Cue weighting of voice quality, pitch, and tonal contour in the tonal register contrast in Chinese Wu dialects

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Introduction

- Chinese Wu dialects use redundant cues in tonal register contrast (Gao et al., 2011; Zhang & Yan, 2015; Jiang & Kuang, 2016)
  - Upper register: higher pitch + modal phonation
  - Lower register: lower pitch + breathy phonation
- The steepness of the tonal contour differs in the two registers
- Shanghai Wu in the process of losing breathiness (Gao et al., 2011; Gao & Hallé, 2013)

Tone inventory of Shanghai (upper) and Jiashan (bottom)

Shanghai (SH)	falling	level	rising	checked
Upper	53	34		5
Lower	23			2

Jiashan (JS)	falling	level	rising	checked
Upper	53	44	35	5
Lower	31	13		2

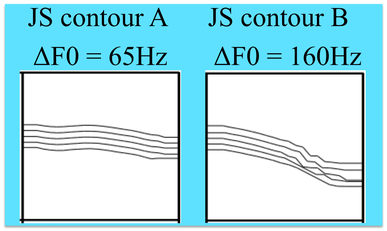
Research Questions:

- Do listeners from both dialects (SH and JS) use breathiness to perceive the register contrast?
- If so, how important it is compared to other cues?
- Given SH is less breathy, do listeners from the two dialects have different cue weighting?

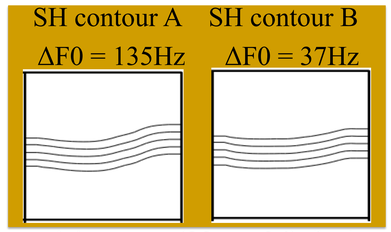
Methods

Breathiness continuum: created in TANDEM STRAIGHT (Kawahara et al., 2008)

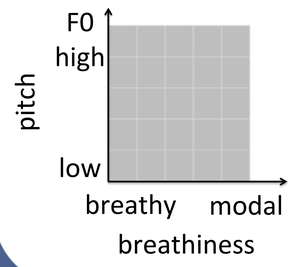
Pitch continuum: (modified in Praat (Boersma & Weenink, 2016))



falling tone (31 vs. 53) /ka/



rising tone (23 vs. 34) /ka/

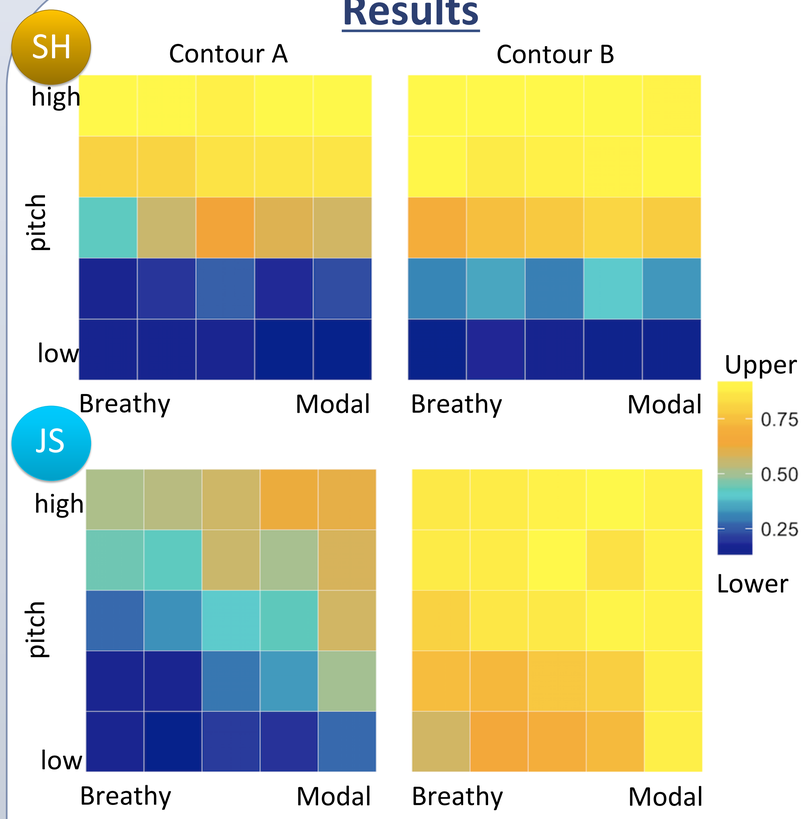


Stimuli: 5-step pitch * 5-step breathiness * 2 contours * 5 repetitions

Experiment: forced-choice lexical decision task

Participants: 34 JS; 35 SH

Results



Stats: mixed-effect logistic model, by-participant random intercept and slopes.

