An Investigation of Affricate Simplification in Conversational Mandarin

Aletheia Cui & Taylor Jones

Department of Linguistics, University of Pennsylvania

ICPhS2015

Penn
University of Pennsylvania

Background

- Consonant reduction is an extremely common process cross-linguistically
  - e.g. the reduction of /s/ in Spanish. While /s/ has been described as having three phonetic variants [s], [h] and [∅], detailed phonetic study has shown that /s/ reduction has a much larger range of variation [2, 5, 6]
- There has been a number of studies on syllable reduction and contraction in Taiwanese Mandarin [3, 4, 7]
- No systematic treatment of consonant lenition in spoken Mandarin, especially mainland Mandarin

Research Questions

1. What processes characterize the reduction of /tɕ/ (e.g. voicing, deletion, consonant simplification)?
2. What is the rate of reduction in different environments (i.e. word-initial vs. word-medial)?
3. Are consonant reduction and syllable contraction aspects of the same phenomenon?

Methodology

Material

- CALLHOME Mandarin Chinese Speech Corpus [1]
  - 120 unscripted telephone conversations among native speakers of Mandarin with family members or close friends
  - Each call is around 30 min, and a continuous 5- to 10-minute portion is transcribed

Data Collection

- Sampled a total of 466 tokens
  - 327 tokens of *jia*
    - 60 monosyllabic words
    - Among the rest, 90 have *jia* as the first syllable, and 177 have *jia* as a word-medial syllable
  - 139 tokens of *bi3jiao4* 'relatively'

Token Classification

- Each token was inspected individually in Praat and classified according to the presence or absence of acoustic cues of a voiceless affricate

Results: Realizations

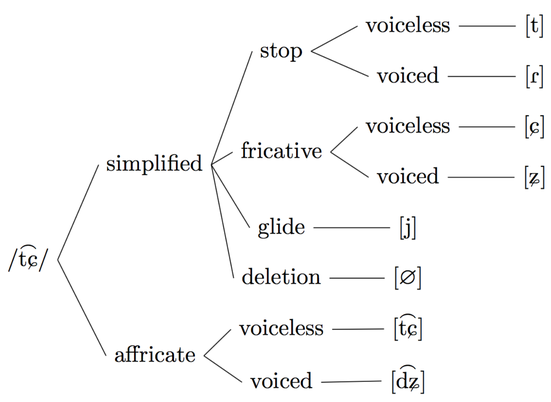
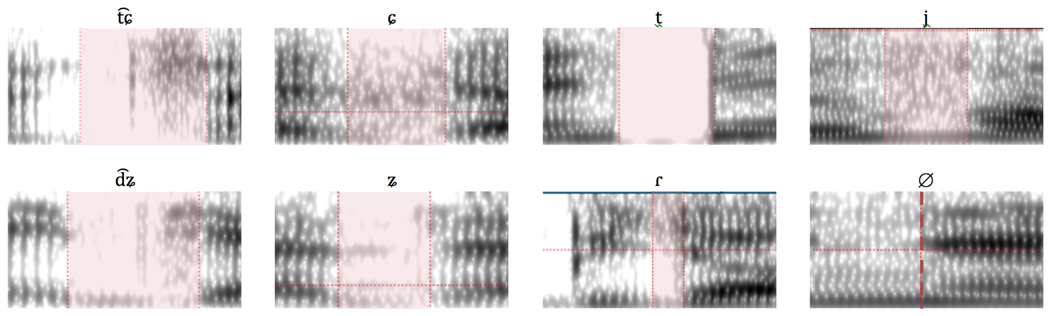


Fig. 1: A schematic showing the types of reduction found in our tokens.

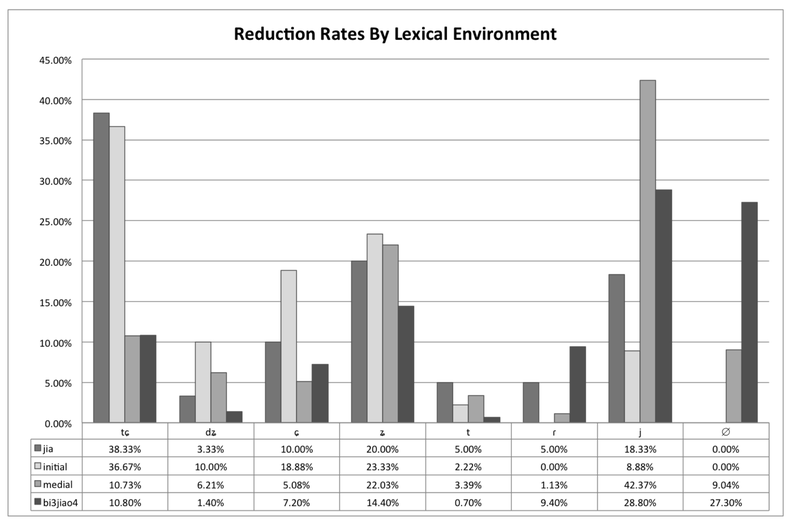
- The realizations of /tɕ/ can be classified into 8 categories
- Reduction strategies include voicing and/or the deletion of one or more features of the affricate
- In some cases, /tɕ/ is completely deleted

Results: Realizations, Cont.



