The Preliminary Study of Influence on Tone Perception from Segments

Chong Cao[1], Yanlu Xie[1], Ju Lin[1], Qian Li[2], Jinsong Zhang[1]

1. SAIT, Beijing Language and Culture University, Beijing, China
2. Chinese Academy of Social Sciences， Beijing, China

Outline

- Background
- Method
- Results
- Discussion and Conclusion

Background

- Standard Chinese
  - Tones

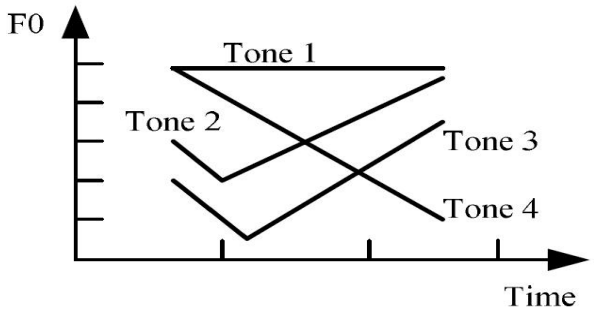


Fig1: Distinctive F0 Patterns of Chinese Four Tones.

  - Syllable Structure

(Consonant) (Medial) [Nucleus Vowel] (Coda)

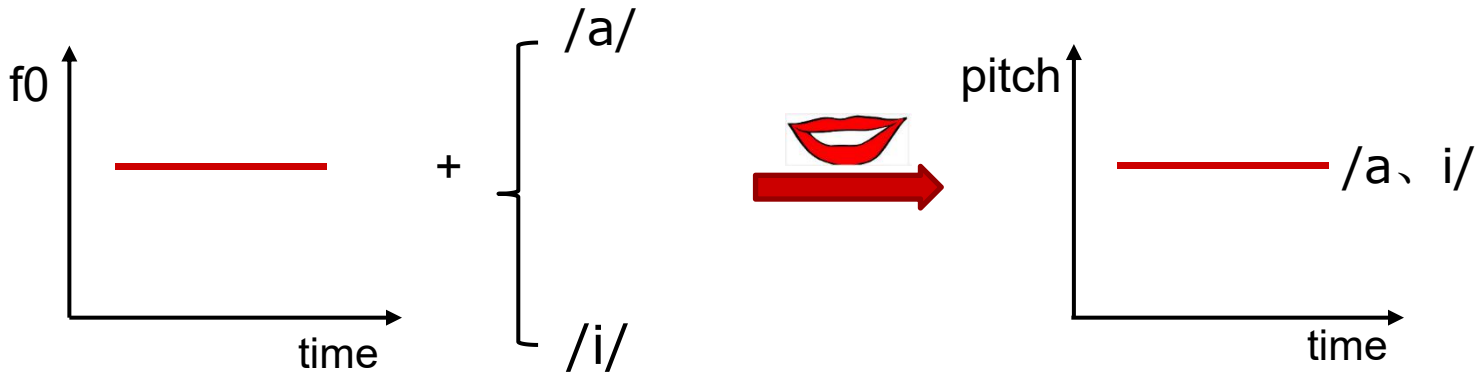
Initial — Final

(Medial): [i], [u] , [y]

(Coda): [n], [ŋ]

