

The polysemy advantage in lexical access: The role of context availability and orthographic neighborhood variables



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Is the ambiguity advantage in lexical decision limited to polysemous words?

We examined polysemous English words and asked how number of senses (NOS) interacts with:

- Context availability,
- Word frequency, and
- Orthographic neighborhood features

Previous research has demonstrated:

- Lexical decision advantage for polysemous words (Rodd, Gaskell, and Marslen-Wilson, 2002) and words high in context availability (CA) (Tokowicz & Kroll, 2007)
- NOS and CA interact: polysemy advantage only for low context availability words (Tokowicz & Kroll, 2007), and for abstract but not concrete nouns (Jager & Cleland, 2014)
- NOS and word frequency interact: low frequency unambiguous words slowest to be recognized (Pexman et al., 2004)
- Concreteness advantage for words with higher frequency orthographic neighbors (Samson & Pillon, 2004)

Extends previous research by:

- Examining relationship of concreteness and CA
- Examining relationship of word frequency and NOS
- Controlling for orthographic neighborhood features

Predictions

- Interaction of CA and NOS: low CA/high NOS recognized most quickly
- Interaction of word frequency and NOS: low frequency/low NOS slowest

Method

Concreteness and CA norms

Participants

- 141 native English speakers
- Concreteness N= 71, CA N=70
- Rated 497 words from Tokowicz & Kroll (2007) on scale from 1 to 7
- 1 = low concreteness/low CA
- 7 = high concreteness/high CA
- Calculated average values

Method

Stimuli

- 497 English words from Tokowicz & Kroll (2007)
- WordNet (Miller, 1995) used to select for one meaning, but varying NOS (range: 1 to 35)
- 451 words for analysis

497 pseudowords, matched to words on word length, bigram frequency, and number of orthographic neighbors (Balota et al. 2007)

Table 1. Stimulus properties

	Words		Pseudowords	
	Mean	SD	Mean	SD
Length (number of letters)	5.87	1.68	5.79	1.68
Number of senses (NOS) ¹	5.26	3.91	-	-
Orthographic neighborhood frequency ²	0.68	1.36	-	-
Orthographic neighborhood density ²	3.09	4.18	3.27	4.42
Summated bigram frequency ²	1.62	0.89	1.57	0.86
Concreteness	4.55	1.76	-	-
Context availability	5.84	0.61	-	-
Zipf word frequency ³	3.55	0.39	-	-

