The Effects of High Talker Variability on the Perceptual Learning of Mandarin Tones in HVPT

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Why is my study needed? I

- Segmental research has suggested that a key component of HVPT is high talker variability
  - Lively et al. (1993): Japanese trained with multitalker stimuli showed more generalization of English /r/ and /l/
    - Authors' conclusion: high talker variability supports robust category acquisition
  - Sadakata and McQueen (2013): Dutch trained with multitalker stimuli showed more generalization of Japanese singleton and geminate variants of /s/
- However, the extent to which high talker variability improves perception of tones is unclear

Why is my study needed? II

- Tonal HVPT research mostly compared HVPT with a control group who did not receive training (e.g., Wang, 2013; Wang et al., 1999; Zhao & Kuhl, 2015)
- Studies that compared effects of high talker variability to those of low talker variability provided mixed findings
  - Sadakata and McQueen (2014): no effect of talker variability on Mandarin tone perception in Dutch listeners
  - Zhang et al. (2018): no effect of talker variability on Cantonese tone perception in Mandarin listeners
- This suggests that high talker variability might not be as important in tonal perception. *But is this true?*

Methodology I

- Participants: 27 native speakers of English (17 F, 11 M; mean age 21.7 years, *SD* 2.5)
- Lacked prior formal musical training and experience with a tonal language
- Each participant was randomly assigned to multitalker (n = 14) or single-talker (n = 13) training group.
  - *During the 6-month retention phase, 9 from the multitalker group and 10 from the single-talker group returned*

Methodology II

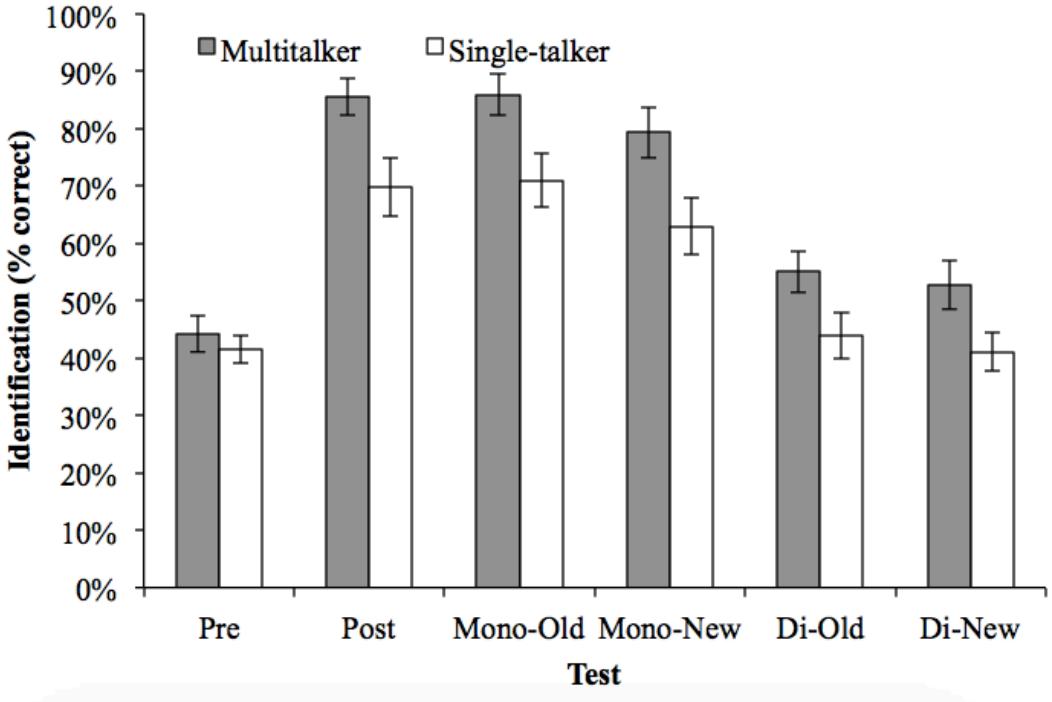
- **Stimuli**: Mandarin words produced by 6 talkers (3 F and 3 M)

# of items	Used in	Mono/disyllabic?	Talker
100	Pre/posttest/ retention test	monosyllabic	M3
180	Training	monosyllabic	M1,M2,F1,F2
60 (for each test)	4 generalization tests: Mono-Old, Mono-New, Di-Old, and Di-New	mono- & disyllabic	M1,F1: Old F3: New old = familiar voice new = unfamiliar voice

