Argumentation in Institutional Dialogues: Corpus Analysis

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Abstract

Estonian spoken dialogues have been analysed with the purpose to model natural argumentation. Calls to travel bureaus have been studied where a travel agent is using arguments for booking a trip by a client. Modelling the behavior of a travel agent in a dialogue system is discussed.

1 Introduction

Analysis of human-human dialogues can provide information about their structure and linguistic features with the purpose of developing dialogue systems (DS) which interact with a user in natural language. There are many dialogue corpora that contain human-human or human-computer dialogues. Most of them involve task-oriented dialogues in fairly simple domains [McTear, 2004]. Dialogue acts and some other phenomena are annotated in the corpora. Different coding schemes are used for various purposes: for annotation and analysis of units of dialogue, to support the design of DS, to support machine learning of dialogue acts and sequences, theoretical analysis of the pragmatic meanings of utterances. DAMSL (Dialogue Act Markup in Several Layers) is a well-known system for annotating dialogues [Jurafsky and Martin, 2000].

Our current research is done on the Estonian Dialogue Corpus (EDiC) which contains dialogues of two kinds [Gerassimenko *et al*., 2004]. The main part of EDiC is made up of spoken human-human dialogues – 508 calls and 115 face-to-face conversations. The remaining part of EDiC – 21 written dialogues – is collected in the Wizard of Oz experiments [Valdisoo *et al.*, 2003]. There are two purposes of collecting the corpus – (1) to study human-human conversations, and (2) to develop a DS which interacts with a user in Estonian. The most practical implementation of such DS is information providing. For that reason, EDiC contains mostly institutional dialogues where a client calls an institution to get some information.

Dialogue acts are annotated in EDiC using a typology which is based on the conversation analysis (CA) approach [Gerassimenko *et al*., 2004]. According our typology, dialogue acts are divided into two groups: (1) acts that form so-called adjacency pairs (AP) like proposal – agreement, and (2) non-AP acts like continuer. The number of the dialogue acts is 126. First of all, the typology takes into account information dialogues but it is expansible.

On the other hand, we have worked out an argumentation model which involves natural reasoning [Koit and Õim, 2004]. Agreement negotiation conversations have been considered theoretically, without using of empirical material.

In this paper, our purpose is to support our theoretical considerations with an empirical material – to investigate our argumentation model on Estonian spoken human-human dialogues.

36 annotated dialogues were taken from EDiC where a client calls a travel bureau having a goal to book a trip to a certain place. A travel agent could be interested in booking the trip by the client. So, we may expect that an agent tries to influence a client in such a way that she would decide to book the trip immediately, in this bureau. The paper will analyse the actual situation.

2 Argumentation that Involves Reasoning

We are considering conversations where A (a travel agent) has a communicative goal that his/her partner B (a client) will agree to do an action D (to book a trip). B can whether agree or disagree, depending on the result of his/her reasoning. Disagreement can be supported with an argument. Arguments can be used as giving information about the reasoning process that brought B to his/her decision.

Our reasoning model as a naïve theory of mind consists of two functionally linked parts [Koit and Õim, 2004]: (1) a model of human motivational sphere; (2) reasoning procedures. We represent the model of motivational sphere of a subject by the vector of weights

$\boldsymbol{w}$ = *(w(are-resources), w(pleasantness), w(unpleasantness), w(usefulness), w(harmfulness), w(is-obligatory), w(is-prohibited), w(punishment-for-doing-a-prohibited-action), w(punishment-for-not-doing-an-obligatory-action))*

where resources for doing D, its pleasantness and unpleasantness, punishment for doing a prohibited action or not doing an obligatory action, etc. have numerical values.

In the motivational sphere three basic factors that regulate reasoning of a subject concerning D are differentiated:

his/her wishes, needs and obligations. We call these factors WISH-, NEEDED- and MUST-factors, respectively. There are three reasoning procedures in our model which depend on the factor that triggers the reasoning. A reasoning procedure represents steps that the agent 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 or not to do D.