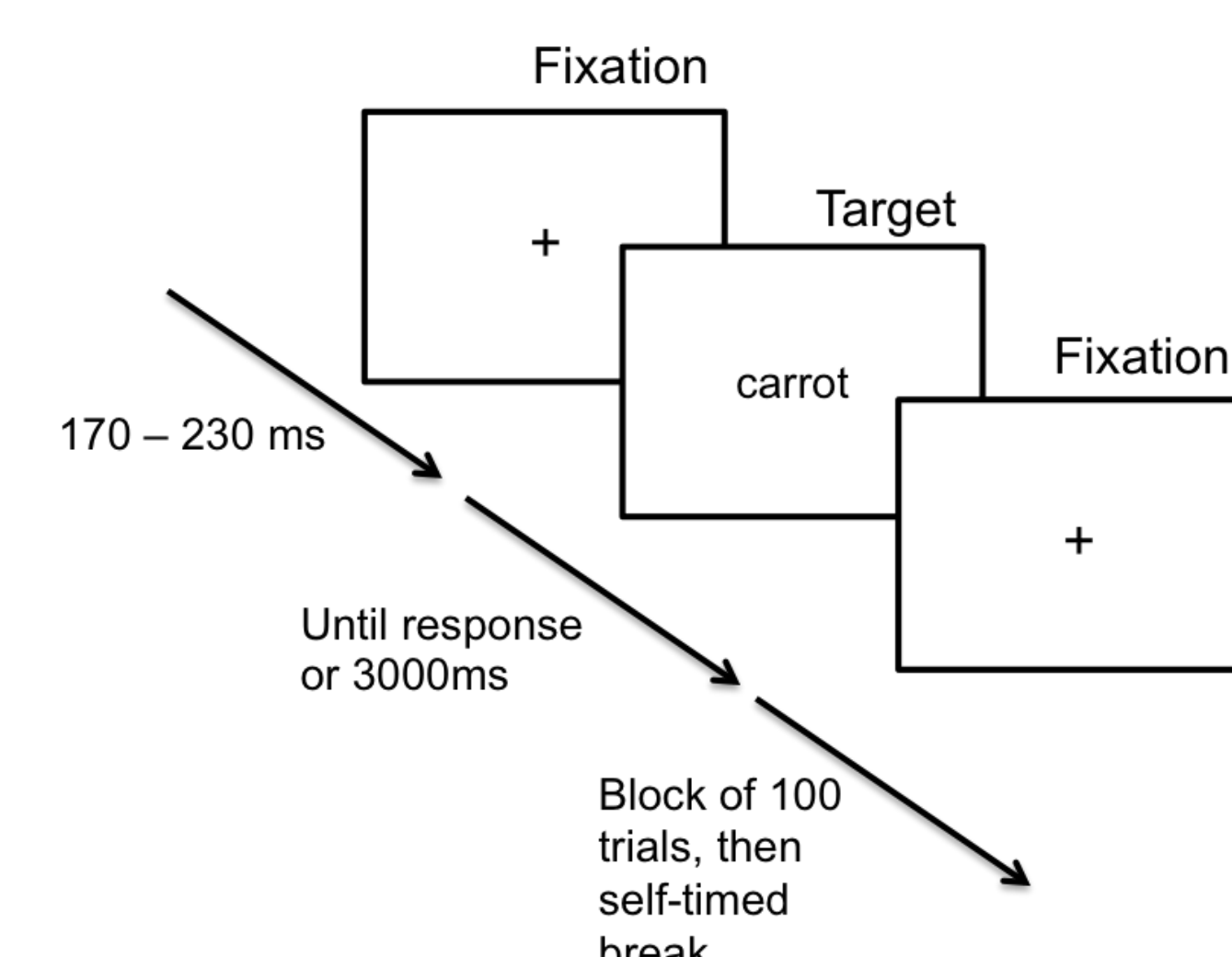
¹From WordNet (Miller, 1995) ²From eLexicon database (Balota et al., 2007) ³Zipf log transformation of SubtlexUS occurrence per million, ranges from 1 (low) to 7 (high), and accounts for very low frequency and unobserved words (van Heuven et al., 2015).

Participants

- Final set of 82 monolingual English speakers
- Recruited from University of Pittsburgh Psychology Subject Pool
- 18 years old or older, right-handed, normal vision

Procedure

- Visual lexical decision task
- Collected response time (RT)
- Language History Questionnaire (Tokowicz, Michael, & Kroll, 2004)



Analyses

- Linear mixed effects modeling used to examine both subject and item variance
- Critical $t > 2.0$ for significance (Baayen, 2008)
- Analyses used R lme4 package (Bates et al., 2014)

Model specifications (**bold** indicates theoretical interest; MEs of critical interactions included):

Model1 <- lmer(wordRT~ prevtrialRT + prevtrialACC + wordlength + bigramfrequency + orthofrequency*concreteness + orthodensity*concreteness + orthofrequency*CA + orthodensity*CA + **NOS*Concreteness** + **NOS*CA** + **NOS*wordfrequency** + Wordfrequency*concreteness + Wordfrequency*CA + (1|Subject) + (1|Item))

Discussion

- Evidence for **polysemy advantage**
- But, polysemy effects **qualified by an interaction with word frequency**
 - No effect of ambiguity for high frequency words
 - Processing disadvantage** for low NOS/low frequency words
 - Similar to Pexman et al. (2004)
 - Semantic feedback hypothesis: low frequency words take longer to identify, perhaps during this time information about meaning becomes active. Words with high NOS have greater activation/feedback. Low frequency/low NOS words don't have as much activation/feedback, and take longer to be recognized
- We hypothesized an interaction of CA and NOS
 - Found significant main effects for CA, concreteness, and NOS
 - No interaction, contrary to hypotheses and previous research
 - Additional control variables and significant interaction of CA x word frequency accounted for variance that past studies reporting CA x NOS interaction did not examine
 - Context availability advantage persists, even when orthographic neighborhood variables controlled

