Testing the real-time status of covert movement of *wh*-operators and QPs in English.

Keywords: Semantic processing, English, quantifiers, covert movement, psycholinguistics, semantics

Austin Kraft, Jon Coltz, Dustin A. Chacón (University of Minnesota)

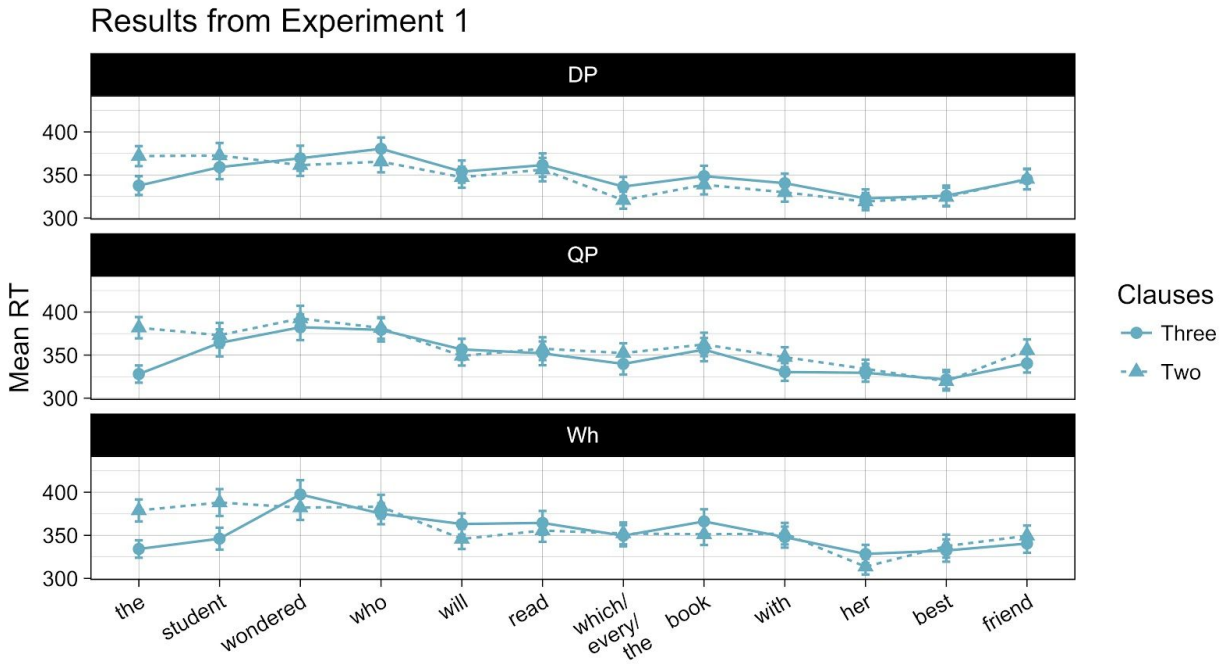
Most grammatical theories posit an indirect mapping between surface syntactic representations and semantics. For instance, *in-situ wh*-operators (*wh*Ps) are claimed to "covertly" move to a scope position (May 1977; Huang 1982). Similarly, quantificational phrases (QPs) also must covertly move because of semantic type-mismatches (Heim & Kratzer 1995), although they may target a much lower position, i.e., *v*P (Fox 2000). However, whether these "covert" relations are computed in real-time processing is relatively unexplored. Recent work in Mandarin Chinese, using a number of paradigms, shows that comprehenders retrieve all possible scope positions upon detecting a *wh*P (Xiang *et al* 2014, 2015). However, based on the processing of ambiguous antecedent-contained deletion constructions, Kotek & Hackl (2013) argue that English speakers move both *wh*Ps and QPs to a "local" position. Taking these results together, comprehenders appear to retrieve multiple scope positions upon detecting a *wh*P, but then resolve the ambiguity locally. However, Xiang *et al*'s (2014, 2015) findings have not been carefully replicated in English, and the processing profiles of QPs and *wh*Ps have not been directly tested. In this paper, we test whether the processing of QPs and *in-situ wh*Ps are sensitive to the number of clauses (= scope positions) in the sentence in English. However, we fail to find any effect of number of clauses on QPs and *wh*Ps. We tentatively submit that our results suggest that English-speakers may not initially access all possible scope positions upon encountering a *wh*Ps and QPs. Instead, comprehenders immediately access the closest scope position, reflecting their later preference (Kotek & Hackl 2013). If so, this implies a systematic difference in the mechanisms deployed for computing covert relations in English and Mandarin Chinese speakers.

