An Investigation of a Gricean Account of Free-Choice OR

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1. Conjunctive Force

It's a familiar fact that in many languages, occurrences of the word for inclusive disjunction in certain sentential contexts will by default induce readings of the embedding sentences that have *conjunctive force* (CF). Examples divide into two groups, one unproblematic, the other less so. In the unproblematic group are the cases where conjunctive force is a straightforward outcome of the semantics of inclusive disjunction and the embedding context. For instance, we have

(1) a. $\neg(A \vee B) \dashv\vDash \neg A \wedge \neg B$
b. $(A \vee B) \rightarrow C \dashv\vDash (A \rightarrow C) \wedge (B \rightarrow C)$
c. X *V*'d before (Y *V*'d $\vee$ Z *V*'d) $\dashv\vDash$ (X *V*'d before Y *V*'d) $\wedge$ (X *V*'d before Z *V*'d)

In (1b), '$\rightarrow$' may be material or a conditional of a strict kind. (1c) is unsurprising: a disjunction becomes true as soon as either disjunct becomes true, so if, say, I arrived before you or your friend did, then I arrived before the disjunction *you arrived or your friend arrived* became true, and therefore before either disjunct became true. So I arrived before both of you.[1]

1. Note that analogous reasoning for 'after' is incorrect – arriving after the earlier of you did doesn't imply arriving after both of you did, and consonant with this, the 'after' variant of (1c) has no CF reading. There are complications – (see Forbes 2014:178–9) – but this does seem to explain the main differences between 'before' and 'after' noted in (Larson 1988).

In the second group of CF cases, illustrated for English in (2) below, there is no comparably straightforward account of the conjunctive force they manifest:

(2) a. Socrates is taller than Plato or Aristotle.
b. Socrates could have been a lawyer or a banker. (Metaphysical *could*.)
c. If Socrates had been a lawyer or a banker, he'd have lived longer.
d. Socrates might speak in Doric or Ionic. (Epistemic *might*.)
e. Socrates may speak in Doric or Ionic. (The permitted conference dialects.)

Each of these would normally be understood, in the absence of cues to the contrary,[2] to make the same claim as its counterpart below:

(3) a. Socrates is taller than Plato and taller than Aristotle.
b. Socrates could have been a lawyer and could have been a banker.
c. If Socrates had been a lawyer he'd have lived longer, and if he'd been a banker he'd have lived longer.
d. Socrates might speak in Doric and might speak in Ionic.
e. Socrates may speak in Doric and may speak in Ionic.

I will put '(+CF)' next to sentences like those in (2) which are understood by default as equivalent to a conjunction, and '(–CF)' next to disjunctions which do not have a conjunctive reading, such as *Socrates taught Plato or Aristotle*. The *or* which figures in (2) is known as *free-choice* disjunction because it was originally studied in connection with the *may* of permission, as in (2e) (Stenius 1982).[3]

There are many accounts of free-choice disjunction which are semantic in nature. On one kind of account, CF is present in virtue of the literal meaning of *or*, of which

2. The main 'cue to the contrary' is the appearance of a *wh*-rider; for example, CF in (2a) vanishes if we append *whomever is younger* or *but I forget which one*.

3. Instances of CF which I do not discuss in this paper include *dogs or cats make good pets*, *he'll like the red one or the blue one*, and *you need an umbrella or a raincoat* (which is not normally understood in a way that makes it a consequence of *you need an umbrella* – see Forbes 2006:118–21).

some revisionary account is given; see, for instance, (Barker 2010; Zimmerman 2000). There are other semantic accounts on which CF is present in virtue of a special interaction between the familiar inclusive *or* and its embedding context, perhaps involving the presence of a covert operator.[4] But there are also approaches to CF which are, at least partly, pragmatic in nature: (Franke 2011) uses game theory with Gricean principles built into the model, while (Fox 2007) proposes a hybrid account on which (+CF) readings are scalar implicatures generated by the covert presence of an 'exhaustification' operator. My aim here is to investigate a simpler Gricean account of the CF in at least some cases in (2), according to which it is a generalized conversational implicature produced by reasoning from a Cooperative Speaker assumption, employing premises which normally hold in contexts in which disjunctions like some of those in (2) are used.

2. A Gricean derivation of AND from OR for epistemic possibility

Broadly, a Gricean explanation of CF proposes that the conjunctions in (3) are inferred from the literal meanings of the corresponding disjunctions in (2) by reasoning which assumes that the speaker is being *cooperative*, in the sense defined by Grice's well-known maxims (Grice 1975; 1989:26). Such reasoning is often an inference to the best explanation of why a speaker U says one specific thing when there are other statements that are in some sense 'live alternatives' or 'competitors' in the context, that U might have made instead.[5] Usually the conclusion reached is U *believes* q. In the simplest cases, given p as the literal meaning, the enriched meaning is just $p \cap q$.

4. See, for example, (Makinson 1984), which assimilates (2)-type cases to the left side of (1b), and also (Simons 2005), though arguably her approach belongs in the revisionary group. See (Humberstone 2011:810–12) for supportive discussion of Simons, and (Forbes 2014) for Makinson.