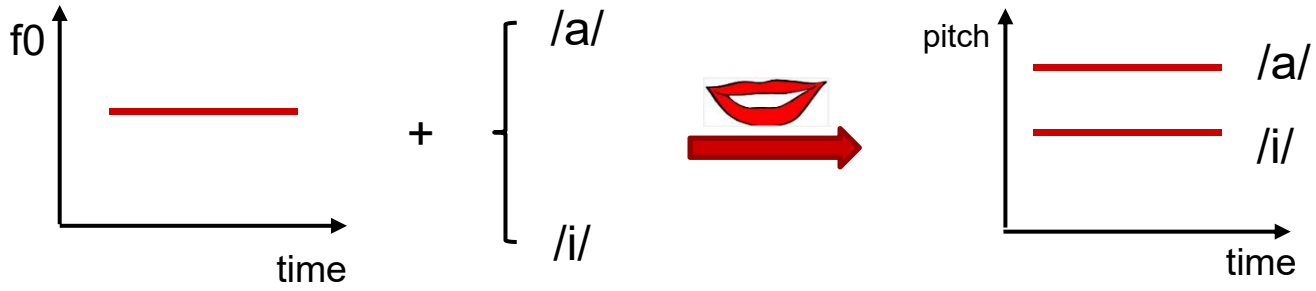
Background

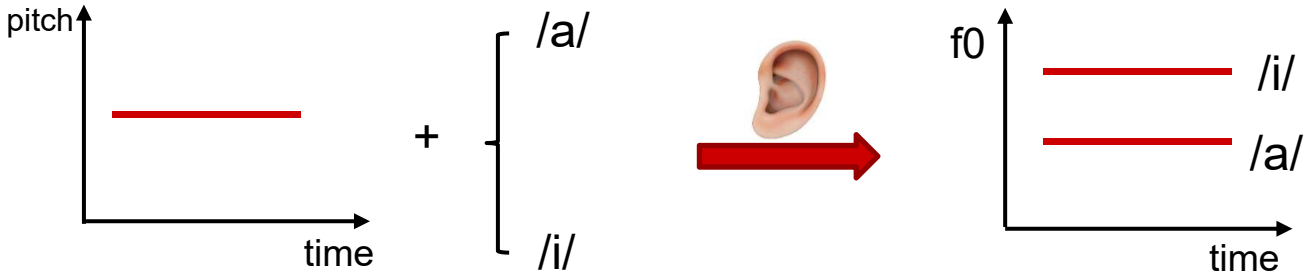
- Tradition source-filter model
  - In speech production, source and filter are largely independent. (Fant,1970).



Background

- Possible correlation btw. Source & filter (Titze, 1989; Fitch & Giedd, 1999).





Background

- Traditional definition of tone ignored the relationship between tone and segments.

Segments influence tone perception

Background

- Consonant

Plosive + { aspiration → lower tones ; unaspiration → higher tones } (Yang, 1989).

- Vowel

vowel + { lower intrinsic f0 → higher tones ; higher intrinsic f0 → lower tones }

(Yang, 1989; Fox & Qi, 1990; Zheng, 2014 ; etc.).

Background

- About segments' influence on tone perception, previous research:
  - Simple syllable structure
    - V (/a/,/i/)
    - CV (/pa/, C mainly for plosive)
  - Investigated the effect of vowels and consonants on tone perception separately rather than integrally

- Research Problem

1、Whether other articulatory manner of consonants and complicated syllable structure influence tone perception?
2、Whether consonant and vowel interact to influence tone perception?

Method

Tone continua perception experiment

synthesizing a tone continuum imposed on various syllable structures to conduct tone perception experiment.