A communicative strategy is an algorithm which is used by a participant of communication to achieve his/her communicative goal. The participant A having the goal that the partner B decides to do D can realize his/her communicative strategy in different ways (using different arguments for): stress pleasant aspects of D (i.e. *entice* B), stress usefulness of D for B (i.e. *persuade* B), stress punishment for not doing D if it is obligatory (*threaten* B). We call these concrete ways of realization of a communicative strategy communicative tactics. Actually, communicative tactics are ways of argumentation. The participant A, trying to direct B's reasoning to the positive decision (to do D), proposes various arguments for doing D while B, when opposing, proposes counter-arguments.

There exist 3 tactics for A in our model: enticing, persuading, and threatening. The tactics are connected with the reasoning procedures WISH, NEEDED, and MUST, respectively. By tactics of enticing the reasoning procedure WISH, by tactics of persuading the procedure NEEDED and by tactics of threatening the procedure MUST will be tried to trigger in the partner.

In our case, both of enticing and threatening can be excluded because a travel agent is an official person and is obligated to communicate cooperatively, impersonally, friendly, peacefully (i.e. to stay in a fixed point of the communicative space). He only can persuade a client. The general idea underlying the tactic of persuading is that A proposes arguments for usefulness of D trying to keep the weight of usefulness for B high enough and the possible negative values of other aspects brought out by B low enough so that the sum of positive and negative aspects of D would bring B to the decision to do D [Koit and Õim, 2004].

3 Empirical Material

Our empirical material is formed by one kind of institutional dialogues – calls to travel bureaus. In most of conversations, a travel agent behaves only as an information provider and does not influence a client to book the trip in his bureau. The conclusion can be made that he actually is not interested in selling a trip to a client. Still, there are some dialogues where a travel agent tries to persuade a client.

The following example illustrates a dialogue where the travel agent (A) is persuading the client (B) who needs to travel to Budapest and is looking for the cheapest flight. A's communicative goal is that B books the flight immediately. Transcription of CA is used in the example [Gerassimenko *et al.*, 2004]. Dialogue acts are annotated by two persons independently and then unified by a third person. The overall number of annotators was 7. The kappa value lies between 0.64 and 0.79, thus tentative conclusions can be made from the annotated material [Carletta *et al*., 1997]. Act tokens (in capital letters) were originally in Estonian. Every token consists of two parts separated by a colon: the first two letters form an abbreviation of the act group name (DI = directives, OP = opinions, SA = single acts, AI = acts for additional information, FR = free/voluntary responses, etc.). The third letter is only used for AP acts: the first (F) or the second (S) part of an AP act. The second part of a token is the full name of the act (e.g. PROPOSAL, CONTINUER) [Gerassimenko *et al*., 2004].

```
/--/
A: tändab on präegu välja pakkuda (.) kül-
laltki `soodne variant on `Finnääriga
lend=on. | SA: GIVING INFORMATION |
an advantageous variant exists to fly with
Finnair
B: jah?  | FR: CONTINUER |
yes
/--/
A: peab mõtlema selle `hinna=üle praegu on
`kolm=tuhat üks`sada tuleks nagu koos `täk-
sidega `kokku.   | SA: GIVING INFORMATION |
one must think about this price it is three
thousand one hundred with taxes
(.) see `hind. | AI: SPECIFICATION |
this price
(.)
B: ah[ah] | FR: CONTINUER |
ahah
A: [jä]rgmine hinna`klass akkab peale
`kolm=tuhat `kaheksada=kolm`kend `pluss
`täksid aga `neid läheb vähemalt `tonn
`juurde sinna.   |SA: GIVING INFORMATION|
the next price class begins with three
thousand eight hundred thirty plus taxes and
these are at least one ton
B: mhmh=   | FR: CONTINUER|
mhmh
A: =nii=et `hinna`vahe on päris `suur.
| AI: INFERENCE |
so the difference is quite big
(.) järgmisest hinna`klassist.  | AI:
SPECIFICATION |
from the next price class
(0.5)
B: .hh [ < `selge. > ]  | FR: BOUNDER |
hh clear
A: [`präegu mo`mendil] `kohti `on. | SA:
GIVING INFORMATION |
there are free places at the moment
(0.5)
B: [ < `selge. > ]   | FR: BOUNDER |
clear
A: [a kolme `päeva] jooksul tuleb `välja
[osta.]   | AI: EMPHAZISE |
but it must be bought off within three days
B: [mhmh] mhmh.  | FR: ACKNOWLEDGEMENT |
mhmh
/--/
```

```
A: se=on ´hiljemalt ´esmaspäev tuleks ´välja
 osta.    |  DIF: PROPOSAL |
it must be bought off not later than on Mon-
day
B: mhm ei ma `präegu veel ei bro`neeriks.
| DIF: DISAGREEMENT |
mhmh no I do not book at the moment
.hh aga nüüd ma vähemalt ´tean=h. |  AI:
SOFTENING |
but now I know
A: se=on muidugi ´odav.  | OPF: ASSERTION |
it is cheap
B: jah, see on ´tõesti odav ´hind.= | OPS:
AGREEMENT |
yes it is really a cheap price
/--/
```

