Modelling Attitudes of Dialogue Participants
Reasoning and Communicative Space

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Abstract: The paper introduces a dialogue model, concentrating on attitudes of dialogue participants. Two kinds of attitudes are under consideration: (1) attitudes related to different aspects of a negotiation object (in our case, doing an action) which direct reasoning in communication, and (2) attitudes related to a communication partner (dominance-subordination, cooperation-antagonism, communicative distance, etc.) which are modelled by using the concept of communicative space. Telemarketing calls in the Estonian dialogue corpus are analysed in order to illustrate communicative space and to find out linguistic cues for automatic recognition of different coordinates. A limited version of the dialogue model is implemented on the computer.

1 INTRODUCTION

When communicating, people express their attitudes which depend on their individual characteristics, social roles, topic of conversation, etc. Social attitude or interpersonal stance is an affective style that can be employed in an interaction with a person or a group of persons. It consists of conveying a particular feeling in the interaction, for instance, being friendly, dominant, hostile or polite (Scherer, 2005). These attitudes can be conveyed by words and voice features but also by nonverbal means – facial expression, body movement, and gestures (Knapp and Stone, 2009). There are some important cues generated with speech: tone, volume, speed of voice can change, depending on the social attitude. Similarly, the relations we have with other people influence our body gestures. These verbal and nonverbal cues are used in an interaction in an unconscious process to communicate and understand an attitude. Depending on the gestures and facial signals one is displaying, a social attitude can be perceived (Ravenet et al., 2012).

The results of studies of human-human communication can be used when modelling interaction with the computer. Different features have to be taken into account in order to make it possible for a user to interact with the computer like with another human, by using verbal as well as nonverbal means. Attitudes expressed by gestures and facial signals are especially important when modelling socio-emotional agents.

Our aim is to develop a dialogue system (DS) which interacts with the user in a natural language following norms and rules of human communication. For that reason, we study how people are using their language when communicating and how they are expressing their attitudes by language means. We have worked out a formal model of negotiation dialogue (Koit and Õim, 2014; Koit, 2015). In the current paper, we will further develop the model concentrating on attitudes of communication participants. We consider two kinds of attitudes: (1) related to a negotiation object when reasoning in communication, and (2) related to a communication partner. We introduce the concept of communicative space – a mental space which coordinates correspond to the attitudes of communication participants (their social distance, degrees of cooperation and intensity of communication, etc.). When communicating, the participants can 'move' in communicative space from one 'point' to another and depending on their locations, they choose suitable communicative strategies in order to achieve their communicative goals.

The remainder of the paper is structured as follows. Section 2 introduces our dialogue model which includes a reasoning model about doing an action. Attitudes of a communication participant in relation to the action will be represented as

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coordinates of the vector of motivational sphere of a reasoning subject. The attitudes are changing in dialogue as influenced by arguments of a dialogue partner. Section 3 considers the concept of communicative space which dimensions express attitudes of a communication participant in relation to a communication partner. The dimensions will be illustrated with dialogue examples from the Estonian dialogue corpus. Section 4 considers an implementation of the dialogue model based on information states. Section 5 discusses how communicative space can be used when developing a dialogue system. Section 6 draws conclusions.

2 DIALOGUE MODEL

We are modelling negotiations between two participants A and B in a natural language. The initiator A makes a proposal to his communication partner B about an action D. The communicative goal of A can be either doing or not doing the action by B. If B rejects A's communicative goal (and/or there are obstacles that do not allow B to accept the goal) then a negotiation will start where both participants can present their arguments and counterarguments. The dialogue finishes with B's decision (to do D or not).

2.1 Reasoning Model

When negotiating, a communication participant must know how to direct the functioning of the partner's psychological mechanisms in communication, in order to change his/her attitudes in relation to the object of reasoning.

In our reasoning model, we use a naïve, 'folk' theory (D'Andrade, 1987; Davies and Stone, 1995). With respect to a naïve theory of reasoning, there are three kinds of determinants which can cause humans to reason about an action D (Õim, 1996). The *internal* determinants are the wishes of the subject related to the action (WISH-determinants) and his/her considerations that it would be needed, reasonable, or necessary to do D (NEEDED-determinants). The *external* determinants (or MUST-determinants) originate from outside the subject and operate through the concept of punishment which is a reaction to subject's not fulfilling obligations or prohibitions.