5. One can think of the live alternatives as relevant answers to potential questions (this is worked out very precisely in Spector 2007), though it's unclear exactly how relevance, or the list of questions, is to be circumscribed (for more on this problem, see Fusco 2014).

If a speaker U asserts (2d), the audience might work out the conjunctive pragmatic enrichment (3d) of the literal (disjunctive) meaning by means of the following idealized reasoning. We begin with general assumptions about the speaker U, along with the premise (A):

(A) U asserts (2d), *Socrates might speak in Doric or Ionic*, i.e., $\Diamond_U$[*soc speak in doric* $\vee$ *soc speak in ionic*], and asserts nothing else.
(C) U is cooperative, i.e., U conforms to Grice's maxims.
(R) U is rational, and has the capacity to make elementary modal inferences.
(E) Epistemic possibility for U: $\Diamond_U p$ is true iff p is consistent with what U believes about the topic of p (this could be tweaked in any way that allows for a transparency principle comparable to (T) immediately below).
(T) Transparency: when the subject-matter is mundane and the propositions in question easily grasped, U can tell by privileged, first-person, access, whether or not a given proposition is consistent with U's beliefs about the subject-matter.[6]

The audience reasons as follows:

(a1) Assume for *reductio*: $\neg\Diamond_U$(*soc speak in doric*). By (E), therefore, it's inconsistent with what U believes that Socrates speak in Doric.
(a2) From (a1), U believes $\neg\Diamond_U$(*soc speak in doric*), using Transparency and Rationality (assume U has no reason to give up some *other* belief).
(a3) By Cooperativeness and the fact (A) of U's utterance, U believes (2d), $\Diamond_U$[*soc speak in doric* $\vee$ *soc speak in ionic*].
(a4) By Rationality, U will infer and come to believe $\Diamond_U$[*soc speak in ionic*] (using $\neg\Diamond_U p, \Diamond_U(p \vee q) \vDash \Diamond_U q$).

6. van Rooij (2010:11) endorses a similar transparency principle.

(a5) By (A), U asserts only something weaker than $\Diamond_U$(*soc speak in ionic*), for $\Diamond_U$(*soc speak in ionic*)] $\not\models\!\!\!\dashv$ $\Diamond_U$[*soc speak in doric* $\vee$ *soc speak in ionic*].

(a6) So U is uncooperative, since U violates the maxim *Quantity*, having information that should be contributed but which is not contributed.

(a7) Because of this contradiction (cooperative and uncooperative) we reject (a1) and obtain the first conjunct of (3d), $\Diamond_U$(*soc speak in doric*).

(a8) Now assume for *reductio* that $\neg\Diamond_U$(*soc speak in ionic*), and by the same steps infer $\Diamond_U$(*soc speak in ionic*).

(a9) From (a7) and (a8) conclude $\Diamond_U$[*soc speak in doric*] $\wedge$ $\Diamond_U$[*soc speak in ionic*].

In sum, then, from the assumption of the negation of one of the epistemic possibility claims, $\neg\Diamond_U$[*soc speak in doric*], we derive a contradiction with the cooperativeness principle, and similarly for the other. Or we can think of the proof as establishing two conditionals,

(4) a. $\neg\Diamond_U$[*soc speak in doric*] $\rightarrow$ *U is uncooperative*

b. $\neg\Diamond_U$[*soc speak in ionic*] $\rightarrow$ *U is uncooperative*

It's a premise that U is cooperative, so classical *modus tollens* gives us (3d). Thus with K = {(C), (R), (E), (T)}, we have established

(5) K,(A) $\vdash$ $\Diamond_U$[*soc speak in doric*] $\wedge$ $\Diamond_U$[*soc speak in ionic*].

To the extent that the premises in K might *normally* be expected to hold when $\Diamond_U(p \vee q)$ is asserted by U, the conjunctive force in (2d) is a *generalized* (or *standing*) conversational implicature. That is, it is akin to the implicature *not both* of *p or q* and the implicature *if not p*, *then not q* of *if p then q*: they are additions to what is conveyed that are independent of context in that they depend only on the literal meaning of the assertion together with what can normally be inferred from the assumption that U is rational and cooperative, and, in the present case, that the subject-matter is transparent to U.

In the following sections of this paper I shall consider some objections to the reasoning, and then discuss whether its availability is just an idiosyncracy of epistemic *might*. The threat the argument presents to accounts of free-choice *or* mentioned earlier should be obvious: we don't need *complicated* pragmatic accounts of the phenomenon, and we don't need semantic accounts at all.