A is giving various information to B – these are arguments for usefulness of booking the trip. B disagrees regardless of arguments proposed by A.

We do not annotate arguments as separate dialogue acts in our dialogues. Every argument formally is whether giving information (*the price is three thousand crones*) or opinion (*it is cheap*).

An institutional dialogue (call) typically consists of three parts: (1) a ritual beginning, (2) the main part where (one or more) questions are asked, requests or proposals are made and answers are got, (3) a ritual ending. The kernel of the main part is an AP of dialogue acts (question – answer, directive – fulfilling the directive). In this paper, we are looking for directive APs.

The first parts (DIF) of directive APs are: request (for information), proposal (that the partner will do an action) and offer (that an action will be done by the speaker himself) in our typology. The second parts (DIS) are giving information, missing information, agreement, restricted agreement, disagreement, refusal, postponement.

Proposal must be differentiated from offer. In the first case, the action originates from the hearer (proposal: *please call me later*), in the second case from the speaker (offer: *I'll send you the programme*). Offer must be differentiated from promise which is a non-AP act. In promise, the speaker commits to do an action like in the case of offer whereas the promise does not need an agreement of the partner. Sometimes it is hard to differentiate a promise from an offer.

We are interested here in proposals and offers which differ from requests because they expect the different second part. The suitable responses to proposals and offers are agreement, restricted agreement, and disagreement in our act typology.

4 Corpus Analysis

Our analysed corpus consists of 36 dialogues which contain 1896 utterances (11724 running words). The number of dialogue act tags is 2496, there are 87 different acts. The most frequent acts are questions (QUF), answers to questions (QUS) and free reactions (FR) which is quite typical for phone conversations – QUS: GIVING INFORMATION (298 cases), FR: CONTINUER (193), FR: ACKNOWLEDGEMENT (141) and QUF: WH-QUESTION (132).

4.1 Proposal/Offer – Fulfilling

12 dialogues from 36 contain proposals, and 13 contain offers (5 dialogues contain both proposals and offers; 16 dialogues do not contain neither proposal nor offer). There are 18 proposals, all of them are made by A. The number of offers is 19 (16 are made by A and 3 by B), and that of promises is 5 (all are made by A).

The second parts of proposal or offer APs are as follows: 14 agreements, 19 restricted agreements, and 4 disagreements. In most cases, a proposal is immediately followed by a restricted agreement (7 cases) or agreement (4 cases). An offer (where the speaker expresses his readiness to do an action) is mostly followed by agreement (10 cases) or restricted agreement (6 cases). Typically, the word *mhmh* is used to express restricted agreement and *jah/yes* for agreement.

4.2 Argumentation

As said before, our current typology of dialogue acts does not include an act tag 'argument'. Still, a group of non-AP acts is formed by acts that add information to a previous act (AI = additional information): account, explication, inference, conclusion, emphasize, softening, assessment, specification. Account can be considered as a kind of argument – previous dialogue act is argued by an account:

```
B: Would the bus trip be more expensive?
| QUF: OFFERING ANSWER |
A: I can not say,| QUS: MISSING INFORMATION|
we don't deal with bus trips.| AI: ACCOUNT |
```

190 acts that add information have been found in our corpus. 20 of them are accounts, all are made by A.

Argumentation – a process of exchanging of arguments that begins with a proposal or offer by one participant to do an action and ends with an agreement or disagreement of the partner – has only been found in 4 dialogues (from 36). The reason is that our existing empirical material is formed by information dialogues where the communicative goal of the initiator of communication (a client) is to get information. Inversely, all the persuasions initiated by a travel agent finish with disagreement of a client.

