

## Computing scalar implicatures is cost-free in supportive contexts

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Recent experimental work uses on-line measures to test competing theories about the interpretation of scalar expressions (e.g. ‘some’, ‘two’), specifically whether they are given upper-bounded interpretations (e.g. ‘some but not all’, ‘exactly two’) through a context-sensitive pragmatic implicature computed on-line ([1]-[3]), or a context-insensitive “default” process ([4]-[5]). Studies using a variety of methods have found evidence for processing difficulty associated with upper-bounded interpretations of ‘some’ (e.g. [6]-[9]). In contrast, upper-bounded (“exact”) interpretations of numerals do not seem to elicit such a cost ([9]-[10]), raising the possibility that different interpretive mechanisms are involved. However, before attributing processing difficulty to generating or cancelling implicatures, other factors that can affect on-line processing must be ruled out. For example, in [7] and [8], reading times at the quantifier were crucial to the interpretation of the results, but the preceding context differed systematically across conditions in ways unrelated to the intended comparison. In the current experiment, we set out to replicate the reported processing cost for implicatures, using very closely matched contexts. We also directly compared the processing of ‘some’ and numerals in identical environments. The results show that in suitable contexts there is no cost associated with accessing appropriate interpretations (whether upper- or lower-bounded) for ‘some’ or numerals, suggesting that some previous results may reflect experimental materials rather than interpretive mechanisms.

Participants’ (n=24) eye movements were recorded as they read pairs of sentences. The first sentence established a contextual upper or lower bound (UB vs. LB). The second sentence contained the quantifier ‘some’ or a numeral (e.g. ‘two’), which could potentially trigger a scalar implicature. The context sentences for each condition differed by only one word: in the LB context they contained the same quantifier as the second sentence, while in the UB context they contained a stronger expression from the same scale (see Table 1). The regions of interest were the triggering quantifier and a subsequent region containing ‘the rest’. The interpretive processes of interest (generating or cancelling an implicature) should occur at the triggering quantifier. Processing at ‘the rest’ indicates how participants interpreted the quantifier: it should be less difficult when the quantifier is given an upper-bounded interpretation, which invokes the contrast set.

We used linear mixed-effects models to compare first fixation durations, first-pass times, probability of regression, and right-bound reading times in each region across conditions. There were no significant differences between conditions in any measures at the triggering quantifier or its spillover region. At ‘the rest’, LB contexts elicited a significantly greater probability of regression and longer right-bound reading times than UB contexts for both ‘some’ and numerals, indicating that participants did arrive at a lower-bounded interpretation in the LB contexts. Thus, although the different contexts gave rise to different interpretations, there was no difference in the difficulty of computing these interpretations.

These findings are consistent with several interpretations. One possibility is that participants do compute an implicature when they read the triggering quantifier, but this process is cost-free, or at least not measurable via eye-movements. A second possibility is that participants do not compute a specific interpretation of the quantifier until it becomes necessary at the phrase ‘the rest’, and at that point the lower-bounded interpretation is more costly. In either

case, the processes involved in interpreting ‘some’ and numerals do not seem to differ, so there is no need to posit separate mechanisms for each.

**Table 1:** Sample item. Regions for analysis are indicated with vertical lines. Critical regions are in bold.

Context	Quantifier	Example
Upper bound	<i>some</i>	Ethan needed to pass  <u>all</u> his exams  in the last week of school in order to graduate.  Without much effort,  he  passed  <b>some</b>   in math and chemistry,  <b>but the rest</b>   were far too difficult.
Lower bound	<i>some</i>	Ethan needed to pass  <u>some</u> exams  in the last week of school in order to graduate.  Without much effort,  he  did  pass  <b>some</b>   in math and chemistry,  <b>but the rest</b>   were far too difficult.
Upper bound	numeral	Ethan needed to pass  <u>five</u> exams  in the last week of school in order to graduate.  Without much effort,  he  passed  <b>two</b>   in math and chemistry,  <b>but the rest</b>   were far too difficult.
Lower bound	numeral	Ethan needed to pass  <u>two</u> exams  in the last week of school in order to graduate.  Without much effort,  he  did  pass  <b>two</b>   in math and chemistry,  <b>but the rest</b>   were far too difficult.

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