Modelling Debates on the Computer

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Keywords: Debate, Argument, Dialogue Model, Knowledge Representation, Human-Human Dialogue.

Abstract: In the paper, a model of debate is developed which includes a model of argument. When starting interaction, the participants have opposite communicative goals. They are exchanging arguments and counter-arguments and one of them has finally to abandon his or her initial communicative goal, i.e. one participant 'wins' and another 'loses'. An analysis of human-human dialogue corpus is carried out in order to evaluate the suitability of the model for describing natural debates. A computer implementation is introduced. Notions of negotiation, debate and argument are discussed.

1 INTRODUCTION

Negotiation is a process where each party tries to gain an advantage for themselves by the end of the process (Čulo and Skendrović, 2012). The aim of negotiation is to reach a compromise. Debate is a negotiation between teams or individuals in which they express different opinions about something. The participants of a debate have conflicting interests and they exchange arguments in order to influence the partners' mental states. Argument consists of two or more assertions where the last one is an inference (claim) and the preceding assertions are presuppositions (Martinich, 1995).

Many researchers have been modelling negotiation on the computer and investigating formalization of argument (see overviews Chesñevar et al., 2000; Amgoud and Cayrol, 2002; Besnard and Hunter, 2008; Scheuer et al., 2010). Logical models of argument support decision making by participants, guide negotiation and allow to reach agreements.

We are studying the interactions where the participants can have conflicting interests. One participant, *A*, has a communicative goal that his partner, *B*, will decide to perform an action *D*. The goal of the partner *B* is opposite: do not do *D*. In the course of interaction, *A* tries to influence *B*'s reasoning processes in such a way that *B* still decides to do *D* (doing *D* can be a part of the object of negotiation). A single way for *A* to do so is to propose arguments that show to *B* which pleasant, useful, etc. positive aspects will *D* or its consequences have for *B*. We have worked out a dialogue model which includes a reasoning model as its part (Koit and Õim, 2014). Our reasoning model is based on the studies in the common-sense conception of how the human mind works in such situations; we suppose that in communication people start, as a rule, from this conception, not from any consciously chosen scientific one. The reasoning model includes some principles which represent the interaction relations between different aspects of the action under consideration and the causal connection between the aspects and the decision taken.

In the current paper, we will further develop the model and present a formal model of debate where the participants exchange arguments for and against of doing *D*. They can also ask and answer questions in order to make choices among the arguments for averting the partner's counter-arguments.

The rest of the paper is structured as follows. Section 2 gives an overview of related work. Section 3 introduces our model of debate. Section 4 gives the results of analysis of human-human debates, in order to justify the model. Section 5 discusses some questions related to the concepts of debate, negotiation and argument in human-human interaction and in our computer model from a somewhat more general point of view. Conclusions are made in Section 6.

Koit M. and Õim H..
Modelling Debates on the Computer.
DOI: 10.5220/0005129303610368
In *Proceedings of the International Conference on Knowledge Engineering and Ontology Development* (KEOD-2014), pages 361-368
ISBN: 978-989-758-049-9

2 RELATED WORK

Main sources of inspiration for this paper have been presented in several studies.

Dungh (1995) introduces an argumentation system as a pair <A, R> where A is a (finite) set of arguments, and R an attack relation between arguments ($R \subseteq A \times A$).

Wagner (1998) discusses the basic concepts of argumentation and defines an argument in favour of an assertion G in the form

$$<\{f_1,\ldots,f_m\}, <r_1,\ldots,r_n>>$$

consisting of a set of strict and defeasible assertions $\{f_1,\ldots,f_m\}$, also called base assertions or facts, and a sequence of instantiated rules $r_1,\ldots,r_n$, where r_n is called top rule, and conclusion of r_n is G. He considers artificial agents as transition systems participating in disputes and negotiations.

Karacapilidis and Papadias (2001) implement an argumentation system on the computer for collaborative decision making through debates and negotiations.

