A path to ignorance: The default computation of Scalar Implicatures

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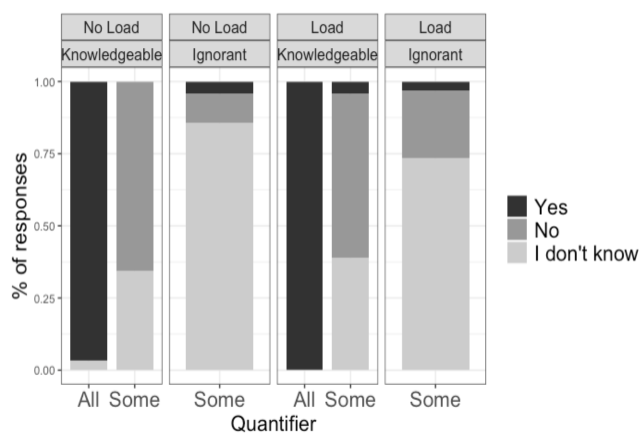
We provide experimental evidence that listeners compute scalar implicatures (SIs) by default, even in contexts where speakers are ignorant about stronger alternatives (i.e., contexts that should yield ignorance implicatures, IIs). Furthermore, these default computations are grammatically encapsulated, in the sense that the computation of SIs seems to be separate from general reasoning processes or the representation of contextual information. We show that people under cognitive load (e.g., engaged in a task that taxes their working memory) over-compute strong SIs. For example, they compute that *some* implies *not all* in contexts where it is obvious that the speaker is using *some* to imply their ignorance about *all*. They over-compute these types of inferences despite overtly acknowledging that the speaker is ignorant about the status of *all*.

1. Background & Controversy: One of the defining properties of natural language is that weak statements often provide information about the status of stronger propositions. This information comes in one of two forms: either such statements imply that stronger propositions are false (SIs, e.g., "some of the rabbits jumped" implies that not all of them did) or they imply that speakers do not know whether stronger propositions are true or false (IIs, e.g., "Franny ate a banana or an apple" implies that the speaker doesn't know whether or not Franny ate a banana). Although much has been said about the differences between these two types of implication (see [1-9] among others), very little is known about the interaction between them. Some linguists and philosophers have suggested that contextual cues signal whether or not a speaker is knowledgeable about certain stronger propositions (see the discussions in [2-5]). If context indicates that the speaker is most likely knowledgeable about stronger propositions, hearers compute an SI, whereas if context indicates the opposite, hearers compute an II. Others have suggested that SIs are computed by default (see [6-9]). According to them, hearers automatically assume that speakers are knowledgeable/opinionated, only abandoning such an assumption when contextual information makes it impossible to maintain. Currently, however, there is little experimental evidence to differentiate these claims. A notable exception is a recent study that tested the pragmatic abilities of teens on the autism spectrum ([10]). This study demonstrated that autistic teens over-compute SIs in contexts that should only license IIs. Critically, autistic teens answered questions showing that they understood that the speaker was ignorant about the status of stronger alternatives, yet they still interpreted weak statements from the speaker as implying that the stronger alternatives were false. In other words, autistic teens were unable to consistently integrate their knowledge of the context (and the speaker's state of mind) in order to block the computation of SIs. It remains an open question whether this separation between contextual information and (conscious) knowledge of the context is unique to autistic teens, or whether similar evidence can be found in neuro-typical adults. In the current study we attempt to answer this question by inhibiting the ability of neuro-typical adults to integrate contextual information. We tested their ability to compute implicatures under cognitive load by getting them to perform a memorization task while simultaneously computing SIs & IIs.

2. The Experiment: We tested 60 English speaking university students, ranging in age from 18 to 45 years old (mean 23.5). Participants were divided into a control group, who participated in a scalar implicature task, and an experimental group who performed the same task but under cognitive load. Specifically, experimental participants were asked to memorise a dot pattern at the beginning of each trial, and then recall the pattern at the end. In the scalar implicature task, participants were introduced to a "helpful" speaker who provided them with as much information as he could about the content of three boxes. For each trial, the speaker and the participant were able to see what was inside the first two boxes, but the third was covered so that the participant could not see what was inside. The first two boxes always contained the same thing (e.g., two tiny orange cubes in each). Trials differed only in terms of what happened with the third, covered box. In some trials, the speaker looked into the third box (knowledgeable-speaker trials) and then made a statement either using the quantifier “some” or “all” (e.g., “Some of the boxes have orange cubes” vs. “All of the boxes have orange cubes”). In other trials, the speaker didn’t look inside the third box (ignorant speaker trials) and made a statement with the quantifier “some” (e.g., “Some of the boxes have orange cubes”). At the end of each trial, participants were asked whether the speaker knew what was in the third box. Participants were required to answer this question correctly before moving on. If they did not answer correctly, the scene was replayed. Once they could answer this question correctly, participants were then asked whether the third box contained the same items as the first two (e.g., “Does the third box have orange cubes?”). They were told explicitly that they could respond, “yes”, “no” or “I don’t know.” Given the experimental paradigm, participants without cognitive load were expected to take the speaker’s knowledge-state into consideration when determining whether the third box had the same objects in it or not. If the speaker looked inside the third box, then participants were expected to answer “yes” when the speaker used the quantifier “all” (via entailment), but “no” when the speaker used the quantifier “some” (via SI). On the other hand, if the speaker didn’t look into the third box and uttered a statement with “some”, then participants were expected to answer “I don’t know” (via contextual cues and II).

Results: The control group performed as expected, computing SIs in the knowledgeable-speaker condition and IIs in the ignorant-speaker condition (65.6% and 85.6% respectively). In contrast, the test group exhibited a significant increase in their “no” response in the condition where the speaker was ignorant (from 10% to 23.3%), despite the fact that they acknowledged that the speaker did not know what was in the third box. We constructed a generalized linear mixed-effects model that predicted “no” responses on critical *some* trials from cognitive load, knowledge state, and their interaction. The model revealed a main effect of knowledge state (β =-5.06, SE = 0.8, $p < .001$), and importantly, an interaction effect between knowledge state and cognitive load (β =2.62, SE = 0.86, $p < .01$). This reflected the fact that the “no” responses (and thus SIs) were more frequent under cognitive load in conditions of speaker ignorance, where no implicature was supported.



3. Discussion: The results reported here are compatible with the conclusion that people compute SIs by default, even in contexts that do not support such an inference. Such results complicate the traditional analysis of implicatures through a neo-Gricean perspective. The participants in this study explicitly acknowledged that speakers were ignorant about the status of scalar alternatives, yet still frequently computed SIs. Under the traditional neo-Gricean approach, hearers must assume that speakers are knowledgeable/opinionated about alternatives in order to derive an SI. The results here suggest that the computation of SIs must be separated from general reasoning about the speaker’s epistemic state.

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