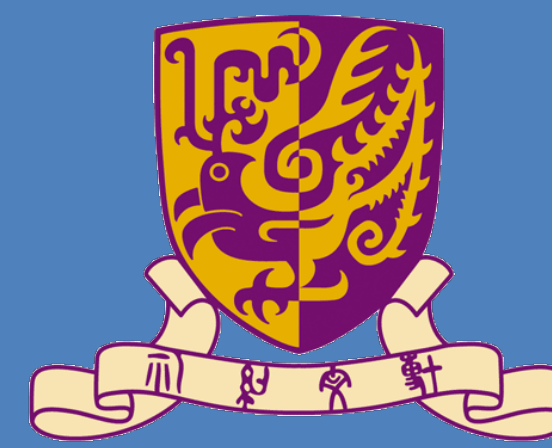


Age differences of the non-modal phonation in Suzhou Wu Chinese

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Introduction

Consonant voicing, phonation type and tone in Wu Chinese:

- Voiceless consonants: low register tones, modal voice
- Voiced consonants: high register tones, breathy voice

The disappearance of breathy voice in Shanghai Wu:

- Low tone breathiness is better maintained by old speakers than young speakers (Gao, 2016)
- No significant difference in H1*-H2* and CPP between high and low tones for young speakers (Zhang & Yan, 2018)

Question: Is the breathy voice in Suzhou Wu also disappearing?

Table 1. *The tone system of Suzhou Wu*

Tone category	Register	Phonation	Tonal value	Symbol
Yinping (阴平)	High	Modal	44	T1
Yangping (阳平)	Low	Breathy	23	T2
Shangsheng (上声)	High	Modal	52	T3
Yinqu (阴去)	High	Modal	412	T5
Yangqu (阳去)	Low	Breathy	31	T6
Yinru (阴入)	High	Modal	55	T7
Yangru (阳入)	Low	Breathy	23	T8

* T4 has merged with T6

Method

Materials:

1. CV syllables of all seven tones
2. C = /p b t d k g f v s z/
3. V = /a ɪ ε/ for unchecked tones and /aʔ ɪʔ əʔ / for checked tones
4. 103 words in total for each speaker

Participants:

Age group	Female	Male	Mean age
Young	5	5	24
Middle	10	6	49.8
Old	5	5	71.3

Measurements:

1. Spectral measurements: H1*-H2*, H1*-A1*, H1*-A2*, H1-A3*
2. Noise measurements: Cepstral Peak Prominence (CPP), Harmonic-to-Noise Ratio (HNR) at bands of 0-500, 0-1500, 0-2500, and 0-3500 Hz
3. The measurements were made at ten equidistant points during the vowel
4. T2 is changing across age groups and is creaky voiced at the middle of the syllable for young speakers
5. The first four points were selected to avoid the influence of creaky voice

