

Rapid Adaptation to Unfamiliar Mandarin Dialect Tone Systems: Evidence from Bottom-up Tone Processing

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Outline

Introduction

Perception Experiment

Conclusion & Discussion

Adaptation to accented speech: segments

Previous findings generally converge on listeners' flexible and proficient adaptation to unfamiliar speech (after appropriate exposure)

- Rapid adaptation to foreign accented speech with brief exposure
 - e.g. Faster processing of Spanish- and Chinese-accented English after 2-4 sentences' exposure (Clarke & Garret, 2004)
- Significant adaptation to made-up accents after exposure
 - e.g. Adaptation to *the Weckud-Wetch-of-the-Wast* accent after 20-minute exposure (Maye et al., 2008)

Many studies focused on adaptation on segmental level, e.g. vowel quality, but not much research has been done on perceptual adaptation to tone variation

Adaptation to accented speech: tone

What happens when the unfamiliar accent mostly targets the realization of lexical tone?

General consensus on lexical tone processing

- The use of **both top-down (context) and bottom-up (tone acoustics) information** (Liu & Samuel, 2007; Gao et al., 2019)

We hypothesize an essential role of **top-down information** in perception of unfamiliar tone systems

BUT!

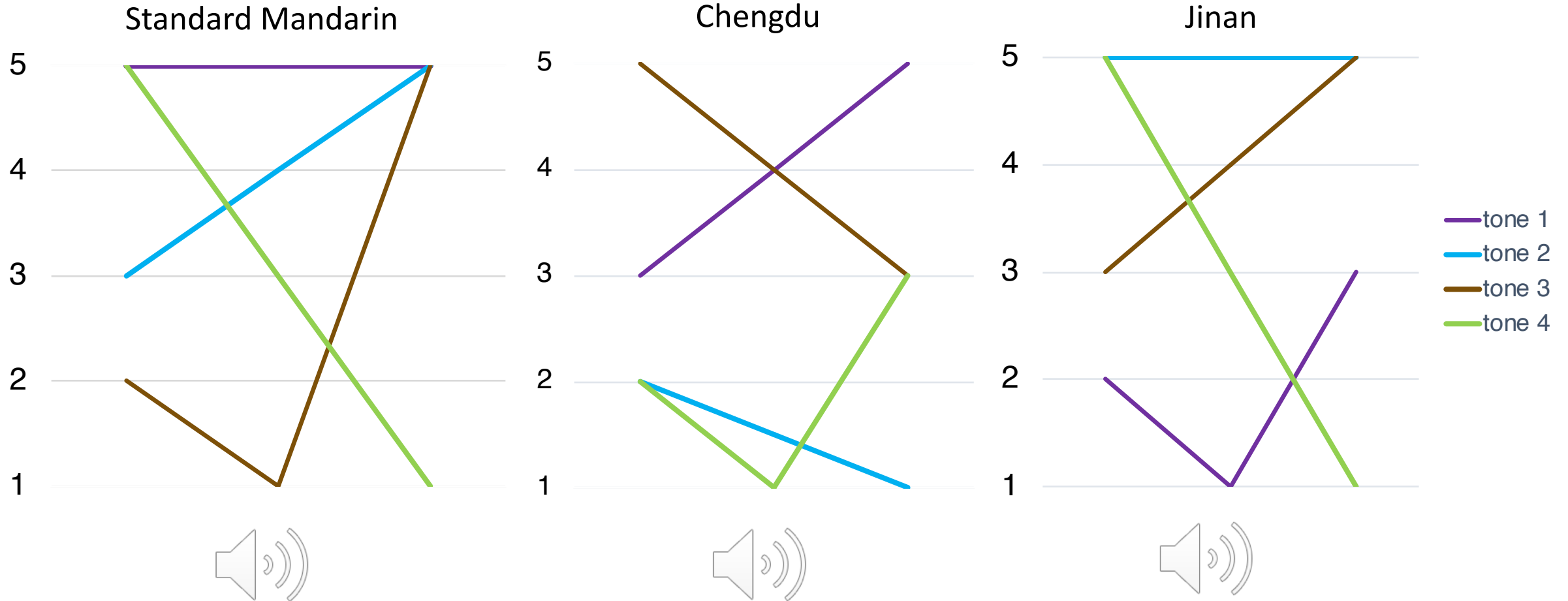
- Fully top-down? Can they learn the novel contour–category mapping?
- Would perception to unfamiliar tone system improve after exposure?
- Would perception differ across dialects and why? (Chengdu and Jinan Mandarin)

Adaptation to accented speech: tone

Would perceptual adaptation differ across dialects?