3. A problem about epistemic possibility

Premise (E), the definition of epistemic possibility for U as consistency merely with what U believes, is controversial. Perhaps the most pressing problem for (E) is that if statements about epistemic possibility are taken to be literal assertions of consistency with the speaker's personal body of information, this makes a mystery of disagreement about what is epistemically possible. For example, if Watson says *Holmes might be in Paris right now* and Lestrade replies *No, he can't be, I saw him in The Strand an hour ago*, Lestrade appears directly to contradict Watson. But if Watson was only asserting the consistency of *Holmes is in Paris right now* with his own personal information about Holmes's whereabouts (plus general truths about how fast people can get around in the late nineteenth century), while Lestrade was only asserting that *his* (Lestrade's) own body of information entails that Holmes is not in Paris by now, there is no contradiction at all. Yet Lestrade's *No* certainly signals, at a minimum, a rejection of Watson's modal judgement, as if Watson had said *For all* we *know*, *Holmes is in Paris right now* (instead of *for all* I *know*), so that the truth-value-relevant body of information is what results from some kind of pooling of the individual bodies of information possessed by the conversational participants.[7] And then a third party, eavesdropping on the conversation, might think *No, the guy who said Holmes can't be in Paris was wrong, because…*, which seems to widen the boundaries of the truth-value-relevant body of information even further.[8]

We could treat (E) as simply defining a new connective, $\diamond_U$, into existence. Our derivation would then show that the new connective, if taken for $\diamond$, generates conjunctive readings of $\diamond(p \vee q)$. We might then propose that the new connective be pronounced *for all U knows*, and our argument (a1)–(a9) would explain how this epistemic operator bestows conjunctive force, which it does seem to.[9] But this would be a mere curiosity, if the explanation could not be extended to the standard existential modals. To this end, it is worth asking if we can find an understanding of apparent contradiction-dialogues like the one between Watson and Lestrade that doesn't interpret them as manifesting direct disagreement about the epistemic possibility of the same proposition, *that Holmes is in Paris right now*.[10]

One way of doing this is to regard assertions of epistemic possibility as also con-

7. It is equally natural to understand Lestrade's *No, he can't be* as an expression of *causal* impossibility, though this still leaves work to explain how Lestrade is contradicting Watson. However, *No, that's not true* would be a relatively unambiguous contradicting of Watson, since it is difficult to hear *that* as referring to the embedded non-modal *Holmes is in Paris*.

8. The eavesdropper complication is introduced in (Egan et al., 2005).

9. *For all U knows, Holmes is in Paris or Berlin* seems to have as its preferred reading that Holmes' being in Paris is consistent with what U knows *and* his being in Berlin is consistent with what U knows. The mere consistency of the disjunction *Holmes is in Paris or Holmes is in Berlin* with what U knows only guarantees that at least one of the locations is consistent with what U knows. So if the goal is just to have *some* case of (+CF) accounted for by an argument like (a1)–(a9), this is it; the counterparts of (E) and (T) are very plausible for this operator.

10. Of course, there are other objections to speaker-relative accounts of *might*. For example, there is the alleged phenomenon of 'self-correction': after Lestrade has spoken, Watson might concede with *Then I was wrong* (he clearly wouldn't have been wrong at t, just before Lestrade spoke, if all he had said at t was *For all I know, Holmes is in Paris*). For scepticism about self-correction, see (Wright 2007). Other problems concern embedding epistemic modals in attitude ascriptions or conditionals; for discussion, see (Silk 2016, Chapter 3).

veying something *else*, and Lestrade's *no* as rejecting this something else. A possible candidate would be some implicit commitment of Watson's statement, or of typical claims of epistemic possibility, that the audience can be expected to grasp. This could be commitment to the view that the speaker's current body of information about the topic is an *adequate* body of information for the purposes of, say, formulating plans of action (e.g., a plan to look for Holmes) rationally designed to achieve some goal, such as finding Holmes, or finding a time to do something while Holmes is well out of the picture. *For all I know*, p does not have this adequacy commitment. Judgements of epistemic possibility are characteristically in the service of ensuring that such plans are not too narrowly focussed, just as judgements of epistemic necessity (*Holmes can't be in Paris right now*) are characteristically in the service of ensuring that plans are not formulated to take account of contingencies that really needn't be considered. In our case, Lestrade's *No* encodes the rejection of the thesis that Watson's body of information relating to Holmes's whereabouts is *sufficiently good* for the formulation of plans in pursuit of goals of a certain sort, those whose achievement turns in some way on the fact about where Holmes is located. And for Lestrade to be in a position to utter *No* to this effect, Watson's actual words must give information of just the kind (E) implies they do.

So there is an account of contradiction dialogues on which (E) is defensible. But is the account *ad hoc*? We can defend it from the charge of special pleading by noting other examples where *No* is used in an indirect way to contest some claim. For instance, *The Economist 1843* magazine (Dec/Jan 2017) describes Olivier Rousteng, chief designer at Balmain, as *the man who polarises Paris*. I cannot have been the only reader who thought *No he isn't*, it being unlikely that, say, the Muslim banlieus fiercely debate the wisdom of M. Rousteng's embrace of American celebrity-trash culture. That is, my *No he isn't* was not to imply that Parisian fashionistas are solidly for, or against, his innovations, but rather rejected the restriction of *Paris* to the small segment of the population for which the description *the man who polarises Paris* has some chance of being accurate. So here an apparent contradiction-dialogue does not really involve contradicting what the speaker has said, but does involve rejecting it less directly, by rejecting the domain restriction the speaker is employing and thereby implicitly endorsing.[11]

