

Modeling of interactions based on a pragmatic analysis

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Abstract

Our aim is to study information technologies and their impact on organization. We focus on problem solving and especially argumentation and decision making interaction. We apply pragmatic tools based on speech act theory. We plan to define techniques and methods to capitalize argumentation messages in computer mediated communications.

1 Introduction

Project actors do not have time enough for interviews as recommended in classical knowledge engineering methods. The challenge nowadays is to define methods that help to capitalize knowledge directly from actor workspace. This type of problem is also encountered in organizational memory evolution, in which even knowledge and the memory structure evolve.

One of our objectives is to study continuous knowledge capitalization and define techniques to support it. We study CSCW approaches that analyze cooperative activities and define techniques (such as Design-Rationale and communication facilities). We focus, in this paper, on mediated communication studies. We aim at exploiting some of these studies in order to define a method that helps to structure an interaction and identify argumentation. This method is based on the one hand, on a pragmatic communication analysis (Levinson, 1983) and in the other hand, on argumentation representation (Figure 1.). The structure defined in this way, it enables tracking of most negotiation and decision making.

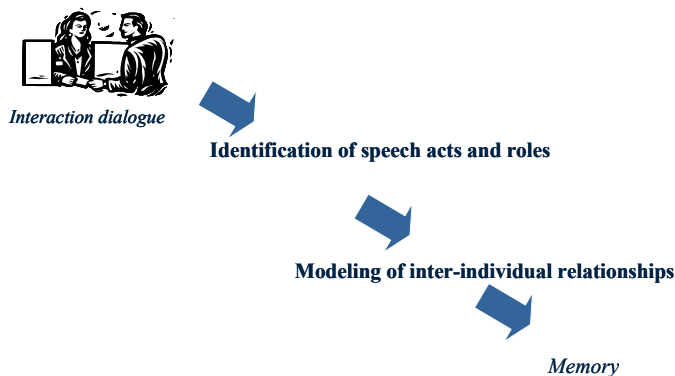


Figure 1. Bottom-up approach

First of all, we present in the next part, an overview of Design-Rationale approaches by emphasizing their contribution to represent negotiation. Then, we describe the basic principles of pragmatic analysis in order to show its application in the analysis of a negotiation. This application is illustrated by an example. Finally, we present how this analysis allowed us to structure negotiation and pinpoint its argumentation.

2 Design-rationale approaches

A number of methods like QOC (MacLean, 1991), DRCS (Klein, 1993), etc. have defined frameworks to represent justifications and decision making. The main criteria emphasized in these frameworks are questions, propositions and justifications. First of all, knowledge can be represented using the following methods.

2.1 QOC

In QOC (MacLean, 1991), design rationale is structured in Questions, Options and Criteria (Figure 2). This representation allows the characterization of arguments by criteria and thus brings out influences in decision. So, QOC has been qualified as a decision oriented approach. Questions, options and criteria are organized as a decision tree.

The representation of options (positions) and their argumentation (arguments or criteria) can demonstrate several given choices in order to solve a problem. They also show the advantages and disadvantages (corresponding to the given problem) of the different solutions. QOC can also be adapted in order to represent a chronological order and, hence, keep track of the design process. However, in this type of representation, the identification of questions or issues is not obvious. The reporter has to be able to find out these elements from discussions and meetings.

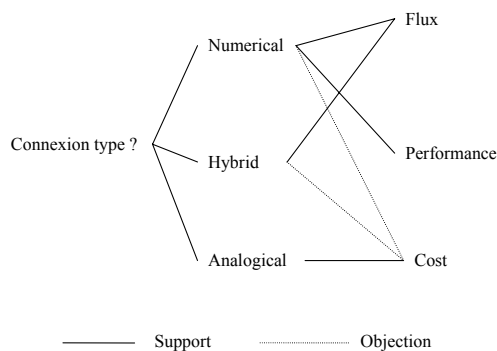


Figure 2. QOC representation: Question/Option and Criteria tree

2.2 DRCS

In DRCS (Klein, 1993), three models are defined in order to represent design rationale : “Intent, Version and Argumentation” models. The “Intent” model shows the question in relation to a given problem and the solving strategies. The “Version” model represents several options as different versions of a problem solution. Finally, the “Argumentation” model (Figure 3.) emphasizes arguments that support or deny a “claim”. These models are represented as a semantic network in which the links show the roles of various elements.

