Inquisitive pragmatics: entailment as relatedness

What a Gricean pragmatics can account for depends on the underlying notion of meaning. Recent years have seen Gricean explanations based on *inquisitive semantics* (Groenendijk and Roelofsen, 2009; Westera 2012). Coppock and Brochhagen (2013) use 'inquisitive pragmatics' to account for puzzling experimental data on modified numerals. But while the useful concepts circulate, there is no canonical theory. We propose one, that maintains and streamlines old functionality, while gaining new. As an illustration, we apply this to the implicatures of partial answers under neutral (falling) intonation and (rise-)fall-rise intonation.

Observations Consider (1), where the question has non-contrastive (open, final rise) intonation. The response provides information only about John; Mary is 'left unattended'.

 (1) Will John go, or Mary? - John will go.

The intonation used on the response has a striking effect on its interpretation. With falling intonation, it implicates that Mary won't go (i.e., *exhaustivity*). With fall-rise, it merely implicates that the speaker suspects that John's going may have some bearing on whether Mary will go, but it is left undecided what this bearing is. (See (Ward and Hirschberg, 1985) for an early characterisation of fall-rise). To see from another angle what might be going on, consider the response in (2a), which is logically unrelated to the question.

 (2) Will John go, or not? - a. It will rain. / b. Will it rain, or not?

With fall-rise, the response is cooperative, implicating that the responder thinks rain might have some bearing on whether John will come (though leaving it unspecified what this bearing is). With falling intonation, it seems less cooperative, and it could even be followed by a derogatory 'so what do you expect?!'. Implicatures similar to those triggered by fall-rise intonation can be observed for responding with a polar question, e.g., (2b).

Semantics We adopt unrestricted inquisitive semantics for propositional logic (Ciardelli, 2009), with entailment from Westera's algebraic characterisation. Propositions are sets of possibilities, each possibility a classical proposition, i.e., set of worlds. Let $\neg\varphi := \varphi \to \bot$, $?\varphi := \varphi \vee \neg\varphi$ and $\varphi \leftrightarrow \psi := (\varphi \to \psi) \wedge (\psi \to \varphi)$. Let $\mathbf{W}$ be the set of possible worlds assigning truth values to proposition letters. An interpretation [.] is defined inductively, for p a proposition letter, φ, ψ formulae, and pointwise intersection $A \sqcap B = \{a \cap b \mid a \in A, b \in B\}$:

 (3) $[p] \quad = \{\{w \in \mathbf{W} \mid w(p) = \mathsf{true}\}, \varnothing\}$ $\qquad [\varphi \vee \psi] = [\varphi] \cup [\psi]$
   $[\bot] \quad = \{\varnothing\}$ $\qquad\qquad\qquad\qquad\qquad [\varphi \wedge \psi] = [\varphi] \sqcap [\psi]$
   $[\varphi \to \psi] = \{\{w \mid \text{ for all } a \in [\varphi], \text{ if } w \in a, \text{ then } w \in f(a)\} \mid f : [\varphi] \to [\psi]\}$

 (4) For all propositions A, B: B **entails** A, $B \vDash A$, iff $\exists C, A \sqcap C = B$

This notion of entailment is very sparse, intuitively because it is sensitive to the possibilities a proposition *draws attention to*, e.g., we have $[p] \nvDash [p \vee q]$, but $[p \vee (p \wedge q)] \vDash [p \vee q]$.

Pragmatics We shape our theory as a set of *maxims* à la Grice that govern the behaviour of a cooperative speaker. The relevant maxims translate into the constraints in (5), on the speaker's epistemic state s, modeled as a set of possible worlds, when uttering proposition A in response to a proposition Q (e.g., a question under discussion). Additional maxims of manner/quantity apply that are not immediately relevant, e.g., be clear and concise and do not make your possibilities smaller than necessary.

(5) a. $s \subseteq \bigcup A$ (Quality 1: be truthful)

      b. For all $a \in A$, $a \cap s \neq \varnothing$ (Quality 2: include only live possibilities)

      c. $A \sqcap \{s\} \vDash Q$ (Relation)

      d. For all $q \in Q$, if $\bigcup A \nsubseteq q$, then $s \nsubseteq q$ (Quantity: support as many pos. as you can)

We assume that the maxim of relation can be complied with also if some adequate state s is merely *suspected* to obtain, but this must be marked by fall-rise intonation. This shares with (Ward and Hirschberg) the context-dependence and uncertainty associated with fall-rise.

For brevity in what follows, we use modal logic: for a speaker with knowledge state s, let $\Box\varphi$ iff $s \subseteq \bigcup[\varphi]$ and $\Diamond\varphi$ iff $s \cap \bigcup[\varphi] \neq \varnothing$. We predict the following implicatures (the translations into logic, of the examples discussed, are simplistic, but sufficient for our purposes):

(6)

	Initiative	Response	Relation implicature	Other implicatures
(1)	$p \vee q$	p	$\Box(p \to q)$ or $\Box(p \to \neg q)$	$\Box p, \Diamond p, \Diamond \neg q$
(1')	$p \vee q$	$p \vee (p \wedge q)$	-	$\Box p, \Diamond p, \Diamond(p \wedge q), \Diamond \neg q$
(2a)	$?p$	q	$\Box(q \to p)$ or $\Box(q \to \neg p)$	$\Box q, \Diamond q, \Diamond \neg p, \Diamond p$
(2b)	$?p$	$?q$	$\Box(q \leftrightarrow p)$ or $\Box(q \leftrightarrow \neg p)$	$\Diamond q, \Diamond \neg q, \Diamond \neg p, \Diamond p$
(7)	$?p$	$p \leftrightarrow q$	$\Box(q)$ or $\Box(\neg q)$	$\Box(p \leftrightarrow q), \Diamond \neg p, \Diamond p$

The implicatures in the rightmost column are as one would expect, though the generation of ignorance implicatures, e.g., $\Diamond \neg p$ and $\Diamond p$ in (2a), improves on (Groenendijk and Roelofsen). The relation implicatures are the main novelty. If (1) has falling intonation, the relation implicature must be *actual*, and together with the ignorance implicature $\Diamond \neg q$, it would entail that $\Box \neg q$. This reproduces Westera's results on exhaustivity, but our approach generalizes to cases where the response is not a subset of the initiative. With fall-rise on (1), the relation implicature is merely *suspected*, and exhaustivity does not follow. In addition, we predict that (1'), where the response 'John and maybe Mary too' already entails the initiative, is strange with fall-rise intonation. (2a), on the other hand, is predicted to require fall-rise intonation, for otherwise, together with $\Box q$, the relation implicature would entail $\Box p$ or $\Box \neg p$, contradicting the ignorance implicatures $\Diamond \neg p$ and $\Diamond p$. In each case, the relation implicature fits the observations we made earlier. Further illustrations are (2b) and (7), where (7) is particularly interesting because the relation implicature reads as an *evoked question* à la Wiśniewski's (2001) *erotetic implication* or Ginzburg's (2009) *dependence*. Applying the pragmatics to conditional questions and answers more generally is a promising work in progress.

Final remarks   Our main innovation is to use entailment as a base for relatedness. This goes against most, if not all, existing work, where logical consequence and discourse coherence are usually presented as analogous but clearly distinct domains, e.g.: '*Just as the standard logical notion of entailment rules the validity of argumentation, the logical notion of compliance rules the coherence of information exchange.*' (Groenendijk and Roelofsen, 2009, p.1). The inquisitive pragmatics we developed suggests that we revise this picture.

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