Results

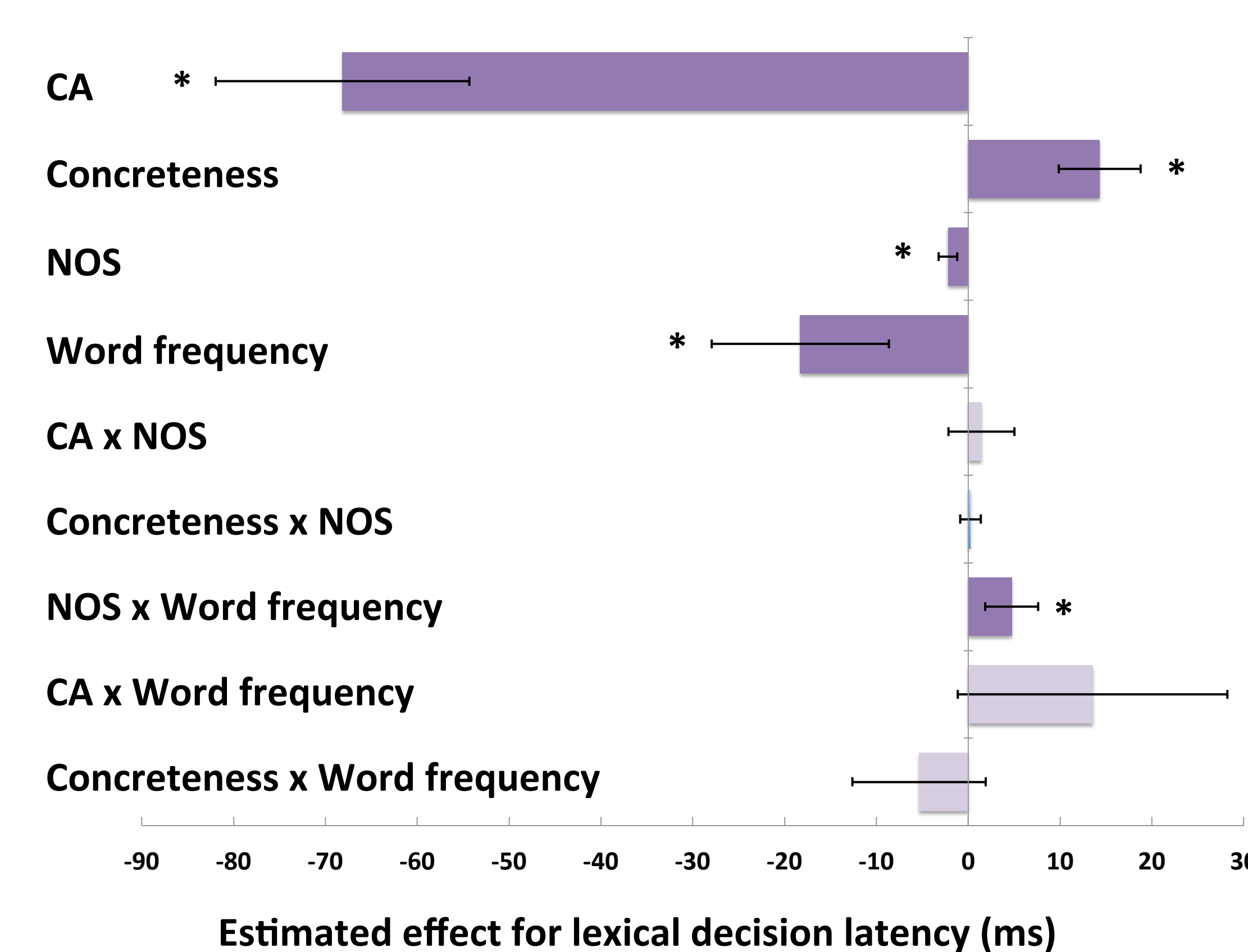


Figure 1. Estimated effect of fixed effects of theoretical interest on lexical decision latency (ms). Bars represent 95% CI; * = significant $t > 2.0$.