The typical chain of dialogue acts that form argumentation is as follows:

A: DIF: PROPOSAL/ DIF: OFFER
--**>A**: SA: GIVING INFORMATION / AI: ACCOUNT
--**>B**: FR: CONTINUER
B: DIS: DISAGREEMENT

The subsequence marked by --> can be repeated (11 times in the longest dialogue). Thus, the client lets the travel agent to give his arguments while she only signals that she is hearing, and after that, she informs about her decision.

The subsequence can be considered as an information-sharing subdialogue [Chu-Carroll and Charberry, 1998] which is initiated by A to give to B further information for that B could to make an informed decision about whether to accept a proposal or not.

5 Modelling a Travel Agent

The DS that plays the role of a travel agent uses a vector of weights as a user model (cf. Chapter 2). DS's goal is to achieve an agreement of a user to book a trip (to do the action D). DS assumes that the user has resources for doing D (*w(are-resources)*=1), and that D is useful for her (*w(usefulness)*=1). The values of the remaining aspects of D can equal to 0. The reasoning which is triggered by NEEDED-factor yields a positive decision (to do D) on this model.

If the client does not agree then persuasion starts. The DS changes the user model depending on the user's argument. For example, if the user points on the unsuitable departing time of the offered flight then the DS concludes that *w(are-resources)*=0 in the user model, and a new flight must be offered. If the user does not argue her disagreement then DS may assume that its next argument which increases the weight of usefulness will yield a positive decision. DS uses the dialogue acts 'giving information', 'account' or 'opinion'. Every act increases the value of *w(usefulness)* by 1.

A simple DS is implemented which can play the role of a travel agent. The computer operates with semantic representations of linguistic input/output only, the surface linguistic part of interaction is provided in the form of a list of ready-made utterances (sentences in Estonian) which are used both by the computer and user. These sentences are only classified semantically according to their possible functions and contributions in a dialogue. The DS uses a database of the flights departing from the Tallinn Airport.

6 Conclusion and Future Work

The initial goal of this paper was to verify our argumentation model on Estonian spoken human-human dialogues. Travel bureau dialogues were chosen from the dialogue corpus with the aim to find out communicative strategies and ways of argumentation which are used by a travel agent to force a client to book a trip. It turned out that there are very few dialogues where a travel agent actually tries to influence a client. The reason can be that the communicative goal of the client is only to get information, and not to book a trip during the conversation.

Our next aim is to collect agreement negotiation dialogues. We plan to record calls in an education company where an agent proposes courses to a client, and to investigate our argumentation model on this empirical material.

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References

[Carletta *et al*., 1997] J. Carletta, A. Isard, S. Isard, J. Kowtko, G. Doherty-Sneddon, and A. Anderson. The reliability of a dialogue structure coding scheme. *Computational Linguistics*, 23(1):13–31, 1997.

[Chu-Carroll and Carberry, 1998] J. Chu-Carroll and S. Carberry. Collaborative Response Generation in Planning Dialogues. *Computational Linguistics* 24(3):355–400, 1998.

[Gerassimenko *et al*., 2004] Olga Gerassimenko, Tiit Hennoste, Mare Koit, Andriela Rääbis, Krista Strandson, Maret Valdisoo, Evely Vutt. Annotated dialogue corpus as a language resource: an experience of building the Estonian dialogue corpus. In *The first Baltic conference "Human language technologies. The Baltic perspective". Commission of the official language at the chancellery of the president of Latvia*, 150–155, Riga, 2004.

[Jurafsky and Martin, 2000] Daniel Jurafsky and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics*. Prentice-Hall, 2000.

[Koit and Õim, 2004] Mare Koit and Haldur Õim. Argumentation in the Agreement Negotiation Process: A Model that Involves Natural Reasoning. In *Proc. of the Workshop W12 on Computational Models of Natural Argument. 16th European Conference on Artificial Intelligence*, 53–56, Valencia, Spain, 2004.

[McTear, 2004] Michael F. McTear. *Spoken Dialogue Technology. Toward the Conversational User Interface.* Springer, 2004.

[Valdisoo *et al.*, 2003] Maret Valdisoo, Evely Vutt, and Mare Koit. On a method for designing a dialogue system and the experience of its application. *Journal of Computer and Systems Sciences International*, 42(3), 456–464, 2003.