Other examples of unstraightforward uses of *No* involve predicates of personal taste. M may say to G, *cheese grits are tasty*, and G may reply, *No they're not*. On the face of it, there is something absurd about this dialogue: surely the two participants know that M can only mean they're tasty *to her*, and G only that they're not *to him*? The disagreement is spurious – as they say, *de gustibus non est disputandum*. But M may persist, for as betrayed by her insistence that cheese grits really are tasty, she may implicitly be making a claim to the effect that her tastes are in some relevant way superior to G's. G's *No* can then be understood as contesting this supposed superiority.[12]

Despite initial appearances, therefore, clause (E) is defensible, and its simplicity recommends it. And this definition of $\Diamond_U$ links to the Transparency Principle (T) (if the body of information that matters to epistemic possibility for U were less accessible to U, (T) could be true without import for epistemic possibility). However, (T) is in need of refinement. This is evident from the fact that although we moved from

11. Examples in which the domain of quantification is disputed play a central role in (Silk 2016).

12. Wright (2005) notes that 'there is a challenge involved in the question: *if*, *as you say*, [*cheese grits are tasty*], *how come nobody here but you likes* [*them*]*?* which goes missing if the proper construal of it mentions. . . standard-relativity in the antecedent'. Certainly, that no-one else likes them seems compatible with the mere fact that *you* find them tasty, but their unpopularity is a challenge to the idea that your taste-judgements are authoritative. In the same vein, one might ask *If Rousteng polarises Paris*, *how come no-one in Clichy sous Bois has heard of him*? If all parties were accepting the narrow use of *Paris*, the question would have no point. Its point is to challenge the narrow use.

the assumption $\neg\Diamond_U$(*soc speak in doric*) to a contradiction and thus obtained the conclusion $\Diamond_U$(*soc speak in doric*), we could even more easily have assumed $\Diamond_U$(*soc speak in doric*) for *reductio* and derived $\neg\Diamond_U$(*soc speak in doric*), and similarly for $\Diamond_U$(*soc speak in ionic*) and $\neg\Diamond_U$(*soc speak in ionic*):

(b1) Assume for *reductio*: $\Diamond_U$(*soc speak in doric*). So by (E), it's consistent with what U believes that Socrates speak in Doric.
(b2) From (b1), U believes $\Diamond_U$(*soc speak in doric*), using Transparency.
(b3) By Cooperativeness and the fact (A) of U's utterance, U believes (2d), $\Diamond_U$[*soc speak in doric* $\vee$ *soc speak in ionic*].
(b4) Given (A), U asserts only something weaker than $\Diamond_U$(*soc speak in doric*).
(b5) So U is uncooperative, since U violates the maxim *Quantity*, having information that should be contributed but isn't.
(b6) Since U is in fact cooperative, we conclude $\neg\Diamond_U$(*soc speak in doric*).
(b7) By assuming $\Diamond_U$(*soc speak in ionic*) and using the same reasoning we arrive at $\neg\Diamond_U$(*soc speak in ionic*).

And so (2d), *Socrates might speak in Doric or Ionic*, has the pragmatic enrichment that Socrates certainly won't speak in either!

Transparency delivers (b2), and the question is whether the intuition that supports Transparency is being correctly applied in making this move. It is surely the case that subjects have easy access to accurate positive judgements of *inconsistency* with their current beliefs when the proposition p under consideration is not complicated, p's subject-matter not recondite, and p really *can* be shown to be inconsistent with their current beliefs by a few simple steps. This is the motor that drives belief revision except in cases where subjects have some emotional attachment to the doxastic *status quo*. But this is only to endorse as much Transparency as is needed by the *original* version of the reasoning, (a1)–(a9), where the subject was expected to recognize the correctness of $\neg\Diamond_U$(*soc speak in doric*), on the assumption that it is correct. To generate the absurd implicature just noted *via* (b1)–(b7), subjects must have equally easy access to recognition of *consistency* with their current beliefs. And consistency judgements are negative existentials, that there does not exist a derivation of $p \wedge \neg p$ from the updated belief-set.[13] A Gricean might reasonably claim that reliable detection of absence of a derivation of $p \wedge \neg p$ when it is indeed absent is not an assumption we make in generating enrichments of speakers' literal meaning, since it asks too much. So if we weaken Transparency to acknowledge this, we can derive only the correct pragmatic enrichment by reasoning in the style of (a1)–(a9).[14]

4. An objection from non-monotonic logic

Another objection to our Gricean derivation of conjunctive force is that it employs classical logic. Levinson (2000:42–9) argues that instead, the inferring of conversational implicatures uses *non-monotonic* logic, specifically logic with 'default rules'. In monotonic logic, augmenting a premise-set preserves entailments: if Γ entails p and Δ is an arbitrary set of sentences, then $\Gamma \cup \Delta$ also entails p. In non-monotonic logic, by contrast, even if Γ entails p, it may be that $\Gamma \cup \Delta$ does not: because of the nature of the new information in Δ, the previous inference of p may no longer go through. According to Levinson, this is how reasoning about implicatures works; new information about or provided by S prevents inference by the audience A of the enrichment

13. There is also a semantic version of consistency, *satisfiability*, which is an existential claim that a certain function exists. But in the mathematical realm, existence is grounded in consistency, so the existential claim rests on a consistency, i.e., negative existential, claim.