Rahwan et al (2004) discuss three approaches to automated negotiation: game-theoretic, heuristic-based and argumentation-based. A dialogue game is a rule-based structure for conversation where arguments are exchanged between two participants reasoning together on a turn-taking basis aimed at a collective goal (Yuan et al., 2008). Heuristic methods offer approximations to the decisions made by participants. Agents exchange proposals (i.e. potential agreements or potential deals). Both game-theoretic and heuristic approaches assume that agents' utilities or preferences are fixed. One agent cannot directly influence another agent's preference model, or any of its internal mental attitudes (e.g., beliefs, desires, goals, etc.) that generate its preference model. A rational agent only modifies its preferences if it receives new information. Argumentation-based approaches to negotiation allow agents to 'argue' about their beliefs and other mental attitudes during the negotiation process. In negotiation, argument can be considered as a piece of information that may allow an agent to: (a) justify its negotiation state; or (b) influence another agent's negotiation state (Jennings et al., 1998). Thus, in addition to accepting or rejecting a proposal, an agent can offer a critique of it.

Scheuer et al (2010) consider how argumentation has been taught to students using computer-based systems. Argumentation systems can be beneficial for students. Still, both on the technology side and on the educational psychology side, there remains a number of research challenges that need to be addressed in order to make real progress in understanding how to design, implement, and use educational argumentation software.

Besnard and Hunter (2008) formalize argumentation by using classical logic and define an argument as a pair $<\Phi, \alpha>$ where Φ is a set of formulas (a subset of the knowledge base) and α is a formula such that

1. Φ is not contradictory
2. Φ implies α
3. Φ is a minimal subset of the knowledge base which satisfies 2.

If $<\Phi, \alpha>$ is an argument, it is said that it is an argument for α and it is also said that Φ is a support for α. Here α is called the claim of the argument.

Rahwan and Larson (2011) explore the relationships between mechanism design and formal logic, particularly in the design of logical inference procedures when knowledge is shared among multiple participants.

Hadjinikolis et al (2012) provide an argumentation-based framework for persuasion dialogues, using a logical conception of arguments, that an agent may undertake in a dialogue game, based on its model of its opponents.

Our main aim is to model argumentation in agreement negotiation processes. Because of this, as said above, we consider as a critically important subtask modelling of the reasoning processes that people supposedly go through when working out a decision whether to perform an action (Koit and Õim, 2014). People construct folk theories, or naïve theories, for the important fields of their experience and they rely on these theories when acting inside of these domains. The theories include knowledge, belief and image structures concerning the corresponding domains, but also certain principles and rules that form the basis of operating with these mental structures.

3 COMPONENTS OF DEBATE

Here we introduce our dialogue model and apply it to debates where exchanging arguments and counter-arguments is an important part. As compared to the models reviewed in the preceding section, it would be appropriate to point out two distinctive features of our dialogue model. First, it includes a model of human reasoning. Second, the concepts of communicative strategies and tactics are introduced.

3.1 Dialogue Model

Let us consider a dialogue between two participants (humans or artificial agents) – *A* and *B* – in a natural language (see Koit and Õim, 2014). Let the communicative goal of *A* be "*B* makes a decision to do an action *D*". *A* has a partner model – an image about *B* which gives him an opportunity to believe that *B* will agree to do the action. In constructing his first turn, *A* must plan the dialogue acts (e.g. proposal, request, question, proposal together with an argument, etc. depending on his picture of *B*) and determine their verbal form (i.e. utterances). The partner *B* interprets *A*'s turn and before generating her response, triggers a reasoning procedure in her mind in order to make a decision – to do *D* or not. In the reasoning process, *B* weighs her resources for doing *D*, positive and negative aspects of doing *D* and its consequences and finally makes a decision. Then she in her turn plans the dialogue acts (e.g. agreement, refusal, refusal with argument, etc.) and their verbal form in order to inform *A* about her decision. If *B* agrees to do *D* then the dialogue finishes (*A* has reached his communicative goal). If *B*'s response is refusal then *A* must change his partner model (it did not correspond to the reality because *A* supposed that *B* will agree to do *D*) and find out new arguments in order to convince *B* to make a positive decision.

B's refusal can be supported with arguments. These (counter-)arguments will be used by *A* as giving information about the reasoning process that brought *B* to the (negative) decision.

