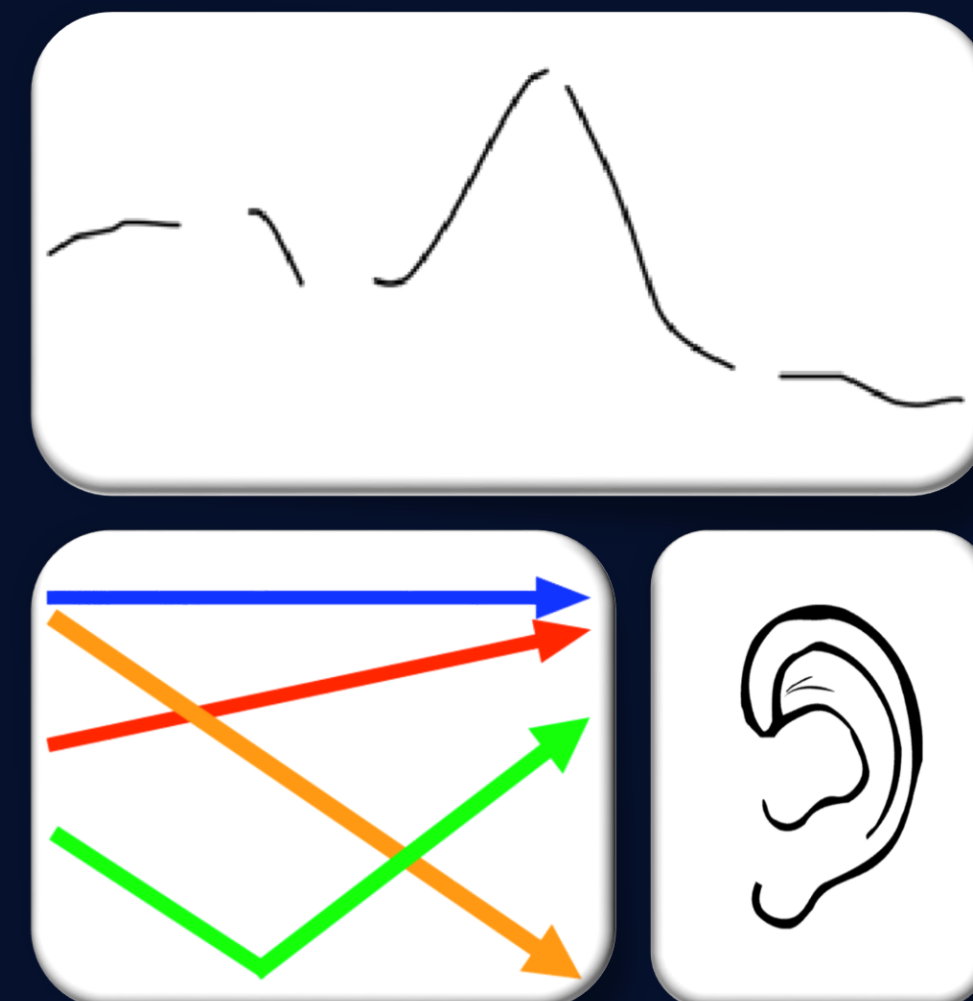


Tones and Tunes in Tianjin Mandarin: Production and Perception

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Introduction

- Intonational tunes are intrinsically linked with pitch modulation so a language with lexical tones, is bound to have a complex interaction.
- Ways of asking a yes-no question vary:
 - High or Rising:** H*+LH% (BrE) / H* + H- H% (AmE) (Pierrehumbert, 1980) ; %H%/L + H*L/L*H/L* +H% (Gussenhoven, 2005); etc.
 - Rise-fall:** L*+HL% (Bengali: Hayes & Lahiri, 1991); L*L+H-L% (Greek: Arvaniti et al., 2006); etc.
 - Fall/ Low:** !H*+L% / H+L*+L% (Puerto Rican Spanish: Armstrong, 2012; similarly in Majorcan Catalan: Venrell et al., 2012); L+H*/H+L* + L-L% (Bari Italian: Grice&Savino,2003); etc.
- Other ways:** in African languages – various ways of making question tunes (such as vowel lengthening, breathy termination, cancellation/reduction of downdrift, register expansion, etc.) (Rialland, 2007).

Research Questions

- How do tonal speakers ask an intonational yes-no question?
- Can tonal speakers perceive intonational yes-no questions equally well for all tones? What cues do they use for identification?