14. Even those who have their doubts about the reading of $\Diamond_U$ as epistemic possibility should agree to restricting (T) to detection of inconsistency, if they would like the argument to explain the (+CF) remarked upon in note 8.

of S's statement that A had previously deduced.

To illustrate with one of Grice's most famous examples of conversational implicature (1989:33), suppose that a search committee receives an application from Dr. Y for a position. Y's file contains a letter of reference from Y's supervisor, Professor X, which, to the Committee's surprise, says only that Dr. Y's dress sense and handwriting are praiseworthy. After a moment's reflection, the committee members conclude that Professor X is telling them that Dr. Y is a poor candidate for the job. They arrive at this conclusion using such default assumptions as (C), that the writer is being co-operative, and a knowledgeability premise, that if there were anything *relevant* to recommend Dr. Y, then X, being Y's supervisor, would know about it. But, diverging from Grice's story, suppose evidence then comes in that (C) is false: e.g., the Committee learns that Professor X has a peculiar sense of humor, and often sends letters of reference intended just to be funny (a serious letter follows a few days later). So they keep Dr. Y's file active.

Here new information makes the Committee drop its previously deduced enrichment *Dr. Y is a weak candidate*. So this process can be modelled non-monotonically (see note 18), which will require, among other things, changes to the classical treatment of conjunction, where the standard Gentzen rules $\wedge$I and $\wedge$E guarantee single-sentence monotonicity. That is, given $\Gamma \vdash p$, we can prove $\Gamma \cup \{q\} \vdash p$. For $q \vdash q$, hence $\Gamma \cup \{q\} \vdash p \wedge q$ by $\wedge$I, so $\Gamma \cup \{q\} \vdash p$ by $\wedge$E. The simplest way to block this is to require that $\wedge$I is used only when the premise sets for the two conjuncts are the same.[15] But then, if the *reductio* rule is that from $\Gamma \vdash q \wedge \neg q$ we can infer $\Gamma \backslash p \vdash \neg p$,

15. There are many kinds of non-monotonic entailment relations, and many relations of each kind. But we can illustrate in terms of 'default assumption' entailment (Makinson 2005:31). Define '$cosat(\mathcal{P}(x),y)$' to be the set of all subsets of x that are cosatisfiable with y; i.e., $z \in cosat(\mathcal{P}(x),y)$ iff $z \subseteq x$ and $\exists v$: $\forall \sigma \in z \cup y$, $v(\sigma) = \top$. And say that z is *maximal* in a family of sets $\mathcal{F}$ iff $\nexists z' \in \mathcal{F}$: $z \subsetneq z'$. Then, where K is a set of assumptions (e.g., {C, R, E, T}), we may define a simple non-monotonic semantic entailment relation $\Gamma \mathrel{|\!\approx}_{\mathrm{K}} p$, read '$\Gamma$ entails p relative to default assumptions K' by:

some classical applications will be blocked for want of a proof of $\Gamma \vdash q \wedge \neg q$, there being no common premise-set for q and $\neg q$.[16] Other classical principles such as *modus tollens* also fail, and our derivation, as we observed following (4), can be regarded as obtaining the conjunctive force enrichment $\Diamond_U$[*soc speak in doric*] $\wedge$ $\Diamond_U$[*soc speak in ionic*] from *modus tollens*. So it's an important question whether non-monotonic reasoning is really employed in place of classical logic in explicit or implicit working out of conversational implicatures.

The case for non-monotonic entailment here is analogous to the case for a semantics for the conditional which does not validate *antecedent-strengthening*. To change our running example from Greek philosophers to British athletes, we may suppose, apparently coherently, that on the morning of the men's 1500m final at the Moscow Olympics in 1980, (6a) below is true, even though (6b) is obviously false:

$$(\mid\!\approx_{\mathrm{K}}): \Gamma \mid\!\approx_{\mathrm{K}} p \text{ iff for each X maximal in } cosat(\mathcal{P}(\mathrm{K}), \Gamma),\ \mathrm{X} \cup \Gamma \vDash p.$$

