Form Interference Effects During Silent Reading

Iya Khelm, Naoko Witzel, & Jeffrey Witzel

University of Texas at Arlington

What is the role of phonology in sentence comprehension during silent reading?

Although many studies have shown that phonological repetition causes reading comprehension difficulties ([1], [2], [3], [4]), the nature of these processing costs remains unclear.

Purpose of the study:
to shed light on this issue by examining
(i) the time-course of form interference effects,
(ii) the interaction of these effects with syntactic processing difficulty,
(iii) the extent to which these effects relate to phonological or orthographic overlap.

Sentence Types

(1a) **unreduced/reduced RC; O+P+**
The infection (that was) left **by the injection** badly hurt the young child.
(1b) **unreduced/reduced RC; control**
The infection (that was) left **by the medicines** badly hurt the young child.
(2a) **unreduced/reduced RC; O+P-**
The laughter (that was) caused **by the daughter** continued on throughout the party.
(2b) **unreduced/reduced RC; control**
The laughter (that was) caused **by the minister** continued on throughout the party.

Methodology

Experiment 1: Unreduced and reduced RCs with orthographically and phonologically related (O+P+) words (1a) or length/freq. matched controls (1b)
Length: 5-9 letters, *M*=5.85
Freq.: O+P+ → 22.35 Control → 19.70

Experiment 2: Unreduced and reduced RCs with orthographically related but phonologically unrelated (O+P-) words (2a) or length/freq. matched controls (2b)
Length: 5-8 letters, *M*=5.67
Freq.: O+P+ → 33.57 Control → 23.38

Materials: 48 sets of sentences, 60 fillers.

Task: Eye-tracking during single-sentence reading
- Y/N comprehension questions after each item

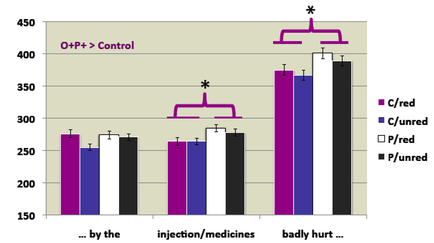
Participants: 64 UTA students, English NSs
- 32 for Experiment 1, 32 for Experiment 2

Results

Experiment 1 (O+P+)

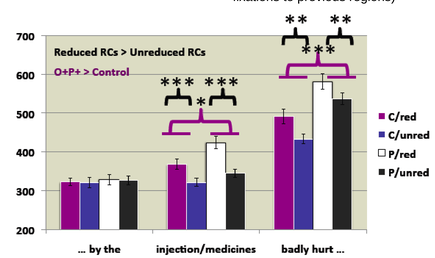
First-pass RT

sum of fixation durations after entering a region until leaving in any direction



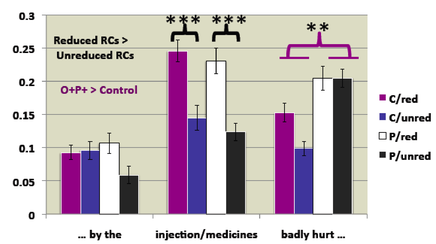
Go-past RT

sum of fixation durations after entering a region until leaving to the right (includes regressive fixations to previous regions)



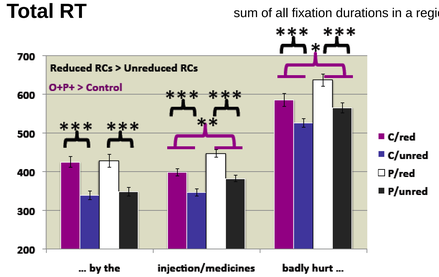
First-pass regression proportion

proportion of trials on which there is a regressive eye movement to a previous region on the initial pass through the sentence.