Background

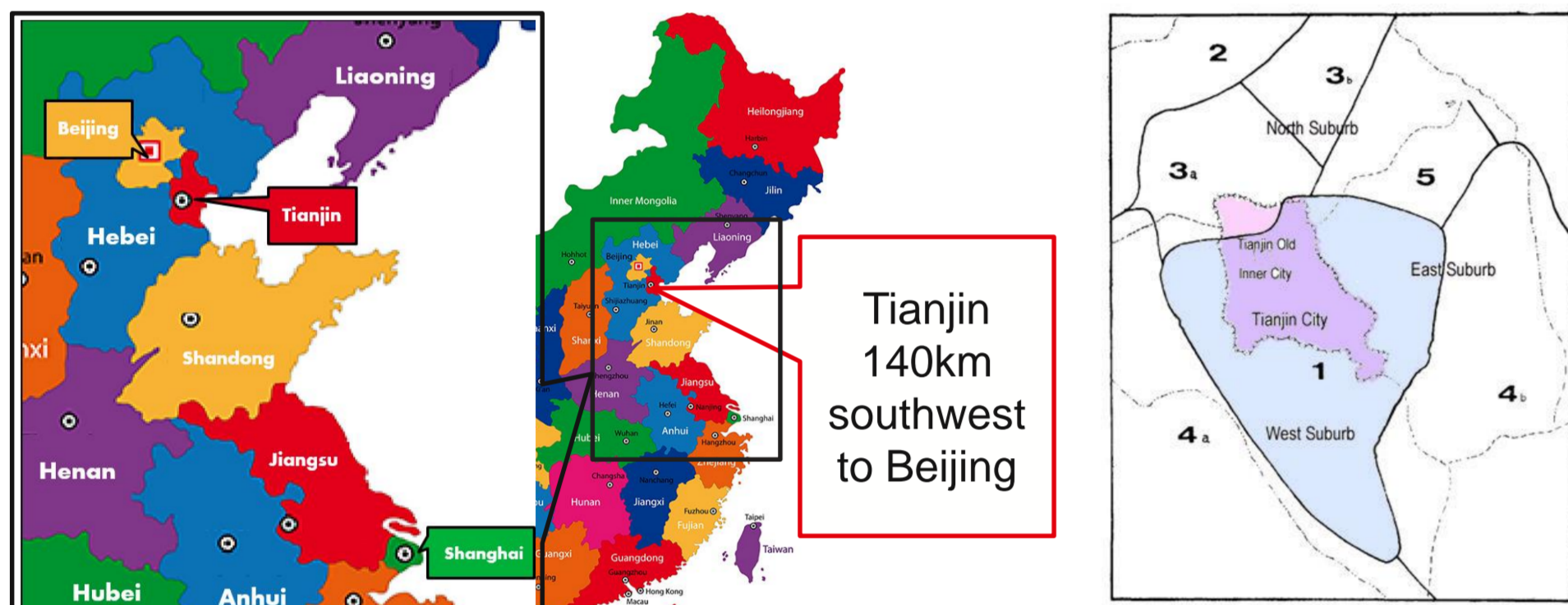


Figure 1: Map of part of China

Figure 2: Tianjin dialect island (Li & Han, 1991)

Tianjin Mandarin is a dialect island. It is very different from the dialects of the surrounding areas. However, it is very similar to some Northern Anhui dialects. The triangular area in Figure 2 is where Tianjin Mandarin is spoken.