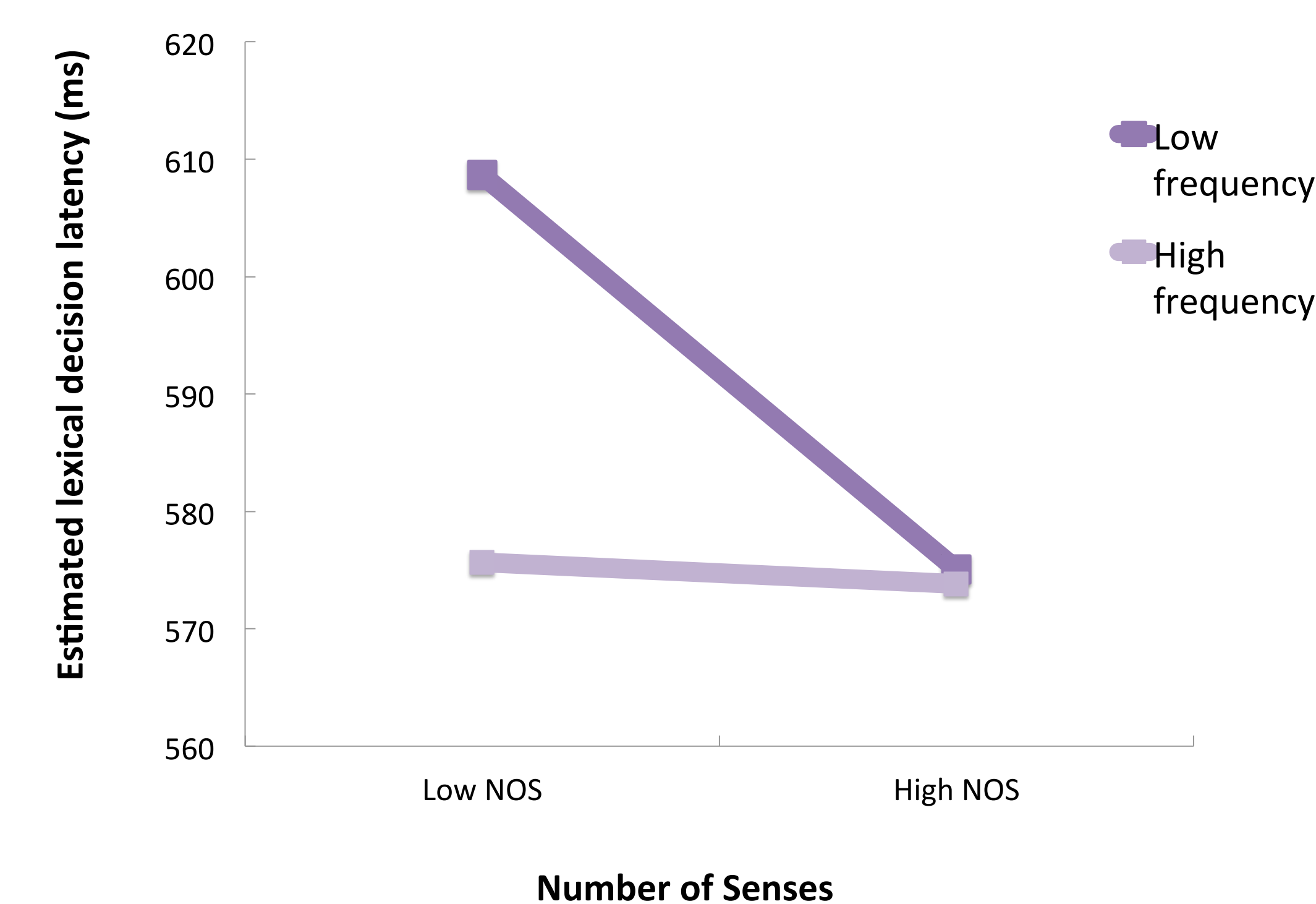


Figure 2. Estimated lexical decision latencies for words high or low in NOS and frequency. Generated from regression equation, where low = -1 SD and high = +1 SD

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