3.1.1 Reasoning Model

Our reasoning model is presented in (Koit and Õim, 2014). In general, it follows the ideas realized in the well-known BDI (belief-desire-intention) model but it has a certain particular feature – we want to model a 'naïve' theory of reasoning that people use when they interact with other people trying to predict and influence their decisions.

The reasoning model consists of two parts: (1) a model of human motivational sphere; (2) reasoning procedures. In the motivational sphere three basic factors are differentiated that regulate reasoning of a subject concerning an action *D*. First, a subject may *wish* to do *D* if the pleasant aspects of *D* for him/her overweight the unpleasant ones; secondly, a subject may find it reasonable to do *D* if *D* is *needed* to reach some higher goal, and the useful aspects of *D* overweight the harmful ones; and thirdly, a subject can be in a situation where s/he *must* (is obliged) to do *D* – if not doing *D* will lead to some kind of punishment. We call these factors WISH-, NEEDED- and MUST-determinants, respectively.

We represent the model of motivational sphere of a subject by the following vector of 'weights' (with numerical values of its components): w = (w(resources), w(pleasant), w(unpleasant), w(useful), w(harmful), w(obligatory), w(prohibited), w(punishment-do), w(punishment-not)). In the description, w(pleasant), etc. mean the weight of pleasant, etc. aspects of *D*; w(punishment-do) – weight of punishment for doing *D* if it is prohibited, and w(punishment-not) – weight of punishment for not doing *D* if it is obligatory. Here w(resources) = 1, if subject has the resources necessary to do *D* (otherwise 0); w(obligatory) = 1, if *D* is obligatory for the reasoning subject (otherwise 0); w(prohibited) = 1, if *D* is prohibited (otherwise 0). The values of other weights can be non-negative natural numbers.

The second part of the reasoning model consists of reasoning procedures that supposedly regulate human action-oriented reasoning. Every reasoning procedure represents steps that the subject goes through in his/her reasoning process; these consist in computing and comparing the weights of different aspects of *D*; and the result is the decision to do *D* or not.

The reasoning procedure depends on the determinant which triggers it (in our model, WISH, NEEDED or MUST). As an example, let us present a reasoning procedure which is triggered by the NEEDED-determinant, that is, if the subject believes that it would be useful to do *D* (the decision tree in Fig. 1). The NEEDED-determinant gets activated when a reasoning subject finds that the action *D* itself or some of its consequences would be useful to him/her, i.e. w(useful) > w(harmful).

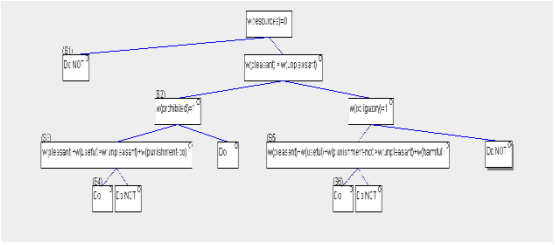

Figure 1: Reasoning procedure NEEDED.

The vector $\mathbf{w}^{AB}$ (*A*'s beliefs concerning *B*'s evaluations, where *B* denotes the communication partner) is used as a partner model while the vector $\mathbf{w}^{B}$ – the model of *B* herself – represents *B*'s actual evaluations of *D*'s aspects (which exact values *A* does not know).

3.1.2 Communicative Strategies and Tactics

A communicative strategy is an algorithm used by a participant for achieving his/her goal in the interaction. The initiator (participant *A*) can realize his communicative strategy in different ways: stress pleasant aspects of *D* (i.e. *entice* the partner *B*), stress usefulness of *D* for *B* (i.e. *persuade B*), stress punishment for not doing *D* if it is obligatory (*threaten B*), etc. These concrete ways of realization of a communicative strategy we call communicative tactics. *A*, trying to direct *B*'s reasoning to the positive decision (to do *D*), proposes arguments for doing *D* while *B*, when opposing, proposes counter-arguments, i.e. arguments for not doing *D* (Koit and Õim, 2014).

The simplest tactics, which *A* can use, is so-called defence. Then *A* does not especially stress any positive aspects of *D* but only averts (down-grades) counter-arguments presented by *B*. For example, in the following dialogue excerpt, *B* repeatedly points to missing resources while *A* tries to indicate that the resources can be obtained (Koit et al., 2009):

A: Please prepare a potato salad for party.
B: I do not have enough time.
A: I will help you.
B: My mother is waiting for me.
A: Call home.