Here $\vDash$ is classical semantic consequence. In words, $(\mid\!\approx_{\mathrm{K}})$ says $\Gamma \mid\!\approx_{\mathrm{K}} p$ iff p is a classical consequence of: Γ augmented by any subset of K maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$; note how K has acquired a new role from (5). In terms of $\mid\!\approx_{\mathrm{K}}$, the revised rule of $\wedge$I, from $\Sigma \mid\!\sim_{\mathrm{K}} p$ and $\Sigma \mid\!\sim_{\mathrm{K}} q$ infer $\Sigma \mid\!\sim_{\mathrm{K}} p \wedge q$, is clearly sound, since the augmentations of Σ allowed by $(\mid\!\approx_{\mathrm{K}})$ are the same for all three sequents. This justification cannot be given for the standard formulation, from $\Gamma \mid\!\sim_{\mathrm{K}} p$ and $\Delta \mid\!\sim_{\mathrm{K}} q$ infer $\Gamma \cup \Delta \mid\!\sim_{\mathrm{K}} p \wedge q$: although the assumption $\Gamma \cup \Delta \not\mid\!\approx_{\mathrm{K}} p \wedge q$ gets us a counterexample with an X maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma \cup \Delta)$, such an X needn't be maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$ or $cosat(\mathcal{P}(\mathrm{K}), \Delta)$. For example, let $\mathrm{K} = \{\mathrm{A} \rightarrow \mathrm{B}\}$, $\Gamma = \{\mathrm{A}\}$, $\Delta = \{\neg\mathrm{B}\}$. Then $cosat(\mathcal{P}(\mathrm{K}), \Gamma) = cosat(\mathcal{P}(\mathrm{K}), \Delta) = \{\varnothing, \{\mathrm{A} \rightarrow \mathrm{B}\}\}$, whose sole maximal member is $\{\mathrm{A} \rightarrow \mathrm{B}\}$. So $\Gamma \mid\!\approx_{\mathrm{K}} \mathrm{B}$ since $\{\mathrm{A} \rightarrow \mathrm{B}, \mathrm{A}\} \vDash \mathrm{B}$, and $\Delta \mid\!\approx_{\mathrm{K}} \neg\mathrm{A}$ since $\{\mathrm{A} \rightarrow \mathrm{B}, \neg\mathrm{B}\} \vDash \neg\mathrm{A}$. But $cosat(\mathcal{P}(\mathrm{K}), \Gamma \cup \Delta) = \{\varnothing\}$, whose sole maximal member is $\varnothing$. Hence $\Gamma \cup \Delta \not\mid\!\approx_{\mathrm{K}} \mathrm{B} \wedge \neg\mathrm{A}$, since $\{\mathrm{A}\} \cup \{\neg\mathrm{B}\} \cup \varnothing \nvDash \mathrm{B} \wedge \neg\mathrm{A}$. Note that even if $\Gamma \subsetneq \Delta$, the X given by $\Gamma \cup \Delta \not\mid\!\approx_{\mathrm{K}} p \wedge q$ needn't be maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$, which provides grounds for rejecting the deduction (a1)–(a9).

16. The conventional formulation of $\neg$I, from $\Gamma \mid\!\sim_{\mathrm{K}} q \wedge \neg q$ infer $\Gamma \backslash p \mid\!\sim_{\mathrm{K}} \neg p$, is sound for $\mid\!\approx_{\mathrm{K}}$ (see note 14 for definitions). For if $\Gamma \backslash p \not\mid\!\approx_{\mathrm{K}} \neg p$, then we have an X maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma \backslash p)$ for which there is a v satisfying $\Gamma \backslash p$, X and falsifying $\neg p$. This v shows $\Gamma \not\mid\!\approx_{\mathrm{K}} q \wedge \neg q$, so long as X is also maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$, which it is: (i) X is in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$ since v satisfies $\Gamma \cup \mathrm{X}$, and (ii) since X is maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma \backslash p)$, X is also maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$ – clearly, if Y is in $cosat(\mathcal{P}(\mathrm{K}), \Gamma)$ then Y is in $cosat(\mathcal{P}(\mathrm{K}), \Gamma \backslash p)$, so if $\mathrm{X} \subsetneq \mathrm{Y}$, X is not maximal in $cosat(\mathcal{P}(\mathrm{K}), \Gamma \backslash p)$.

(6) a. If Ovett wins the gold, Coe will win the silver.[17]

b. If Ovett wins the gold and Coe withdraws through injury, Coe will win the silver.

If (6a) and (6b) were material conditionals, they would both be true because Ovett didn't win the gold, which verges on the ludicrous as an explanation of their truth-values. But (6) may still not be a counterexample to antecedent-strengthening, properly formulated. Precise accounts differ over the details, but proof-theoretically, the truth of (6a) consists in the derivability in some favored logic of its consequent from its antecedent plus auxiliary premises Γ assumed in the context but not made explicit. A counterexample to antecedent-strengthening has to hold Γ fixed: those who reject antecedent strengthening should motivate their view with examples of Γ, p, q and r such that $\Gamma \vDash p \rightarrow r$ but $\Gamma \nvDash (p \wedge q) \rightarrow r$. So (6) won't do the trick, since one auxiliary premise (6a) relies on is *Coe runs*, and this premise is no longer available for (6b) in the context, because the conjoining of *Coe withdraws through injury* to (6a)'s antecedent updates Γ by deleting *Coe runs* from it.[18]

In the same way, a proponent of non-monotonic logic for Gricean derivations of conversational implicature has to show that when an implicature is withdrawn, the monotonic perspective cannot make as good sense of the process leading to the withdrawal as the non-monotonic perspective can. According to Levinson (2000:56–

17. In the late 70's into 1980, Steve Ovett and Sebastian Coe were the world's leading middle-distance runners, the two of them far ahead of the rest. In the year or so before the Moscow Olympics in 1980 they'd swapped the world 1500m and mile records back and forth, though they had deliberately avoided running in the same race. Ovett was coming off what is still one of the longest winning streaks in top-class 1500m races. But there had been a few he hadn't been in, where Coe had run and won just as convincingly as Ovett did, or even more so (it was often hard to know how much Ovett could have won by, because of his habit of slowing down at the end of a race and waving to the crowd as he crossed the line). There was huge anticipation of their meeting in the 1500m final in Moscow, when both were in top form. As it happened, Ovett beat Coe to the gold earlier in the week in the 800m, and seemed to lose focus. Coe won the 1500; Ovett could only manage bronze.

