The Non Cooperative Basis of Implicatures

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Abstract This chapter presents a model according to which implicatures, which are traditionally analyzed in terms of cooperative principles, remain rational in strongly non cooperative settings.

Keywords Implicatures · Politeness · Game theory · Gricean cooperativity · Pragmatics · Discourse structure

1 Introduction

According to (Grice 1975), conversation is a biproduct of rational behavior, to be analyzed in terms of beliefs, desires, and intentions. In addition, Grice makes specialized cognitive hypotheses about conversational agents—in particular that they are highly cooperative. Grice's conversational maxims of quantity quality and relevance encode this cooperativity in a highly informal fashion, but since the work of (Cohen and Perrault 1979; Allen and Litman 1987; Grosz and Sidner 1990; Lochbaum 1998) and others, researchers have formalized these principles in terms of BDI (belief, desire, intention) logics.

There are two problems with this sort of formalization. The first is that propositional attitudes like belief, desire and intention are *private* attitudes, not common knowledge or even part of the mutual beliefs of dialogue agents. The link between what agents say or dialogue content and their private beliefs, preferences and intentions is much less robust than what many Griceans and Neo-Griceans have postulated

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for content cooperative conversation. Any model of dialogue must infer information about mental states from the observed dialogue actions and vice versa. So we must *interpret* those actions—in other words, we must provide a representation of dialogue content and a procedure for constructing it during dialogue processing. The current mentalist approaches to dialogue content, couched within BDI logics, all equate dialogue interpretation with updating mental states: for instance interpreting an assertion that p and updating the model of the speaker's mental state to one that includes a belief in p are treated as equivalent. But they clearly are not equivalent in even in cooperative dialogue. If I am having a bad day, then my wife may say something to make me feel better even though she does not believe it.

With dialogue content separated from the agents' mental states, we need a term for what a speaker engages in when he or she makes a conversational move: following (Hamblin 1987), say that a speaker makes a *public commitment* to some content—exactly what content he commits to depends on the nature of the speech act he's performed. In fact, (Lascarides and Asher 2009) make speakers publicly commit to the *illocutionary effects* of their speech acts and not just to the locutionary content so as to accurately predict implicit agreement and denial.

In cooperative conversation, most of the time people say or commit to what they believe. So we can offer one informal precisification of some of Grice's maxims by appealing to defeasible generalizations like the following.

- Sincerity: Normally agents who commit to ϕ believe ϕ.
- Quantity: say as much as you can say to achieve conversational goals.
- Competence: Normally if B believes that A believes that ϕ, then B should believe that ϕ.
- Strong Competence: Normally if B believes that A doesn't believe ϕ, then B should not believe that ϕ.
- Sincerity about Intentions: Normally if A publicly commits to the intention that ϕ, then A intends that ϕ.
- Strong cooperativity: Normally if A publicly commits to the intention that ϕ, then B should intend that ϕ.

Defeasible rules link various sorts of speech acts to intentions, beliefs and actions of their agents; for instance, if an agent asks a question, then he normally intends to know the answer to it.

2 Implicatures and the Problem

Such rules provide the basis of an account of implicatures, and inter alia scalar implicatures. Implicatures are defeasible inferences that involve the following problem: under what conditions can one reasonably infer from a speaker's not committing to ϕ that he commits to $\neg\phi$? Consider (1).

(1) a. A: Did all of the students pass?
b. B: Some passed.

In (1) *A* does not commit to the claim that all of the students passed, and most speakers would reasonably infer that *A* in fact commits to the claim that not all the students passed. Here is a sketch of the kind of reasoning that one can adduce as a Gricean in favor of such an inference. Suppose a set of alternative moves, that the move chosen normally conforms to all the constraints above, and those that do not deviate from one of the constraints. Suppose also as given, either by discourse structure or by the lexicon, a set of alternatives for *some*, {some, all}. We can now sketch an informal derivation of the scalar implicature that B believes that not all the students passed.

- Sincerity: implies B believes his response to A's question. Competence implies that A should believe it.
- Strong Cooperativity: B wants A to know an answer to his question—that either all the students passed or they didn't.
- So B's response should provide A an answer. (rationality)
- He didn't say all the students passed, which would have implied an answer.
- Choosing the alternative would not have violated Cooperativity (since it clearly provides an answer), so it must violate Sincerity.
- So B doesn't believe the all the students passed. And by Strong Competence, A shouldn't believe it either.

Rather than fully formalize this reasoning in a particular nonmonotonic logic,[1] let's step back and consider what this kind of approach does and doesn't do. First it requires a strong form of cooperativity to derive scalar implicatures—that interlocutors defeasibly adopt each other's conversational goals and that speakers tell the truth. While it's not clear that Grice ever committed himself to something like Strong Cooperativity as I have formulated it, it isn't clear how we can derive scalar implicatures otherwise. Second, it doesn't account for why B provides an "over-answer" to the question; with the implicature, B's answer not only provides a direct answer to A's question but tells him more by picking out a subset of the worlds that constitute the direct, negative answer to the question. Neither these axioms nor any Gricean account of which I am aware provides an account of why didn't B just give a direct answer to A's question. It's clearly not a matter of the Gricean maxim of Quantity, since the over-answer provides more information and is longer and more complex than a simple "No" answer! Yet over answers are very common in dialogue; for instance in the Verbmobil corpus (Wahlster 2000), for instance, there is a far higher proportion of over answers than direct answers to questions. Are we following a maxim of being as informative as possible? If so, then people would never shut up (of course some people don't)!

[1] See Asher (2012) or Schulz (2007) for details.

None of these reflections show that the Gricean account of the implicature is wrong, only that it is incomplete. But the real problem is that when these defeasible generalizations don't apply, the account fails to generate any implicatures; the machinery is silent on what happens when these defeasible generalizations don't apply. Let me explain. Real conversations can have many purposes, not just information exchange. People talk to bargain, to bluff, to mislead, to show off or promote themselves, to put others down, to persuade others what they want them to do regardless of the facts. They often misdirect or conceal crucial information. In other words, conversation is often, even largely, non cooperative in the Gricean sense.