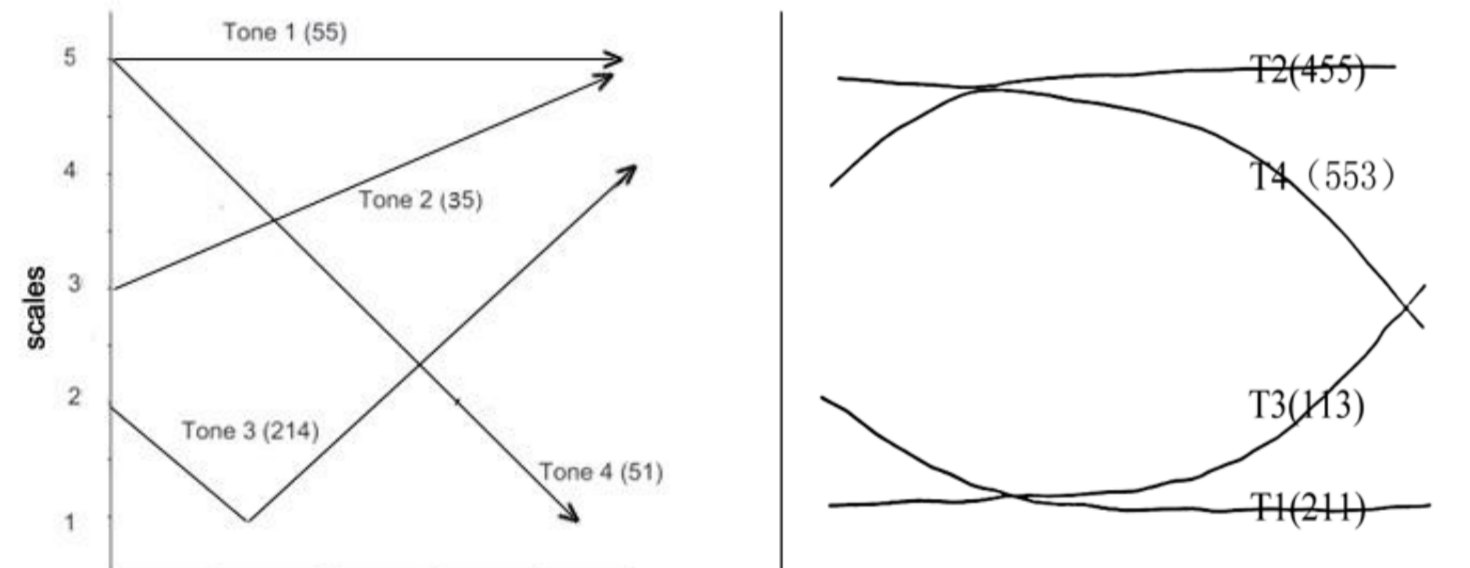


Figure 3: Stylized lexical tones of Standard Mandarin (left); Tianjin Mandarin (right) (Shi, 2009)

- Four tones:
T1: L(211), T2: H(455), T3: LH(113), T4: HL(455)
- Tianjin Mandarin has corresponding word tones with Standard Mandarin in most of the cases, but the tone values are very different.
- Tianjin Mandarin tones have two sets of symmetrical tones (L vs H; LH vs HL). L and H are not level tones – L (211) falls gradually and H (455) rises gradually.

Production Study

Participants: 6 native Tianjin speakers (3 male, 3 female)

Task: Lab recording

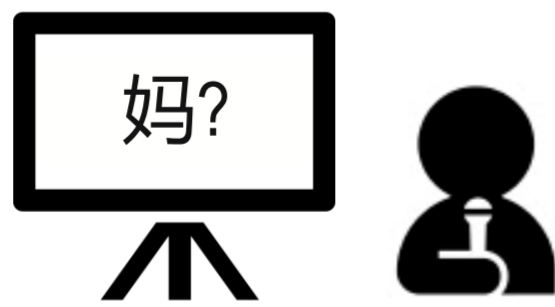
Ask a question when see a question mark

Make a statement when see a Chinese full stop

Materials:

Monosyllabic words: [ma] / [mau] / [mi] * 4 tones (L, H, LH, HL) * 2 types (Statement, Question) * 3 repetitions

Syllables	T1: L Tone	T2: H Tone	T3: LH Tone	T4: HL Tone
[ma]	妈 'mother'	麻 'hemp'	马 'horse'	骂 'scold'
[mau]	猫 'cat'	毛 'fur'	铆 'rivet'	帽 'hat'
[mi]	咪 'meow'	迷 'riddle'	米 'rice'	蜜 'honey'



Results (Production)

- There is no visible difference between the contours of statements and yes-no questions. Yet statistical analyses suggest something more:

Register (Mean Pitch)