When reasoning about doing D, the general balance of the 'weights' of positive and negative aspects should be computed. The weights express beliefs/attitudes of a reasoning subject in relation to different aspects of the object of reasoning (in our case, doing an action).

The reasoning itself depends on the determinant which triggers it (respectively, WISH, NEEDED, or MUST), thus, we can describe three different prototypical reasoning procedures.

Our reasoning model is a kind of BDI (belief-desire-intention) model (Bratman, 1999). It consists of two parts: (1) a model of human motivational sphere which includes attitudes of a reasoning subject in relation to the aspects of the action under consideration, and (2) reasoning procedures (Koit and Õim, 2014).

We represent the model of motivational sphere as a vector with numerical coordinates which correspond to the different aspects of the action D:
w_D = (w(resources$_D$), w(pleasantness$_D$), w(unpleasantness$_D$), w(usefulness$_D$), w(harmfulness$_D$), w(obligatory$_D$), w(punishmentfornot_doing$_D$), w(prohibited$_D$), w(punishmentfor_doing$_D$)).

Here $w(resources_D)$ = 1 if the reasoning subject has all the resources needed for doing D (or 0 if some of the resources are missing), $w(obligatory_D)$ = 1 if the action is obligatory for the subject (otherwise 0), $w(prohibited_D)$ = 1 if the action is prohibited (otherwise 0). The values of the remaining components can be natural numbers on the scale from 0 to 10. Still, our numerical scales are simplifications – when reasoning, a human subject hardly ever uses numerical weights. (S)he rather operates with words of a natural language or with fuzzy evaluations in order to express his/her attitudes in relation to the object of reasoning.

We use two vectors (w^B_D and w^{AB}_D) in our model of dialogue. Here w^B_D is the model of motivational sphere of B who has to make a decision about doing D; the vector includes B's (actual) evaluations (attitudes) of D's aspects and it is used by B when reasoning about doing D. The other vector w^{AB}_D is the partner model which includes A's beliefs concerning B's evaluations and it is used by A when planning the next turn in dialogue. We suppose that A has some preliminary information about B in order to compose the initial partner model before making the proposal to do D. Both the models will change as influenced by arguments presented by the participants in negotiation. For example, every argument presented by A targeting the pleasantness of D should increase the corresponding values of $w^B_D(pleasantness_D)$ as well as $w^{AB}_D(pleasantness_D)$.

2.2 Communicative Strategies and Tactics

A communicative strategy is an algorithm used by a

participant for achieving his/her goal in communication (Koit and Õim, 2014). The initiator *A* can realize his communicative strategy in different ways, for example, he can *entice, persuade* or *threaten* the partner *B* to do or, respectively, avoid doing *D* (respectively, he stresses the pleasantness or usefulness of doing/not doing *D* or punishment for not doing/doing *D* if it is obligatory/prohibited). We call these ways of realization of a communicative strategy *communicative tactics*. The partner *B* uses a similar communicative strategy. Some algorithms are presented in (Koit, 2017).

When reasoning in order to make a decision, *B* considers her resources as well as different positive and negative aspects of doing *D*. If the positive aspects weigh more than negative then the decision will be "do *D*" otherwise "do not do *D*". The initiator *A* chooses a suitable communicative strategy and the communicative tactics in order to direct *B*'s reasoning to the desirable decision. When trying to influence *B* to make the pursued decision (for example, to do the action *D*) and to change her attitudes (the model w^B_D), *A* uses a partner model w^{AB}_D. *A* stresses the positive and downgrades the negative aspects of the action. Various arguments for doing/not doing *D* are presented in a systematic way, for example, when persuading *B* to do *D*, *A* stresses time and again the usefulness of *D*. The partner *B* can similarly stress or downgrade a certain aspect of the action by her counterarguments.

3 COMMUNICATIVE SPACE

The models w^B_D and w^{AB}_D capture the attitudes of communication participants in relation to the action *D* under consideration. In order to model the attitudes of a participant in relation to a communication partner we use the concept of communicative space (Koit, 2015).