Consider the cross-examination in (2) of a defendant by a prosecutor, from Solan and Tiersma (2005) (thanks to Chris Potts for this example):

(2) a. Prosecutor: Do you have any bank accounts in Swiss banks, Mr. Bronston?
b. Bronston: No, sir.
c. Prosecutor: Have you ever?
d. Bronston: The company had an account there for about six months, in Zurich.

The locutionary content of (2d) is true. But Bronston succeeds in deflecting the prosecutor's enquiry by exploiting a misleading implicature, or what one might call a *misdirection*: (2d) implicates that Bronston never had any Swiss bank account and this is false.

Misdirections can happen outside the courtroom too. Dialogue (3) occurred in a context where Janet and Justin are a couple, Justin is the jealous type, and Valentino is Janet's former boyfriend (from Chris Potts and Matthew Stone (pc)).

(3) a. Justin: Have you been seeing Valentino this past week?
b. Janet: Valentino has mononucleosis.

Janet's response implicates that she hasn't seen Valentino, whereas in fact Valentino has mononucleosis but she has seen him.

Clearly, neither Janet nor Bronston are abiding by Gricean principles as I have formulated them; they're not trying to help their interlocutors achieve the intention behind their questions—to know an answer. They are not cooperative at the level of intentions, which is required to generate implicatures à la Grice. However, they *are* relying on their interlocutors to draw these implicatures. Why would Janet bring out a random fact about Valentino, unless she intended Justin to draw the implicature that she didn't see Valentino? Why would Bronston announce a random fact about his bank, unless he hoped the prosecutor would draw the implicature that *Bronston* didn't have a bank account and find an answer to his question?

This much Griceans can readily admit to. The Gricean principles are defaults that are believed by the interpreters of messages, and the implicatures that interpreters draw can be false while the at issue content of the speaker's contribution is true.

The real problem arises when we push the reasoning one step further: it is reasonable to assume the prosecutor in (2) doesn't believe that Bronston is abiding by principles like Strong Cooperativity, so the prosecutor *shouldn t* derive the implicature intended by Bronston. Nevertheless, the prosecutor *does* derive the implicature, because he takes Bronston's response in (2d) to answer his question. In fact, he used

this response to convict Bronston of perjury. But on the Gricean account, our prosecutor appears to be irrational—mutatis mutandis for Justin in (3): he knows that the relevant defeasible generalizations for drawing the scalar implicature needed to make a response to a prior question an answer don't apply, and yet he draws the implicatures anyway.

Misdirection is quite different from another form of conversation that is known as *opting out*. Gricean maxims also don't apply when a speaker simply opts out of quite basic conversational requirements. Consider dialogue (4) (from Chris Potts (pc)):

(4) a. Reporter: On a different subject is there a reason that the Senator won't say whether or not someone else bought some suits for him?
b. Sheehan: Rachel, the Senator has reported every gift he has ever received.
c. Reporter: That wasn't my question, Cullen.
d. Sheehan: The Senator has reported every gift he has ever received.
e. We are not going to respond to unnamed sources on a blog.
f. Reporter: So Senator Coleman's friend has not bought these suits for him? Is that correct?
g. Sheehan: The Senator has reported every gift he has ever received. (Sheehan says "The Senator has reported every gift he has ever received" seven more times in two minutes. http://www.youtube.com/watch?v=VySnpLoaUrI)

This is different from misdirection. Sheehan's utterances cannot be interpreted as implying an answer, and so contrary to Bronston's utterance (2d) this *exposes* that Sheehan hasn't adopted the reporter's intention.

Dialogue (5) is another real life example of an 'opting out' move that happened the author in New York City:

(5) a. N: Excuse me. Could you tell me the time please?
b. B: Fuck you!

In opting out, the speaker doesn't intend for his or her interlocutors to assume any sort of cooperativity is in play. Opting out occurs when an answer to a question isn't provided, or when an appropriate response to another's speech act isn't provided. In misdirection the response is intended to thwart the asker's goals, though the response *appears* cooperative. In opting out, no cooperative response is given. Notice that opting out moves are thus a way of quickly ending the conversation; if you can't attach someone's response to the rest of the discourse context in a coherent fashion, then you're probably not going to continue talking to that person.

With respect to opting out, the Gricean account fares better. The defeasible generalization of Strong Cooperativity doesn't apply, and so Griceans predict that no implicature is drawn—which is what the facts show. However, misdirections like that in (2) pose severe problems for extant, Gricean accounts of scalar implicature that are based on Strong Cooperativity. To investigate this in detail, we need some some background. We need to set out a minimal level of cooperativity that distinguishes misdirection and normal cooperative conversation on the one hand, from opting out on the other. I call this level *rhetorical cooperativity*. Rhetorical cooperativity has

to do with a cooperativity at level of speech acts. Some examples will clarify; when someone greets you, you greet him or her back or make at least some recognition of the greeting. When someone asks a question, you respond by either giving a direct answer to the question, an indirect answer, which relies on an implicature, or you say that you can't answer the question.

We can make this notion of rhetorical cooperativity precise by appealing to a theory of discourse structure like SDRT (Asher and Lascarides 2003).[2] Such theories postulate that a text or a conversation is coherent, just in case each contribution to the discourse can be linked to some other element via a relation that makes clear the contribution's rhetorical function in the conversation. A speaker is *rhetorically cooperative* if and only if her contribution to a conversation can be linked to the conversational context via a rhetorical relation. While previously many argued that the inference to a discourse relation was often a matter of extralinguistic competence (for example myself in Asher 1993), matters have changed somewhat with the advent of powerful machine learning methods that show one can go quite a long way towards reliably labelling discourse relations in text using only linguistic information (Subba and Eugenio 2009; duVerle and Prendinger 2009; Muller et al. 2012). It now seems that grammar encodes in a subtle way a lot of information about rhetorical structure. When conversational agents tailor their contributions so that the grammar allows their interlocutors to conclude a rhetorical connection, they are being rhetorically cooperative.

