Exploring performance-based predictors of phonological judgments in Mandarin

Abstract

- We collected native-speaker judgments of Mandarin syllables, looking for effects of:
  - Syllable properties (lexical status, frequency, phonotactics, neighborhoods)
  - Performance factors (modality, judgment speed, relations with nonjudgment tasks)
- Results showed influence of all of these, especially lexical status

Modeling judgments

- All evidence for competence comes from performance, but little is known about how the judgment making process works
- The literature on phonological judgments has focused on phonotactic and neighborhood influences (e.g., Coleman & Pierrehumbert, 1997; Bailey & Hahn, 2001)
- Work on typologically different languages and on other performance factors is lacking

Mandarin syllables

- Mandarin syllable structure is simpler and thus there are fewer lexical syllables than in English (under 1400, including tone)
  - Practically, this means that a larger proportion of both lexical and “logically possible” syllables can be tested than in English
  - Theoretically, this means that neighborhoods are “denser”: all syllables will have at least one neighbor, which may affect judgment-making

Mandarin syllable judgments

- Anecdotal evidence suggests that Mandarin speakers may be less willing to accept nonlexical syllables than English speakers
- Nevertheless, Wang (1998) and Myers (2002) found that Mandarin speakers do judge (apparent) systematic gaps as worse than (apparent) accidental gaps
Collecting the data

- So far we have collected judgments from 120 Mandarin speakers across a variety of judgment conditions on a 6-point scale:
  1 = “most unlike Mandarin”
  6 = “most like Mandarin”
- We’ve also conducted some nonjudgment tasks that presumably tap into components of the judgment process

Choosing the syllables

- 235 lexical (“words”), 149 nonlexical (Li, Li, & Tseng, 1997; Tsai, 2000)

Our results for Wang’s categories

- Why? Maybe because TAGs aren’t so accidental.

Three influences on judgments

- Frequency: relevant for real words only
- Phonotactics: operationalized as phoneme transition probabilities (PTP)
  - Specifically, we used the geometric mean of PTP with onset-toneme “transition” probability
- Neighborhood density: operationalized as number of nearest neighbors (NNB)
  - For some analyses we also used Bailey & Hahn’s Generalized Neighborhood Model (GNM) with coefficients fit to our data

Frequency affects word judgments

Phonotactics affect words (even with frequency factored out)
Neighborhoods affect words (even with frequency factored out)

\[ R^2 = 0.435 \]
\[ p < .0001 \]

\[ \text{NNB} \ p < .01 \]

(LogFreq + PTP + GNM: \( R^2 = 0.483, p < .0001 \))

Neighborhoods don’t affect nonwords

\[ R^2 = 0.002 \]
\[ p > .6 \]

Modality effects

• Bailey & Hahn (2001) found no important differences in judgments made on auditory vs. written items in English
• Does modality affect how well phonotactics and neighborhoods predict Mandarin judgments?
  - Written forms in Taiwan’s phonetic system: e.g. Pinyin “man” vs. “mang” is ㄇㄢ vs. ㄇㄤ

Modality doesn’t change neighborhood effects

Yes, phonotactics predict visual nonword judgments!
Effect of speed* on judgments

<table>
<thead>
<tr>
<th>Speed × Lexical status interaction</th>
<th>Immediate</th>
<th>Delay</th>
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<tr>
<td>Words</td>
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*Immediate: within 2 s; delayed: after forced 5 s delay.

Speed doesn’t change phonotactic or neighborhood effects

(Similarly null results for NNB and GNM)

Predicting judgments from tasks

- Finally, we attempted to predict judgments from other measures given by the same people in nonjudgment tasks:
  - Perception: proportion correct in identifying syllables presented in noise (PercPC)
  - Production: speed of reading aloud phonetically presented syllables (ProdRT)
  - Recall: speed of correctly recognizing previously presented syllables (RecallRT)

Word judgment correlations

- Perception accuracy, production speed and recall speed were all correlated with judgments, even when all were included in a multiple regression along with PTP and NNB.

Nonword judgment correlations

- The same was true for nonwords, though the correlation with recall RT was weaker than for words.

Summary

- Our experiments on Mandarin have shown:
  - Phonotactics affect both word and nonword judgments, but neighborhood density only affects word judgments
  - Nonword phonotactic effects on judgments are stronger with written stimuli (?!)
  - Slower judgments improve word scores, without affecting phonotactic or neighborhood influence
  - Both word and nonword judgments correlate with perception, production, and recall measures
References


