Measuring the effect of cancelling the Maxim of Quantity

A. Summary: Fox (2014) points out that we could dissociate competing theories of implicature if we could cancel the Maxim of Quantity. Specifically, the neo-Gricean approach predicts an absence of both scalar implicatures and speaker ignorance inferences, whereas the grammatical approach predicts that ignorance inferences should disappear but scalar implicatures should remain. We provide experimental evidence supporting the prediction of the grammatical approach that scalar implicatures remain even in contexts in which the Maxim of Quantity is inactive.

B: The Maxim of Quantity and Basic and Strengthened Meanings: The basic meaning of a sentence can be strengthened by the computation of scalar implicatures (SIs). For example, the basic meaning of the disjunctive sentence *Susie ate cookies or ice-cream* is an inclusive disjunction, but this can be strengthened by conjoining it with the sentence's SI that Susie did not eat both cookies and ice-cream. Furthermore, the sentence gives rise to ignorance inferences that the speaker is ignorant about the truth of the disjuncts. The computation of SIs and ignorance inferences has been characterized by two competing cognitive architectures that have been proposed in response to the observation that the pure Gricean Maxim of Quantity (MQ) cannot derive scalar implicatures. MQ demands that speakers provide the strongest information that is relevant and that they know to be true. The well-known symmetry problem (von Fintel & Heim, 1999) teaches us that this maxim cannot be the source of SIs, because it only derives ignorance inferences (Fox, 2007; Katzir, 2007). The neo-Gricean response is to give up MQ in favor of a new maxim – the neo-Gricean Maxim of Quantity (NG-MQ) – that is sensitive to formal alternatives. Specifically, NG-MQ requires speakers to give the strongest information that is relevant and that they know to be true *from within a set of formally restricted alternatives* (Horn, 1972 and much work since). This maxim derives both ignorance inferences and SIs (e.g., Sauerland, 2004, and much other work). The grammatical approach argues that MQ is the correct pragmatic maxim and is responsible for deriving ignorance inferences, but it proposes that SIs are derived from the application of a covert grammatical operator, EXH, whose semantics is similar to that of *only* (Chierchia, 2004; Fox, 2007; Chierchia et al., 2012).

C: Fox's (2014) Game Scenario: Fox (2014) asks us to imagine what would happen if quantity reasoning – whether Gricean or neo-Gricean – were to be contextually cancelled as a conversational expectation. Specfically, Fox describes a game show scenario in which individuals are asked to choose between two options (out of a larger sample) that might be associated with a million dollars. The host can (but need not) help contestants by providing hints in the form of disjunctive statements (e.g., *there is money in box 20 or 25*). The host's contributions are thus required to *not* be maximally informative, as that would defeat the purpose of the game and the host's role as merely a hint-giver. Fox's scenario can dissociate the competing theories: the neo-Gricean view predicts that SIs are unavailable because they are derived by quantity reasoning, but the grammatical view predicts that SIs can persist because EXH is available even when MQ is not.

D: Experiment: We adapted Fox's game show scenario by contrasting participants' responses to (i) plain disjunctive sentences *p or q*, which in principle permit an exclusive disjunction interpretation, and (ii) disjunctive sentences which only permit an inclusive disjunction interpretation like *(p or q) or both*. For each experimental item, participants were told about the results of a previous contestant's round (either the contestant chose a box with money it or they chose a box with no money in it) and were required to make decision based on that knowledge and hints in the form of sentences like (i) and (ii). For example:

(1) Your task is to choose a numbered box. There are 5 boxes associated with a million dollars. The host tells the first contestant that there is money in {box 20 or 25 / box 20 or 25 or both}. This contestant chooses box 20 and {wins a million dollars / discovers that the box is empty}. Imagine you are the next contestant. The host does not give you any other hints. Which action are you most likely to take?

(a) Choose box 25.

(b) Choose another box.