Let's now take a closer look at a particular discourse configuration that concerns our present examples. It is a matter of a question by A and some sort of response by B. SDRT postulates different sorts of rhetorical responses to questions. One is labelled *QAP*, or *Question-Answer-Pair*. $QAP(\pi_1, \pi_2)$ entails K_{π_2} is a true direct answer to the question K_{π_1} according to the compositional semantics of questions and answers. So when Bronston answers *No, Sir* to the prosecutor's first question in (2a), the response would have been linked to the question via *QAP*.

(2) a. Prosecutor: Do you have any bank accounts in Swiss banks, Mr. Bronston?
b. Bronston: No, sir.

Another is called *IQAP* or *Indirect Question Answer Pair*. $IQAP(\pi_1, \pi_2)$ entails K_{π_2} defeasibly implies, via default rules that the questioner and respondent both believe, a direct answer to the question K_{π_1}. Moreover, *IQAP* entails that the answer is true.[3] This is the relation that holds between Bronston's response and the prosecutor's second question. Bronston's response implies a direct answer via a quantity implicature.

There are other ways of responding to questions. One way is with another question, which may be connected to the first question in a variety of ways (Asher and Lascarides 2003). One is using a question to get more details about what sort of response the first question requires, a sort of follow-up question, which in SDRT is called Q-elab.

[2] Griceans can think of SDRT roughly as a large-scale development of the principle of relevance.

[3] In SDRT terms, *IQAP* is right veridical.

(6) a. A: How do I solve this problem?
b. B: Do you know how to do derivatives?

From a discourse theory point of view, calculating the relevant scalar implicature here is part and parcel of calculating the discourse connection between B's contribution and the discourse context. The scalar implicature is required to link Bronston's answer in (2d) with IQAP; it's the scalar implicature that links (2d) to a direct answer to P's question in (2c). Without the scalar implicature, (2d) is no better a response to (2c) than some random assertion about anything. And because rhetorical cooperativity is a basic form needed for the conversation to continue, we will infer rhetorical cooperativity unless it's clearly at odds with the data. Thus B *banks on* P's interpreting his response as an IQAP.

We now come back to the real problem for Gricean accounts. In fact, we all attach Bronston's answer with IQAP, regardless of assumptions about cooperativity. The derivation of IQAP in SDRT is triggered simply by sentence mood, as can be gleaned from the axiom in SDRT's logic GL for computing discourse relations.

- SDRT's GL axiom for IQAP:

- $(\lambda :?(\alpha, \beta) \wedge int(\alpha)) > \lambda : IQAP(\alpha, \beta)$

In words the axiom says that if β is to be attached to α and α is in interrogative mood, then normally β attaches with *IQAP*. In other words, sentence mood alone triggers the inference to *IQAP*. But the soundness of the rule as explained in Asher and Lascarides (2003) and the quantity implicature the IQAP is based on in cases of misdirection rely on cooperativity principles as we saw above that are not sound in this scenario. Clearly, Bronston does not share the prosecutor's goal of finding out whether Bronston had an illegal bank account in Switzerland, and the prosecutor believes this. Probably the audience believes it too. But then how do we conclude IQAP? Are we all irrational? Or perhaps there is another type of derivation of the implicature given by IQAP.

There are several possible strategies to rescue the situation. First, Griceans can attempt to maintain that implicatures depend on Gricean maxims and strong cooperativity, but that the example under discussion poses no problem for the view. Here's how a Gricean might put it:

> Ps question establishes the immediate public goal of the conversation as being to decide whether B has ever had Swiss bank accounts or not. Bs contribution can be taken to decide the issue and thus to be cooperative in achieving this goal under the assumption that he answers cooperatively a more general question, namely, who, among the relevant alternatives, had such accounts, as far as B knows. By mentioning his company but not himself, B conversationally implicates that he did not have such accounts, which settles the initial question negatively. B can be taken to be publicly committed to the claim that he didnt have such accounts, a claim that he implicated but was not semantically entailed by what his utterance said. B behaves as if his decision to answer the higher level question and implicate the answer that decides the immediate question is driven by a desire to be even more informative than Ps question requires: B is offering information on who *did* have such accounts.

The key weak spot in this response is the "assumption that he answers cooperatively a more general question". Why on earth should we or P assume this sort of cooperativity? But without this cooperativity, no implicatures should be drawn. So this "solution" in fact labels us all as irrational. I suspect that this response is even worse because cooperativity of intentions is the only way a Gricean has of providing implicatures like the following relevant to the interpretation of direct answers like (2b).

- X can be taken as an answer to Y, and so interpreters take X as an answer to Y.

Without cooperativity of intentions for the Gricean, there aren't implicatures of any kind. So there isn't even rhetorical cooperativity. But clearly the facts show that there can be rhetorical cooperativity without cooperativity at the level of intentions.

One might argue that implicatures can arise from other sources besides cooperativity of intentions. One such source could be an external constraint on conversation like the oath to tell the truth, the whole truth and nothing but the truth in a courtroom, or the threat of perjury. These constraints haven't stopped witnesses from lying in court under oath, but they do make it more costly to lie and so provide grounds for supposing that speakers under oath are not lying. It's unclear how one can support the conclusions of scalar implicatures from the oath, however. The oath doesn't force the implicature, as far as I can see, unless the Gricean stipulates that nothing but the truth entails all scalar implicatures. This is far too rigid an interpretation considering what happens in actual conversation. If the oath did force all implicatures to be entailed, then the Supreme Court would have had no business overturning the conviction, which in this case it did. Thus empowering the oath would also vitiate the distinction between what is said and what is implicated, something dear to Griceans. Thinking for a bit about how to force scalar implicatures to hold, we might take "the whole truth" to introduce something like an exhaustivity operator into Bronston's response. If that's right, we have as an entailment that Bronston never had a bank account. That is, it follows on this move that Bronston in fact *said* he didn't have a bank account, not only that he implicated it. Entrapment would be an easy matter for a prosecutor if this is what the oath actually did! And without such an explicit argument about the oath, we haven't gotten anywhere. Furthermore, in the Justin and Janet example of a misleading implicature (3), Janet is under no obvious external constraint like an oath when talking to her boyfriend.