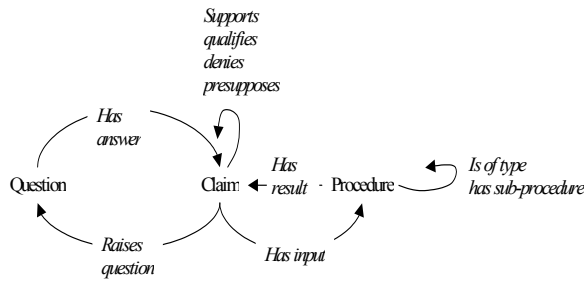


Figure 3. DRCS Argumentation model

This kind of representation can be richer than a simple tree but, it may not seem obvious organization actors. It is not obvious to represent decision elements directly or their mutual influence by a semantic network. There is no global view to show how the interaction led to a decision.

2.3 Discussion

A number of criteria can be distinguished in these approaches. These criteria help to represent negotiation and decision-making. We especially use : questions, positions or options, criteria, arguments, influence relationships, etc. These criteria, on the one hand emphasize negotiation characteristics and mutual influences and on the other hand are easily understood by organization actors. We aim at using these criteria in order to represent the part of negotiation dealing with questions and solutions.

These criteria have been presented as trees, graphs or models. We have chosen tree presentation plus a graph in order to have a clear and rich presentation of design-rationale. We plan to add other representations such as models and projections in order to show up (a) the relationships between negotiation and the problem solving process, and (b) between decision and results.

The difficulty in the use of these methods is to bring out directly these criteria from discussions or communications between organization actors. This paper defines a method that helps to distinguish these elements using a pragmatic analysis of interaction. This technique can enhance a bottom-up analysis and improve the structure and the structuring of argumentation.

In addition, decision making is little influenced by the relationships established between interaction participants. We feel design-rationale approaches can not represent these relationships satisfactory. We aim at analyzing sociology and organization studies in order to define a representation of social relationships (alliance, conflicts, etc.).

For that, we have looked at some conflict and argumentation studies. There are a number of conflict classifications ; for example, a global typology (Castelfranchi, 2000) that distinguishes (a) subjective from objective conflicts, (b) the means from the aims. Other classifications are defined for specific domains, especially those defined by Klein and Easterbrook in the design domain (Matta, 2000). They emphasize task coordination conflicts, incoherence of used means, incompatibility of team members, misunderstanding of terminology, etc.

Some theoretical argument studies can offer techniques for characterizing justification in interaction, such as Sycara Studies (Sycara, 1991) that distinguish several argumentation processes (appeal to universal principles, status quo, counter examples, etc.). J. Sillince (Sillince, 2000) treats several negotiation objectives : aims to means, question to answers, hypothesis to theory, conflict to solution, cause to effects and problem to decision. We have aimed at a thorough analysis in order to define a representation of relationships between a negotiation actors.

As previously, we have proceeded with a pragmatic analysis and represented identified arguments by a design-rationale structure. Our approach is considered a bottom-up analysis : an interaction analysis providing argumentation modeling, using theoretical structures and classifications. The basic principles of pragmatic analysis follow :

3 Pragmatic analysis

2.4 Basic principles

This study is based on a pragmatic analysis of speech acts. The pragmatic analysis deals with problems related to the constitution of the segments or units and their classification. These difficulties of labelling, coding are based, mainly, on the multiplicity of criteria that help to distinguish what is a " sentence " and a " non sentence " (Gary-Prieur, 1985).

The pragmatic analysis of the speech acts deals, moreover, with other difficulties :

- it is necessary to distinguish the direct and explicit acts and the direct and ambiguous acts. The sentences with a performative verb "I order you to leave" are direct and explicit acts. They contain a clarification of their pragmatic value in the form of a verb whereas the sentence " leave!" is a direct attempt which aims at leading the listener to leave, but it is ambiguous considered from the point of view of its pragmatic force: advice, command, recommendation?
- The utterance sentences are different from the speech acts. The same grammatical utterance can convey different speech acts. For example, one evening, a woman says " It is late ". The statement of this sentence can be a simple observation of a fact. But if its interlocutor has just pointed out that it is still very early, that can be received as an objection; for her husband, it could be a suggestion or even a request (" let us go ") or a warning " you will not be well tomorrow if we do not go " (Searle, 1979).
- A speech act is also complex simultaneously. Labov and Fanshel, (Lakov, 199) consider that a sentence does not correspond in a univocal and single way to only one act and can carry out several acts at the same time. Consequently, they propose three distinct hierarchical levels to analyze each statement. For example, a girl addresses her mother: " Well, when are you planning to come home?"