The measure of interest is the proportion of (a) responses. In addition to disjunctive sentences, we also tested our predictions using numerals (*e.g., there is money in* {*one / at least one*} *box greater than 20*). As with disjunctions, one variant permits strengthening and the other does not: bare numerals are ambiguous between a weak 'at least' reading and a strengthened 'exactly' reading, but numerals modified by 'at least' do not permit the strengthened 'exactly' meaning (e.g., Spector, 2013; Schwarz, 2016; and much other work). For space considerations we focus our discussion here on disjunctions; the results for numerals are similar.

Under the neo-Gricean approach, without quantity there should be no difference between *p or q* and *(p or q) or both*; both mean an inclusive disjunction and there are no ignorance inferences (in this context) and hence the proportion of (a) responses should be insensitive to the presence or absence of *or both*. When the previous contestant finds an empty box, participants should choose (a) and when the previous contestant finds money participants have no rational basis on which to make a decision between (a) and (b). Under the grammatical approach, *or both* ensures that the sentence as a whole denotes an inclusive disjunction, whereas without *or both* the sentence *could* have an exclusive disjunction and hence proportion of (a) selections could depend in a rational way on the previous round. Specifically, an exclusive reading of the disjunction gives an incentive to choose another box when the previous contestant finds money because box 25 cannot contain a million dollars (when the previous contestant finds an empty box, then of course the contestant should choose (a)). Thus, under the grammatical approach there should be *fewer* (a) choices in *box 20 or 25* than in *box 20 or 25 or both* when the previous contestant finds money in box 20.

E: Results: Data from 23 participants reveal a significant interaction between manipulations of implicature availability and prior outcome (χ^2 = 7.74, p = 0.0054). If the previous contestant did not win any money, participants strongly preferred (a) (box 25) whether the implicature was available (*box 20 or 25*) or not (*box 20 or 25 or both*; z = 0.000, p = 1). However, if the previous contestant did win money, participants were more likely to choose (a) (box 25) when no implicature was available (*box 20 or 25 or both*) than when an implicature was available (*box 20 or 25*; z = 3.915, p = 0.0005). Further to this point, when the implicature was unavailable and the previous contestant won, participants were choosing between (a) and (b) at about chance level. Our results combine disjunctive and numeral items, but the overall pattern of results persisted when examining disjunctions and numerals independently. Figure 1 illustrates the interaction relationship. This result is consistent with the prediction of the grammatical view as it demonstrates that participants are generating a scalar implicature despite MQ not being available.

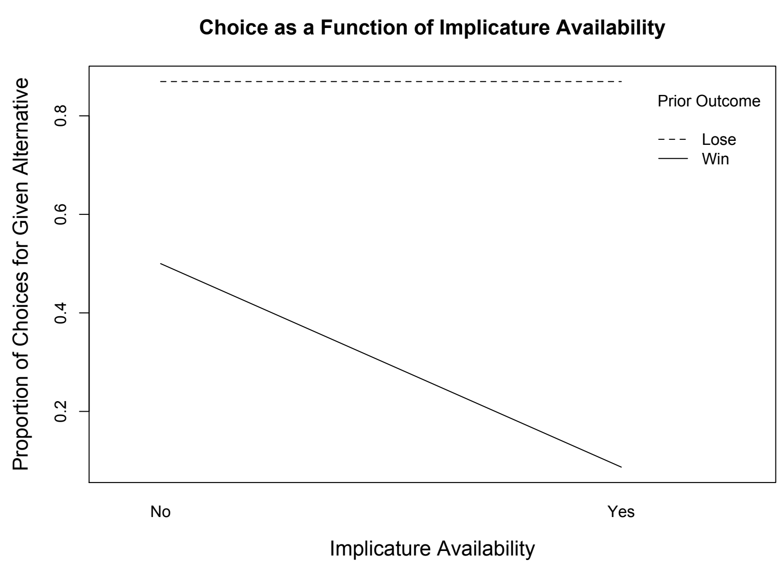

Figure 1: *Spreading Interaction of Implicature Availability and Prior Outcome*