

PROCESSING COMPLEXITY AT THE LEXICAL AND SENTENCE LEVELS: DO THEY INTERACT?

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RESEARCH QUESTION

- Is processing complexity a combination of lexical level and sentence level difficulty?
 - I investigate this question by looking at negative polarity items (NPIs) and word frequency effect.

NEGATIVE POLARITY ITEMS

- NPIs like *any* must be licensed in specific contexts, such as negation, which can be expressed explicitly, as in (1), or arise implicitly from the non-asserted content, as in (2) [1, 2]:
 - She does not have *any* friend.
 - I am surprised that she has *any* friend.
- NPIs are subject to a licensing dependency, as opposed to other linguistic items that do not need to be licensed, such as the indefinites *a* and *an* [3, 4].
 - Compared to an indefinite, an NPI should impose a greater integration cost when it is encountered, because it must be linked to previously processed material.

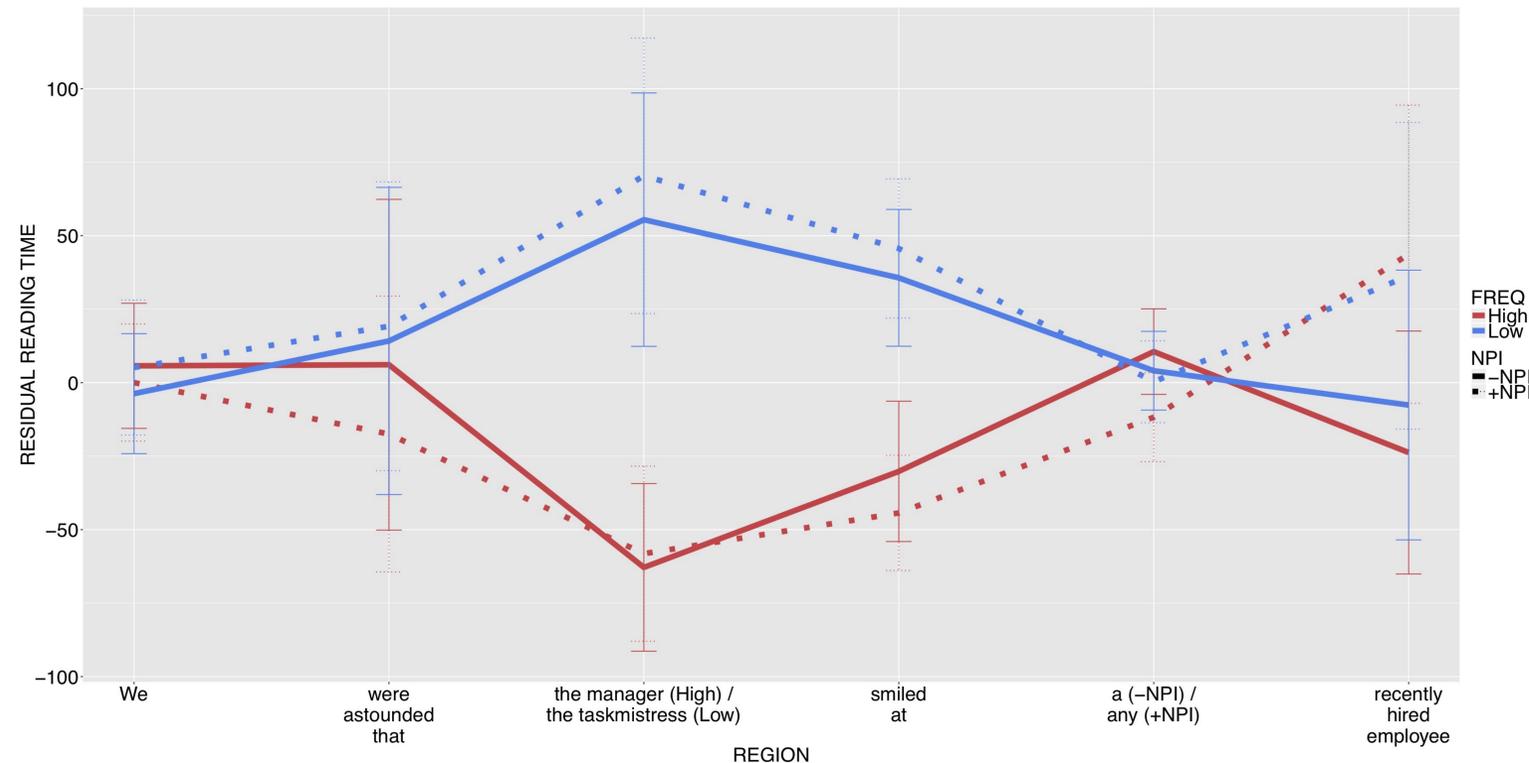
WORD FREQUENCY EFFECT

- It is well known that high frequency words are faster to recognize than low frequency words.
- There are different views about how the effect of word frequency interact with structural processes.
 - While one view suggests that lexical and structural components are processed in the same system [5], the other view advocates for separate processing systems for different levels of a linguistic structure [6].