Methodology III: Procedure

- **4 phases (ordered):** pretest, training, posttest and generalization tests, 6-month retention test
- All phases used an identification task
  - Four buttons labeled from left to right by 1 to 4 and by the pinyin tonal diacritics (◌̄, ◌́, ◌̌, and ◌̀)
  - Disyllables: identified the 1st syllable because the 2nd syllable had neutral tone, e.g., 口袋 kǒudai "pocket"
- **Training**: 8 sessions spanned ~2 weeks
  - Corrective feedback provided

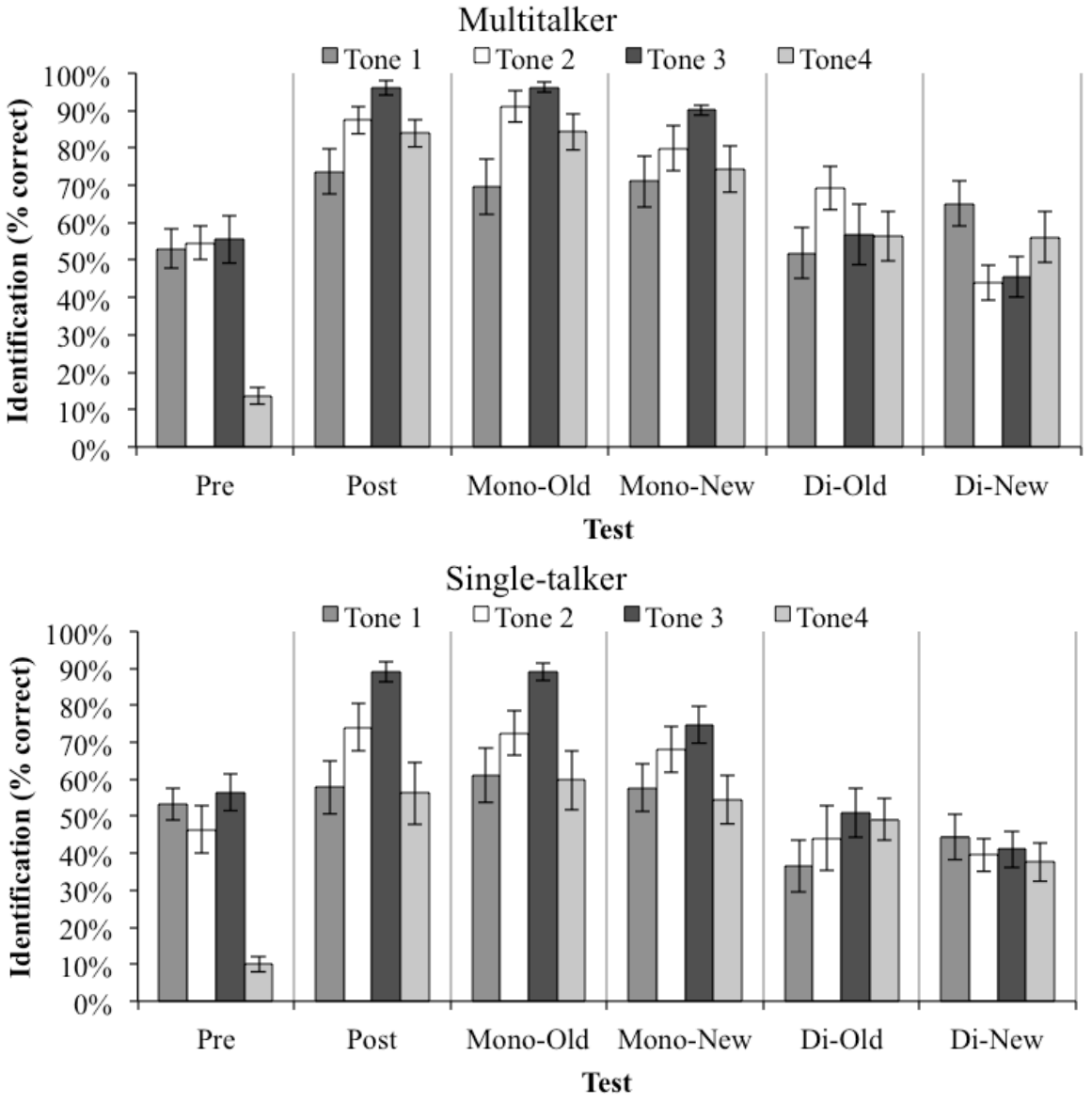
Results I: Overall performance



- Multitalker group significantly outperformed single-talker (*p*s < 0.05) (results from mixed ANOVA w/ Test as the within-subjects factor and Group as the between-subjects factor)
- Both groups: significantly improved during Post, Mono-Old, and Mono-New

