Towards Extraction of Dialogical Arguments

Katarzyna Budzynska[1,2], Mathilde Janier[3], Chris Reed[2], and Patrick Saint-Dizier[3]

[1] Institute of Philosophy and Sociology, Polish Academy of Sciences, Poland
[2] School of Computing, University of Dundee, Scotland
[3] IRIT-CNRS, Toulouse, France

Abstract. The argument structures of real debates are linguistically extremely sophisticated. Recent work in the philosophy of language has started to demonstrate how they might be teased apart, and it seems for the first time as though computational techniques might perhaps be brought to bear on the task of analysing such discourse. A first step is to develop models that can determine dialogical acts such as assertions, questions and challenges. Here, we report on a first experiment in classifying these structural components on the basis of a linguistic marks.

1 Problem and aims

Our approach uses Inference Anchoring Theory (IAT) [2] as the theoretical foundation for connecting dialogical structures with argumentative structures. Consider a small example with argumentation performed in a dialogical context:

(1) a. Bob: *p is the case.*
b. Wilma: *Why p?*
c. Bob: *q*

In IAT, different relations between propositions distinguished by logic and argumentation theory can be expressed like e.g. a reasoning structure with a conclusion q, a premise p, and a relation between p and q (see *rule application instance #1* in Fig. 1). In the standard language for describing argumentative structures, Argument Interchange Format (AIF) [3], propositions correspond to information (I-) nodes, while relations between them – to scheme (S-) nodes.

On the other hand, when focusing on dialogical structures, (1) contains three utterances whose performance is governed by dialogue rules which express how sequences of utterances can be composed (they correspond to protocol in formal dialogue games [7], and transition application (TA-) nodes in the extended AIF$^+$ [9]). For example, the dialogue rules permitted Wilma to perform (1-b), by virtue of the fact that at (1-a), Bob committed himself to p (*transition instance #1*).

Characterising the application of dialogue rules specifically as transitions between locutions is rather more unusual, but is a central part of IAT, because these transitions can act as "anchors". Logical structures are "anchored" in dialogical structures via *illocutionary connections* related to different illocutionary forces (i.e. the speaker's communicative intentions, [12]). The dialogical acts (e.g. "Bob said, p") are linked to their propositional contents (p), by illocutionary connections (*asserting instance #1*).

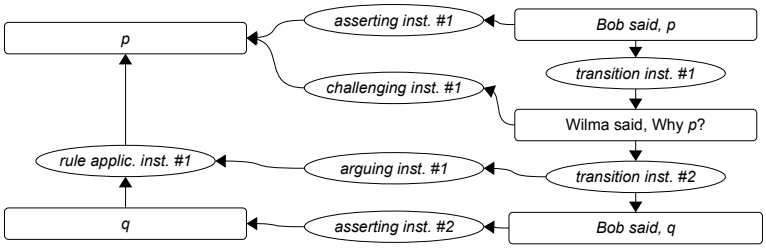

Fig. 1. Interaction between argument and dialogue.

In order to be able to extract arguments and make explicit the logical structures that are invoked in a dialogue, we first need to identify the types of illocutions of the dialogical moves involved. In real-life communication, this task is particularly difficult. We have been working with discourse taken from the BBC Radio 4 programme *The Moral Maze*, which is explicitly structured around a debate format. The MM2012 corpus[1] comprises 65,000 words of transcript, and includes the following example in which it is discussed whether the British Empire behaved in an uncivilised way during a war in Kenya in the 1950s:

(2) a. Lawrence James: *It was a ghastly aberration.*
b. Clifford Longley: *Or was it in fact typical? Was it the product of a policy that was unsustainable (...)*?

Intuitively, what Longley claims in (2-b) is that uncivilised behaviour was typical for the Empire, and he supports this claim with a premise that such behaviour was the product of an unsustainable policy. On the linguistic surface, however, not only do we have neither conclusion nor premise asserted explicitly, the act (2-b) is cast as a series of questions. What we need is to be able to identify the assertive intentions behind such questions. Only then can we assemble the parts of the argument and attempt to model their composition into large structures.

