Towards a Model of Tonal Processing During Mandarin Chinese Spoken Word Recognition

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Spoken word recognition

- Using incoming auditory information to identify a word
- Guided by both phonology and semantics
- Integration of features across levels
Research questions

1. At what level should tone enter models of spoken word recognition?

2. Does tone warrant its own distinct processing structures?

3. What would the representational nature of these structures be?
Timing of Access to Tonal Versus Phonemic Information
Tonal Competitor

Rime Competitor

Target

(Chuang2)

(Chuang1)

(Chuan2)
The graph shows the proportion of looks to the target over time since target onset (ms).

- **Proportion of looks to target**
- **Time since target onset (ms)**

The data is represented by a line graph with markers. The x-axis represents time in milliseconds (200 to 1000 ms), and the y-axis represents the proportion of looks to the target (0.1 to 0.6).

The graph includes a line labeled **Control**, indicating a trend in the data over time.

Malins & Joanisse (2010)
Malins & Joanisse (2010)

Proportion of looks to target

Time since target onset (ms)

Control
Rime competitor present
Graph showing the proportion of looks to the target over time since target onset. The x-axis represents time since target onset in milliseconds (200 to 1000 ms), and the y-axis represents the proportion of looks to the target (0.1 to 0.6).

- **Control** line (black with square markers)
- **Rime competitor present** line (red with triangle markers)
- **Tonal competitor present** line (blue with circle markers)

The graph is sourced from Malins & Joanisse (2010).
Event Related Potentials (ERPs)
Did the sound match the picture?
Malins & Joanisse (in press)

Fz

N400

- 4

200

500

μV

ms

Match

Rime mismatch

Malins & Joanisse (in press)
Conclusion #1

- Tones and phonemes are accessed at the same time when recognizing Mandarin spoken words.
- This doesn’t rule out a difference in mechanism for processing these two types of information.
Cognitive Processes Underlying Tonal Versus Phonemic Processing
Tone Minus Rime Mismatches in the N400 Window
Convergent Evidence

- Functional magnetic resonance imaging (fMRI)
- Patients with brain lesions
- Studies of word production
Conclusion #2

- *Separate* cognitive processes underlie tonal versus phonemic processing
Developing a Model of Spoken Word Recognition That Includes Tone
Syllables

Phonemes

/\a/\n
Phonemic feature detectors

Tonemes

T4

Tonal feature detectors

Ye & Connine (1999)
Next Steps

- Simulate model
  - Currently simulating eyetracking and ERP studies using jTRACE (Strauss, Harris, & Magnuson, 2007)

- Refine model using experimental data
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Representing Tones in the Brain
Conclusion #3

- Tones and phonemes are represented *in a similar fashion*
  - Perceived categorically
  - Distinctive features for tones