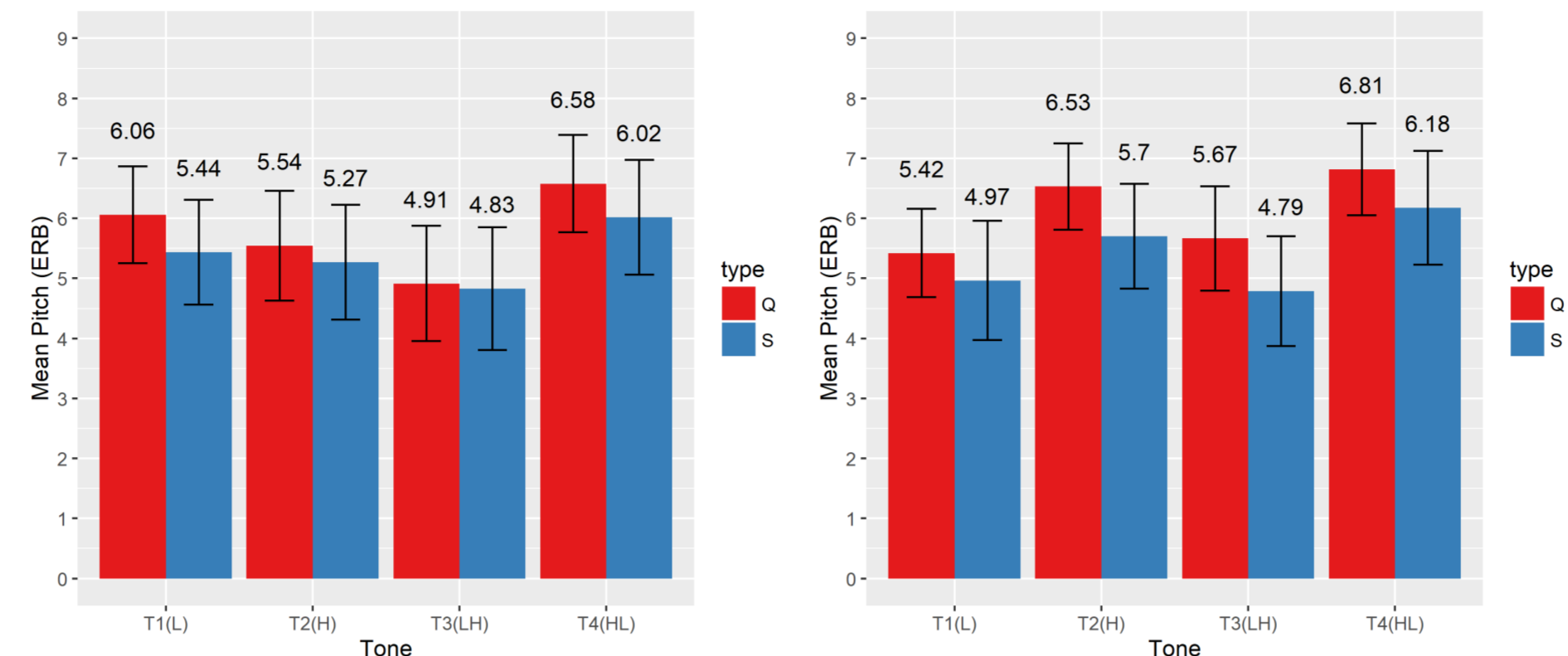


Figure 4: Mean pitch of syllable onsets (left) & Mean pitch of syllable rhymes (right) (bar: \pm standard deviation)

- The register of Questions are significantly higher than Statements across all tones.