- Perceptual Assimilation model
 - Greater dissimilarity to the native/familiar speech may lead to easier discrimination or better perception (So & Best, 2011, 2014; Reid et al., 2015)
 - Regarding tone systems, more similar the tone system is to the listener's native speech, more difficult it might be to adapt to.

Mandarin dialects: comparable segmental inventories, but **disparate** tone realizations



Example: tang1 (“soup”; 汤)

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Perception experiment

Participants

- Ten native speakers of Standard Mandarin, randomly assigned with Chengdu or Jinan task

Task

- Semantic plausibility judgment task of a spoken sentence
 - **“Does this sentence make sense?”** and clicked **“yes”** or **“no”** on the screen after hearing the whole sentence
- Accuracy and response time measured as dependent variables
 - Responses matched with the expected plausibility was considered correct

An example sentence frame manipulated by **surprisal**

	Low-surprisal sentence	High-surprisal sentence
Chengdu Mandarin	有 一只 鹰 在 天上 <u>飞</u> You3 yi4 zhi1 ying1 zai4 tian1 shang4 <u>fei1</u> There is an eagle in the sky <u>flying</u> “There is an eagle flying in the sky”	有 一只 鹰 在 天上 <u>肥*</u> You3 yi4 zhi1 ying1 zai4 tian1 shang4 <u>fei2*</u> There is an eagle in the sky <u>gaining weight*</u> “There is an eagle gaining weight in the sky”
Jinan Mandarin	有 一只 鹰 在 天上 <u>飞</u> You3 yi4 zhi1 ying1 zai4 tian1 shang4 <u>fei1</u> There is an eagle in the sky <u>flying</u> “There is an eagle flying in the sky”	有 一只 鹰 在 天上 <u>肥*</u> You3 yi4 zhi1 ying1 zai4 tian1 shang4 <u>fei2*</u> There is an eagle in the sky <u>gaining weight*</u> “There is an eagle gaining weight in the sky”

- Half the critical words were in sentence-medial position, half in sentence-final position

Perception experiment

Stimuli

24 pairs of low/high-surprisal sentences were created manipulating Mandarin dialect in a between-item design (12 for pre-exposure test and 12 for post-exposure test)

Experimental manipulation (48 trials)

- **Surprisal**: low surprisal vs. high surprisal
- **Dialect**: Chengdu Mandarin vs. Jinan Mandarin
- **Exposure**: pre- and post-exposure

Procedure

Familiarization phase (with feedback) >> pre-exposure test >> exposure phase >> post-exposure test

(no feedback) (two repetitions of North Wind and the Sun)

Predictions

If participants only use top-down information for tone processing:

	accuracy	RT
<i>surprisal</i>	high for low surprisal sentences; low for high surprisal sentences	consistent response time across high and low surprisal
<i>exposure</i>	no effect of exposure	no effect of exposure
<i>dialect</i>	higher for Chengdu sentences	faster responses to Chengdu sentences

