Influencing Reasoning in Interaction: a Model

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Abstract

We are modeling human dialogues where one participant tries to influence the reasoning process of the other in order to get him to perform an action. Our aim is to build a dialogue system which would interact with a user in a `natural human way´. In our model, reasoning is presented as a process of evaluating different aspects of the action. To describe the influencing of reasoning, we introduce two conceptual structures: communicative strategies and communicative tactics.

1 Aims and Background

One of the central tasks of pragmatics is to explain the mechanisms by which people reach their goals in communication; to this end, also several computer models have been built (Jokinen, 2009; Ginzburg and Fernández, 2010). We believe that the central task is here to explain the process we call `influencing the reasoning of a communication partner´. A computer system should include a model of reasoning and account for the means used by people to influence the reasoning of others. This view has got strong support from the (evolutionary) psychologists who claim that the original function of the human reasoning is argumentative: to devise and evaluate arguments intended to lead partners to make/accept certain decisions (see Mercier and Sperber, 2011).

In our *Interaction Model* (IM) we treat dialogues where one of the participants (*A*) is trying to achieve the partner´s (*B*) decision to perform an action (*D*), and have worked out a corresponding computer model. We follow the general ideas of the BDI model (Allen, 1995) and have elaborated it in the aspects relevant for us. The central submodels of IM are: (1) *Model of reasoning subject* (RS) which contains *Model of motivational system* (MS) and *Reasoning model* (RM*)*, by which the process of evaluating (weighing) the relevant aspects of *D* is carried out; and (2) *Models of communicative strategies* (ComStr) *and communicative tactics* (ComT), by which the process of *Influencing the reasoning* is treated (Koit and Õim, 2004). The empirical data of our study are taken from the Estonian dialogue corpus[1].

2 Model of Reasoning Subject

2.1 Motivation and Reasoning

We assume that the reasoning process concerning *D* is *triggered* by one of three *motivational factors* of RS: (1) RS may like to perform *D* (*wish*-factor), (2) RS may assume that *D* is useful for reaching some goal (*needed*-factor), or (3) *D* is obligatory (*must*-factor). Together, these factors constitute the MS of the reasoning subject.

MS is used by RS in reasoning about *D*, by weighing the positive/negative aspects of *D* departing from these factors: *pleasant/unpleasant, useful/harmful, obligatory/prohibited.* If the positive aspects (pleasant, etc.) weigh more, RS will decide to do *D*, otherwise the decision will be not to do *D*.

[1] http://www.cs.ut.ee/~koit/Dialoog/EDiC.html

Thus, we assume that RS is able to `sum up´ the results of weighing. In our model this assumption is formally realized so that the evaluated aspects are represented as *scales* that take numerical values, or *weights.* The scales are different. For example, the weights of pleasant/unpleasant scales, *w(pleasant)*, *w(unpleasant)* have values from 0 to n, where n depends on the participant, whereas weights of obligatory and prohibited scales have values 0 or 1. At the same time, the *punishment* scale is connected with these scales, the weights of *w(punishment-not-D)* and *w(punishment-D)*, correspondingly, can again have scalar numerical values. The scales are not independent: what is useful can also be pleasant; punishment is unpleasant, etc. One more motivational aspect is *Resources* (mental, physical, etc.) needed to carry out *D*.

Reasoning procedures (RP) are represented as algorithms of going through the weights of relevant aspects of the action depending on the initiating factor (*Wish, Needed,* or *Must*). Algorithms are represented as decision trees including *yes-no* questions. For instance, in case of RP triggered by *Wish*-factor one question is: *Is w(pleasant) > w(unpleasant) + w(harmful)?* There are three RPs in our model: *Wish, Needed,* and *Must*. The first step of all the procedures is: *Are there enough Resources for doing D? If not, then do not do D,* and every path of a tree ends with a decision: *Do D* or *Do not do D.*

2.2 Influencing Reasoning

If after the *A´*s first turn (request, proposal, etc.) *B* does not agree to do *D* (and *A* does not give up), interaction follows: *A* tries to influence the reasoning of *B*, departing, according to our approach, from the MS and RM of *B*. The influencing consists in manipulating the weights of the relevant scales on MS/RS of *B*, information about which *A* gets from *B´*s (counter-)arguments during the interaction. This `manipulation´ presupposes certain reasoning procedures of *A*, `reasoning about reasoning (of *B*)´, as the output of which he will choose a coherent line of action: which weights in RS of *B* to increase or downgrade. Here we distinguish between two levels of procedures: *communicative tactics* and *communicative strategies*. ComT-s are procedures determined by the choice of the primary motivational factor (*Wish, Needed,* or *Must*). Accordingly, we have three ComT-s in our model which we call *Enticing, Persuading,* and *Threatening*. They consist in increasing the weights of *w(pleasant)*, *w(useful)*, *w(obligatory)*, correspondingly, while downgrading the negative weights relevant for *B*. For instance, if *A* has chosen ComT *Enticement* but *B* points at harmful consequences of *D*, then *A* tries to downgrade *w(harmful)* for *B*. ComStr-s are higher order procedures that regulate the possible choices between ComT-s in a certain interaction. Concretely, in our model two kinds of ComStr-s are important: *Attack* and *Defense* (these apply to *A* as well as to *B*). In the first case, the participant tries to press his goal on the partner, in the second, he averts taking over the partner´s goal. The choice between these ComStr-s clearly restricts the use of possible ComT-s.

3 Future Work

We will include contextual dimensions to our reasoning-in-interaction model, first, involving personal background of the participants: their social relationships (status, distance: friends-adversaries); and second, characteristics of the interaction (rueful, vehement, etc.).

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