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Modelling Strategic Conversation: model, annotation design and corpus

Stergos Afantenos[1], Nicholas Asher[1], Farah Benamara[1], Anais Cadilhac, Cedric Dégremont[1], Pascal Denis[3], Markus Guhe[2], Simon Keizer[4], Alex Lascarides[2], Oliver Lemon[4], Philippe Muller[1], Soumya Paul[1], Vladimir Popescu[1],Verena Rieser[4] Laure Vieu[1]
1: IRIT, Univ. Toulouse, France
2: Department of Informatics, University of Edinburgh, U.K.
3: Mostrare, INRIA NLE, France
4: Herriott-Watt Univeristy, Edinburgh, U.K.

1 Introduction

A Gricean view of cognitive agents holds that agents are fully rational and adhere to the maxims of conversation that entail that speakers adopt shared intentions and fully aligned preferences– e.g. (Allen and Litman, 1987; Lochbaum, 1998). These assumptions are unwarranted in many conversational settings. In this paper we propose a different view and an annotation scheme for it.

We propose a game theoretic approach to conversation. While we assume like Grice that conversational agents are rational, agents talk to maximize their expected utility (a measure that combines belief and preference). Preferences together with beliefs guide conversational actions as much as they guide non linguistic actions. Conversations are dynamic and extensive games, and they have an in principle unbounded number of possible moves and no mandatory stopping points—you can, in some sense, always say anything, and you can always continue a conversation. The moves for each player consist in making a discourse contribution, which we finitely characterize using discourse structure in the sense of (Asher and Lascarides, 2003). Such discourse structures consist of discourse units linked to each via discourse relations like Elaboration, Question-Answer-Pair (QAP) and Explanation. In addition these discourse relations serve to link one participant's contribution to another; for instance, if one agent asks a question, another may respond with an answer, the two contributions then linked together by the relation QAP. Conversational participants are alternatively senders (S) or receivers of messages (R). S sends a signal s bearing in mind that receiver R has to figure out: (a) what is the message $m(s)$? What is S publicly committed to? (b) Is $m(s)$ credible or not? (c) Given a status for $m(s)$, what signal s' should R send in return? R now becomes sender and S, now the receiver, goes through the calculation steps (a)-(c). We assume that at least part of the conventional meaning of the signal is determined prior to game play. In calculation (a), R must calculate using a form of generalized signaling game what are the public commitments that S has made—these include not only the fixed semantics but also the implicatures that introduce discourse relations between contributions. Sometimes these involve strategic considerations: for instance, is S actually replying to the question asked in the prior turn or is she engaged in some other discourse move? If she is answering the question, is this something that S cannot plausibly later deny? (Asher and Quinley, 2011) argue that a trust game format is the right one for computing optimal moves in task (c).

(Traum and Allen, 1994) advocates a related view on which cooperativity is determined only by the social conventions guiding conversation, obligations that do not presuppose speakers adopt each other's goals (Traum et al., 2008). For us, the social conventions that are foundational on Traum's account are however themselves based on utility. Utility is also the basis for training agents to behave in a certain way through reinforcement learning for conversational agents (Frampton and Lemon, 2009).

2 Example negotiation dialogue

We provide a sample annotation of a negotiation dialogue (table (1) from our corpus, which consists of recorded chat negotiations taking place during on-line games of The Settlers of Catan,[1] a popular boardgame. The annotations are done

[1]See the original game on www.catan.com, adapted by us on homepages.inf.ed.ac.uk/mguhe/socl/

Speaker	Id	Turn	Dom. function	Rhet. function	Prefs
Euan	47	[And I alt tab back from the tutorial.]_1	OTHER		
		[What's up?]_2	OTHER	Result*(47_1,47_2)	
Joel	48	[do you want to trade?]	OFFER ⟨Joel,?,?,Euan⟩	Q-elab(47_2, 48)	
Card.	49	[joel fancies a bit of your clay]	STRAT.-COMMENT	Expl*(48, 49)	Pref(joel)
Joel	50	[yes]	OTHER	Ackn(49, 50)	
Joel	51	[!]	OTHER	Comment(50, 51)	
Euan	52	[Whatcha got?]	COUNTEROFFER ⟨Euan,?,?,Joel⟩	Q-elab([48-50], 52)	
Joel	53	[wheat]	HAS-RESOURCES ⟨Joel,wheat⟩	QAP(52, 53)	
Euan	54	[I can wheat for clay.]	COUNTEROFFER ⟨Euan,wheat,clay,Joel⟩	Elab([52,53], 54)	
Joel	55	[awesome]	ACCEPT(54)	Ackn(54, 55)	

Table 1: Example annotation, with offer arguments: offerer, requested resource, offered resource, receiver.

using the GLOZZ tool developed by the University of Caen.[2]

Our annotation model features both a discourse structure level (DS) and a dialogue act (DA) level, which categorizes elementary discourse units or EDUs, given by a pre-annotation, relative to their role in negotiations. DS encodes communicative functions of EDUs or clusters of EDUs using the relations of (Asher and Lascarides, 2003), similar to but more detailed than DAMSL's (Core and Allen, 1997). Unlike (Sidner, 1994), which also provides domain level acts for negotiations, our semantics for DAs does not assume Gricean cooperativity. Our DAs are: OFFER, COUNTEROFFER, STRATEGIC COMMENT a comment about a play in the game, OTHER. Each act also comes with an annotation of resources that are offered, requested, or simply possessed. With respect to the discourse relations, Expl* and Result* stand for "metalinguistic" relations: Result*(47_1, 47_2) means that the action described in 47_1 causes the speech act of asking the question in 47_2. Similarly, Expl*(48,49) indicates that Cardlinger explains why Joel asked the question in EDU 48. Q-elab is the relation of follow up question or Q-elab, and Ackn stands for the acknowledgment relation, while QAP stands for Question-Answer-Pair. The semantics for all these relations can be found in (Asher and Lascarides, 2003).

Our annotators received training over 22 negotiation dialogues with 560 turns. The inter annotation agreement at both EDU and rhetorical structure levels for this training will be used to refine the guidelines. In over 91 instances of doubly-annotated EDUs considered, we have a kappa of 0.54, a moderate level due to the very high number of "other" acts . For rhetorical structure, using an exact match criterion of success (easy to compute but harsher than necessary), we have a Kappa of 0.45. These figures are very preliminary.

[2] www.glozz.org

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