1- *surface level* = a request for information.

2- *indirectly* = a request for action (Come Home!)

3- *Deep level* = a challenge.

An act does not correspond systematically to a linguistic unit ; it is not a grammatical unit. It may involve a word, a noun phrase, a proposal, a complex sentence, a nonverbal substitute. The act cannot be connected automatically with any particular level of linguistic units. Neither it does correspond systematically to a proposal, nor to a sentence (Kerbrat-Orecchioni, 1990). In addition, not all the verbs indicate different types of speech acts. For example, " to insist " and " to suggest " are used to mark the degree of intensity with which the pragmatic value is presented. " To warn ", " to insinuate " and " to entrust " mark the style or the manner of achieving the act. These verbs do not lead to distinct linguistic goals.

All these difficulties have encouraged us to seek effective and operational descriptive solutions. A simple descriptive solution based, on priority was to provide on grammatical units. Our choice is related to the sentence or autonomous proposal, in the following way: are the simple proposals (coordinated or not between them) introduced as one single proposal or sentence with clauses which

create problem in fixing the separations. When the separation gives two autonomous proposals, we quantify two proposals or sentences. In other cases, we quantify only one.

From our point of view, a grammatical utterance corresponds to only one speech act. The analysis is based on the five basic categories of Searle for whom there are only five fundamental language uses (Searle: 1979).

- REPRESENTATIVES : which commit the speaker to the truth of the expressed proposition.
- DIRECTIVES : which are attempts by the speaker to get the addressee to do something.
- COMMISSIVES : which commit the speaker to some future course of action.
- EXPRESSIVES : which express a psychological state.
- DECLARATIONS : which affect immediate changes in the institutional state of affairs and which tend to rely on elaborate extra-linguistic institutions.

2.5 Example of analysis

2.5.1 Data and methods

We analysed messages extracted from the discussion forum of a large French company of telecommunications. The goal of this discussion is to make its employees react about several questions concerning its image, its employees, its customers, its competitors and its future. The moderator of the forum M.R. begins and feeds the debate by the five following open questions:

- 1- "In your opinion, how are our customers of today different from the users of 1970? "
- 2- "Do you feel you contribute to the services supplied to the customers of the company? If so, why? So if not, why not? "
- 3- "In your opinion, what is the best way to satisfy the customers? How could the manager help you? "
- 4- "Each one of us has heard at least one day, some criticisms about the company?. Can you repeat them? What are your reactions? "
- 5- "What could the managers do to improve and facilitate the relationship with the customer of their teams, so that each one can still improve the contribution which he makes for the satisfaction of our customers?"

We analysed the first sequence of answers corresponding to the first question. Our goal is to determine the distribution of the various categories and sub-categories of the speech acts. This classification is always done according to the pragmatic context, and the initial or reactive interventions of the participants. For example, the assertive ones can be explanations, validations, assertions, opinions, evaluations, refutations, criticisms, etc. The directing ones can be orders, consultations, invitations, proposals, regulations, etc. We study individual strategies to determine what each speaker does, collective strategies to specify what make the participants react collectively and inter-individual strategies to see how they collaborate or not in decision making. These three components can of course be analysed separately or together. Example of our pragmatic analysis is shown in (Figure 4).

WHO	Speech acts, Pragmatic signs	Additional Roles	Argumentative roles (alliance, discord, conflicts)
Moderator 1 M. R.	Directive Question + Request <i>Explain</i>		
2 G. C	Representative Validation + explanation <i>Yes, because</i>		Yes
3 J-L R	Representative Validation + explanation <i>Yes</i>	+ Directive	Proposition <i>"We must find the balance"</i>
4 P. B	Representative Validation + explanation <i>Yes, in addition</i>	+ Opinion + Expressive	Affirmation, exaggeration, overstatement <i>"some seek only the lowest price"</i> Fear <i>"competition will be hard for the company"</i>
5 M. L	Representative Validation + explanation <i>Yes, but</i>	+ Opinion	Affirmation, rectification <i>"many of them appreciate being well treated"</i>
6 G. C.	Representative Validation + explanation <i>Yes, but</i>	+ Opinion + Directive	disagreement Vs PB <i>"have rather quality than the lowest price"</i> Proposition <i>"it is necessary to gain the trust of the customer"</i>
7 J-L R	Validation + explanation <i>Yes, but</i>	+ Opinion + Expressive	Affirmation, minimization <i>"but a part of them will return to the company"</i> Assurance Vs PB <i>"I am persuaded that will not be inevitably better elsewhere"</i>