One could argue that implicatures rely on Gricean cooperativity but have become fossilized. We might try to account for them as an "evolutionary adaptation": over repeated interactions where cooperativity is present, implicatures become automatic and thus are calculated even when the conditions of cooperativity that validate the implicatures are not present. While this is an appealing possibility to some, it is not so easy to provide a formal framework in which this intuition is borne out. Asher et al. (2001) attempt to model strongly cooperative principles of the sort mentioned above using evolutionary game theory. They show, however, that strong Gricean cooperative principles do not form an evolutionarily stable strategy unless rather strong initial assumptions are made.

The same problem bedevils a Gricean analysis of the Janet and Justin misdirection example in (3). First, I summarize the assumptions for the misdirection example (3). Let's assume that Justin does not believe or is not confident that Janet shares his intentions to get a true and informative answer to his question. That is, we're in a non cooperative or strategic situation.

Now what are the facts?

1. Justin, and we, take Janet's response e as an indirect answer to his question. To do this Justin must engage in some non monotonic or defeasible reasoning to connect the response with the question. Note that this doesn't entail that Justin accepts the answer or finds it credible. We are interested just in what information he extracts from it.
2. Janet's not lying but she is trying to mislead, to get, say, Justin off her back. She is committed to only to the factual content of her claim; but as a competent conversationalist, she realizes that it is naturally interpreted as an indirect answer. She realizes that the interpretation of her response as an answer involves some defensible reasoning on Justin's part, and she has the option of denying that that reasoning was sound in the present case or that she was completely responsible for it.

For the Gricean, the problem is that without Cooperativity, Griceans have no way to run through the defeasible reasoning that turns the response into an indirect answer. So Janet's response in the actual context is no different than an assertion of some random fact.

The Gricean might suggest that the difference between an assertion of just any random fact and Janet's actual response is the counterfactual claim that had they been in a cooperative situation, Janet's response would have been an indirect answer—an assertion of some random fact would not. Nevertheless, it's hard to see what this counterfactual claim does for the interpretation of Janet's response in the actual context. Clearly one difference between the counterfactual context and the actual one is that Justin probably doesn't believe the indirect answer or may be wary of it, as you say. But that's a matter of credibility and belief about the information imparted, not a matter of what information is imparted by the response. But in both contexts, the same information is imparted; that's why Justin will be justified in being mad *in the actual context*, when he finds out that Janet has been seeing Valentino. Griceans have no way of explaining why this is the case. Justin knew or suspected he wasn't in a cooperative environment; it would be irrational on Gricean grounds to draw the implicature.

The conclusion: People have diverging interests in many cases; any time someone wants to bargain for a car, invest in stocks, play a competitive game, get his parents to do something for him, his interests are not aligned or may not be with those of his conversational partner or partners. Nevertheless, people do interact, draw implicatures and provide indirect answers all the time. In fact, indirect answering is a pervasive discourse move in such situations. Grice's model doesn't adapt well to such strategic situations, since the implicatures required to link a response to a question as an indirect answer are based on Cooperativity. But why try to force all of this into

Cooperativity? Cooperativity of intentions is a special case of a much more general conversational situation. l have argued that implicatures are inferred when beliefs about cooperativity at the level of intentions are lacking. The Gricean makes a false prediction if he takes implicatures to be generated solely by cooperative principles associated with the maxims. What emerges is the lack of any immediately plausible alternative foundation of implicatures. In the next sections, I will propose such an alternative foundation.

3 The Model

I propose to look at our interpretation of Bronston's response from the perspective of game theory. Saying and interpreting what is said are both actions. Assuming that conversationalists are rational, what they say and how they interpret what is said should follow as actions that maximize their interests given what they believe. Conversation involves moves that are calculated via an estimation of best return given what other participants say, and this is a natural setting for game theoretic analyses.

Game theory has had several applications in pragmatics (Parikh 1991, 2000, 2001; Benz et al. 2005; Franke 2008; Franke et al. 2009; van Rooy 2003; van Rooij 2004). Much of this literature uses the notion of a signaling game, which is a sequential (dynamic) game in which one player with a knowledge of the actual state sends a signal and the other player who has no knowledge of the state. The games I will examine here are different, though they involve two players in a sequential game. I assume that the meanings of all signals are fixed and thus that we have a more orthodox game of strategy involving a player that makes one kind of conversational move and another player that responds with another type of move. I will concentrate on an analysis of the payoffs for different conversational strategies. A crucial feature of the model is that payoffs are fixed, not by coordination on meanings or interpretations (as is the case in signaling games) but by effects of politeness, broadly speaking. I take the view in this chapter that an important aspect of language and linguistic usage is not directly related to truth conditional content but to relationships of power between conversational participants. According to Brown and Levinson (1978)'s strategic theory of politeness, language does not have the role merely to convey or ask for propositional content. Language also serves a second role in negotiating the relationships between speakers and hearers, in particular what they call their "positive" and "negative" face. Positive face involves an agent's reputation and image from the perspective of his interlocutors, while negative face involves the agent's "distance" from his interlocutors, his freedom from constraints imposed by them on his possible actions. While these terms aren't precisely defined, they define relatively intuitive dimensions of an agent's social status in a community. Face is the medium through which conversational participants recognize and negotiate their partner's potential status their needs and their autonomy.