Every tactics implemented by *A* has its 'title' aspect which are, respectively, pleasantness for enticing, usefulness for persuading and punishment for not doing *D* for threatening. *A* attempts to bring out arguments for stressing the title aspect of the chosen tactics (which coincides with the reasoning procedure what *A* is trying to trigger in *B*).

The simplest tactics for *B* is refusal without any argument.

3.1.3 Knowledge Base

The knowledge base for the interaction participant (agent) *A* includes (1) reasoning algorithms, (2) communicative strategies and tactics, (3) the partner model $\mathbf{w}^{AB}$, (4) a list of dialogue acts which *A* can use (proposal, question, assertion, etc.), (5) a list of utterances which he can use for verbalizing the dialogue acts. We suppose here that there is a list of ready-made utterances (sentences in natural language) which can be used in interaction. No morphological and syntactic analysis or generation of texts will be made by an agent. Semantic analysis and generation are simplified by classifying all the utterances. For example, there are utterances informing the partner about the communicative goal, i.e. for expressing such dialogue acts as proposal, request, etc. (*Please prepare a potato salad*), sentences stressing/downgrading the pleasant/ unpleasant/ useful etc. aspects of the action (*I help you; Cutting potato is pleasant with my good knife*, etc.), affirming sentences (*OK; I agree*), etc.

It is important to mention that every utterance has its own (in our model numerical) weight – some of them 'weigh' more than others. The weights depend on the interaction participants (*A*, *B*) and also the action *D*. For example, the sentence *More than ten guests will participate in party* used for stressing the pleasantness of *D* can have the weight 1 for one partner B_1 and 10 for another B_2.

The knowledge base for *B* includes similar knowledge, the only difference is that there is $\mathbf{w}^{B}$ (the model of *B* herself) instead of the partner model $\mathbf{w}^{AB}$.

We suppose that every utterance can be used by a participant only once in interaction. Therefore, if there are no utterances remained for *A* to stress e.g. pleasantness of *D* (the title aspect of enticing) then *A* has to choose new tactics instead of enticing or abandon his communicative goal.

3.1.4 Argument Structure

When negotiating, *A* and *B* exchange arguments. The general structure of *A*'s argument is as follows (cf. Besnard and Hunter, 2008):

$$<\{R, T, \mathbf{w}^{AB}_i, \text{proposition}^A\}, \text{claim}^A>,$$

where R is the reasoning algorithm which *A* is trying to trigger in *B*,
T is the communicative tactics used,
$\mathbf{w}^{AB}_i$ = (w^{AB}_i(resources), w^{AB}_i(pleasant), w^{AB}_i(unpleasant), w^{AB}_i(useful), w^{AB}_i(harmful), w^{AB}_i(obligatory), w^{AB}_i(prohibited), w^{AB}_i(punishment-do), w^{AB}_i(punishment-not)) is the current partner model (at time i),
proposition^A denotes the utterance chosen by *A* in order to influence one of the weights in the partner model, after what R will supposedly give *B*'s positive decision (do *D*) on the changed model; its weight is w(proposition^A),
claim^A = "*B* decides to do *D*".

Many different propositions can be used in an argument (not only a single one).

The proposition^A chosen by *A* in interaction yields a new partner model $\mathbf{w}^{AB}_{i+1}$ (at time i+1):
if $\text{proposition}^A \in P_{\text{increase\_resources}}$, then
w^{AB}_{i+1}(resources):=1;
if $\text{proposition}^A \in P_{\text{increase\_pleasantness}}$, then
w^{AB}_{i+1}(pleasant):= w^{AB}_i(pleasant) + w(proposition^A);
if $\text{proposition}^A \in P_{\text{increase\_usefulness}}$, then
w^{AB}_{i+1}(useful):= w^{AB}_i(useful) + w(proposition^A);

if proposition$^A \in P_{decrease_unpleasantness}$, then w^{AB}_{i+1}(unpleasant):= w^{AB}_i(unpleasant) – w(proposition^A);
if proposition$^A \in P_{decrease_harmfulness}$, then w^{AB}_{i+1}(harmful):= w^{AB}_i(harmful) – w(proposition^A);
if *D* is obligatory for *B* and proposition$^A \in P_{increase_punishment_of_not_doing_D}$, then w^{AB}_{i+1}(punishment-not):= w^{AB}_i(punishment-not) + w(proposition^A);
if *D* is prohibited for *B* and proposition$^A \in P_{decrease_punishment_of_doing_D}$, then w^{AB}_{i+1}(punishment-do):= w^{AB}_i(punishment-do) – w(proposition^A).