Figure 4. Pragmatic analysis Grid. The first column indicates participant. The second indicates the nature of the speech act and may specify the sub-act and the pragmatic signs (italic). The third column shows the additional linguistic acts (the request for explanation). The fourth clarifies the argumentative orientation, the discord and conflicts between the various participants.

Results

Observation and a preliminary analysis of the first sequence based on speech act theory (Searle, 1979), (Vanderveken, 1988) shows that the participants produce not only the answers expected by the organizer, but utter, moreover, several specific contributions especially directive and expressive ones. Some of these linguistic roles have, more than one precise argumentative orientation. Thus we can distinguish a number of argumentative roles corresponding to this additional speech acts (Figure 5):

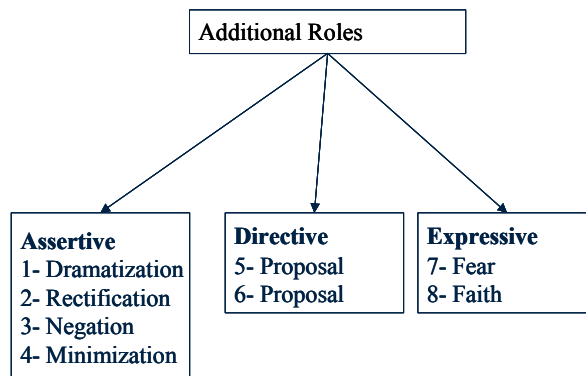


Figure 5. Additional roles

- 1- Dramatization: "Even if certain customers seek the lowest price rather than quality".
- 2- Rectification: "Many of our customers appreciate being well treated".
- 3- Negation: "Today the customer will seek quality rather than a low price".
- 4- Minimization: "But some of them will return to the company".
- 5- Propositions: "The company has to find (for the next year) the balance between these two concepts "The customer hates being disappointed? for fidelity it is necessary to gain his trust".
- 6- Fear: "Competition will be hard for the company".
- 7- Trust: "I am convinced that things will not be inevitably better elsewhere".

Moreover, some moments of discord appear very quickly but never with the moderator. Nobody enters in conflict with her. Divergences exist between certain participants to explain the current situation, its causes and its consequences for the company. This discord reveals at least two dimensions, sometimes alliance strategies or coalition between certain speakers. Thus, P.B is "sandwiched" between JLR and GC who both disagree with his standpoint and his lack of belief.

Consequently, the interaction is by no means limited to a collaborative dialogue between the organizer and the participants, but also reveals opposition, conflict and discord based on a divergence of interests. Thus, in the dynamics of the interaction coalitions are developed between certain participants.

4 Interaction representation

As stated above, we proceed by a pragmatic analysis in order to pick out arguments directly from the interaction. This analysis gives some techniques for distinguishing speech acts and especially linguistic roles. As shown in the example, the pragmatic grid emphasizes linguistic roles and pragmatic signs as : directives, expressive, opinion, etc. These roles correspond to propositions and justifications. In fact, directive speech acts generally correspond to question or proposition, representative acts to argumentation: opinion characterises arguments criteria and influence relationships between arguments (Figure 6.).