Following Asher and Quinley (2011) and Quinley (2011), I use the notion of an exchange game, which is a formal model of two or more agents sending goods to

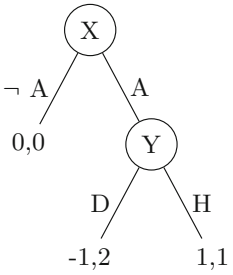


Fig. 1 Extensive form. Trust Games in Extensive Form: Player X has the option to Ask (*A*) Player Y for Help. Y can Help (*H*) or Defect (*D*)

		Player Y	
		H	*D*
Player X	*A*	1;1	-1;2
	¬*A*	0;0	0;0

Fig. 2 Normal form. Trust Games in Normal Form: Player X has the option to Ask (*A*) Player Y for Help. Y can Help (*H*) or Defect (*D*)

one another. Moves are dialogue speech acts, and information and face are the goods exchanged. Asher and Quinley (2011)'s model is asymmetric because the speaker places his fate in the hands of the hearer when making a request, or asking a question. Such conversational moves place one participant in the position of asking another to do something for him—this something is the *speech act related goal* or SARG of the speaker's move. All conversational moves have SARGs (Asher and Lascarides 2003). For instance, the SARG of someone's asking a question is normally to get an answer to the question and perhaps to get answers to follow up questions as well; other SARGs, however, are possible, as when for example a speaker asks a biased or rhetorical question (Asher and Reese 2005). However, to keep things simple here, I'll assume that the SARG of a question is the normal one of getting an answer.

The exchange game I use is a variant of a trust game (McCabe et al. 2003). Trust games depict a scenario where Player X has an initial option to defer to Player Y for a potentially larger payoff for both. Similar to the Prisoner's Dilemma, Player Y could defect on Player X and get a reward while X fares badly. For a one-shot game, this act of deference will not occur for a rational Player X. However, reputation and observation effects and the possibility of repeated games make deference rational (Asher and Quinley 2011) (Figs. 1 and 2).

The question is whether a conversation as I have conceived it is just a one shot two move game, one by each player, or is a conversational game more open ended with many possible continuations. I believe that conversations are not just one shot games, though this is seldom recognized in approaches that use signaling games. Conversational games are extended and dynamic, with an open ended sequence of conversational moves (though exactly the same move is almost never an option). Discourse theories like SDRT model this flexibility of conversation: one can always

attach to the discourse structure with new information. There are natural endings to conversations, but they have to do with a mutual agreement on facts, an exchange or that a disagreement exists with no resolution. It's not clear when this mutual agreement will take place. As conversational games are not just one shot, but may involve several, and even many, actions by each player, reputation effects are *always* an issue in conversation. I propose to capitalize on this fact.

Conversational games also involve many possible moves, perhaps an in principle unbounded number, as one can almost always say anything in a conversation. However, discourse theories like SDRT provide us with a typology of conversational moves with different effects on content. These are the so called *discourse relations* or types of relational speech acts by which we attach one contribution to a conversation to the discourse context. I take these to constitute the moves or actions in the game. A strategy is a function from a finite sequence of such moves to another sequence of moves. Because games are in principle unbounded, I shall consider sub games in which utilities are assigned to (possibly) intermediate nodes in the game tree. To keep things simple, I will not introduce considerations of player types and assume the games are ones of perfect information.

While in principle any conversation may always be continued with further discourse moves, these moves have costs. They induce commitments by the speaker in the case of assertions; a speaker who asserts that p incurs the cost of potentially being challenged and having to defend his assertion. Not to do so leads to a loss of positive face. For questions and requests, the cost involves both a threat to the other's face (being too forward) and inviting a retaliatory attack on the speaker's reputation. Politeness theory following Brown and Levinson (1978) has studied the relative politeness of various types of speech acts, but these speech acts only characterize individual sentences. My proposal here is to look at the costs of relational speech acts, discourse moves that not only characterize the current utterance but affect the structure of the discourse context. A choice of a particular discourse move at stage m by participant i of an extensive game modeling a dialogue may make it very costly for a move of a certain type by participant j at $m + 1$, effectively ending the conversation or turning it in a new direction. The reason for this has to do with already incurred costs. Suppose a speaker i makes a move that involves a particular SARG with a certain cost. Costs of turns by i that continue to develop or help realize that SARG, once such a development is started but not completed, are intuitively lower than the cost of turns that incur a new SARG, ceteris paribus. This will be a key feature in accounting for implicatures.

3.1 Questions and Their Responses in the Model

The next thing to specify is how to model questions and their answers. I understand questions as a dynamic operation on an information state, following the outlines of SDRT. The input information state for a question is a set of sets of possibilities, and a question's semantic effect on this set of possibilities is to introduce further

structure to this set of sets by regrouping the elements of those sets into possibly overlapping subsets, where each one of the subsets corresponds to a direct answer of the question. The linguistically encoded continuations are: eliminate some of the subsets by providing a direct answer or indirect answer (which implicates a direct answer), leave the structure as it is either by doing nothing or with a statement to the effect that the addressee is not in a position to provide any information, or ask a follow up question.

Let's now look at the costs of questions and their responses, in particular the face threatening or face saving nature of responses to questions. To make it concrete let us investigate the details of the conversation between Bronston (B) and the prosecutor (P). Let us assume that B does not wish to converse with P and does not, in particular, want to dwell on the topic of his bank accounts. If B gives an obvious non answer, he doesn't even commit to the question or address P's SARG to get an answer to his question. He affronts P's face, with potential retaliation and an unpleasant discourse move in subsequent turns, perhaps forcing him under oath to perjure himself or to admit damaging information. This would be rational if B were playing a one shot game (this is akin to the defect move in the Prisoner's Dilemma). But B is not playing a one shot game; if he defects, he will pay for it in the subsequent moves by P. B could also respond with a direct answer to P's question; in this case his response links to the question with the SDRT relation *Question Answer Pair* or *QAP*. If B responds with *QAP*, he does address P's SARG, at least as P has so far developed it. But B opens himself up to an explicit admission of guilt or explicit commitment to something perjurable. An *IQAP* answer that supplies additional information besides a direct answer, i.e. an IQAP that is an over answer, is more polite and increases the positive face of P. As such it is a lower cost move for B. More importantly, *IQAP* also increases the probability of no further negotiations on P's SARG, as the added information supplied in the *IQAP* anticipates follow up questions, answering them and so providing a more complete closure with respect to the questioner's SARG. This also increases the positive face of the interlocutor, making the move less costly. But, and importantly in this case, *IQAP* makes a continuation on the same topic by *P* more costly, because it forces him to introduce a new SARG or take the costly step of saying that his interlocutor hasn't answered the question (this is a direct attack on B's face and carries with it reputation effects). As it is in B's interest to avoid further questioning on this topic in particular, *IQAP* is the dominating strategy for him. If B answers *IQAP*, he avoids the potential face-threat and the politeness looks good to a judge and jury too. For P, *IQAP* is also an acceptable move by B to his question, and reputation effects make it less costly for him to accept it. Notice though that *QAP* is also an acceptable move for *P*: B gives him the information he was seeking and in a way that attends to P's reputation. B also gives additional information anticipating follow up questions, and this is information that could be of value to P. So it is in the interest of all to take a discourse move that is not a direct answer to be an indirect answer.