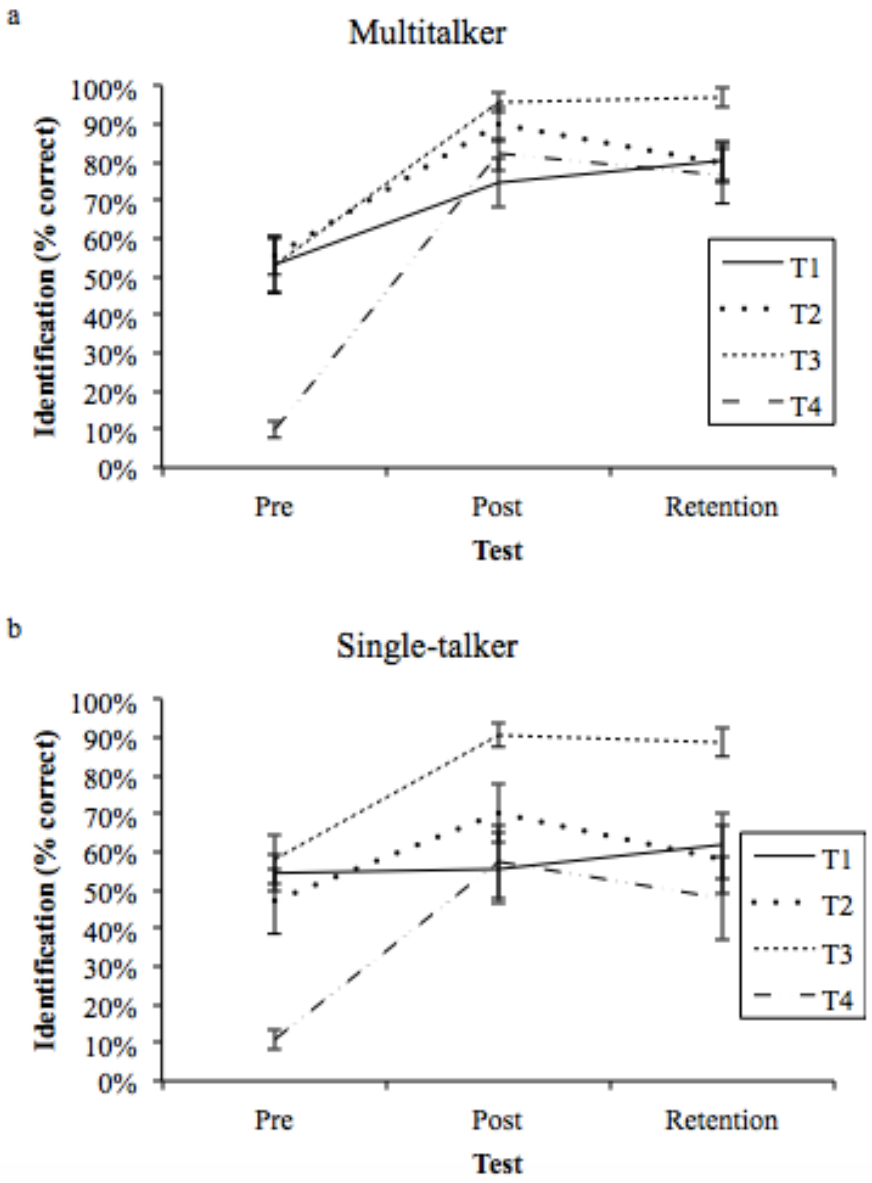
Results II: Individual tones

- **Both groups:**
- Shared mostly the same pattern:
- T1 perception was not improved
  - Its confusion w/ T4 did not significantly reduce
- T3 had highest score after training
- T4 was the most difficult before training



Results III: 6-month retention

- Multitalker group significantly retained learning of all tones ($ps < 0.05$)
  - puzzle: T1 too
- Single-talker group only significantly retained T3 and T4 ($ps < 0.05$)



Discussion I

- Results did not ***completely*** support the hypothesis that high talker variability is superior to low talker variability
- High talker variability plays a key role in enhancing tone perception in nontonal listeners
- High talker variability is also important for learning retention
- However, compared to low talker variability, high talker variability did not improve the perception of more tone categories or yield generalization of learning to more novel contexts (monosyllables to disyllables)