- Tone continua: Tone 2_Tone 3

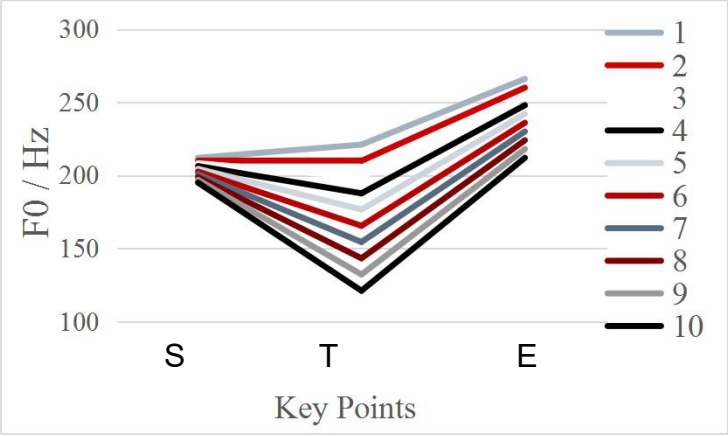
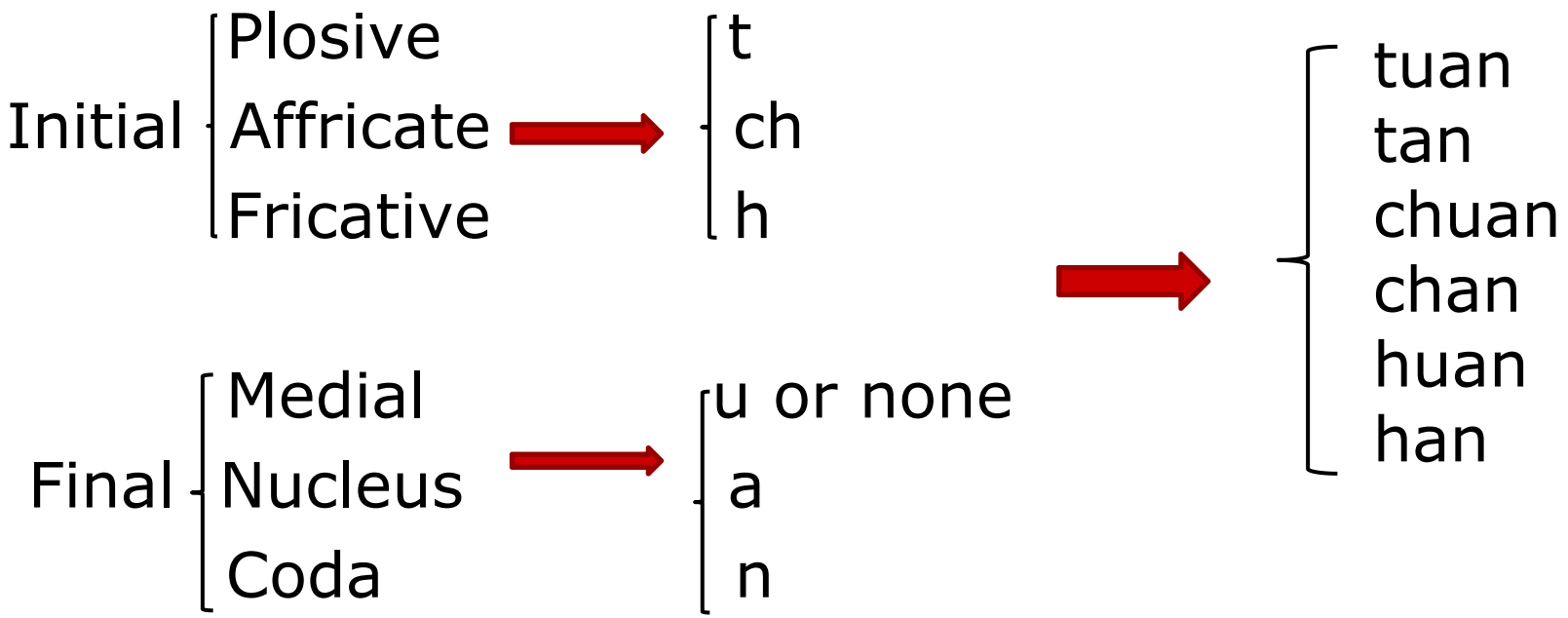


Fig 2:Tone Continua Pattern.

- Turning point: 40% of F0 contour
- S, T and E point were changed equally and simultaneously

- Syllable Structure



Method

Procedure

- Identification task;
- Random order ;
- Two alternative forced choice: Tone 2 or Tone 3.

Participant

- 18 females and 7 males;
- Age range from 22 to 30;
- No speech, language and hearing impairments.