What about outside of the courtroom situation, say in the case of Janet and Justin in (3)? It seems that *IQAP* here too is a preferred move. With it Janet addresses Justin's SARG but also provides a justification for her indirect answer, for why she

wouldn't have seen him. An argument for one's answer is a priori a way of making it more convincing, and of making the message more credible for Justin. This aspect of her *IQAP* reveals another reason why it might be preferable for her. A simple inspection of the trust game model for conversation implies dominance of IQAP over QAP in most situations, whether cooperative or non cooperative. It predicts that a question/IQAP strategy is the best strategy in a question response game. This is the prediction we were looking for.

3.2 Complex Structures in Discourse and Costs of Discourse Moves

There is a close connection between SARG satisfaction and discourse structure in dialogue. Roughly, a move that satisfies a previously unsatisfied SARG forces a discourse "pop"; new material is no longer attached locally but to some higher constituent. This is a familiar principle for questions and their answers in theories that posit "questions under discussion" as a discourse structure organized around a stack of open questions (Roberts 1996; Ginzburg 1996); once the topmost question on the stack has been answered, the question is removed from the stack and the dialogue proceeds by answering the next question on the stack. SDRT has a much more general notion of discourse structure in which not only questions and their answers figure as constituents but also other assertions and relations between them. SDRT allows questions to be related to other questions via various discourse relations, and it allows assertions to attach to questions by other relations than simply answerhood, or in this case *IQAP*. Nevertheless, SDRT also incorporates a notion of discourse pop in its theory of where to attach new information and follows the intuition laid out in theories using questions under discussion in its account of attachment of new material to questions and their answers. Higher attachments incur new SARGs and in general incur higher costs, unless they are discourse closing moves or acknowledgments of a previous move or moves. By looking at discourse structure, we can examine in more detail how *IQAP*, other discourse moves and their possible continuations have different costs.

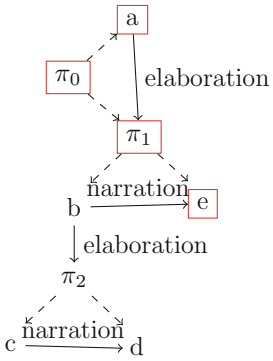
To give some more detail, I need to say more about discourse structure as it's described in a theory like SDRT. Discourse structures are graphs, where the nodes are discourse units and the arcs represent links between discourse units that are labelled with discourse relations (Asher 1993; Asher and Lascarides 2003). Discourse constituents may be elementary or complex. Elementary discourse units (EDUs), the atomic elements of a discourse structure, which correspond typically to clauses but also sub sentential constituents like appositions, non restrictive relative clauses inter alia (Afantenos et al. 2012), may be linked together via (one or more) discourse relations and form complex discourse units (CDUs) that are themselves arguments of discourse relations. CDUs in the ANNODIS corpus come in all sizes but the majority are relatively small (less than 10 EDUs in total (Nicholas et al. 2011)); in the few corpora of discourse annotated dialogues (Cadilhac et al. 2012),

the CDUs that exist are very short, as typically they occur within one conversational turn.

In SDRT discourse graphs have a recursive structure with two sorts of edges in order to represent CDUs, one for the discourse relations and one to encode the relation between CDUs and their constituents. Consider the figure below for (7), an example familiar to those who have read about SDRT.

(7) a. Max had a great evening last night.
b. He had a great meal.
c. He ate salmon.
d. He devoured lots of cheese.
e. He then won a dancing competition.

Here is the discourse structure:



Discourse structure for texts, in particular the presence of CDUs, has interpretive effects. For example, the event described in (7e) comes after the events in (7b, c, d), as detailed in (Asher and Lascarides 2003). The presence of CDUs in a discourse structure is essential because they allow us to give a discourse relation scope over several EDUs, which is especially useful in cases where the relation cannot be "factored" or distributed over the constituents inside the CDU. This occurs for right arguments with relations like Explanation:

(8) James is sick. [He drank too much last night and he smoked too much.]

The part in brackets describes a CDU with two EDUs both of which contribute to an explanation of why James is sick. But we cannot distribute this explanation across the constituent EDUs; both EDUs contribute to cause James's sickness but neither one might be sufficient to cause the sickness on its own.

SDRT distinguishes between two types of discourse relations: subordinating and coordinating discourse relations. Relations like *Elaboration*, *Explanation* and *IQAP* are subordinating relations, while relations like Narration are coordinating. This gives SDRT graphs the 2 dimensional structure seen in the diagram above. If a CDU is closed off and an attachment happens either to the CDU itself or a discourse unit that dominates it (in the sense that there is some sequence of subordinating discourse relations from the unit to the CDU), then a discourse pop occurs. In this structure we see

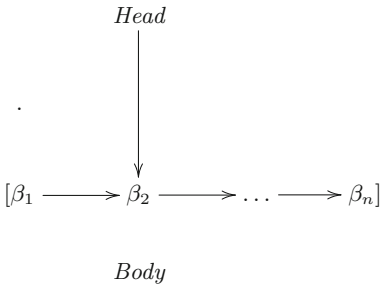


Fig. 3 A subordinate structure with a head

a discourse pop, even though no question answer structure is present: the EDU introduced by (7e) attaches to that introduced by (7b). This higher attachment is needed because the spatio temporal constraints introduced by the relations of Elaboration and Narration would entail that the dancing competition was part of the meal, if (7e) were attached to (7d), which is not plausible. In fact, this example points to a two way dependence between SARGs and discourse structure. Often SARGs for discourse moves are underspecified, especially with descriptive indicative sentences, though underspecification can also arise in the case of interrogatives or interrogatives (Asher and Lascarides 2003). The discourse pop mandated by considerations of plausibility here tells us that the speaker has finished with the SARG associated with (7d), which was to continue the Elaboration of the meal in (7b).