Understanding the ways in which dialogical action can establish inferences stands at the intersection of many disciplines including (at least), discourse analysis, pragmatics and semantics. In discourse analysis, Rhetorical Structure Theory [6] has been enormously influential in facilitating computational models of discourse structure. It is, however, poor at handling structures of argument [8]: first, whether two sentences are related through Elaboration or Justification says little or nothing about whether they form a part of a Modus Ponens or Modus Tollens argument structure; and second, argument structure is often missed entirely by rhetorical structure, a problem which becomes manifest in the abundance of (vapid) Joint relations in RST analyses of many arguments. In pragmatics, one of the most significant approaches to dialogue meaning has come from Segmented Discourse Representation Theory, SDRT [1]. SDRT has much broader goals than IAT and as a result it is less well adapted at handling the structure of inference-establishing discourse units. In particular, because SDRT

[1] Available at http://www.arg.dundee.ac.uk/corpora

defines all locutions as actions performed in the context of the entire history of the dialogue up to that point rather than on the functional relationship, it is impossible to single out that part of the history with which inference is being established. In semantics, Ginzburg [5] has had a major impact on our understanding of the meaning of dialogical actions. The KoS approach, like SDRT, is much more general than IAT, but, also like SDRT, suffers in its ability to handle argumentation as a result. Specifically, KoS does not allow to understand how challenge-response sequences establish inferences.

2 Anatomy of arguments in dialogue

The paper focuses on three simple types of linguistic structures $F(p)$ (where p is a content uttered with an illocutionary force F) occurring in the context of dialogical arguments: assertions, questions and challenges. The speaker S uses an act of *assertion* to directly communicate his opinion about p. Asserting p does not assume S *really* believes p – it is rather a public declaration of belief to which the speaker can be held. When S uses a dialogical act of *question* $F(p)$, he directly expresses that he is asking for the hearer H's opinion on p. Three main subcategories of questions have been distinguished in the MM2012 corpus: pure questions (PQ), assertive questions (AQ), and rhetorical questions (RQ). When S utters a PQ, he is only seeking H's opinion on p. AQ and RQ, in contrast, convey some assertive communicative intention. When S performs RQ: "*Is p the case?*", he is grammatically stating a question, but in fact S communicates that he believes p. Finally, when S uses AQ, he not only directly seeks H's opinion on p, but also indirectly publicly declares his own opinion on p. The speaker uses a *challenge* $F(p)$ in a dialogue, when S directly expresses that he is searching (asking) about the grounds for hearer H's opinion on p. Challenges are a dialogical mechanism for triggering argumentation. For example, in (1) Wilma's utterance "*Why p*?" is a challenge, since she asks Bob about the reasons for believing p. In the next move, Bob provides a reason q and, as a result, the argument "p since q" is constructed by means of the dialogue.

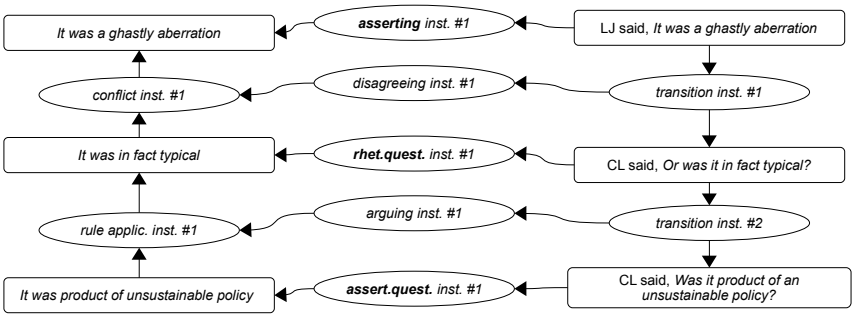

Fig. 2. Assertion, assertive and rhetorical questions in the dialogical argument in (2).