Concepts of space are fundamental to our understanding of human action and interaction. Healey et al. (2008) apply the concepts of (physical) space, place and communication space to the analysis of a corpus of interactions from an online community. Some studies represent social attitude with two dimensions: a dominance dimension (also called power, control or agency), that represents the degree of control one has on another, and a liking dimension (also called appreciation, affiliation or communion), that represents the degree of appreciation, liking of another (Carney et al., 2005; Hess et al., 2005). In other studies these dimensions are used among other dimensions like formality or

trust (Burgoon et al, 1984). Concept of social attitude or interpersonal stance in interaction (being polite, distant, cold, warm, supportive, contemptuous, etc.) is considered in (Carofiglio, 2009). Ravenet et al. (2012) have figured out a table showing the influence of dominance and liking in the nonverbal behavior depending on the gender of the speaker. A two-dimensional T. Leary's interpersonal circle (IPC) has been introduced as a framework to classify four types of interpersonal attitude (Dominant-Hostile, Dominant-Friendly, Submissive-Hostile and Submissive-Friendly).

3.1 Dimensions of Communicative Space

We specify communicative space by a number of dimensions that characterize the relationships of participants in a communicative encounter. Communication can be collaborative or confrontational, personal or impersonal; it can also be characterized by the social distance of participants (near, far), etc. (Koit, 2015). These dimensions represent a sub-system of human communicative competence with deep evolutionary roots, the basic function of which is to regulate the communication process. Together, they bring the social aspect of communication into the model. People have an intuitive, naïve theory of these dimensions; the values of the coordinates can be expressed by specific words. Instead, at present we use numerical values as approximations in our model (like in the model of human motivational sphere, cf. Section 2.1).

We determine communicative space as *n*-dimensional (*n*>0) space. At least, the following dimensions can be specified:

- dominance (on the scale from dominant to submissive)
- communicative distance to the partner (on the scale from familiar to remote)
- cooperation (on the scale from collaborative to confrontational)
- politeness (from polite to impolite)
- personality (from personal to impersonal)
- modality (from friendly to hostile)
- intensity (from peaceful to vehement).

We use the numbers +1, 0 and -1 for the values of the coordinates of communicative space. For example, the value +1 on the scale of modality means friendly interaction and the value -1 means hostile interaction. Communicative distance is -1 if the person feels closeness in relation to his/her communication partner and +1 if (s)he is far from the partner. On any scale, 0 is the neutral value. Still,

one could consider a bigger number of values than three on every scale. It would be also possible to use continuous scales instead of discrete values.

Communication participants can be located in different points of communicative space. For example, a boss can angrily communicate with his subordinate who, on the contrary, remains neutral or even friendly. One communication participant can feel closeness to his/her partner whereas the partner has different feelings, etc. Moreover, the participants can also 'move' from one point to another during the encounter. For instance, the participants who were on confrontational positions at the outset can reach the collaborative one at the end.

3.2 Dialogue Analysis

With the aim to model human-computer interaction we are considering human-human communication. Where do people place themselves in communicative space when communicating and how do they 'move' there? We are especially interested in linguistic means, which would help us to recognize 'the points' of communicative space on the basis of texts of a natural language (in our case, Estonian). We try to find out some cues which are applicable without semantic analysis of text because necessary software is currently missing for the Estonian.

3.2.1 Dialogue Corpus

Our current study is based on the Estonian dialogue corpus (Hennoste et al., 2008). The corpus includes different kinds of dialogues: (1) transcripts of human-human spoken dialogues, (2) written dialogues collected in simulations by Wizard-of-Oz method, and (3) log files of interactions with two DSs which give information in Estonian (movie programs and dentist advice, respectively). The biggest part of the corpus – about 1000 spoken dialogues – is recorded in authentic situations and transcribed by using the transcription system of Conversation Analysis (Sidnell and Sivers, 2012). Each transcription is provided with a header that lists situational factors ('meta-knowledge' about the dialogue session), which affect language use – participants' names, social characteristics, relations between participants in the situation, specification of situation (private/public place, private/institutional conversation), etc.

Dialogue acts (DA) are annotated in the corpus by using a customized typology which is based on Conversation Analysis. Custom-made web-based software is used for annotation. Another custom-made software tool enables to visualize speech features (overlapping speech, comments of transcribers, etc.) by different colors and also to calculate some statistics (the counts of utterances, words, different DAs, frequency of words and certain sequences of DAs, etc.).