Here $P_{increase\_resources}$ denotes the set of propositions (utterances) that can be used by *A* for indicating to *B* that there exist resources for doing *D*; $P_{increase\_pleasantness}$ denotes the set of utterances for increasing the pleasantness of *D*, etc.

The structure of *B*'s (counter-)argument is similar:

$$<\{R^B, T^B, \mathbf{w}^B, \text{proposition}^B\}, \text{claim}^B>,$$

where the reasoning algorithm R^B gives the decision "do not do *D*" (claim^B) on the model $\mathbf{w}^B$, proposition^B indicates the aspect of *D* which (too small or too big) value causes this decision, and T^B is the current communicative tactics of *B*.

B's proposition^B is used by *A* as giving information for choosing his next proposition in interaction. For example, if proposition$^B \in P_{missing_resources}$, then the actual value of w^{AB}_i(resources) is 0 and the next utterance will be chosen by *A* from the set $P_{increasing\_resources}$ (supposedly, after that w^{AB}_{i+1}(resources) = 1 will hold) and another proposition will be chosen from the set of propositions which correspond to the title aspect of R which *A* is trying to trigger in *B* using the communicative tactics T. In other words, *A* responds to the counter-argument set up by *B* (rebutting it) but anyway, he continues his chosen tactics T by presenting the next proposition in order to stress the title aspect of T.

How will *B* choose her next proposition? She triggers her current reasoning procedure R^B on her model $\mathbf{w}^B$. (Both the reasoning procedure and *B*'s model of herself can be different as compared with the reasoning procedure R and the partner model $\mathbf{w}^{AB}$ fixed by *A*.) *B* implements her reasoning procedure and at the end of the procedure she is able to determine the aspect of *D* which brought her to the negative decision. For example, she can choose an utterance indicating harmfulness of *D*, e.g. *I'm afraid I can scratch my finger when cutting potato* but she also can simply say *I do not do*. In the last case *A* cannot avert any counter-argument but he has simply to make a choice among the utterances for stressing the title aspect of the reasoning algorithm R.

If *A* does not have any more utterances for increasing the value of the title aspect then he will whether (1) choose another reasoning algorithm and corresponding communicative tactics (if there are any remained) or (2) give up.

3.2 the Structure of Debate

Let us suppose that the participants *A* and *B* have contradictory goals when starting interaction (debate). *A*'s communicative goal is "*B* does *D*", *B*'s goal is "*B* does not do *D*". We suppose that both of *A* and *B* have a common set of reasoning algorithms. We also suppose that both of *A* and *B* can use fixed sets of dialogue acts and corresponding utterances which are classified semantically, e.g. for *A:* $P_{increasing\_resources}$ for indicating that there exist resources for doing *D*, $P_{increasing\_pleasantness}$ for stressing pleasantness of *D*, etc. and for *B:* $P_{missing\_resources}$, $P_{decreasing\_pleasantness}$, etc.

Starting a debate, *A* fixes (or generates) a partner model $\mathbf{w}^{AB}$ and determines the communicative tactics T which he will use, i.e. he accordingly fixes a reasoning algorithm R which he will try to trigger in *B*'s mind. *B* has her own model $\mathbf{w}^B$. She determines a reasoning procedure R^B which she will use in order to make a decision about doing *D*.