F0 Range

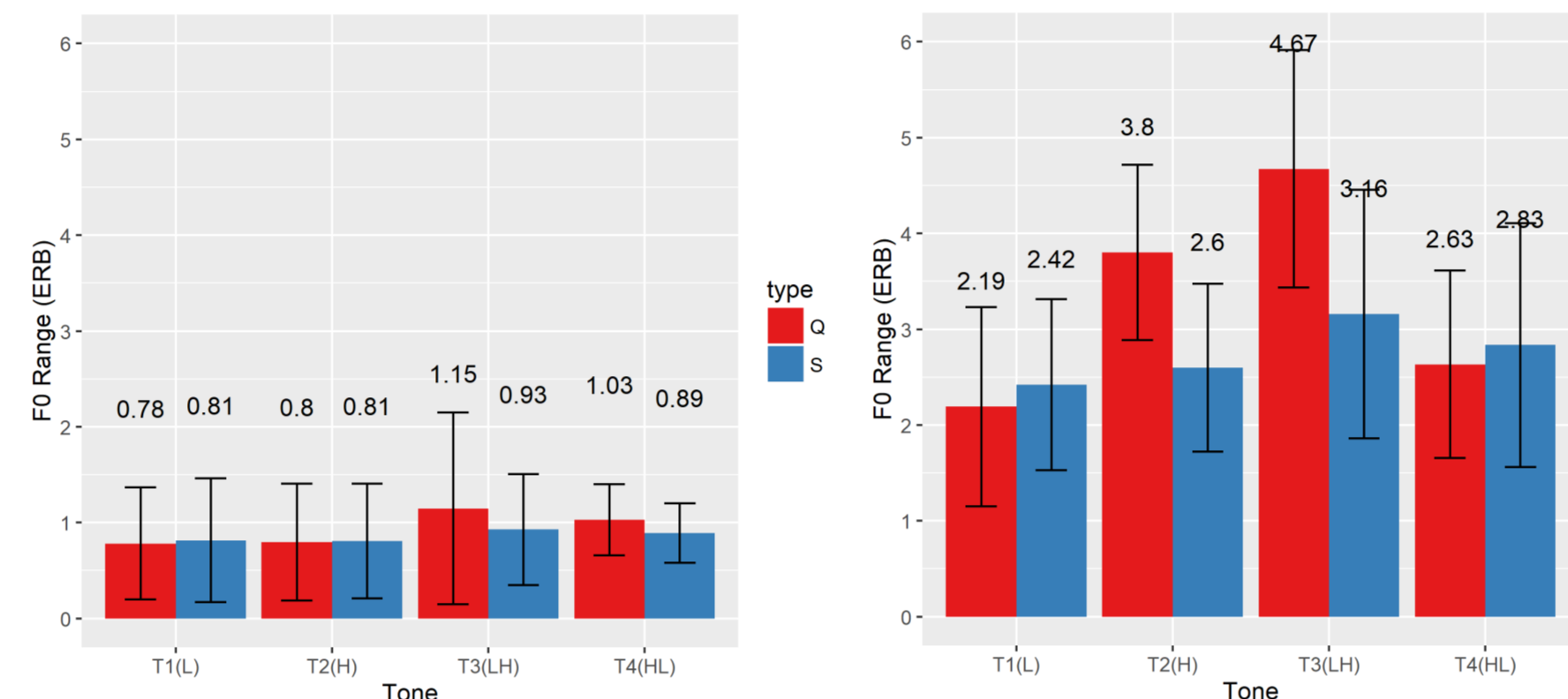


Figure 5: F0 range of syllable onsets (left) & F0 range of syllable rhymes (right) (bar: \pm standard deviation)

- F0 range of onsets: not a significant factor in determining tune type.
- F0 range of rhymes differ in terms of lexical tone types:
Falling tones (L, HL): smaller question range than statement range;
Rising tones (H, LH): bigger question range than statement range.
The tone*type interaction is statistically significant.

Discussion (Production)