Cue weighting:

SH: pitch >> contour > breathiness

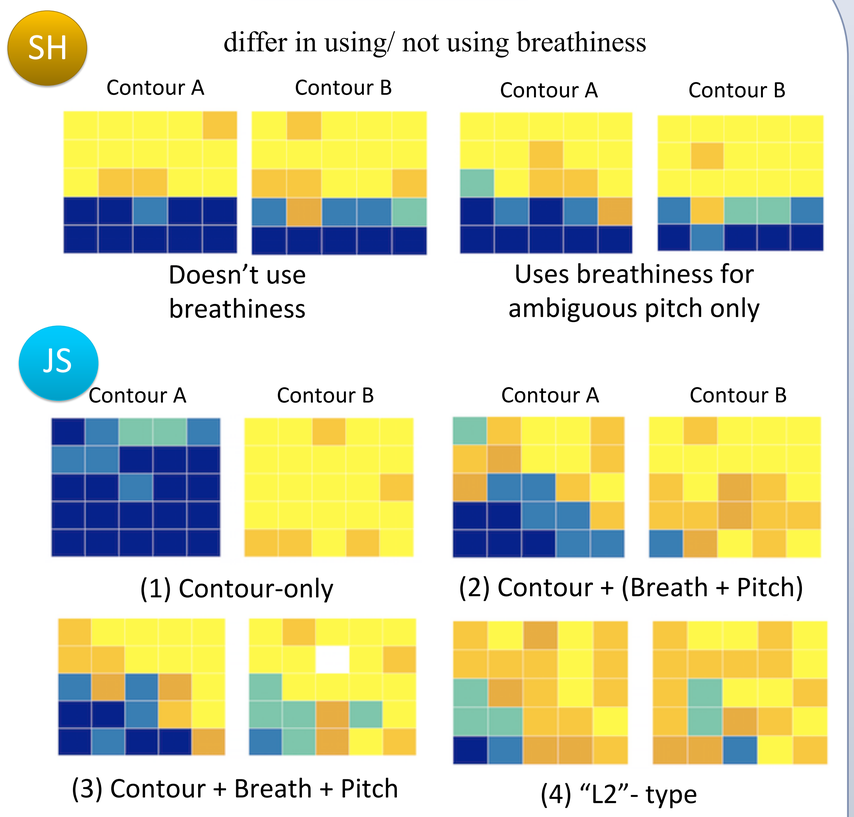
JS: contour > pitch > breathiness

Model β coefficients:

	Pitch	Contour	Breath
SH	**6.446**	1.117	0.359
JS	1.597	**3.130**	0.888

- Effect of breathiness is smaller at higher pitches and with steeper contour
- Effect of pitch is smaller with steeper contour

Individual Variability



Type (1): use contour as their only cue

Type (2): use all three cues, but breathiness + pitch affects perception only when the contour is flat

Type (3): use all three cues, and all are important for both contours

Type (4): use all three cues, but only when all cues associated with the lower register are present can they determine the lower register

Discussion

Cue weighting

- Both groups of listeners use all three cues
- **Pitch** is the primary cue for SH; **contour** is the most important cue for JS

Perceptual sensitivity to breathiness

- SH listeners rely on breathiness less
  - Only some use breathiness
  - Only at ambiguous pitches
- JS listeners use breathiness even at less ambiguous pitches

Listeners adjust their perceptual strategy at different contexts

Possible reasons for the difference in primary cue:

- More complex tone inventory in JS
- Lack of ambiguous contour make contour more distinguishable
- May only apply to this tone (contour)

Selected References

Gao, J., Hallé, P., Honda, K., Maeda, S., & Toda, M. (2011). Shanghai slack voice: acoustic and EPGG data. In 17th International Congress on Phonetic Sciences (pp. 719-722).; Gao, J., & Hallé, P. (2015). The role of voice quality in Shanghai tone perception. In Proceedings of ICPhS (Vol. 18).; Jiang, B. & Kuang, J. (2016). Consonant effects on tonal registers in Jiashan Wu. Proceedings of the Linguistic Society of America, 1, 30-1.; Zhang, J., & Yan, H. (2015) Contextual cue weighting for a laryngeal contrast in Shanghai Wu. In Proceedings of ICPhS (Vol. 18).