The general structure of debate looks like follows (the dialogue acts in parentheses can be missed):

```
A: proposal (argument)
REPEAT
(
 B: question
 A: answer/giving information
)
B: refusal (counter-argument)
(
 A: question
 B: answer/giving information
)
A: argument
UNTIL finishing conditions are
fulfilled
```

Whether *A* or *B* can indicate that the finishing conditions are fulfilled: 1) give up regardless of having utterances for expressing new arguments, 2) there are no utterances to continue the fixed tactics but no new tactics will be chosen regardless of having some tactics not implemented so far, 3) all the tactics are already implemented and all the utterances are used without achieving the communicative goal.

If *B* gives up then she makes the decision to do *D* and *A* has achieved his communicative goal (*A* 'wins' and *B* 'loses'). If *A* gives up then he does not achieve his communicative goal and *B* will not do D (*A* 'loses' and *B* 'wins').

Questions are asked by participants in order to make a choice between different utterances which can be used in argumentation.

The described model is implemented in an experimental dialogue system (DS). The DS can optionally play two roles: (1) of the participant *A* who is influencing the reasoning of the user *B* in order to achieve *B*'s decision to do an action *D*, or (2) of the participant *B* who is rejecting arguments for doing the action *D* proposed by the user *A*. In the first case, the DS does not deviate from the fixed communicative tactics but follows them in a systematic way. In the second case, the DS does not deviate from the selected reasoning procedure. Ready-made Estonian sentences are used both by the DS and the user.

4 HUMAN-HUMAN DEBATES

In order to perform a preliminary evaluation of our model on natural dialogues, we carried out an analysis of human-human debates. Let us consider two examples from the Estonian dialogue corpus. The first example is a call of a salesman (*A*) of the magazine Food to a potential subscriber (*B*). The second example is a call of a sales clerk (*A*) of an educational company who is proposing training courses to a customer (*B*). Transcription of Conversation Analysis is used in the examples.

Example 1. *A* presents different arguments in one turn attempting to indicate that the magazine is interesting/useful for the customer. *B* asks a question in order to make a decision about subscription (which is here the action *D*).

A: /---/
ta on selline ´elu´stiili ´ajakiri.
it is such a life style magazine **proposition$^{A}_{1}$**
et ei ole ´ainult need ret´septid, vaid seal on ka igasugust ´muud lugemist.
not only recipes are presented but different other information **proposition$^{A}_{2}$**
.hhhhhhh uued ´tooted mis tulevad ´müüki, (0.6) siis ´hoiate ´ültse jah ja noh ´kursis uute ´trendidega söögi ja köögi ´maailmas.
new products and new trends in the world of food and kitchen **proposition$^{A}_{3}$**
(0.5) ´kõik nagu ikka puudutab ´kööki seal.
it is related to kitchen **proposition$^{A}_{4}$**
/---/
B: kas see on enamvähem ´samasugune ajakiri nagu see ´Oma Maitse=vä.
is it similar with the magazine Own Taste
/---/ **question**

Example 2. Here the customer *B* presents several counter-arguments against the proposed training courses (asserting that the educational company is not able to teach what is needed for the customer). Sales clerk *A* asks a question and due to *B*'s answer he succeeds to choose a new argument – he indicates that the company still has the competence what the customer supposed to miss.

/---/
B: aga jah ei mul on see läbi ´vaadatud=ja (.) ´kahjuks ma pean ütlema=et (.) et ´teie (.) seda meile (.) ´ei suuda ´õpetada (.) mida (.)´mina: (.) tahan.
but I have looked through your catalogue and unfortunately, I have to say that you can't teach what is needed for us **proposition^{B}**
/---/
A: .h ja mida kon´kreetselt=ee ´teie tahate.
and what do you want **question**
(0.8) mida te ´silmas ´peate.
what do you have in view **question**
B: noo (0.2) ´meie (.) äri´tegevus on (.) ´ehitamine.
still, our business is house-building **answer**
/---/
A: nüüd kas (0.2) näiteks (0.5) ´lepingute ´saamisel (0.5) mt ee ´tegelete te ka: läbi´rääkimistega.
do you need to carry out negotiations in order to get agreements **question**
B: noo ikka.
yes sure **answer**
(0.8)
A: mt et see=on ka üks ´valdkond mida me: (0.2) ´käsitleme.
but that is one of our fields which we cover
/---/ **proposition^{A}**

The corpus analysis confirms our opinion that the introduced model is in general lines suitable for describing debate, more formalisation is not done so far for the human-human dialogues.