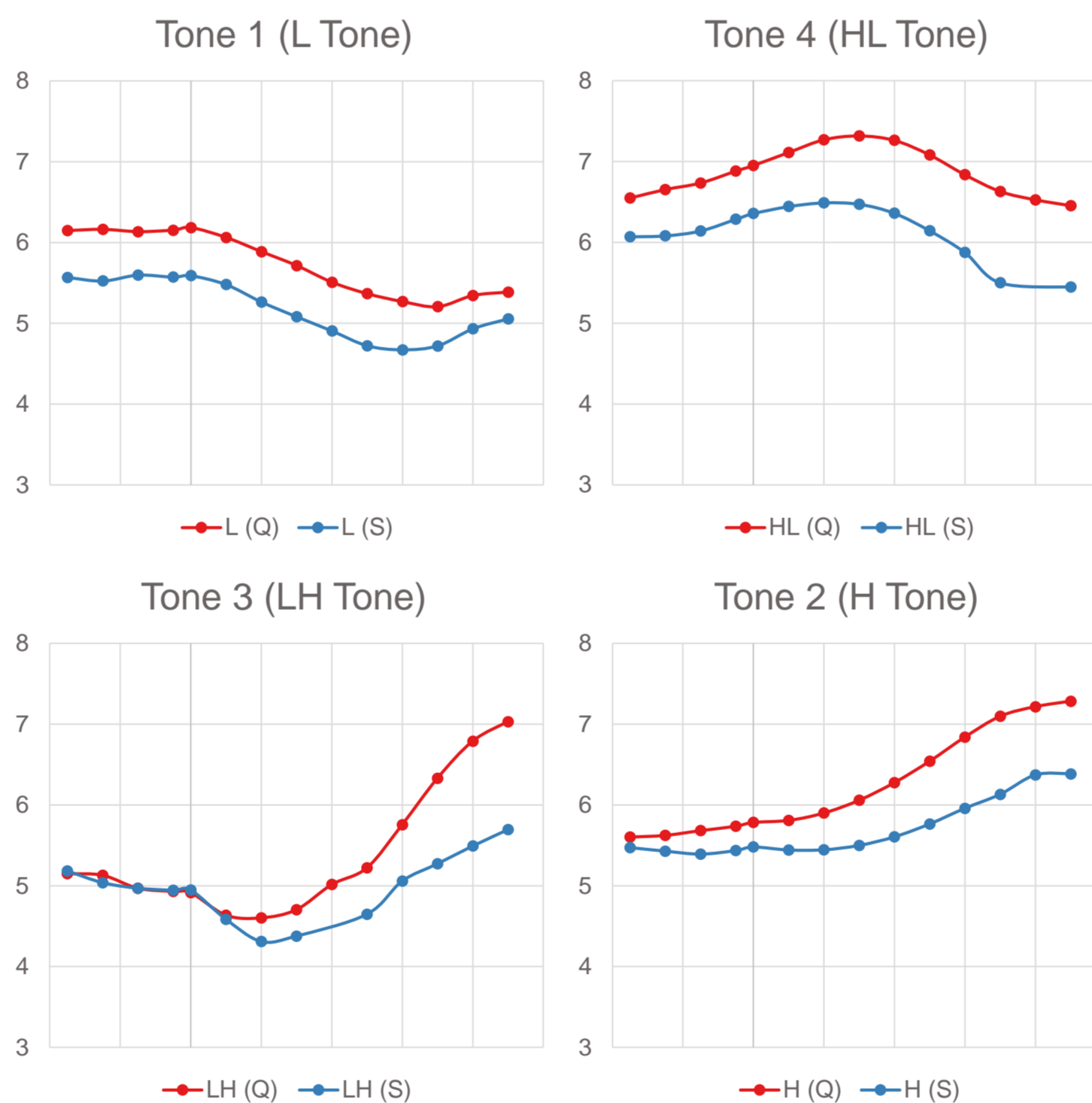


Figure 6: Normalised lines of Intonational yes-no questions (red) and statements (blue) of all four tones (thick vertical line separates onsets and rhymes)

- Since the falling tones fall less and the rising tones rise more, I propose that there is a floating boundary tone (H%) at the end of intonational yes-no questions.
- The floating (H%) boundary tone deters the L tones from falling, and facilitates the H tones with rising.
- It has no phonetic realization itself, but has phonetic effect in triggering a higher last tone.
- In summary, differences between a statement and an intonational yes-no question are:
 - Q has higher register
 - Floating H% boundary tone in Q

Conclusions (Production)

Tianjin Mandarin Tunes:

- Statement:
Lexical tone sequences
- Intonational yes-no question:
Higher register + Floating H%

Perception Experiment

Participants: 28 native Tianjin speakers (15 male, 13 female)

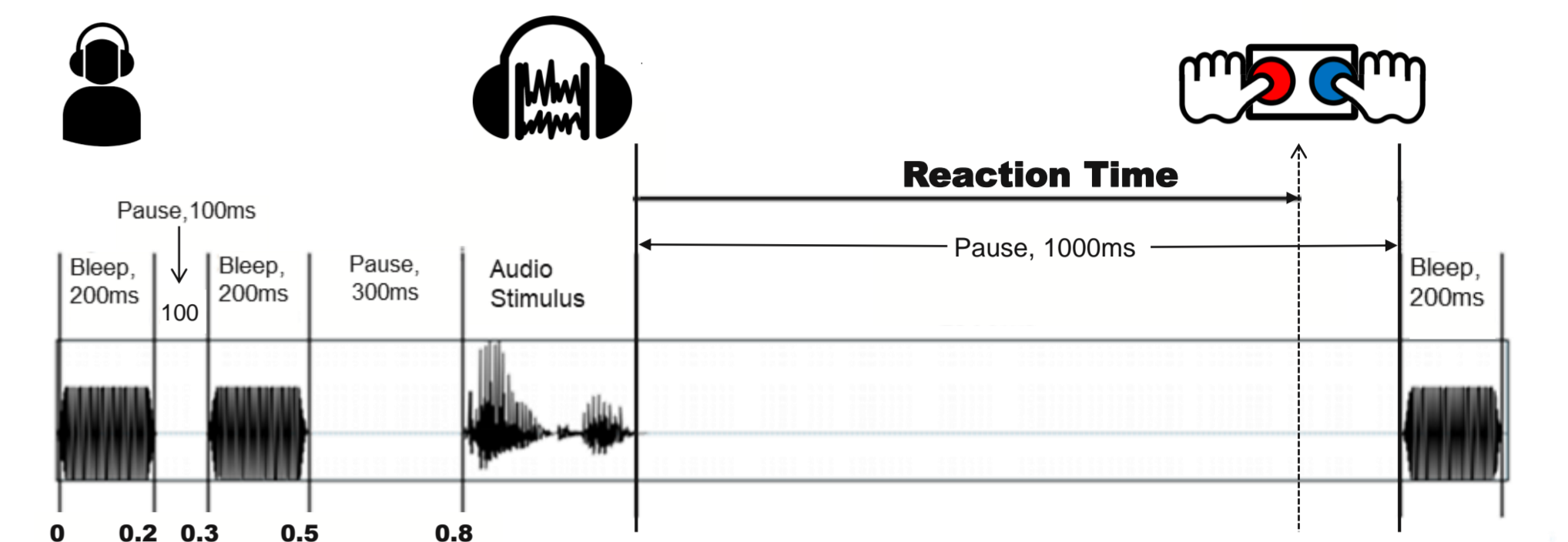
Task: to identify whether the audio stimulus is a question or statement