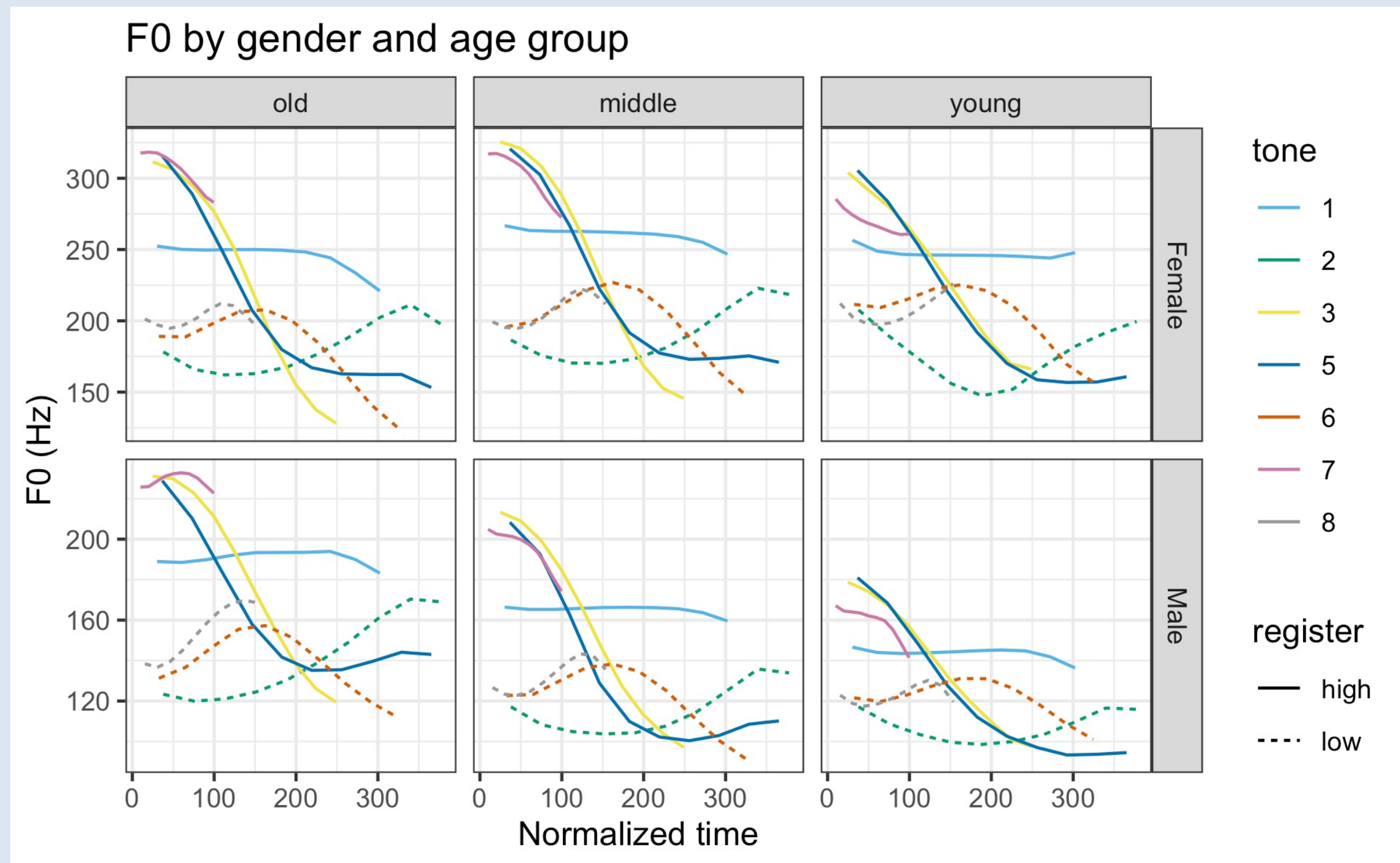


Figure 1: *Pitch contours by gender and age group*

Results

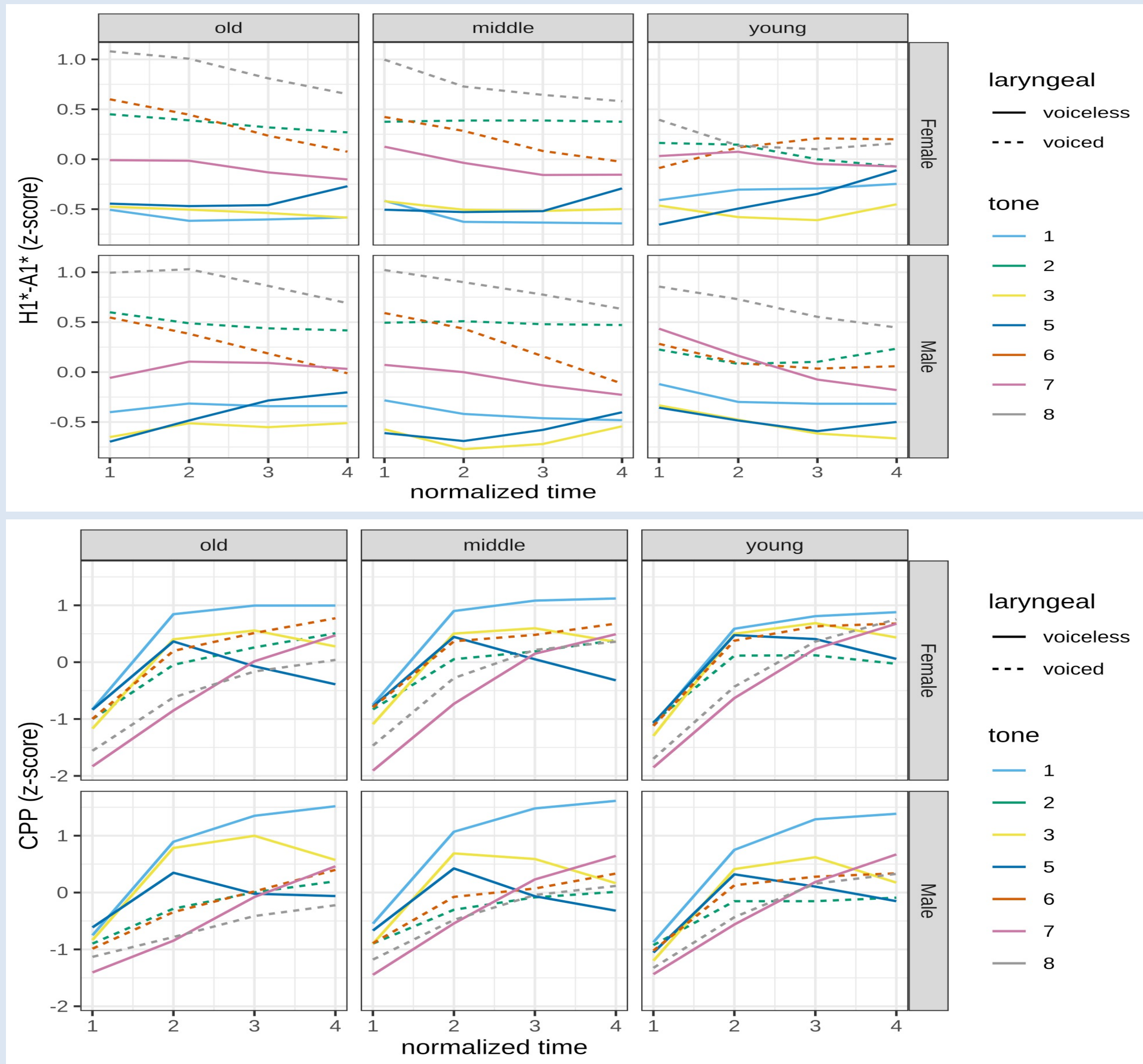


Figure 2. *Normalized H1*-A1* (top) and CPP (bottom) values at the first four points of the vowels of seven tones by gender and age group*

- The difference between T2, T6, T8 (dashed) and T1, T3, T5, T7 (solid) are decreasing for young speakers

			T1	T2	T3	T5	T6	T7	T8
H1*-H2*	female	middle	+	-			-		
	young						-		-
	male	middle					+		+
H1*-A1*	young		+	-	+		-	+	
	female	middle	+	-			-		-
	young			-		-	-		-
H1*-A2*	male	middle		-					
	young		+	-			-	+	-
	female	middle	+	-		-	-		-
H1*-A3*	young			-			-		-
	female	middle		-					-
	young			-			-	+	-
CPP	female	middle		+			+		
	young		-	+			+	+	
	male	middle							-
HNR05	young			+		-	+		
	female	middle					+	-	
	young		+	-	-	-	+		-
	male	middle				-	+		
	young		+	+			+		

Table 2: *Acoustic measurements of Suzhou tones as compared to old speakers, + means greater than old speakers, and - means smaller than old speakers*

- T2, T6 and T8 show less breathiness for young speakers:
 - Smaller for spectral measurements (H1*-H2*, H1*-An*, i.e., flatter spectrum) than old speakers
 - Larger for noise measurements (CPP, HNR05, i.e., less noise) than old speakers for T2 and T6
 - Almost no difference for T8 in CPP and HNR05 from old speakers

Conclusions

Breathy voice in Suzhou Wu is also disappearing:

- Young speakers of Suzhou Wu are less breathy than old speakers in the vowels following voiced obstruents
- The change is more advanced for young speakers than for middle-aged speakers
- T2 and T6 are more advanced in this process than T8

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