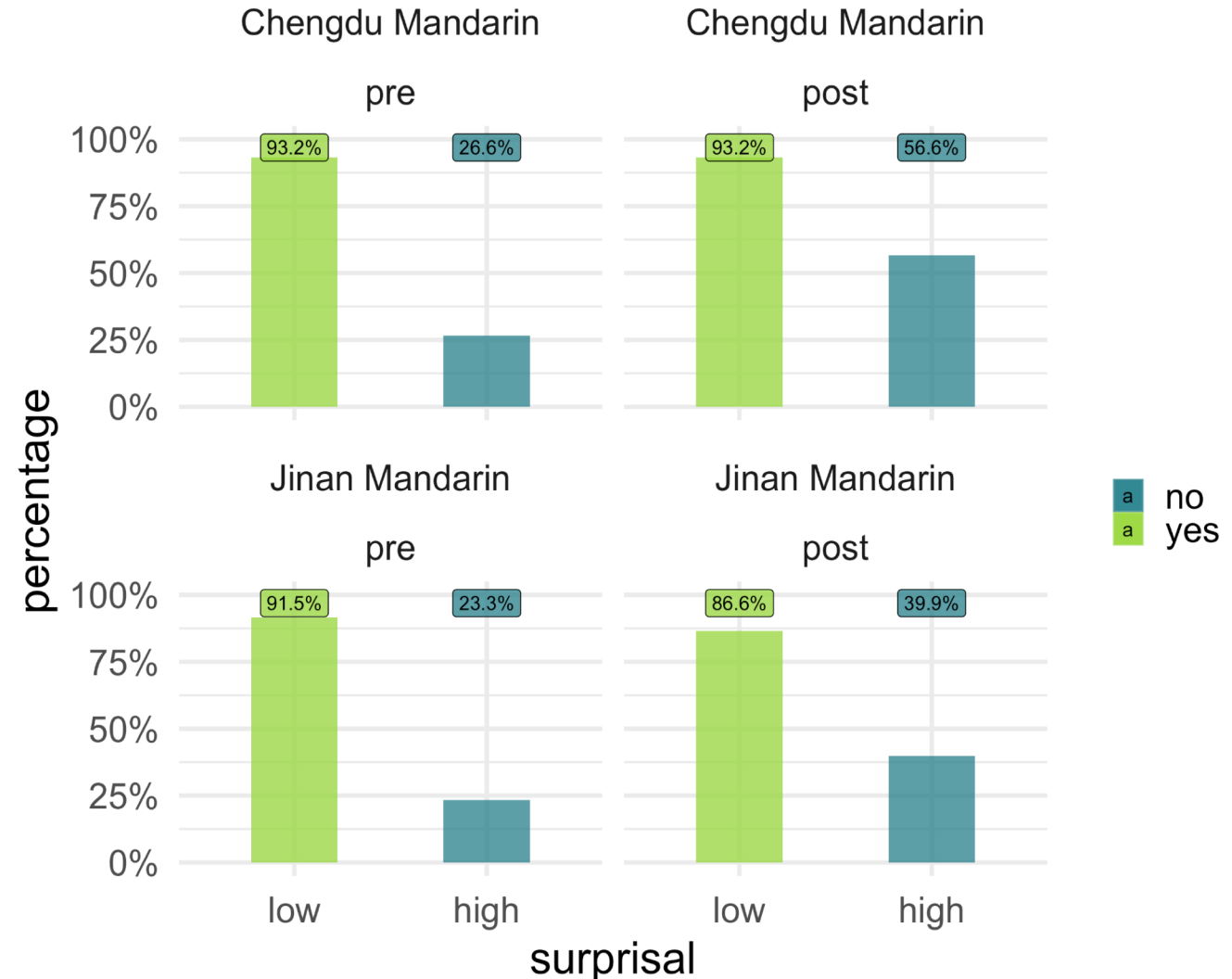
If participants also adapt to novel tone–contour mappings (bottom-up processing):

	accuracy	RT
<i>surprisal</i>	high for low surprisal sentences; low for high surprisal sentences	contrast between high and low surprisal, but perhaps only after dialect exposure
<i>exposure</i>	improve after exposure	faster processing
<i>dialect</i>	higher for Chengdu sentences	faster responses to Chengdu sentences

Accuracy

Credible main effect of *Surprisal*:
low surprisal >> high surprisal

- High accuracy around 90% in low-surprisal conditions as expected
 - The participants understood the task
- Much lower accuracy in high-surprisal conditions
 - Biased to “yes” responses: a major bottom-up *failure* in identifying tone mismatch in high-surprisal conditions
 - top-down influence overriding bottom-up tone acoustics!**