Discussion II

- The finding that high talker variability is important to nonnative tone perception…
  - …is consistent with previous nonnative ***segmental*** studies (e.g., Lively et al., 1993; Sadakata & McQueen, 2013),
  - *…not previous nonnative tone studies (e.g., Sadakata & McQueen, 2014; Zhang et al., 2018).*
  - Why? Perhaps methodological differences (disyllables in Sadakata & McQueen, 2014 and tonal listeners in Zhang et al., 2018)

Discussion III

- The failure to improve the perception of Tone 1 is inconsistent with Wang et al. (1999) who reported improved perception of all Mandarin tones after HVPT
- Why?
  - More experience with Mandarin in their study; thus, tone categories had been created
  - If true, the nonlearners in the present study may have relied more on English stress system

Discussion IV

- Why was Tone 3 perception so high?
  - May have used non-pitch cues such as creaky voice and length

Discussion V

- Implications for L2 tonal teaching in the classroom
  - High talker variability might not be useful for improving perception of certain tones (e.g., Mandarin Tone 1 for complete beginners who speak English)
  - Low talker variability may be useful for improving perception of tones with salient non-pitch cues (e.g., Mandarin Tone 3)

References

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Thank you!

- This presentation is based on:
  - Silpachai, A. (Under Review). The role of talker variability in the perceptual learning of Mandarin tones in American English listeners. *The Journal of Second Language Pronunciation.*
- For a downloadable version of these slides, please visit http://alifsilpachai.com
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EXTRA SLIDES

Concepts

- Talker variability = differences in the production of speech sounds between speakers
- high talker variability = multiple talkers
- low talker variability = usually one talker
- Mandarin tones = level, rising, dipping, and falling (and neutral tone)
- HVPT = High Variability Phonetic Training

Hypotheses

- Hypothesis 1: training with high talker variability ***is not more*** effective compared to low talker variability
- Hypothesis 2: training with high talker variability ***is more*** effective compared to low talker variability

Methodology (extended) I

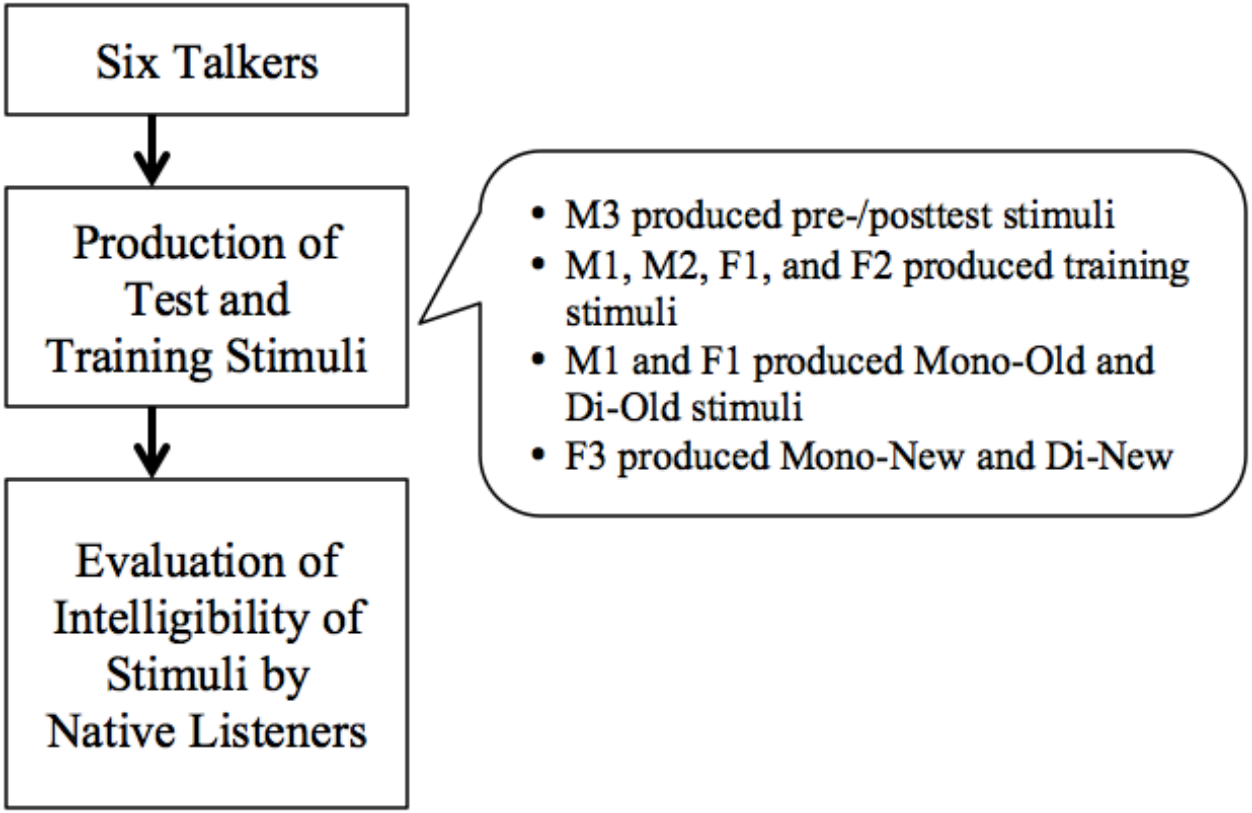
- Participants: 27 native speakers of English (17 F, 11 M; mean age 21.7 years, *SD* 2.5)
- Lacked prior formal musical training and experience with a tonal language
  - Musical experience facilitates pitch perception (e.g., Alexander, Wong, & Bradlow, 2005; Wong, Skoe, Russo, Dees, & Kraus, 2007).
  - Tonal experience may enhance pitch perception

