



Original Articles

When *some* triggers a scalar inference out of the blue. An electrophysiological study of a Stroop-like conflict elicited by single words

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ABSTRACT

Some studies in experimental pragmatics have concluded that scalar inferences (e.g., '*some* X are Y' implicates '*not all* X are Y') are context-dependent pragmatic computations delayed relative to semantic computations. However, it remains unclear whether strong contextual support is necessary to trigger such inferences. Here we tested if the scalar inference '*not all*' triggered by *some* can be evoked in a maximally neutral context. We investigated event-related potential (ERP) amplitude modulations elicited by Stroop-like conflicts in participants instructed to indicate whether strings of letters were printed with all their letters in upper case or otherwise. In a randomized stream of non-words and distractor words, the words *all*, *some* and *case* were either presented in capitals or they featured at least one lower case letter. As expected, we found a significant conflict-related N450 modulation when comparing e.g., 'aLl' with 'ALL'. Surprisingly, despite the fact that most responses from the same participants in a sentence-picture verification task were literal, we also found a similar modulation when comparing 'SOME' with e.g., 'SoMe', even though SOME could only elicit such a Stroop conflict when construed pragmatically. No such modulation was found for e.g., 'CasE' vs. 'CASE' (neutral contrast). These results suggest that *some* can appear incongruent with the concept of 'all' even when contextual support is minimal. Furthermore, there was no significant correlation between N450 effect magnitude ('SOME' minus e.g., 'SoMe') and pragmatic response rate recorded in the sentence-picture verification task. Overall, this study shows for the first time that the pragmatic meaning of *some* can be accessed in a maximally neutral context, and thus, that the scalar inference '*not all*' triggered by *some* should be construed as context-sensitive rather than context-dependent, that is, more or less salient and relevant depending on the context rather than entirely contingent upon it.

1. Introduction

Consider the following exchange:

- (1) A: What time is it?
B: Some of the guests are already leaving. (Levinson, 2000, p. 16)

From B's answer, it can be expected that A will understand that (i) it must be late, and (ii) not all of the guests are already leaving (see Levinson, 2000, pp. 16–17). Both (i) and (ii) contribute to the pragmatic rather than literal meaning of B's utterance and are called *implicatures* (see e.g., Grice, 1975; Levinson, 2000; Sperber & Wilson, 1995). However, implicatures like (ii) can be derived because of the mere presence of particular words such as *some*, whereas implicatures like (i) require a specific context and can only be derived from the complete utterance. The difference is made apparent when changing A's question into "Where is John?" for example (see e.g., Levinson, 2000, p.

17), in which case implicature (ii) remains valid, whereas implicature (i) does not.

In Grice (1975) terms, implicatures such as (i) are Particularized Conversational Implicatures (henceforth PCIs) and those such as (ii) are Generalized Conversational Implicatures (GCIs). A particular case of GCI is the *scalar implicature* or *scalar inference* (hereafter SI), which is triggered when a linguistic expression has a stronger competitor along a scale of informativeness (see e.g., Horn, 1972, 1989; Levinson, 2000). For instance, in (1), *some* contrasts with *all* and thus can trigger the SI '*not all*'. Other examples of such lexical scales are ⟨always, sometimes⟩, ⟨necessarily, possibly⟩, ⟨and, or⟩, ⟨finish, start⟩, ⟨love, like⟩, ⟨hot, warm⟩ (see e.g., Levinson, 2000; van Tiel, van Miltenburg, Zevakhina, & Geurts, 2014).

Following the footsteps of Grice (1975), some scholars endorsed the GCI – PCI distinction and argued that a GCI is the preferred or standard interpretation of a word such as *some* "in the absence of special circumstances" (Grice, 1975, p. 56) relating to "a *default* mode of

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reasoning” (Levinson, 2000, p. 42). A GCI remains an implicature since it is *defeasible*, that is it can be cancelled without resulting in a contradiction, contrary to the case of literal meaning (‘at least one’ as for *some*):

- (2) *Some of the students failed. In fact all of them failed.*
 #*Some of the students failed. In fact none of them failed.*

Other scholars have argued that the distinction between GCI and PCI is unfounded, because all implicatures, including SIs, should be considered particularized (see notably, Sperber & Wilson, 1995; Carston, 2004).

The two views presented above have been referred as ‘default’ and ‘context-driven’ models of SI derivation (see e.g., Breheny, Katsos, & Williams, 2006; Politzer-Ahles & Fiorentino, 2013). The former view predicts that SIs are *relatively* context-independent, realised immediately and effortlessly. The latter view predicts that SIs are context-dependent, only realised in contexts in which they are relevant, derived after the processing of semantic meaning and context, and require additional cognitive effort.

Some studies in experimental pragmatics have concluded that SIs are cognitively costly (see e.g., Bott & Noveck, 2004; Chevallier et al., 2008; De Neys & Schaeken, 2007) and akin to context-dependent pragmatic computations (see e.g., Breheny et al., 2006) that are delayed relative to semantic computations (see e.g., Huang & Snedeker, 2009). However, other studies have shown that SIs are not necessarily delayed (see e.g., Degen & Tanenhaus, 2015; Grodner, Klein, Carberry, & Tanenhaus, 2010), that the cognitive cost associated with them might not stem from the inferencing process itself (Chemla & Bott, 2014; Marty & Chemla, 2013), and that a strong contextual support may not be needed (Politzer-Ahles & Gwilliams, 2015).