Experiment 1. The goal of our study was to determine whether comprehenders access all possible scope positions upon detecting an *in-situ wh*P or QP. Experiment 1 was a self-paced reading task, one of the paradigms used by Xiang *et al* (2015). We manipulated NP Type, including QP and *wh*P as factors, and definite NPs as a control. We also manipulated the number of clauses in the sentence (2 Clauses, 3 Clauses). This manipulation was included because Xiang *et al* (2014, 2015) found increased processing difficulty at the *wh*P region with the addition of multiple clauses, suggesting an interference effect of the additional scope position, as predicted by cue-based theories of memory retrieval (e.g., Lewis & Vasishth 2005). The 2 Clause condition contained a length-matched adjunct. Additionally, all conditions contained an overtly moved *wh*-phrase, since English does not permit *in-situ wh*Ps without a moved *wh*P in the clause. There were 36 items, and 48 fillers, presented in a 3x2 design (N = 32). We hypothesized that reading times at the critical region in the 3 Clause, *wh*P region should increase compared to the 2 Clause, *wh*P condition, if comprehenders are sensitive to the number of scope positions, and similarly for the QP conditions. Materials are exemplified in Table 1, and mean RTs by region are given in Figure 1.

Table 1. Example set of stimuli for Experiment 1.

2 Clause/3 Clause		*WhP/QP/NP*	
According to John		which book	
John said that	the student wondered who will read	every book	with her best friend
		the book	

Figure 1. Mean RTs by region in Experiment 1.



Mixed effects models on preliminary results revealed no significant differences at the critical region, nor any of the subsequent spill-over regions (all *p*s > 0.50). Similarly, pairwise comparisons within each NP Type level revealed no significant difference between 3 Clause/2 Clause conditions at the critical region nor subsequent spillover regions (all *p*s > 0.10). Thus, we fail to find any evidence that comprehenders are sensitive to the number of scope positions in processing an *in-situ* whP or QP.

Although we failed to find a significant effect in our preliminary results, our contribution is significant because it explicitly tests whether the number of scope positions has an effect on the processing of *in-situ wh*P and QPs, and provides a cross-language comparison between Xiang *et al*'s (2014, 2015) findings in Mandarin Chinese. Further work will examine whether our failure to find an effect can be attributed to the overtly moved *wh*P, which is necessitated by the grammar of English. It may be that this introduces a confound that we have not controlled for, e.g., introducing a "family of questions" interpretation that may affect processing in an unexpected way. Alternatively, we suggest that comprehenders in English do not retrieve all possible scope positions in processing *in-situ wh*Ps or QPs.

References. • Fox, D. 2000. *Economy and Semantic Interpretation*. Cambridge: MIT Press. • Heim, I., & A. Kratzer. 1998. *Semantics in generative grammar.* Malden: Blackwell. • Huang, C.-T. 1982. PhD Thesis, MIT. • Kotek, H., & M. Hackl. 2013. Ms, MIT. • Lewis, R., & S. Vasishth. 2005. *Cognitive Science* 29. • May, R. 1977. PhD Thesis, MIT. • Xiang, M., *et al*. 2014. *JEAL* 23 • Xiang, M., *et al*. 2015. *JML* 84.