3.2.2 Communicative Space in Telemarketing Calls

In a previous paper (Koit, 2015) we have analyzed directory inquiries and negotiations between acquaintances in the Estonian dialogue corpus. For the current paper, we have chosen a sub-corpus consisting of 51 telemarketing calls (in total, 35,678 running words, 5744 utterances). Sales clerks of an educational company call to potential customers – managers or personnel officers of other companies – and offer training courses for employees. The communicative goal of a clerk is to achieve a positive decision of a customer (to take a course). A clerk is giving information about his educational company, collecting information about the customer by asking questions, arguing for usability of the courses for the customer in order to awake her interest to take a course. We are looking for linguistic cues in the transcripts of the calls which can give a signal of certain values of the coordinates of communicative space and therefore will contribute to their automatic recognition. We prefer the rule-based approach due to the limited size of our current dialogue corpus which makes it hard to implement statistical methods. However, as demonstrates our analysis, it is difficult to determine the values of coordinates only using texts, without the possibility to take into account speech features and what is more, nonverbal means of communication.

Telemarketing calls are institutional dialogues and this fact in a big way determines communicative space – most of the coordinates typically have neutral values (0). Still, there are some interesting exceptions.

In the following examples, *A* is a sales clerk and *B* is a customer. All the values of coordinates of communicative space can be either +1, 0 or -1. Transcription marks used in the examples are given in (Hennoste et al., 2008). Let us only point out that square brackets are used for overlapping speech and capital letters for a louder segment.

3.2.2.1 Dominance

Headers of transcripts of dialogue recordings can indicate whether the communication participants are

in dominance-subordination relation or not. However, headers of the telemarketing calls do not include such relation – the participants are 'equal'. Instead, we can use another cue – overlapping speech where a participant starts his/her turn before the partner has finished, thereby indicating dominance (value +1 in Example 1; the customer takes initiative before the clerk has finished his turn, overlapping speech is in square brackets).

Example 1

A: nii=et=te ei pea ´vajalikuks inimeste ´arendamist nendes ´vald[kondades.]
Also you (plural) *do not consider it necessary to educate your people in these [domains]?*
B: [tändap=ee] ma ´kordan me saame ´ise selle teemaga ´hakkama.
[It means], I repeat, we can make it ourselves.

3.2.2.2 Communicative Distance

In institutional dialogues like our telemarketing calls, the participants typically are strangers and their communicative distance is whether neutral (0) or long (+1). In Estonian, the 2nd person plural of verbs and pronouns can be used to indicate a long or neutral distance; the singular form indicates a short distance. In Example 1, *A* indicates a neutral distance (0) by using a plural form of the pronoun *you*. *B*'s overlapping speech indicates a long communicative distance (value +1), in addition to dominance (value +1).

3.2.2.3 Cooperation

In our analyzed dialogues, the sales clerks always communicate cooperatively as determined by their social role. Similarly, the customers typically express cooperation. Still, the customers are antagonistic in a few of dialogues where they are driving at a negative decision (do not take a course). One cue to recognize cooperation of a sales clerk is the dialogue act used as a reaction to the customer's counterargument (in our dialogues, a clerk always uses DA 'accept', instead of 'reject'). However, when accepting a counterargument the clerk does not abandon his communicative goal – after that he presents his new arguments for taking a course by the customer (Example 2, DA tags in bold).

Example 2

B: aga näiteks pro´jektijuhtimist teil=ei ´ole, mida mina otsin tegelikult ´prae[gu.]
But you don't have project management what I'm looking for. **Assertion**
A: [mm]mmq noo::: jah.
Uhuh, yes. **Limited accept**

kui keegi=on=meie käest projektijuhtimist ´küsinud, .hhh[h sii]s tegelikult
But if someone would order project management then we actually... **Assertion**
B: [mhmh]
Uhuh. **Neutral continuer**
A: meil=on=need ´vahendid ´olemas.
... we are able to teach it. **Assertion**

3.2.2.4 Politeness

A linguistic cue for recognizing the politeness in institutional dialogues is the 2nd person plural of verbs and pronouns. In addition, there are DAs of greeting and leave-taking in the beginning and at the end of negotiation. In most cases, the participants also thank each other at the end of conversation. Politeness can also be expressed by using of some emotion words and expressions, Example 3 (value +1; *you* in plural; *nice*):

Example 3

A: soovin teile `meeldivat `õhtu jätku
I wish you (plural) *a nice continuation of the evening*
[ja kuulmi]seni
and hear you

3.2.2.5 Personality

In institutional dialogues, the value of personality is typically neutral (0). Still, there are some exceptions, especially in the cases if customers have made a negative decision and are about to finish negotiation. Some cues to stress personality (value +1) are using the 1st person of pronouns, loud speech, DA for expressing a counterargument (Example 4, loud segment in capital letters):

Example 4

B: ühesõnaga (0.3) ´M:INULE ei ole ´vaja tulla ´õpetama firma ´juhtimist?
You can't come to teach ME neither how to manage the company
.hh ega seda kudas ´mina pean müüjat=vel (.) ´õpetama.
nor how I have to teach my shop assistant.

