

English multiple *wh*-questions supposedly exhibit strict order constraints: while (1a) is grammatical, many researchers have claimed that (1b) is ungrammatical in its non-reprise use (Chomsky 1973; Pesetsky 1987):

- (1a) Who bought what?
- (1b) What did who buy?

This apparently categorical contrast has been attributed to principles of Universal Grammar (i.e. Chomsky's (1973) 'Superiority' condition). We present evidence that the ordering of multiple *wh*-phrases in English is actually a non-categorical phenomenon. Following the work of others (e.g. Fanselow & Frisch, 2004; Featherston, 2005; Gibson, 1998), we suggest that acceptability differences between competing *wh*-orders (as judged out of context) may be reducible to increases in cognitive work load.

We propose the **WH-Processing Hypothesis** to account for the relative rareness of examples like (1b): given the choice between several grammatical *wh*-orders ((e.g. (1a) vs. (1b)), speakers disprefer those which (given the context) are associated with a greater processing cost. Combined with existing theories of processing complexity, the *WH*-Processing Hypothesis makes the following predictions:

- I. Gaps that are further from the filler are harder to process
- II. Less accessible fillers are harder to process
- III. Less accessible interveners are harder to process

The natural occurrence of Superiority 'violations' in online corpora, as well as evidence from relative acceptability judgments, suggest that constraints on *wh*-order are non-categorical in nature (Arnon et al., 2005).

Three experiments tested predictions I - III. The first investigated the effect of distance on the processing of unary *wh*-questions, measured by the number of discourse-new referents between the filler and the gap (cf. Gibson, 2000). The results revealed an overall effect of extraction type, with object extractions (which have more intervening discourse referents) being judged as less acceptable than subject extractions ( $F(1,35) = 4.9, p < .05$ ; non-significant by items,  $F(1,35) = 2.5, p = .12$ ).

A second experiment examined the influence of filler and intervener accessibility on processing cost (prediction II and III). Subjects rated the acceptability of structures like (1b) with high (*which* phrases) or low (*who*) accessibility fillers and interveners in 4 conditions:

Mary wondered what/which book who/which student read

Results from 42 participants confirmed that less accessible interveners decreased acceptability ( $F(1,37) = 64.5, F(1,19) = 248.1, P_s < .001$ ), as did less accessible fillers ( $F(1,37) = 19.2, F(1,19) = 15.7, P_s < .001$ ). The same question of filler and intervener accessibility was addressed in an online reading experiment. As predicted, less accessible fillers caused slower processing at the verb ( $F(1,40) = 17.7, p < .001, F(1,19) = 12.3, p < .003$ ), as did less accessible interveners ( $F(1,40) = 10.5, F(1,19) = 11.5, P_s < .01$ ). Taken together, the results argue that the observed differences in acceptability are related to differences in processing complexity and support theories that explicitly link acceptability judgments to processing (e.g. Featherston, 2005; Gibson, 1998).

To summarize, the results of the three experiments provide support for the influence of the three proposed processing factors. We conclude that the *Wh*-Processing Hypothesis can account for a considerable amount of *wh*-order variation using processing-based factors that were independently introduced to explain other phenomena in sentence processing (e.g. locality-and accessibility-based effects).

## References

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