In the present study, we focused on the dependency of SI derivation upon the context. In experimental pragmatics, SI context-dependency has been mostly investigated in reading (see e.g., Breheny et al., 2006; Politzer-Ahles & Fiorentino, 2013) by comparing SI-supportive and SI-non-supportive contexts. In an SI-supportive context, the SI answers the ‘question under discussion’ (henceforth QUD, see e.g., Roberts, 1996; Beaver & Clark, 2008), whereas in an SI-non-supportive context, the SI does not answer the QUD. In, e.g.:

- (3) Mary was preparing to throw a party for John’s relatives. She asked John whether *all/any* of them were staying in his apartment. John said that *some of them* were. He added that *the rest* would be staying in a hotel. (Politzer-Ahles and Fiorentino, 2013)

the predictions drawn from the default and context-driven models are the following: in non-supportive contexts (‘*any*’), the SI is not available, therefore ‘*the rest*’ requires more processing time than in supportive contexts (‘*all*’) in which ‘*not all* of the relatives’ becomes relevant and facilitates the bridging inference that *the rest* means ‘the rest of the relatives’. The two models differ regarding their account of SI unavailability in non-supportive contexts: either it is not derived because it is not relevant in the context (context-driven model), or it is automatically derived and then cancelled once it becomes apparent that it is not relevant (default model). Therefore, the context-driven model predicts an increase in reading time at the segment containing *some* in SI-supportive contexts relative to SI-non-supportive contexts. Contrastingly, the default model predicts no difference between conditions since the SI should automatically be derived in both cases. In self-paced reading studies such as Breheny et al. (2006) or Politzer-Ahles and Fiorentino (2013), an increase in reading time for the anaphoric noun phrase (e.g., *the rest*) was recorded in SI-non-supportive contexts relative to SI-supportive contexts. However, the increase in processing for the *some*-region predicted by the context-driven model was observed in Breheny et al. (2006) study (see also Bergen & Grodner, 2012), but not in Politzer-Ahles and Fiorentino (2013) study (see also Hartshorne, Snedeker, Liem Azar, & Kim, 2015). In sum, the results

obtained for the anaphoric noun phrase suggest that the SI is context-sensitive and thus more salient in supportive contexts in which it answers the QUD. However, it remains unclear whether SI derivation is actually context-dependent.

At this point, we note that Levinson (2000) default model of GCIs might have been inadequately interpreted in the literature. Levinson (2000) uses the expression “implicature cancellation” in the case of:

- (4) A: “Is there any evidence against them?”
 B: “Some of their identity documents are forgeries.” (Levinson, 2000, p. 51)

However, this example of cancellation is given as an example of “predicted (but nonoccurring) scalar implicature”, that is, an example of a case in which “we do not let the inference through. That’s because, intuitively, A is only interested in whether there is at least some evidence against the criminals; given A’s question, all that is relevant is the possession of at least some evidence” (Levinson, 2000, p. 51). Levinson (2000) concludes: “It seems then that Relevance implicatures, or inferences about the speaker’s goals, can limit the amount of further inference that is warranted. Thus even where these further inferences are entirely consistent with all that is known, they do not go through.” (Levinson, 2000, p. 52). In other words, it seems that Levinson (2000) makes a prediction similar to context-driven models: if the SI is irrelevant in the discourse context, it does not arise. Non-supportive *any*-contexts may thus be part of these “special circumstances” (see above) in which SIs are not derived.

In a recent study, Politzer-Ahles and Gwilliams (2015) asked participants whether it was possible, in an example such as (5), that all of John’s relatives stay in his apartment:

- (5) Mary was preparing to throw a party for John’s relatives. She asked John whether *all/any* of them were staying in his apartment. John said that *some of them* were.

Only slightly more than 20% of the responses were ‘yes’ (see Corrigendum), in either the *all*-contexts or the *any*-contexts. Thus, contrary to the predictions of both default and context-driven models, the SI ‘not all’ tends to be computed in *any*-contexts also, even though it is not relevant. Therefore, it appears that SI derivation does not in fact require much context support. Reciprocally, supposedly “blocking” contexts such as *any*-contexts do not guarantee that the SI will not be derived. MEG results from the same study (Politzer-Ahles & Gwilliams, 2015) using the same stimuli, showed greater activation for *some* in non-supportive contexts compared with supportive contexts, suggesting greater effort to derive the SI in non-supportive contexts. However, it is possible that the ‘not all’ interpretation may have been constrained by the presence of *of* following *some* in both contexts. Indeed, Grodner et al. (2010, Appendix A) showed that the partitive *some of* is more likely to give rise to the SI than the bare quantifier *some* (see also Degen & Tanenhaus, 2015; Geurts, 2010, p. 100).

Another way of investigating SI context-dependency would be to use *neutral* contexts, that is, contexts that are unbiased towards a lower or upper-bounded interpretation of *some*. This was the aim of Breheny et al. (2006) second self-paced reading experiment. In this experiment, there was no preceding context to the sentence containing *some*, however ‘*some of the*’ + noun was the grammatical subject or object of the sentence, that is, it was either in a topical or non-topical position, respectively. The sentences containing *some* were followed by sentences beginning with a noun phrase meaning ‘the rest’ or ‘the others’:

- (6) The director had a meeting with *some of the consultants*./Some of the consultants had a meeting with the director. The rest did not manage to attend.

If the SI ‘not all consultants met with the director’ is triggered by default, the referent of ‘*the rest*’ should be equally accessible no matter where ‘*some of the consultants*’ is located in the preceding sentence. In contrast, if the SI is context-dependent, the referent of ‘*the rest*’ should

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