- Spectrograms illustrating the different realizations of /tɕ/
- There is a wide range of realizations, from fully articulated to completely deleted

Results: Rates of Reduction



	tɕ	dʑ	ɕ	ʑ	t	ɾ	j	∅
jia	38.33%	3.33%	10.00%	20.00%	5.00%	5.00%	18.33%	0.00%
initial	36.67%	10.00%	18.88%	23.33%	2.22%	0.00%	8.88%	0.00%
medial	10.73%	6.21%	5.08%	22.03%	3.39%	1.13%	42.37%	9.04%
bi3jiao4	10.80%	1.40%	7.20%	14.40%	0.70%	9.40%	28.80%	27.30%

Fig. 2: The rates of reduction of /tɕ/ in the monosyllabic *jia*, word-initially, word-medially, and in *bi3jiao4*.

- /tɕ/ is reduced the majority of the time
- Word-initial tokens are more likely retain affricate features and have lower rates of reduction
- Word-medially, the tokens are reduced both at a higher rate and to a greater extent
- The realization of the monosyllabic word *jia* often depends what precedes it
- Despite our classification of the tokens into 8 categories, the realizations within each category also show a wide range of variation
  - e.g. duration, VOT, amplitude

Results: Syllable Contraction and *bi3jiao4*

- A number of *bi3jiao4* tokens appeared monosyllabic, i.e. contracted
- Disyllabic *bi3jiao4* and monosyllabic *bi3jiao4* differ in duration by 95ms on average
- We compared monosyllabic tokens of *bi3jiao4* to the monosyllabic words *biao* in CALLHOME
  - The duration of the monosyllabic *bi3jiao4* is on average shorter than monosyllabic words *biao*
  - The reduced *bi3jiao4* shares characteristics with a monosyllable
- However, there is a wide range of reduction between the two extreme forms of *bi3jiao4*

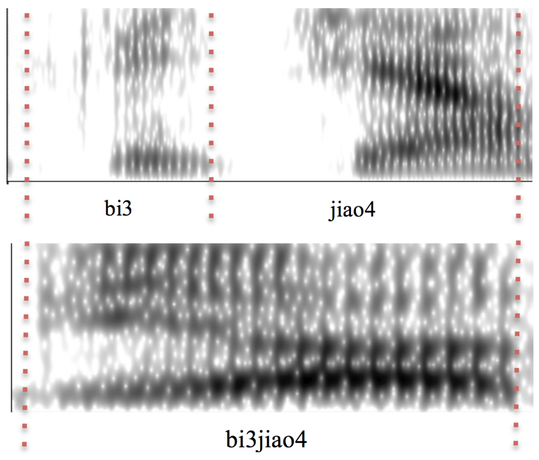


Fig. 3: A disyllabic realization of *bi3jiao4* vs. a monosyllabic realization of *bi3jiao4*.

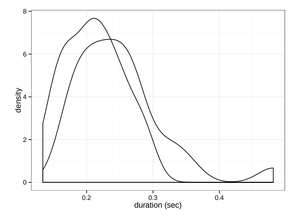


Fig. 4: The duration of monosyllabic realizations of *bi3jiao4* compared to the monosyllabic word biao.

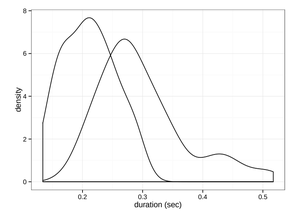


Fig. 5: The duration of monosyllabic *bi3jiao4* compared to disyllabic *bi3jiao4*.

Discussion

- We found that the reduction of /tɕ/ is very frequent in spontaneous speech
- Reduced /tɕ/ has a wide range of acoustic realizations
- Consonant reduction is a gradient process in spoken Mandarin
- Very few tokens are produced with the full acoustic features of an affricate
- Syllable contraction is an extreme form of consonant lenition

Potential Issues

- Tokens were labelled manually
  - Relies on subjective judgment, not direct measurements

Further Questions

- How do speech rate and word frequency affect the rate of reduction?
- Is consonant lenition a change in progress in Mandarin?
- Do other obstruents undergo similar rates of reduction?

Acknowledgments

We would like to thank Mark Liberman, Jianjing Kuang, and Meredith Tamminga for helpful comments and feedback.

References

[1] Canavan, A., and G. Zipperlen. 2016. Linguistic Data Consortium, 1996. [2] Cedergren, H. C. J. 1973. PhD Dissertation, Cornell University. [3] Cheng, C., & Xu, Y. 2009. In INTERSPEECH (pp. 456-459). [4] Cheng, C., & Xu, Y. 2013. The Journal of the Acoust. Soc. of America, 134(6), 4481-4495. [5] File-Muriel, R. J., & Brown, E. K. 2011. Language Variation and Change, 23(02), 223-243. [6] Terrell, T. D. 1979. Hispania, 599-612. [7] Tseng, S. C. 2005. Language and Linguistics-Taipei, 6(1), 153.