This taxonomy can be refined further, but suffices as is to provide a solution to the challenge described in Sect. 1. The utterance (2-a) is an assertion (see *asserting instance #1* in Fig. 2), in which James publicly declares his belief that uncivilised behaviour of the Empire was a ghastly aberration. The first utterance in (2-b) is RQ (see *rhetorical questioning instance #1*), and as a result, we recognise that in saying "*Or was it in fact typical*?" Longley is not searching for James' response at all, but is instead declaring his own belief that an uncivilised behaviour was typical for the Empire. The second utterance in (2-b) is AQ (*assertive questioning instance #1*), in that Longley is not only asking James whether he thinks that an uncivilised behaviour was the product of a policy, but also declared that he believes so himself.

We can thus extract the assertive contents of RQ and AQ, which allow us to identify a relation between them that constitutes an inference and thence to recognise the remaining components such as, e.g., the fact that Longley's argument is a dialogical response in which he communicates his disagreement (*disagreeing instance #1*) and constructs a conflict (*conflict instance #1*) between the conclusion of his argumentation and the content of proponent's utterance (2-a). In fact, the conflict here corresponds to yet another type of argumentative structures studied within the abstract argumentation framework [4].

3 Linguistic modelling and implementation

This section briefly describes how a dialogue can be decomposed into meaningful dialogue text units using a dedicated grammar than can identify and delimit such units and how an illocutionary force can be assigned to each of these units, following the definitions given in Section 2. The experimental work is based on 3 discussions from the MM2012 corpus in which the transcript involves punctuation but no prosodic marks; some very long sentences; several types of statements; and discourse regulators and other forms of dialogue management.

The first step is to develop a specific elementary discourse unit (EDU) [11] system dedicated to dialogical situations with specific structure and marks. In most situations, units can be identified on the basis of discourse marks typical of dialogue, position or belief statements, or aggregation of such marks, e.g. when there is an intention of persuasion. The grammar is implemented using the <TextCoop> platform and the Dislog language [10], specifically designed for discourse processing. The goal is to evaluate the adequacy of the linguistic model we have elaborated, in particular the rules and the lexical resources. The main categories of marks used to delimit text units include: (1) verbs promoting controversies, beliefs, position statement and argumentation: propositional attitude verbs (*think, believe, agree, deny*), epistemic verbs (*know, understand*), communication and report verbs (*claim, hold*) and psychological verbs (*dream, worry, be intrigued*); we also noted a few metaphorical uses (*it tends to*); (2) modal expressions specific to interaction (*could be, may mean*); (3) opinion expression adverbials and related expressions (*definitely, surely, obviously*); (4) specific interrogative forms (*where does it, isn't, why should*). Unit delimiters include connectors (*but, because*), conditional and goal expressions and punctu-

ation (commas and dots). To handle these marks and the associated linguistic elements (subjects, pronouns, negation, modals, etc.) we developed 'local' grammars dealing with e.g. propositional attitude expressions, psychological expressions, etc. A total of 52 rules have been developed. The text unit identification and delimitation is also based on a dedicated grammar, with 8 rules. We have conducted an indicative evaluation (to identify improvement directions) on a previously manually annotated text with 131 relevant text unit occurrences. This is small but turns out to be sufficient for a first analysis, considering the difficulty of the task. Out of this set of units, our system correctly annotated 102 units (78%) (identification and delimitation), while 28 (21%) are correctly identified but the delimitation is not correct (a unit is split into several or vice-versa). Finally, the system identified 7 units which are not directly dialogical text units.

The next step is to identify the illocutionary force types presented in the previous section. Each text unit is assigned a type. We present here the results obtained using linguistic marks. Linguistic forms (aggregation of simple marks) used to identify the types of dialogical acts are different from those used for text unit delimitation, and we have identified 42 such forms and implemented them in Dislog. We introduce polymorphic types to represent ambiguities, which need further analysis. For example, AQ-RQ is the polymorphic type assigned to a text unit, which can be one of the two types AQ or RQ, when it was not possible to make a choice between these two types. Of interest is the study of the overlap situations in linguistic terms, so that the pragmatic factors at stake can be better identified. Polymorphic types concern questions or assertions separately, since these two main categories can be relatively well identified. Some criteria are proper to specific types: RQ – conditional questioning (*why should, should we*), indirect forms based on negation (*aren't, isn't*); AQ – important use of the past (*was it, were we*), forms using would (*would you, would that*); AC – *why* followed by the auxiliary *to be*; PC – *why* followed by *do* or *would*; PQ is the default basic type. Polymorphic types such as PC-RQ include forms which are ambiguous, in particular why + (do) + demonstrative. RQ-PQ includes forms in should + demonstrative or personal pronoun. Considering our corpus of three manually annotated texts, we have the following distributions for polymorphic types: PQ-AQ: 13%, AQ-RQ: 10%, PQ-AQ: 6%, RQ-PC: 4%, RQ-AC: 4%, and 3% for the remainder. This means that about 62% of the text units are unambiguous w.r.t. their illocutionary force, which is a rather low proportion. It is thus crucial to identify additional factors (pragmatic, typographic) that contribute to resolve the ambiguities.