DESIGN

- Experimental materials consisted of 24 sets of 4 items, which varied in lexical FREQUENCY (high vs. low) and the presence of an NPI (*any* vs. an indefinite), as in (3). All of the items are grammatical.
 - We were astounded that the **manager** smiled at **{a / any}** recently hired employee. [High FREQUENCY; +/- NPI]
 - We were astounded that the **taskmistress** smiled at **{a / any}** recently hired employee. [Low FREQUENCY; +/- NPI]

EXPERIMENT 1: SELF-PACED READING



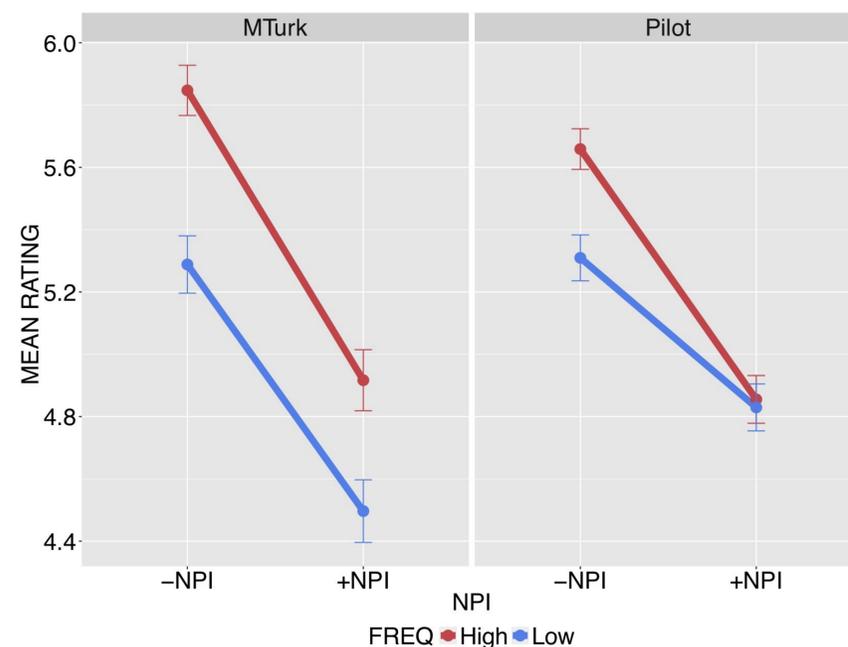
- N = 48 MTurk workers.
- Data were analyzed with a 2 x 2 ANOVA.

RESULTS

- Significant effects of FREQUENCY** were found at the critical region for FREQUENCY ($F_3(1, 47) = 26.10, p < 0.001$), and its immediately following region ($F_4(1, 47) = 40.89, p < 0.001$).
- Significant effects of NPI** were found at the critical region for NPI ($F_5(1, 47) = 4.66, p < 0.05$), and the final region ($F_6(1, 47) = 4.66, p < 0.05$).
 - Both FREQUENCY and NPI impose significant integration costs in processing complexity.
- However, **no significant interactions** ($F < 2$) were found at any region.

EXPERIMENT 2: NATURALNESS JUDGMENT

- MTurk Study:** N = 48 MTurk Workers.
- Pilot Study:** N = 84 UMass Undergrads.
 - Data were analyzed with a 2 x 2 ANOVA.



RESULTS

- MTurk Study:**
 - There is a **significant effect of FREQUENCY** ($F(1, 47) = 28.51, p < 0.001$).
 - There is a **significant effect of NPI** ($F(1, 47) = 76.17, p < 0.001$).
 - However, there is **no significant interaction** ($F < 1$).
- Pilot Study:**
 - There is a **significant effect of FREQUENCY** ($F(1, 83) = 55.51, p < 0.001$).
 - There is a **significant effect of NPI** ($F(1, 83) = 8.33, p < 0.005$).
 - There is a **significant interaction** ($F(1, 83) = 7.022, p < 0.01$).

DISCUSSION

- The presence of an NPI or a low frequency word significantly increases reading times and decreases the naturalness of a sentence.
- Despite significant effects of lexical FREQUENCY and NPI as sources of processing complexity, one type of complexity may obscure the other.
- The results show that there is no interaction and that there are sub-additive effects, which stand in contrast with previous studies showing super-additive effects for multiple sources of comprehension difficulty.
- The findings suggest that there are independent processing systems for the two types of complexity.
- Further work is needed to narrow down the import of sub-additive effects vs. that of no interaction.

REFERENCES: [1] Linebarger, M. (1987). *L&P*. [2] Xiang, M., Grove, J. & Giannakidou, A. (2016). *JNL*. [3] Xiang, M., Dillon, B. & Phillips, C. (2009). *B&L*. [4] Parker, D. & Phillips, C. (2016). *Cognition*. [5] MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. S. (1994). *Psychological Review*. [6] Kretzschmar, F., Schlesewsky, M., & Staub, A. (2015). *JEP*.

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