CDUs are also important for dialogue. The opening and closure of CDUs, or their boundaries, here too have to do with the SARGs of conversational turns. All discourse and dialogue moves, like asking a question for example, are defeasibly associated with a SARG–for instance, the asking of a question is associated with a goal of knowing the answer of the question. However, a SARG for a question may involve more information than just getting a direct answer to an explicit question; it may also include getting answers to certain follow up questions, demands for justification and so on. A SARG can develop and this development provides the grounds of a single local dialogue structure. Such a structure consists of a head or superordinate element, which gives rise to the general SARG together with a subordinate part, which develops the SARG. Such a structure is depicted in Fig. 3.

A question is typically an opening move in a CDU. The closure of that CDU will occur when an answer goal of that question is either satisfied or known not to be satisfiable and related follow up questions have similarly been answered or are known not to be answerable.

Let's now go back to our examples. An *IQAP* response to a question like that in (2) answers the question but also typically provides an "over answer". We've seen two kinds of over answers: one that anticipates follow up questions, another that provides a justification for the response, providing a priori grounds for rendering it more credible. It's more difficult to continue a SARG development once an indirect answer has been given. For instance (2e') is an example of an elaboration move on the answer.

(2e) Can you elaborate?

(2e) sounds silly, given the extended answer.

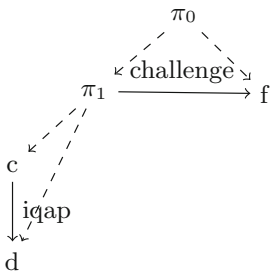
An *IAQP* answer thus provides a higher probability closing off of the local discourse structure: the SARG underlying the original question is satisfied and follow up questions are anticipated or justifications are provided. Continuations in this situation are more likely to be on the whole structure, which I hypothesize is a higher code move. For example, if P pursues this line of questioning in (2) it will most likely be on the whole structure—e.g. "challenge" to B's indirect answer. A challenge would be something like (2f) or (2f'):

(2f) Would you please answer the question, yes or no.

(2f') That wasn't my question. I'm not interested in whether the company had an account. I want to know whether you ever had an account.

The challenge takes as its left argument the response to the question, and the relation it bears to the question itself, thus the entire CDU. Such a challenge move is a higher cost move. The higher cost comes from a threat to face, generally perceived as very aggressive. IQAP thus raises the probability of a move by P to another topic or to exit the conversation. This is precisely what would suit B best.

Here's a picture of the IQAP scenario:



Once again, the situation is similar for the exchange between Justin and Janet. Justin can challenge the indirect answer, but it will be a higher cost move. Janet is rational in calculating that an IQAP will lead Justin to move to a different topic or to stop the conversation.

Let's now consider the alternative moves to *IQAP*, either *QAP* or ¬*Ans*. The *QAP* response is dispreferred for strategic reasons by *B*. It's also not a move in Janet's interest; either she admits to seeing Valentino or explicitly lies. A short answer QAP invites follow up questions, and so makes it easy for *P* to stay on this topic and get more information. For B or Janet, a non answer, which I label here with ¬ *Ans*, is a good one shot move, but in an extended game with further moves, it invites a low cost restatement of the question, since the SARG is not satisfied. It also invites a retaliation since it does not address the SARG of the questioner and so is attack on his positive face. The low cost move by *P* is depicted in Fig. 4.

The game tree in Fig. 5 for the exchange between *P* and *B*, where the costs of the different moves are motivated by the discussion above. I abstract from details

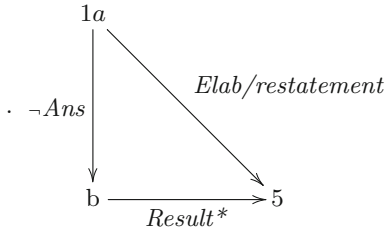


Fig. 4 The structure of a low cost move

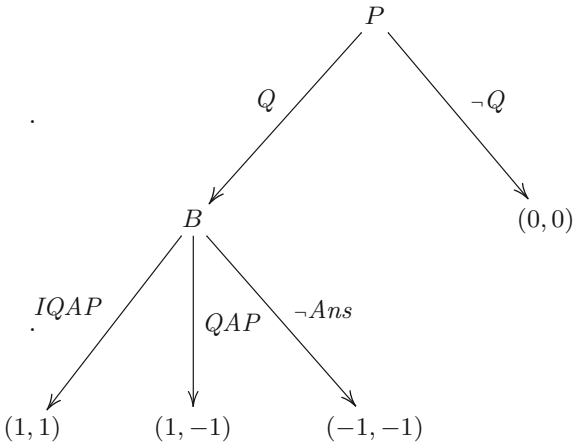


Fig. 5 The game tree for the Prosecutor and Bronston

and hypothesize three different discourse actions of B. The utilities provided, where P's utility is the first element of the pair and B's utility is the second element, are motivated by the preceding discussion:

The game over responses to questions is sub-tree compatible with a sequential trust game (McCabe et al. 2003) and its solution concept. While IQAP and Not Answer are equally rational for B in a one shot game, Not Answer puts P at a disadvantage. This disadvantage may lead to an unpleasant conversational turn, and reiteration of the question; the utilities on the $\neg$ *Ans* reflect this. In this case QAP is dispreferred by Bronston for reasons having to do with extra linguistic issues (the problem of explicit perjury).