18. If Γ is empty, (6a) is false, since (6b) is.

7) the monotonic perspective is untenable because it says that the new information will result in 'the deletion of a premise and the construction of a new deduction based on new premises', and this is just to say that 'the speaker has produced an utterance yielding inconsistent deductions – a contradiction at the level of utterance meaning from which every proposition under the sun will follow…this account would suppose that we are forced constantly to make sense of self-contradictory speakers.' But it's unclear that the audience A will construct a new deduction; perhaps A just settles for the utterance's literal meaning. It's also unclear what 'inconsistent deductions' means in Levinson's claim. A different implicature may be arrived at from a different premise-set, so it is at most the conclusions of the deductions that conflict with each other. But resolving such a conflict isn't a matter of making a self-contradictory speaker intelligible. For the premise sets do not characterize the speaker with equal accuracy, and A should prefer whichever conclusion it is that A derives from what A takes to be *the more accurate* premise-set, about which A can be expected to have views anyway. For example, in the case of the appointment committee, committee members simply drop (C) and withdraw implicatures which don't follow just from K\(C),(A). In sum, there seems to be nothing about the process of imputing an implicature to a speaker, then withdrawing it on receipt of new information, that the monotonic perspective cannot account for.[19]

19. However, non-monotonic logic handles such cases well. Consider the example of the appointment committee again, and the consequence relation $\Gamma \mathrel{|\!\!\approx_{\mathrm{K}}} p$ defined in note 14. Here the premise-set Γ is expanded by new information about Professor X, to produce new premises Γ' ($\Gamma \subsetneq \Gamma'$). This prevents the inclusion of the Cooperativeness Principle (C) in any member, hence any maximal member, of $cosat(\mathcal{P}(\mathrm{K}), \Gamma')$. So (C) is no longer available to play the crucial role it had in deriving (from Γ) the implicature that Dr. Y is a weak candidate. This is, unquestionably, a nice application.

5. Other modals

If the derivation (a1)–(a9) is a possible account of how CF arises in judgements of epistemic possibility embedding a disjunction, the next challenge for the Gricean who finds it appealing is to show that the reasoning works as well when other kinds of possibility are at issue, and doesn't generate absurd implicatures, as the derivation (b1)–(b7) threatened to until we weakened Transparency. This is the biggest hurdle the Gricean faces, and I am not sure it can be overcome.

I shall suppose (as I think is correct) that possibility concepts are essentially consistency concepts, where consistency is understood as the underivability of a contradiction in some favored logic. Thus, to say that p is mathematically possible is to say that p is consistent with the laws of mathematics, $\Lambda_{math}, p \nvdash q \wedge \neg q$; to say that p is deontically possible is to say that p is consistent with the code that is in force, $\Lambda_{deon}, p \nvdash q \wedge \neg q$; to say that p is metaphysically possible is to say that p is consistent with the principles of metaphysics, $\Lambda_{met}, p \nvdash q \wedge \neg q$; and so on. So the question is whether Transparency is a special case of something more general that is applicable to all these existential modal concepts.

Granted that we are still restricting p to propositions whose subject-matter is mundane and which are easily grasped, something like Transparency may be plausible for metaphysical modality. If speakers have *a priori* access to metaphysical laws and can be relied on to detect inconsistency in the relevant range of cases, then an audience can be expected to arrive at $\Diamond_m p \wedge \Diamond_m q$ as a CF implicature of the speaker's assertion of $\Diamond_m (p \vee q)$ via reasoning like (a1)–(a9).[20] This view has the interesting benefit of explaining the following phenomenon, which is awkward for semantic approaches. The examples in (7) below exhibit a contrast in conjunctive force:

20. For discussion of how *a priori* access squares with the necessary *a posteriori*, see (Forbes 1985: 230–1).

(7) a. Socrates could become a lawyer or [could become] a banker (+CF)
b. Socrates will become a lawyer or [will become] a banker (–CF)

Assuming modal and tense auxiliaries are both existential operators, there is enough common structure between the two examples for it to be puzzling that the force isn't with (7b).[21] The puzzle is harder for a semantic account if it is not simply going to posit brute differences between modality and tense. But the Gricean can say that while speakers may be assumed to know enough of the laws of metaphysics to detect evident inconsistencies, they may not be assumed to know the future: Transparency is defensible for modality, but not for tense (even past tense).