3.2.2.6 Modality

As expected, the value of modality is neutral (0) in most of the dialogues. In a few of cases, clerks are especially friendly (+1). In some other dialogues a customer who has already made a negative decision and does not want to continue communication, expresses hostility (value -1, cf. Examples 1 and 4). The cues are overlapping and loud speech. Therefore, big values of dominance and personality can also imply hostility.

3.2.2.7 Intensity

Typically, the value of intensity is neutral (0) as expected for institutional dialogues. An exception is a dialogue where the customer gives a lot of counterarguments against the course offered by the clerk (Example 4). Here, personality and hostility expressed by counterarguments also imply vehemence. The most important cue is loud speech.

When communicating, both sales clerks and customers are restricted on their social roles because both of them are official persons who represent their institutions. A sales clerk having the communicative goal to sell training courses of his company has to keep the fixed communication point which can be represented as (0, +1/0, 0, 0, 0, 0, 0), and the fixed communicative tactics (persuasion – stressing the usefulness of the courses). A customer has more freedom – she can present a lot of counterarguments to the clerk's proposal being sometimes confrontational, vehement and even hostile (Examples 1 and 4).

4 IMPLEMENTATION

A limited version of our dialogue model is implemented as a simple DS which interacts with a user in written Estonian. Information-state dialogue manager is used in the implementation (Traum and Larsson, 2003).

There are two parts of an information state – private (information accessible only for one participant) and shared (information accessible for both participants). For example, the private part of an information state of the initiator A (where A's communicative goal is "B will do D") consists of the following information slots:

- current partner model (vector w^{AB}_D of A's attitudes about B's attitudes in relation to the action D)
- current location of A in communicative space (A's attitudes in relation to B, that is, the values on the scales of dominance-subordination, cooperation-antagonism, etc.)
- communicative tactics t_i^A which A has chosen for influencing B
- reasoning procedure r_j which A is trying to trigger in B (and bring to a positive decision)
- stack of (sub-)goals under consideration. In the beginning, A puts the initial goal ("B will do D") into the stack
- set of dialogue acts: proposal, assertions

(arguments) for increasing or decreasing the weights of different aspects of D for B (that is, for changing B's attitudes in relation to D), etc.
- set of utterances for verbalizing the dialogue acts.

The shared part of an information state contains world knowledge, language knowledge, set of reasoning procedures $R=\{r_1,...,r_k\}$, set of communicative tactics $T=\{t_1, t_2, ..., t_p\}$, and the dialogue history – the utterances together with the participants' signs and dialogue acts: $p_1:u_1[d_1]$, $p_2:u_2[d_2],..., p_i:u_i[d_i]$ where $p_1=A$; $p_2, p_3,...$ are whether A or B; $u_1, u_2,...$ are utterances and $d_1, d_2,...$ are DAs.

Update rules will be used by a participant for moving from one information state to another. There are different categories of update rules both for generating and interpreting of turns.

The computer plays A's role and the user B's role. A's communicative goal is "B will do D", and B's goal is "do not do D" (Koit, 2017). The computer has ready-made sentences (assertions) for expressing of arguments, i.e., for stressing or downgrading the values of different aspects of the proposed action, which depend on its user model. The user (B) can put in free texts. Communicative space is not involved in the current implementation, thus, the attitudes of participants in relation to each other are not yet taken into account.

Starting a dialogue, A determines a partner model w^{AB}_D, fixes its communicative strategy and chooses the communicative tactics which it will follow, that is, the computer respectively determines a reasoning procedure which it will try to trigger in B's mind. A applies the reasoning procedure in its partner model, in order to 'put itself' into B's role and to choose suitable arguments when convincing B to decide to do D. Supposedly, the models w^B_D and w^{AB}_D are different when a dialogue starts but they are approaching each to another during negotiation, as influenced by the presented arguments and counterarguments. Still, the user B is not obliged (but can) to follow neither certain communicative tactics nor reasoning procedures. (S)he is also not obliged to fix his/her attitudes in relation to D by composing a model w^B_D. However, A does not 'know' B's attitudes (the values of the coordinates of the supposed vector w^B_D), it only can choose arguments on the basis of B's counterarguments. Respectively, A is making changes in its partner model w^{AB}_D during a dialogue.