Notice that P is indifferent between *QAP* and *IQAP*, since they both satisfy the SARG underlying the question. In the game that I have been using to model the situation, I have taken the contribution of each participant to be unambiguous. For the purposes of evaluating the rationality of *IQAP* responses, the assumption of non-ambiguity is harmless. However, a more detailed analysis of the moves by B reveals a sub game of an interpretive sort, i.e. a type of signaling game: B emits a signal, which we can assume has a fixed lexical and compositional semantics, and

P must infer from this semantic content what sort of move P is making. From the words themselves uttered by B, P has in fact two options: *IQAP* and $\neg Ans$. Though he is indifferent between *IQAP* and *QAP*, he may be suspicious of B's desire to avoid the *QAP* move. The satisfaction of the questioner's SARG in the *IQAP* case depends on some defeasible reasoning about discourse attachment, reasoning which does not entail the answer. This reasoning is not guaranteed to be sound, and so the commitment by B to the answer might be challenged, if P takes the answer on board as the move. B might try to deny that he was answering P's question. A full analysis of the signaling game as in Asher and Lascarides (2012) would introduce different player types for B, one where he is deceptive and one where he is not. Asher and Lascarides (2012) argue that P should be indifferent between QAP and IQAP only if IQAP remains an equilibrium in a larger game, in which facts about B's player type that might distinguish between these IQAP and QAP are taken into account in the interpretation of B's response to the question. But I will not go into the lengthy discussion that this engenders here, as it is not relevant for demonstrating the utility of *IQAP* moves.

4 Back to Implicatures

So far, I've developed a game theoretic model based on politeness and on assumptions of costs of continuations of certain discourse structures. I've shown that it's reasonable to suppose that certain kinds of responses to questions are preferred in non cooperative conversations—in effect over answers to questions and *IQAP* moves are preferred for strategic reasons. Thus, the account fills a gap in the Gricean account. But what about our puzzle about implicatures in non cooperative contexts?

Given the model, *IQAP* is strategically favored as a response. What I do is turn the problem on its head. For Griceans, it's only the presence of the implicature that allows us to treat the contribution in a misdirection as an *IQAP*. Here it's the choice of discourse relation itself, inferred on independent grounds and justified on the basis of game-theoretic and prudential grounds, that generates the implicature. The way to the implicature is relatively straightforward, once the discourse relation is fixed. When the move doesn't entail a direct answer, we have to engage in defeasible reasoning to get a direct answer. Sometimes this reasoning depends on a set of alternatives generated lexically or by the discourse context (see (Asher 2012) for a discussion of this issue and a proposal). The counterfactual reasoning goes as follows for P. B would know whether he had a bank account and so, given this presumption, would have said so; this would have been a natural and relevant issue to include in an *IQAP*. The *IQAP* move is designed to anticipate follow up questions, and a natural one in this case would be the question of whether Bronston himself had a bank account. In fact, it's the question that P asked! P can reasonably assume that since B doesn't want the questioning to go on, he says all that is relevant to P's question—he is anticipating follow-up questions. Since B didn't say that he had a bank account, he commits to not having one, given the type of discourse turn. So in this case

¬Commit(ϕ), B's not committing to having a bank account, leads defeasibly to Commit¬ϕ, the commitment to the implicature that B didn't have a bank account. The scalar inference to the conclusion that Bronston doesn't have a bank account can be justified without appealing to any theses about cooperativity. Here I've substituted utility of *IQAP* and its semantics for cooperativity to get generate the implicature. The more general perspective, developed in Asher (2012) is that it is inferences about discourse structure that drives most if not all implicatures.

Other cases of misdirection have a similar analysis. Once again, we infer *IQAP* from the presence of an interrogative sentence mood to which is attached a contribution in indicative mood. The reasoning to *IQAP* is once again justified on prudential and game-theoretic grounds. The implicature generated by Janet's response to Justin in (3) is itself triggered by the search for a link between what is said and an answer to Justin's question; Janet's response in fact explains why she hasn't been seeing Valentino and this discourse configuration entails a negative answer to the question.

Nevertheless, misdirection is still possible. People who misdirect say the truth but exploit discourse structure to generate incorrect implicatures. The inference to *IQAP* remains consistent with the facts, despite the fact that the implicature generated is incorrect. And in so doing, the implicature remains as well. This contrasts with the Gricean approach, on which arguably the implicature simply doesn't arise. Our assumption of *IQAP*, though consistent and even reasonable, is fragile. The problem lies, as I intimated above, in the interpretation of B's signal. Is it really an *IQAP* or is it in fact an evasion? Normal speakers do anticipate follow up questions, especially ones directly relevant to the issue. Were Bronston a normal uncooperative speaker, the inference to IQAP and the commitment to not having a bank account would follow. That is, B would in fact commit to not having a bank account (note that the question as to whether he commits to not having a bank account is a *very* different question from whether this information is credible, as I said before). But B in fact did claim that he did not *say* that he had a bank account. He was just giving some background information about the bank and his firm. So he argued that P in fact misinterpreted what he actually said; it wasn't a normal case. B's argument, however, doesn't challenge the rationality of *IQAP* but rather the reasoning involved in the signaling game. Of course the prosecutor P is also at fault as Asher and Lascarides (2012) argue. He should have realized that Bronston's commitment here is less strong than one based just on compositional semantics; it relies on defeasible reasoning about discourse moves, which are ambiguously signaled. He should have realized that Bronston might try to weasel out of his commitment, and the attendant charge of perjury. In fact, this is what happened.

5 Conclusions

I have proposed in this chapter a model and an argument for supporting implicatures without Gricean assumptions about general beliefs in cooperativity. I've argued that certain discourse moves like over answers or *IQAP* moves are equilibrium points in a

question response game, and that these over-answers generate the implicatures. The implicatures are drawn, even in the presence of misdirection. The model also explains why over answers are so frequent. The model makes clear on a hidden reputation effect that is constant in extended conversation. The foundation of this model rests on ideas from politeness theory, regimented within the framework of game theory. And thus face and reputation emerge as important factors in the evolution of discourse structure for conversation. Which perhaps points to a new and important role for expressive meaning.

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