Accuracy

Credible main effect of *Dialect*:

Chengdu Mandarin >> Jinan Mandarin

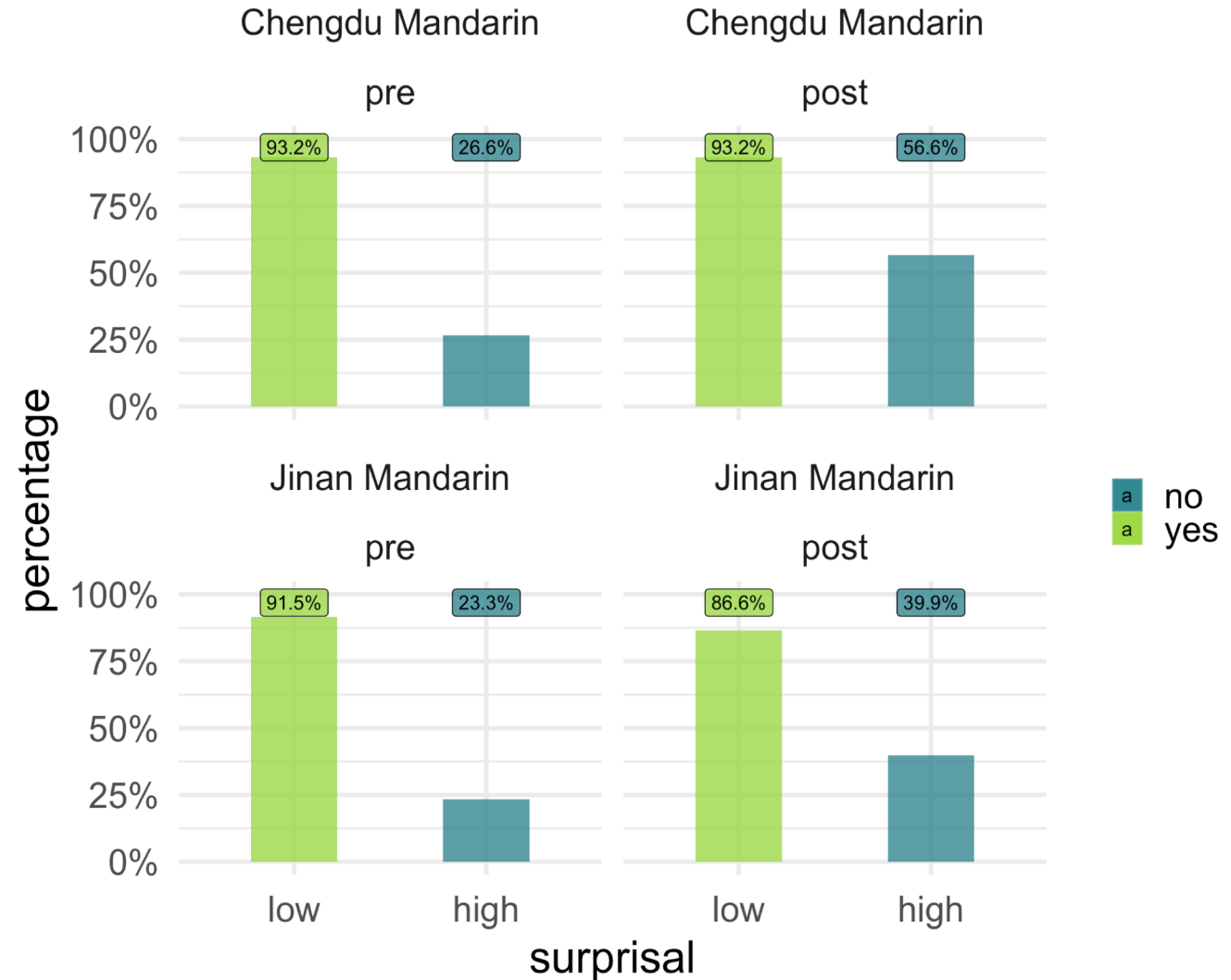
- possibly driven by improvement after exposure