There may also be a reinforcing pragmatic consideration (as Mark Richard pointed out to me): $\mathbb{F}(p \vee q)$ is equivalent to $\mathbb{F}p \vee \mathbb{F}q$ on the simple existential account of $\mathbb{F}$, and perhaps appearance of *incompatibility between the disjuncts* of $\mathbb{F}p \vee \mathbb{F}q$ generates a *won't both become a lawyer and become a banker* exclusiveness implicature for $\mathbb{F}p \vee \mathbb{F}q$ which transfers to $\mathbb{F}(p \vee q)$. In the case of (7b), an appearance of incompatibility arises from the thought that over a lifetime, a professional's career is typically in a single profession. On the other hand, $\diamond(p \vee q)$ is equivalent to $\diamond p \vee \diamond q$, and compatibility of disjuncts is usually the presumption for judgements of the form $\diamond p \vee \diamond q$, where the mere possibility of p, in whatever sense of possibility, will not typically preclude the mere possibility of q, or vice-versa (*cf.* (2b)). Exceptions to this will usually involve embedded necessity, as in $\diamond\Box p \vee \diamond\Box\neg p$ in S5.[22]

21. Of course, one could take the CF contrast between (7a) and (7b) as evidence that *will* is not a simple existential over future times, but involves a universal modal: *Socrates will become a lawyer* means not that at some time in *the* future, Socrates becomes a lawyer, but rather that in *each possible future*, Socrates becomes a lawyer (see Klecha 2014 and references therein), and the necessity operator explains the lack of CF. Prior called these contrasting accounts of *will* 'Ockhamist' and 'Peircian' respectively (Prior 1967:128–36). A serious problem for the Peircian view, noted by Thomason (1970:267), is that it renders an example like *either we'll arrive on time or we'll fail to arrive on time* ($\mathbb{F}p \vee \mathbb{F}\neg p$) invalid, though it certainly sounds trivial; see (Forbes 1996) for further discussion.

22. Richard's point here threatens to show that the entire literature on free-choice disjunction with

For other senses of *could*, *can* or *may*, however, anything like a Transparency principle is a stretch. For example, the permission-reporting reading of *Socrates can speak in Doric or* (*can speak in*) *Ionic* would have conjunctive force by reasoning in our style only if we accept Transparency in the following guise:

(8) If Socrates can't speak in Doric (Ionic) then U knows that Socrates can't speak in Doric (Ionic).

But it's not obvious why we should accept this. Granted that knowledge is a norm for assertion, a speaker who asserts $\Diamond(p \vee q)$ ought to be knowledgeable about the subject-matter, perhaps somewhat beyond what's required for the isolated statement (2e). However, this falls well short of what's needed for (8): knowing that at least one of some range of options is allowable is far from a guarantee of knowing, for each disallowed option in the range, that it is disallowed.

On the other hand, this objection assumes that the assumptions used in deriving conjunctive force have to be realistic or plausible. Yet in standard Gricean derivations of some other conversational implicatures, this isn't required. For instance, in deriving the *not all* enrichment of an existential, an assumption perhaps analogous to (8) is employed. Thus *some suspects confessed* is said to have the enriched meaning *some but not all suspects confessed*, because the speaker U could have made the stronger statement *all suspects confessed* but did not, indicating that U was not willing to assert this, i.e., given Cooperativeness, did not believe it. But we only get the enriched meaning if we are willing to move from *U does not believe p* to *U believes not-p*. So this assumption, sometimes labelled the Opinionated Speaker as-

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modals rests on failing to notice the typical compatibility of $\Diamond p$ and $\Diamond q$. So intuitions of CF in cases with the form $\Diamond(\Box p \vee \Box\neg p)$ will be important. Natural cases of this sort are hard to come by. I offer: "it's consistent that Goldbach's conjecture is provable or its negation is", which sounds (+CF) to me even if we assume S5 modalities (so that it's false).

sumption, is taken to be at work in deriving the implicature (see, e.g., Fox 2007:76). But, of course, people often suspend judgement. Hence, if the knowledgeability assumption embodied in (8) is comparable to Opinionated Speaker – call it Charitable Audience – the consequent derivation of conjunctive force is no worse off.[23]

Our Gricean account of CF in disjunctive permission reports, therefore, does not inevitably founder on the unrealistic character of (8): we may *make* such an assumption, even if we couldn't really defend it, just as we couldn't really defend ignoring the possibility of suspension of judgement.[24] But remaining readings of modals are harder to accommodate. Suppose, for example, that we understand *can* in the sense of *has the capacity to*. Then for *Socrates can speak in Doric or* (*can speak in*) *Ionic* to have CF bestowed on it by reasoning in our style, we would have to require (8) to hold for *can't* in the sense of *lacks the capacity to*. Perhaps this is *too* excessively charitable an extension of the knowledgeability we concede to U in virtue of U's making the disjunctive assertion.[25]

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23. An alternative account of the scalar implicature *some* $\rightsquigarrow$ *some but not all* might say that the enrichment only arises occasionally, when U is taken by the audience to satisfy a knowledgeability condition, that if all were F, U would know this (*cf.* Professor X's knowledgeability with respect to Dr. Y's suitability for the job). The problem is then to explain how such an occasional conversational implicature turns into a standing one.

24. If what's reasonably suspected to be a biased coin is tossed, rationality requires suspension of judgement about *this coin will always fall heads*. But *this coin will sometimes fall heads* still conveys *not always*. And for a fair coin on a particular occasion, *this coin may fall heads or tails* is (+CF), though rationality requires suspension of judgement about the individual disjuncts.

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