Predicting phonological information in L1 & L2: A visual world eye-tracking study

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Comprehenders can sometimes predict a specific word and its sound (e.g., DeLong et al., 2005) ⇒ How?

• Meaning (imagining a situation) → Specific lexical item → Sound

⇒ If phonological prediction is late, it may not occur/ may be delayed when resources are limited (L2 comprehension)?

Time-course of phonological prediction in L1 & L2 comprehenders
Predicting phonological information in L1

“The day was breezy so the boy went outside to fly ... kite

an

N400 effect

L1 participants can predict phonological information

DeLong et al., 2005
Predicting phonological information in L2

“The day was breezy so the boy went outside to fly … kite"

No evidence for L2 phonological prediction

Martin et al., 2013

L1

N400 effect

an

No N400 effect

L2

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Research question 1

Time-course of phonological prediction?

- Evidence for L1 phonological prediction
- ERP studies (word-by-word presentation) - unclear when the phonological prediction occurs
- A visual world experiment can track people’s eye movements continuously
Research question 2

Do L2 comprehenders predict phonological information?

- No evidence for L2 phonological prediction, but L2 cloze probability in Martin et al. was not particularly high (65%)
- Evidence for prediction of specific words in L2 when L2 cloze probability was higher (81%) (Foucart et al., 2014)
- Phonological/orthographic word form prediction depends more on cloze probability compared to semantic prediction (Ito et al., 2016)

⇒ Very high cloze probability may be necessary for L2 comprehenders to predict phonological information
Research question 3

Do L2 comprehenders pre-activate phonological information in L1?

- Evidence for L1 activation when L2 comprehenders hear L2 words (e.g., Mishra & Singh, 2014)
- Does this occur predictively?
Experiment design

Phonological competitor design (based on the design from Rommers et al., 2013)

“In 1969 Neil Armstrong was the first man to set foot on the ...”

(Mean cloze = 72%)
Rommers et al., 2013 Results

Prediction of shape information

Shape competitor
↓
Phonological competitor
Current study: Participants

**L1**: 24 native British-English monolinguals (no knowledge of Japanese)

**L2**: 24 Japanese-English late bilinguals

<table>
<thead>
<tr>
<th>L2 proficiency measures</th>
<th>Mean</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>First exposure to English (years)</td>
<td>10</td>
<td>5 – 15</td>
</tr>
<tr>
<td>Length of exposure to English (years)</td>
<td>13</td>
<td>4 – 20</td>
</tr>
<tr>
<td>Self-rated L2 proficiency (scale 1-10)</td>
<td>7</td>
<td>3 – 10</td>
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<tr>
<td>IELTS (15 participants)</td>
<td>7</td>
<td>6.5 – 8</td>
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</table>
“In order to have a closer look, the dentist asked the man to open his **mouth** a little wider.” (Mean cloze L1 = 98%; L2 = 89%) 16 items
Current study: Predictions

Presented in non-predictive contexts in filler trials to test visual bias independent of sentence contexts.

Phonological prediction
↓
Effects before target word onset
Current study: Procedure

Drift correct

- Picture familiarization before the eye-tracking

In order to have a closer look, the dentist asked the man to open his ...

1000 ms before target word onset

Did the sentence mention anything?

Yes - No
Comprehension Q
Eye-tracking data analyses

Linear mixed-effects model

- Fixation proportion as predicted by Condition (Target vs. Unrelated/English competitor vs. Unrelated/Japanese competitor vs. Unrelated)
  - Fixation proportion – arcsine transformed
  - Random intercept by participant & item
  - For every 50 ms time bin

- Data exclusion
  - 2 items with higher fixation proportions to English competitor pictures when presented with non-predictive sentences (excluded from L1 data only)
  - Incorrectly answered trials: 3 trials (1%) in L2 data

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Results: L1 participants
Results: L2 participants
Results: L2 participants

Positive correlation:

Length of exposure to English

English competitor effect

(arcsine-transformed fixation % difference in 600 – 1000 ms)

$r(22) = .55, p < .01$
Summary

1) Predictive looks to target objects in L1 & L2 participants
   *Both groups of participants made predictions*

2) Predictive looks to English phonological competitors in L1 participants
   *Prediction of phonological information in L1*

3) Looks to English phonological competitors after hearing target words in L2 participants
   *Sensitivity to phonological overlap (priming from mouth to mouse)*
   *but no prediction of phonological information*

4) No Japanese phonological competitor effects
   *No evidence for co-activation of Japanese phonological information*
Discussion

- L1 participants but not L2 participants predicted phonological information
  - Limited prediction in L2 may underlie difficulty in L2 online comprehension
  - The L2 data fit with the proposal that not all levels of prediction are necessary to understand language (Huettig & Mani, 2015)
Discussion

- Why was the phonological competitor effect in L1 very short-lived (150 ms) compared to the shape competitor in Rommers et al. (about 1000 ms)?
  - Semantic vs. Phonological?
  - Prediction by production model (e.g., Pickering & Garrod, 2007, 2013)

- No Japanese competitor effect in L2 participants
  - No Japanese activation?
  - The competitor effect too weak to affect eye movements? (recall the small effect for the English competitor)
Conclusion

L1 comprehenders predict phonological information associated with highly predictable words, but L2 comprehenders don’t.

This work has been submitted for publication as:

“Investigating the time-course of phonological prediction in native and non-native speakers of English: A visual world eye-tracking study”

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