5 DISCUSSION

As said in Introduction, we are interested in dialogues where the participants have conflicting

goals and exchange arguments to further or defend their standpoints during interaction. We are considering such type of interaction as a kind of debate. In Section 3 a formal model of debate was presented. Here we would like to place this treatment in a more general context by explaining our understanding of the relationships between such concepts as negotiation, debate and argumentation (and some other concepts) as used in the paper. Of the three types of (verbal) interaction named before, argumentation as a process of exchanging certain types of assertions for or against some standpoint, decision etc. surely is the most neutral one. To introduce a still more general concept: also a simple discussion of some topic can have the form of exchanging arguments. Participants of a discussion hold and defend their views but are open to learning and accepting alternative views; in a prototypical discussion there are no winners and losers. At the same time, in discussion as in every argumentative communication event its participants must reason, i.e. make use of their reasoning model, have and monitor model(s) of partner(s), use certain communicative strategies and tactics based on these models, etc.

In the same sense argumentation constitutes a necessary part of negotiations and debates. But there is a critical difference as compared with discussions in the above sense. The origin of this difference lies in the motivational sphere of the participants and their communicative goals: these dictate the ways in which the reasoning processes in every participant are directed to construct suitable arguments, communicative strategies and tactics.

Both in negotiation and in debate there are clearly fixed 'sides' with different goals as considering the outcome of the communicative event. But negotiation covers much more divergent possible variants than debate. The main uniting feature of all variants of negotiation is that the participants start the communicative event with the ultimate aim to reach an agreement which (at least in theory) is seen as a compromise, that is, all sides are ready to accept some losses. However, the ways of reaching this aim (strategies, tactics) can be quite different in case of different types of negotiation.

Debates, on the other hand, are adversarial events from the start: the participants have conflicting goals and the aim of each participant is to promote his or her goal only. It is this feature of the debates, first of all, because of which we chose 'debate' as the cover term for the type of communicative events we were analyzing.

Let us stress that this characteristics of debate does not free its participants from the need to carry out active reasoning and 'working' with the partner model during the event. This is well illustrated by the Example 2 in the previous section. But since these processes are focused on promoting the participant's own goals without the need to consider the additional task of reaching a compromise, the choices between different strategies, tactics and even concrete dialogue acts are less restricted, the task of building computer model of debate in this sense is easier than doing it for negotiations in general.

At the same time, proceeding from such a model of debate to a general model of negotiation requires only elaboration of the acceptable communicative strategies and tactics, and of the underlying reasoning procedures used by the participants. Of course, the ontological, domain-specific aspects of treating the corresponding problems – e. g what can be considered a compromise in a concrete situation – become more important accordingly.

6 CONCLUSION AND FUTURE WORK

We are studying the interactions where one participant, *A*, has the communicative goal that his partner *B* will make a decision "do an action *D*". *B*'s goal, on the contrary, is "do not do *D*". When debating, *A* is trying to influence the partner's reasoning processes in such a way that *B* will abandon her initial goal and decides to do *D*.

We introduced a model of debate which includes exchange of arguments and counter-arguments. A model of argument (counter-argument) is presented which consists of a partner model (or, respectively, a model of herself for *B*), a reasoning procedure which *A* tries to trigger in *B* (or what *B* is implementing), communicative tactics and (a set of) proposition(s) (utterances) which together would bring to *B*'s conclusion "do *D*" (or for *B*, respectively, "do not do *D*"). The conclusion (decision about doing *D*) is interpreted as a claim in the structure of an argument (counter-argument).

We evaluated our model on actual human-human debates taken from a dialogue corpus. The corpus study gives an opportunity to believe that the introduced model can be used for the analysis and modelling of human-human dialogues.

The natural way to proceed in developing the conceptual abilities of our model is to elaborate it – for certain ontological domains – to cover also

negotiation dialogues where participants try to reach a compromise between their initially opposite communicative goals.

ACKNOWLEDGEMENTS

This work was supported by the European Regional Development Fund through the Estonian Centre of Excellence in Computer Science (EXCS) and the Estonian Research Council (grants IUT20-56, ETF9124, and ETF8558).

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