Methodology (extended) II

- Each participant was randomly assigned to multitalker (n = 14) or single-talker (n = 13) training group.
  - *9 from the multitalker group and 10 from the single-talker group returned to take retention test*
- **Pre-training assessments**
  - **Questionnaire**: age, gender, foreign language experience, musical background, and any hearing or speech difficulties
  - **Pitch-Contour Perception Test (PCPT)** adapted from Wong and Perrachione (2007)
    - Assesses perceptual ability of pitch patterns (level, rising, and falling)
    - Identification task: map tone contours to arrows (→,↗,↘)
    - 2 non-Mandarin-like pitch contours were added to increase variability
    - Lasted about 10-15 minutes.
    - A two-sample t-test showed no significant difference in the scores between the training groups (multitalker = 69.0%, *SD* 15.4%; single-talker = 59.1%, *SD* 15.2%, $p > 0.05$).

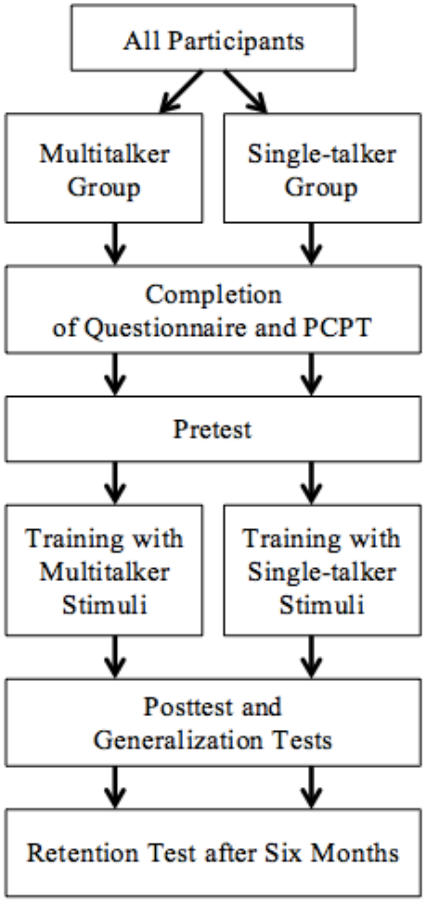
Methodology (extended) III

- **Stimuli**



Methodology (extended) IV

- **Procedure**
- Identification task used during all phases
  - Four buttons labeled from left to right by 1 to 4 and by the pinyin tonal diacritics (◌̄, ◌́, ◌̌, and ◌̀)
  - Disyllables: identified the 1st syllable. The 2nd syllable had neutral tone
- **Training**: 8 sessions spanned ~2 weeks
  - Corrective feedback provided during training



Discussion (extended) I

- Results did not ***completely*** support the hypothesis that high talker variability is superior to low talker variability

Summary of results

- Multitalker group overall outperformed single-talker group
- They also retained their learning for six months, unlike single-talker group who showed retention of fewer tones
- ***However***
  - both groups improved Tones 2, 3, and 4, especially Tone 3, but not Tone 1,
  - …and they generalized their learning to new monosyllabic, not disyllabic, words produced by a familiar talker and an unfamiliar talker.

Discussion (extended) II

- The failed disyllabic generalization may have been due to L1 influence and/or task difficulty
  - In English, pitch can unfold over multiple syllables
  - Thus, it might have been difficult to focus on the first syllable