Stimuli: production data from a female speaker and a male speaker

(a) monosyllabic words in isolation, e.g. /ma/(T1)

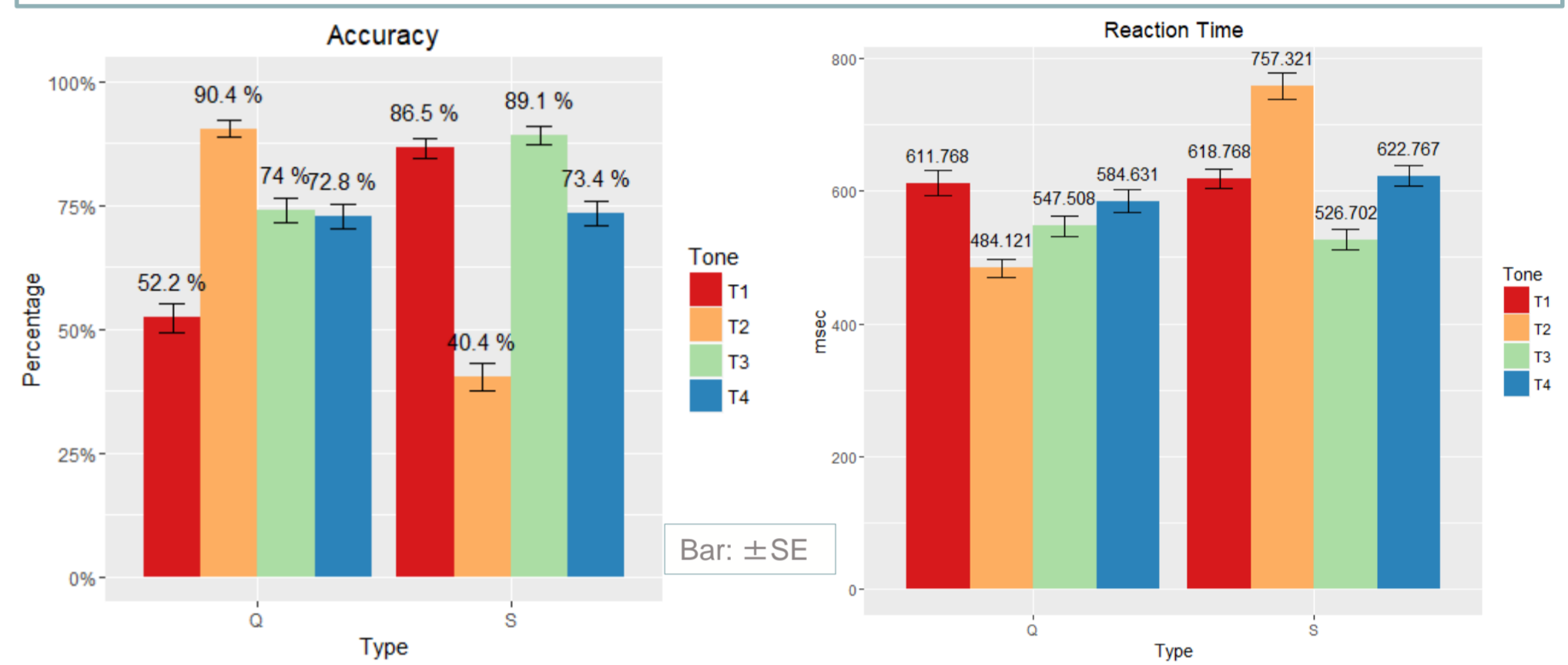
(b) monosyllabic sentence prominence, e.g. /ma/ in carrier sentence 'ta xie ma zi'

Procedure:



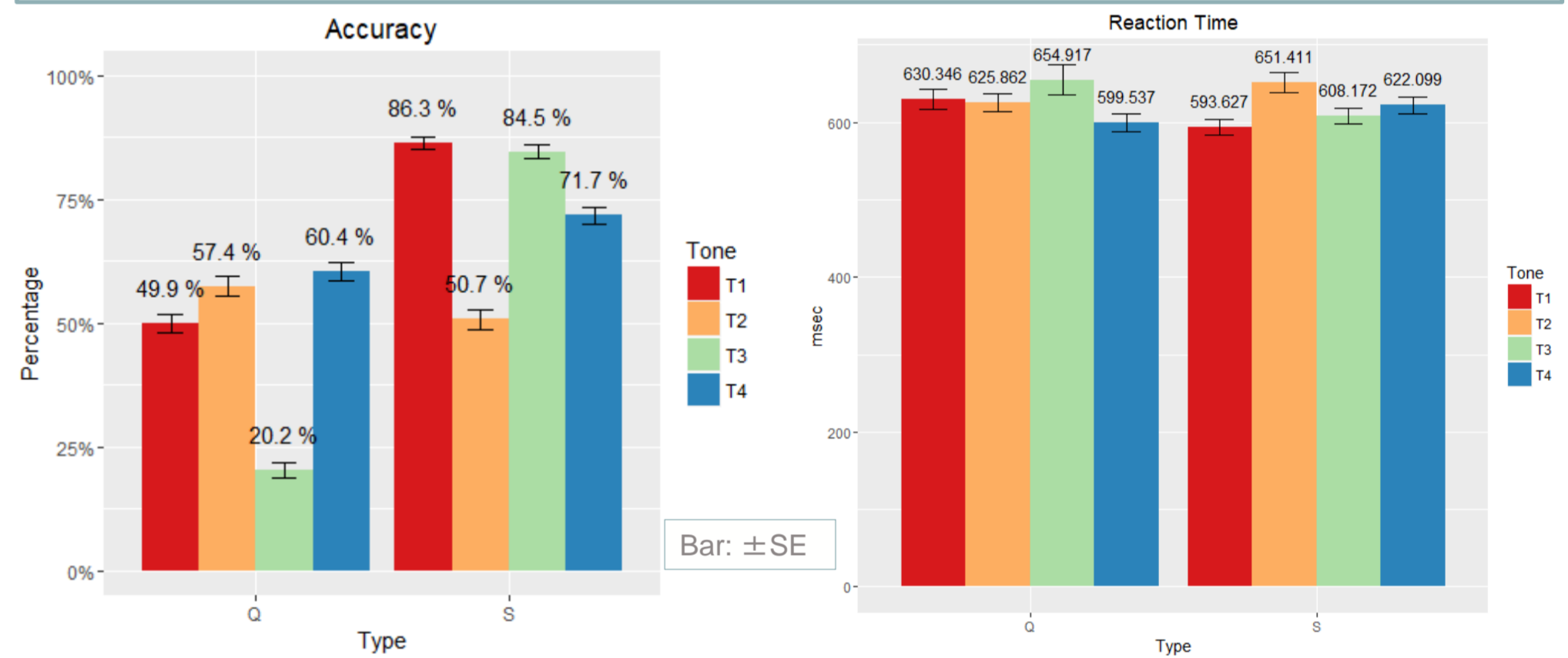
Results (Perception)

Condition (a): Monosyllabic words in isolation



- Accuracy-Q: T2 > T3 \approx T4 > T1
- Accuracy-S: T3 \approx T1 > T4 > T2
- The more accurate, the shorter RTs are.

Condition (b): Monosyllabic sentence prominence



- Accuracy-Q: T4 \approx T2 > T1 > T3
- Accuracy-S: T1 \approx T3 > T4 > T2
- RTs are generally long.
- May have hit a ceiling effect due to high difficulty of the task

Discussion (Perception)

Condition (a): Monosyllabic word in isolation

- When identifying YNQs, the ending H tone is the most crucial cue; then, initial L tone further interferes with the identification.
- When identifying Statements, the initial L is the most crucial cue; then, the ending H interferes with the identification.

Condition (b): Monosyllabic sentence prominence

- Due to the influence from the tones of the neighbouring syllables, the focused tone goes through assimilation or dissimilation, which makes the syllable difficult to identify. This causes RT to be extremely long regardless of tones or types.
- The accuracy of the YNQs is all around chance level, which indicates that missing the floating H% tone makes the task extremely difficult.
- The accuracy of statements is higher in general. However, T2 falls to chance level again, which indicates that people regard H% ending as the most important cue for identifying Qs. A H ending is extremely confusing for statement identification.

Conclusions (Perception)

- The pitch height of the start and the end of a tone are both used in question and statement identification, in different orders and with different effects.
- Floating H% is crucial in question identification; sentence prominence alone cannot effectively indicate a question.

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