Credible interaction of *exposure* ~ *dialect*

- Greater improvement after exposure for Chengdu than Jinan

No credible main effects of *exposure, trial*

- No** overall improvement over the course of experiment



Response time

Reliable main effects for *surprisal* and **no** reliable effects of *dialect*, *exposure*, *trial*

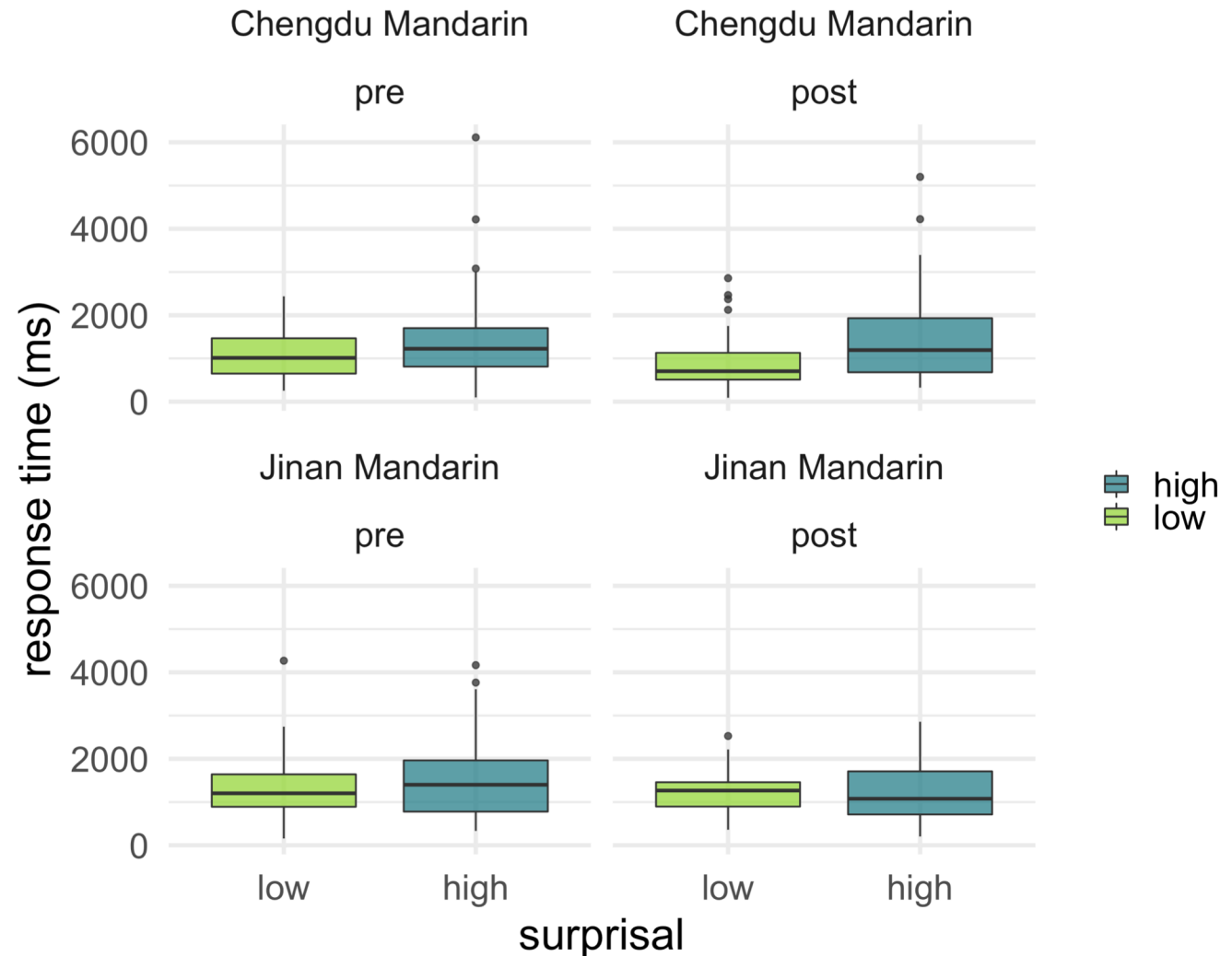
- Reliable slowdown for high-surprisal sentences consistent for **all** dialect and exposure conditions

---Bottom-up processing is present!