5 DISCUSSION

Our dialogue model considers two kinds of attitudes of a dialogue participant: (1) his/her attitudes in relation to an action (which is the object of negotiation), and (2) his/her attitudes related to a communication partner. Both kinds of attitudes are changing in dialogue as influenced by behavior and arguments of the communication partner.

When reasoning about doing an action, a subject is weighing different aspects of the action (its pleasantness, usefulness, etc.) which are included into his/her model of motivational sphere. We evaluate these aspects by giving them discrete numerical values on the scale from 0 to 10. Still, people do not operate with numbers in a reasoning process. Instead, they rather use words of a natural language. For example, the pleasantness of an action can be evaluated by such words and expressions as *excellent*, *very pleasant*, *not so pleasant*, etc. Further, when reasoning, people do not operate with exact values of the aspects of an action but they rather make 'fuzzy calculations', for example, they suppose/believe that doing an action is much more pleasant than unpleasant and therefore they wish to do the action. A problem is that the aspects of actions considered here are not fully independent. For example, harmful consequences of an action as a rule, are unpleasant (while unpleasant will not always be harmful). In addition, if a reasoning object is different (not doing an action like in our case) then the attitudes of a reasoning subject can be characterized by a different set of aspects.

We represent the relations of communication participants that influence the communication process and its results as dimensions of communicative space. As said, we use the values +1, 0 and -1 for the coordinates. Still, it is possible to divide all the scales to a bigger number of values (for example, from 0 to 10 like in the case of the aspects of actions). Likewise, it is possible to operate with continuous scales instead of discrete values (cf. Mesiarová-Zemánková, 2016). It is also possible to use words of a natural language for the values. For example, the modality of communication can be *friendly, ironic, hostile*, etc. The problem remains how to determine objective criteria and apply them when dividing the scales. However, annotation of the points of communicative space in written dialogues is difficult and subjective already with three different values (+1, 0, -1).

A serious problem is that the dimensions are not fully independent (like in the case of aspects of actions). For example, dominance usually implies a longer communicative distance. A longer communicative distance can imply a smaller value on the scale of personality, etc. as demonstrated in the examples (Section 3.2).

Further empirical research is needed in order to determine the list of dimensions of communicative space, their relations and values on different scales (which can be different). Linguistic cues can be used for recognizing of values of some coordinates (Section 3.2). For example, if a participant uses the 2nd person singular form of pronouns in Estonian then (s)he is indicating a short communicative distance (-1) and a big value on the personality scale (+1). Emotion words and expressions help to recognize the values of some coordinates, for example, *please* and *thank* indicate politeness. The comments of transcribers in transcriptions of spoken dialogues help to determine the modality of communication (for example, the comment *((friendly))* indicates the value +1). The dialogue act tags contribute to recognizing of some coordinates. For example, conventional (ritual) DAs of greeting and thanking express politeness. Opinion mining (Liu, 2015) could be used to automatically annotate communication points. Still, the small size of the Estonian dialogue corpus does not yet allow implementing statistical or machine learning methods.

How to use the concept of communicative space in human-computer systems? Let us point out two general research areas. Firstly, the systems which model human communication, not participating in communication but analyzing human dialogues on the expert level, e.g. analyzing communication protocols, reconstructing locations and movements of participants and making conclusions. The second direction is development of DSs which interact with people in a natural language and perform certain roles. An interesting and useful kind of DSs rapidly developing in the last years are embodied conversational agents (Harthold et al., 2013; Ravenet et al., 2015; Dermouche, 2016). Such a conversational agent behaves like a human thereby expressing a suitable emotional attitude.

6 CONCLUSIONS

We introduce a model of dialogue concentrating on modelling of attitudes of dialogue participants. We consider two kinds of attitudes expressed by participants in negotiation about doing an action: (1) related to the action, and (2) related to a communication partner. We represent the first kind of

attitudes as coordinates of a vector of motivational sphere of a participant (who is reasoning about doing an action). The second kind of attitudes is represented by using the concept of communicative space – a mental space where communication takes place.

In order to explain the concept of communicative space we analyze a sub-corpus of human-human telemarketing calls of the Estonian dialogue corpus.

We have implemented the model of negotiation as a simple dialogue system where the computer plays *A*'s and the user *B*'s role. So far, the implementation does not include communicative space. This needs deeper investigations and remains for the further work.

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