Total RT

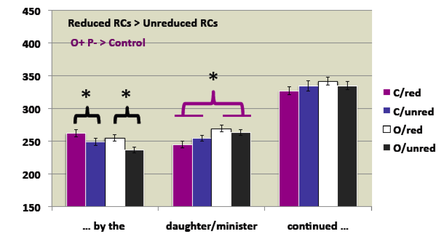
sum of all fixation durations in a region



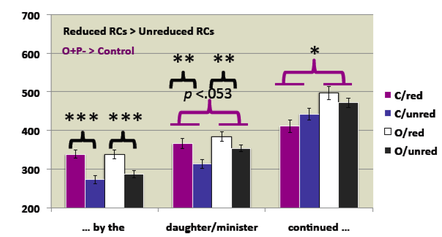
* p <.05 ** p < .01 *** p < .001

Experiment 2 (O+P-)

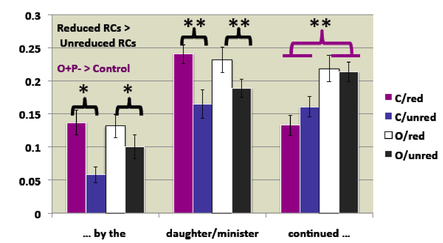
First-pass RT



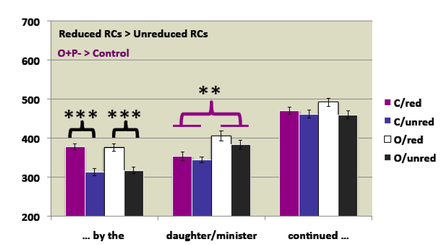
Go-past RT



First-pass regression proportion



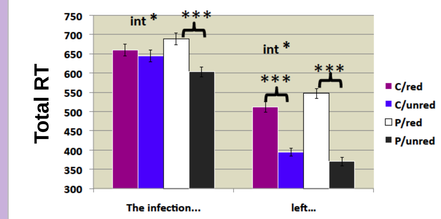
Total RT



* p <.05 ** p < .01 *** p < .001

Results (cont.)

Interaction of form interference and syntactic difficulty?



- only in EX1
- only in late measures

Discussion

- Robust syntactic processing effects in both experiments at the disambiguating *by*-phrase in reduced RC sentences (consistent with previous research [5]).
- Processing difficulty under first-pass and total RT measures in both experiments at the form-related word, i.e.,
  at the O+P+ word in EX1
  at the O+P- word in EX2.
- No interaction of form interference effects with syntactic processing effects in first-pass RT measures.
- In EX1, however, there was an interaction of form overlap and RC type under total RT.

Conclusion:
- Form similarity causes interference even in the early stages of silent reading.
- This interference
  - occurs independently of syntactic processing difficulty.
  - cannot be attributed exclusively to phonological form overlap (i.e., costs for both O+P+ and O+P- words).
- The late interaction of form overlap and syntactic processing effects only for O+P+ sentences suggests that phonological info might play a more important role than orthographic info in comprehension processes related to the retention of sentence representations in working memory.

References

[1] Acheson, D. J., & MacDonald, M. C. (2011). The rhymes that the reader perused confused the meaning: Phonological effects during on-line sentence comprehension. *Journal of Memory and Language* 65, 193–207.
[2] Kennison, S. M., Sieck, J. P., & Briesch, K. A. (2003). Evidence for a late-occurring effect of phoneme repetition during silent reading. *Journal of Psycholinguistic Research* 32(3), 297-312.
[3] McCutchen, D., Bell, L. C., France, I. M., & Perfetti, C. A. (1991). Phoneme specific interference in reading: The tongue-twister effect revisited. *Reading Research Quarterly* 26, 87–103.
[4] Perfetti, C. A., & McCutchen, D. (1982). Speech processing in reading. In N. Lass (ed.), *Speech and Language: Advances in Basic Research and Practice* 7, 237-269. New York: Academic Press Inc.
[5] Ferreira, F., & Clifton, C., Jr. (1986). The independence of syntactic processing. *Journal of Memory and Language* 25, 348-368.