If, finally, we consider the same 131 text units as in the previous section. Results are as follows: 38% of the units are correctly assigned a basic type, while 40% are correctly assigned a polymoprhic type. 22% of the units get an incorrect type. In the case of polymorphic types, it is important to note that 65% of the polymorphic types is the combination of different strengths of assertions where the distinction, even for humans, is difficult. The erroneous assignment can still be improved by some typographic and linguistic adjustments. We feel these

results – of 78% accuracy with polymorphic types – although still preliminary, are very encouraging considering the difficulty of the task.

The results of the parse is the original text annotated as for the example (2):

<utterance speaker = "lj" illoc = "standard_assertion"> <textunit nb = "215"> it was a ghastly aberration < /textunit> .
<utterance speaker = "cl" illoc = "RQ"> <textunit nb = "216"> or was it in fact typical ? < /textunit> < /utterance> . <utterance speaker = "cl" illoc = "RQ-AQ"> <textunit nb = "217"> was it the product of a policy that was unsustainable that could only be pursued by increasing repression? < /textunit> .

4 Conclusions

The paper proposes a simple taxonomy of language structures that typically accompany argumentation in dialogical contexts, and reports preliminary results for recognition of those illocutionary structures in raw, spoken-language transcripts. These results are encouraging and bring the automatic identification of dialogic argument structure in discourse such as the real-world, complex example (2) one step closer, with the parse above representing a crucial milestone. The two initial language processing phases presented above: text unit delimitation and illocutionary force identification, run on the <TextCoop> platform implemented in Prolog. A demo can be presented to the CMNA participants. The rule system, the lexical data, and the way the system is updated will be explained.

References

1. N. Asher and A. Lascarides. *Logics of Conversations*. Cambridge UP, 2003.
2. K. Budzynska and C. Reed. Whence inference? In *University of Dundee Technical Report*, 2011.
3. C. Chesnevar, J. McGinnis, S. Modgil, I. Rahwan, C. Reed, G. Simari, M. South, G. Vreeswijk, and S. Willmott. Towards an argument interchange format. *The Knowledge Engineering Review*, 21(4):293–316, 2006.
4. P. M. Dung. On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. *Artificial Intelligence*, (77):321–357, 1995.
5. J. Ginzburg. *The Semantics of Dialogue*. Cambridge University Press, 2012.
6. W. C. Mann and S. Thompson. Rhetorical structure theory: Toward a functional theory of text organization. *Text*, 8(3):243–281, 1988.
7. H. Prakken. Formal systems for persuasion dialogue. *The Knowledge Engineering Review*, 21:163–188, 2006.
8. C. Reed. *Generating arguments in natural language*. Unpublished doctoral dissertation, University College London, 1998.
9. C. Reed, S. Wells, K. Budzynska, and J. Devereux. Building arguments with argumentation: the role of illocutionary force in computational models of argument. *Frontiers in Artificial Intelligence and Applications*, 216:415–426, 2010.
10. P. Saint-Dizier. Processing natural language arguments with the <textcoop> platform. *Journal of Argument and Computation*, 3(1):49–82, 2012.
11. H. Schauer. From elementary discourse units to complex ones. *Sigdial workshop, ACL*, 2006.
12. J. Searle. *Speech Acts: An essay in the philosophy of language*. Cambridge, 1969.