Results

- The accuracy of Tone 2

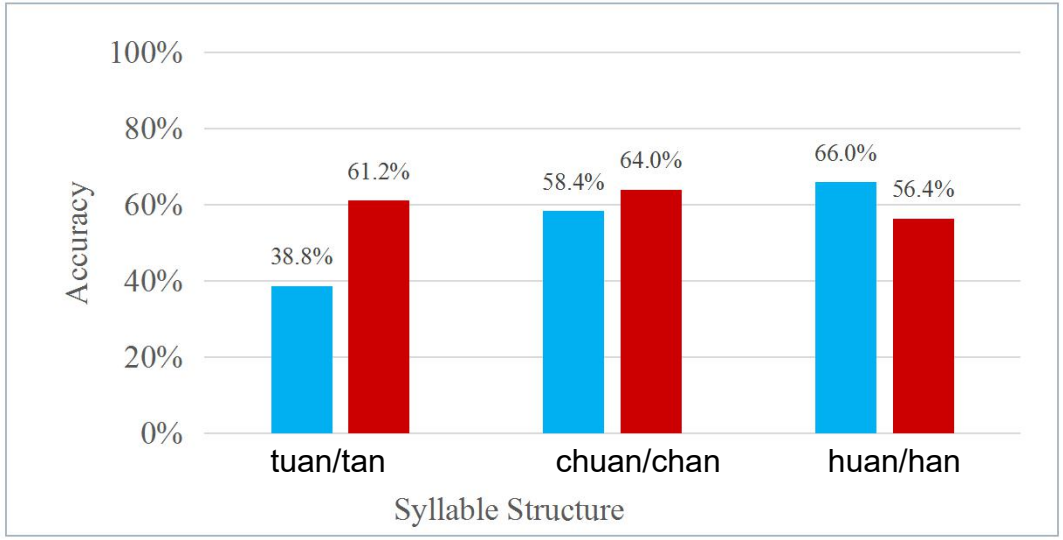


Fig 3: The Average Response Percentage of Tone 2

Results-Initial

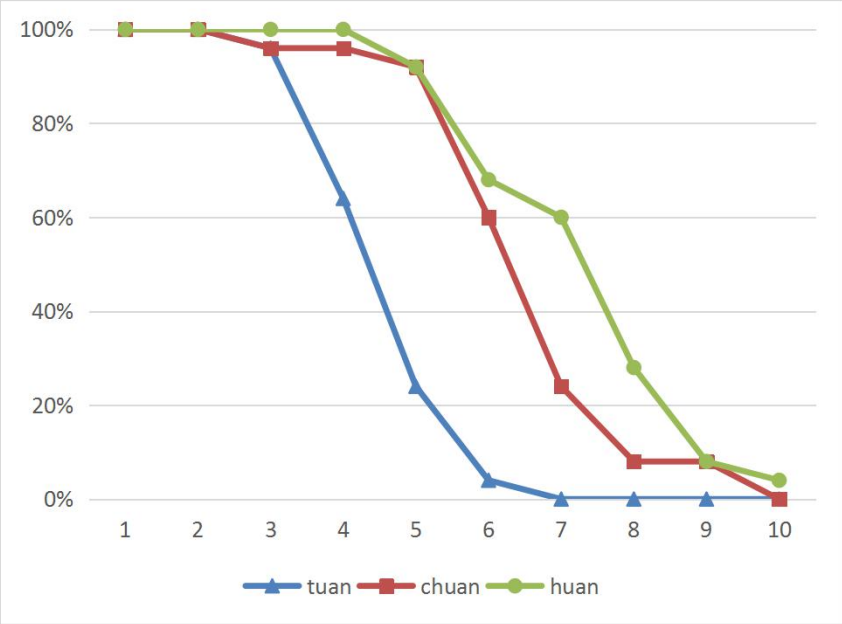


Fig 4 (a):Identification Curves of Syllables with Medial

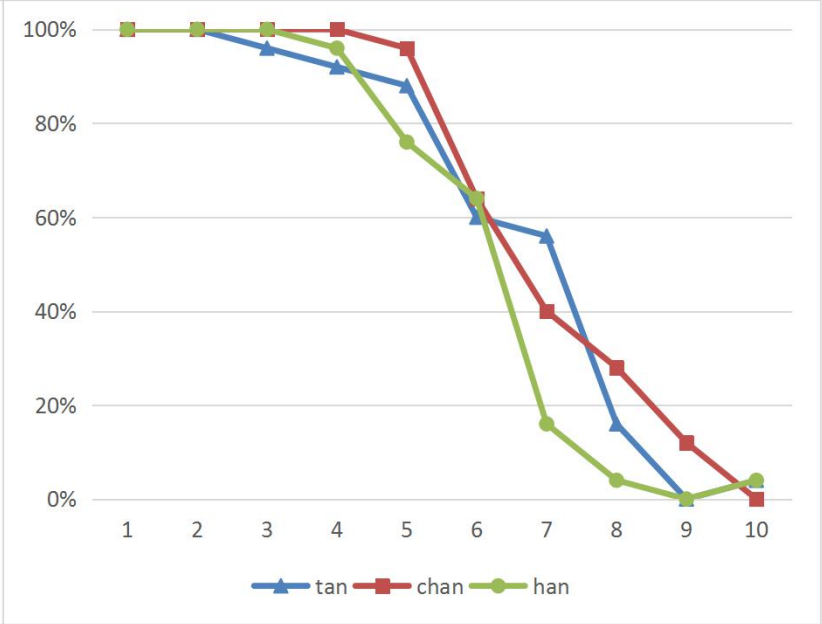


Fig 4 (b):Identification Curves of Syllables without Medial

Results-Final

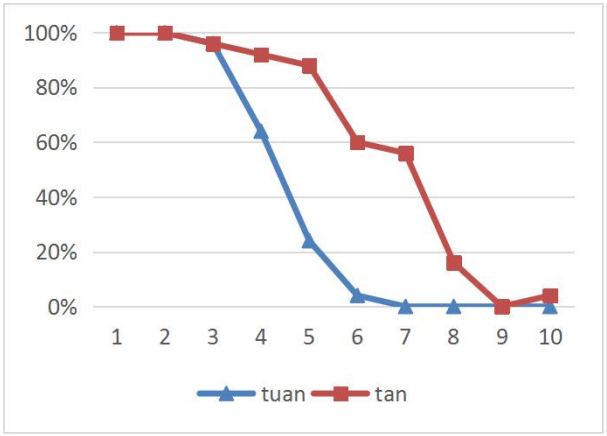


Fig5 (a): Identification Curves of syllalbles with plosive.

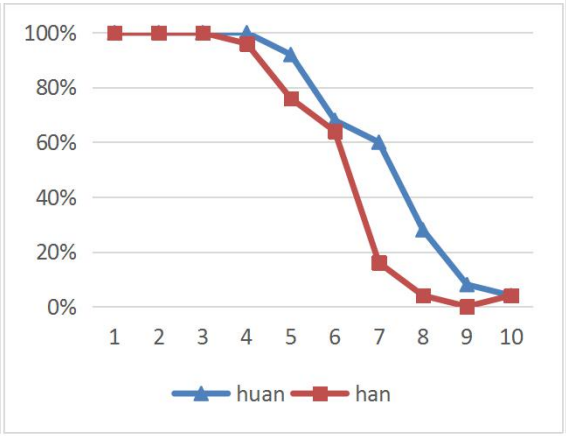


Fig 5 (b): Identification Curves of syllables with fricative.

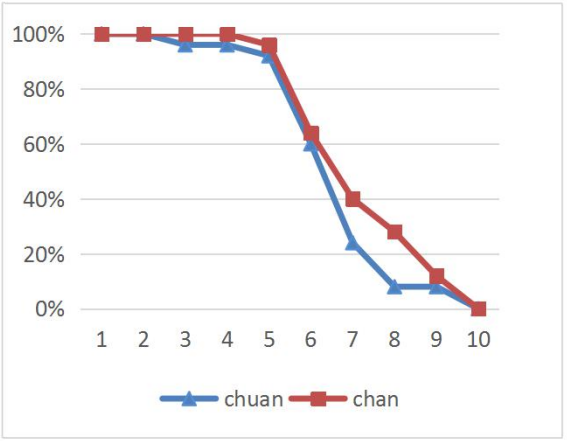


Fig5 (c): Identification Curves of syllables with affricate.

Discussion and Conclusion

- The present preliminary study examines how consonants and vowels influence tone perception with Tone 2_Tone 3 continua based on six syllable structures by controlling the turning point at 40% of f0 curves.
  - Apart from plosive, affricate and fricative also influence tone perception as well as complicated syllable structure;
  - Consonant and vowel interact to influence tone perception.
- Our results support the hypothesis that tone perception is influenced by segments, f0 and segmental information jointly contribute to tone perception.

Discussion and Conclusion

Impact

we offer a preliminary investigation of the role of consonant types and vowel conditions on tone perception in Standard Mandarin. The results have significance in the second language teaching and computer-aided pronunciation training.

Future work

the accurate location of turning point;

more tonal types and segmental types.

Thank you for your attention