- No main effect of exposure and trial indicates listeners' **equal sensitivity to the surprisal tones** before and after exposure, and in both dialects over the course of experiment

----Attention to the tone surprisal maybe as early as the experiment commenced

---Rapid adaptation to unfamiliar tone systems



Discussion

Accuracy: an overriding effect of top-down information in determining sentence meaning (ultimate bias towards plausible judgment)

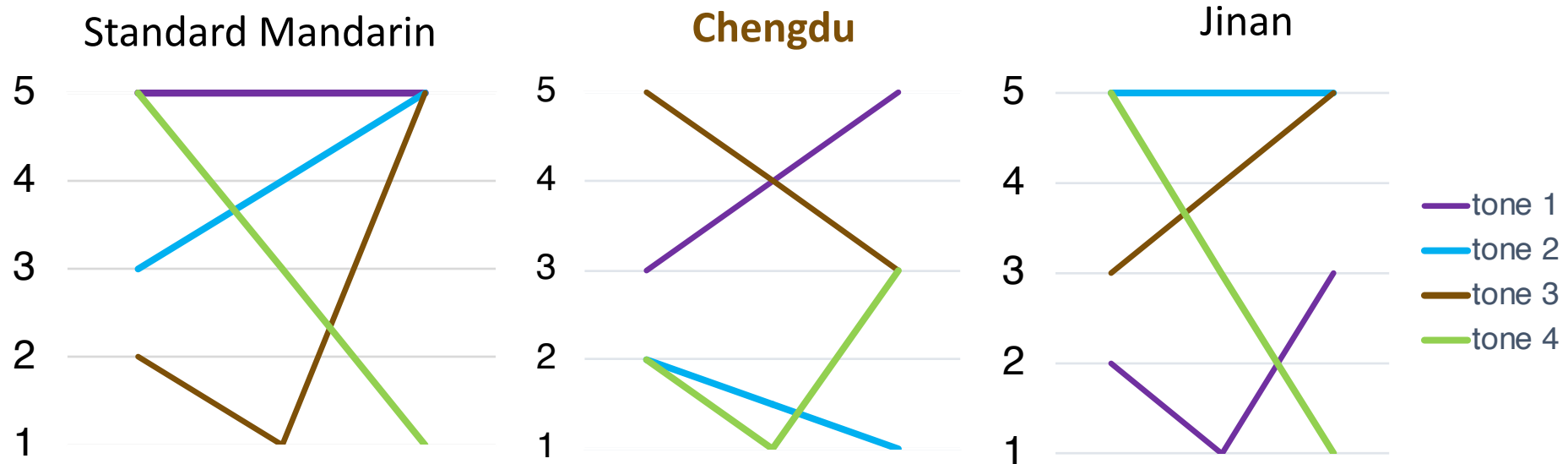
Response times: differences in between high- and low-surprisal indicated integration of bottom-up information

- One explanation: listeners are constructing *impoverished tone representations* during online processing (bottom-up)
- But, the updated tone systems are not reliable enough and thus top-down information overrides the output of tone-level processing
- Rapid adaptation to unfamiliar tone systems: exposure , trial order and relevant interactions not reliable in either accuracy and response time models

Discussion

Easier adaptation to Chengdu relative to Jinan after the exposure

- greater dissimilarity to the native speech (Standard Mandarin in our study) leads to easier discrimination (So & Best, 2011, 2014; Reid et al., 2015)



Future directions

Current study could be extended:

- To experiment on more Mandarin dialects to test the hypotheses
- To investigate whether certain tone categories are easier to adapt to the unfamiliar tone systems

Thank you!