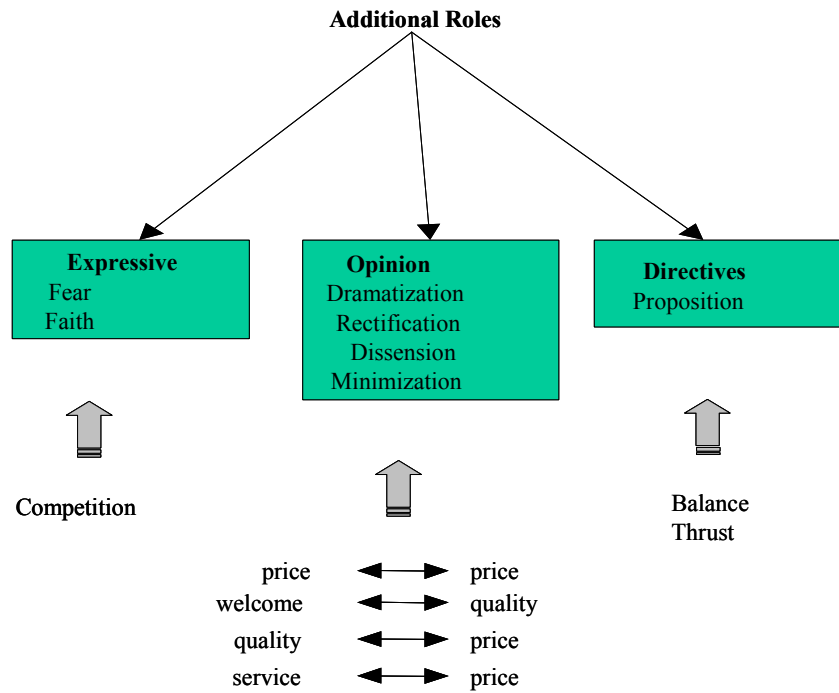


Figure 6. Extraction of knowledge from Additional roles

We represent this elements by a decision tree, similar to the QOC tree, in which question, option and criteria are emphasized. We have also chosen a semantic network graph to show relationships between arguments. This representation is richer than a simple support or object relationships as defined in QOC approach. It is close to the DRCS argumentation model. So, our representation corresponds to a decision tree completed by an expressive graph (Figure 7.).

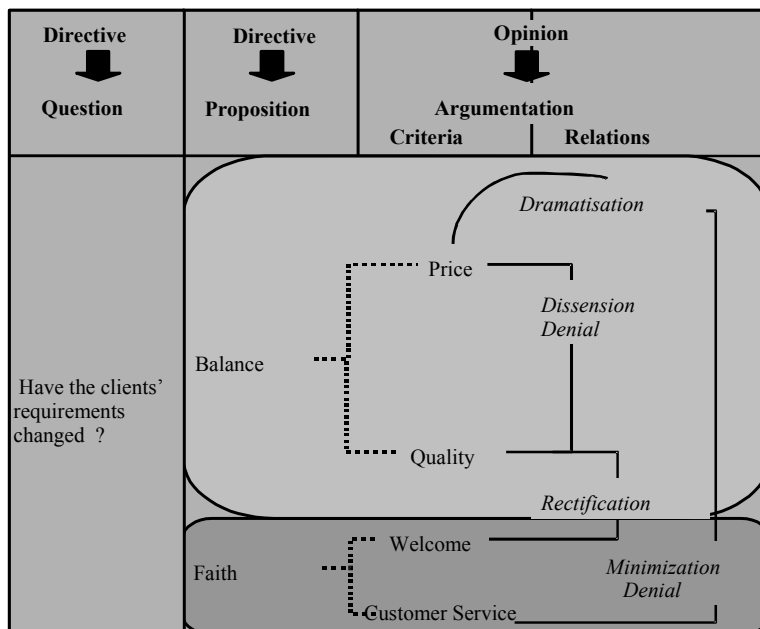


Figure 7. Interaction representation

As shown in this figure, two propositions related to Balance “the company has to find for the next year the balance between these two concepts” and trust “the customer hates being disappointed? for the fidelity it is necessary to gain his trust” are sent as an answer to the question “Have the clients’ requirements changed?”. These answers are expressed as directives. Several criteria can influence the balance and trust propositions: essentially, the price “some seek only the lowest price”, the quality “prefer quality to the lowest price”, the customer service “many of our customers appreciate being well treated”, etc. Relationships such as denial and dissention have been identified according to the price and the quality. The dramatisation “certain customers seek only the lowest price rather than quality” characterizes the price arguments. We also see relationships as minimisation between customer service and the price “but some customers will return to the company”, etc.

It is obvious from this interaction, there is no decision which can be characterize by a commissives speech act.

Otherwise, pragmatic analysis has revealed some participants relationships as alliances and some as conflicts. That is for example the role of expressive acts. In fact, we can distinguish an alliance between G.C. and J.L. who prefer quality and faith. They do not agree with P.B. about the price influence in the market (Figure 8.). This conflict is also shown when P.B. proves fear and J.L.R. is not worried. We can characterize these relationships as objectives. They concern goals. Relationships evolved also during interactions.

The representation of relationships as shown in Figure 6. is not pertinent. It does not provide a good characterization of the relationships using organization models and relation classifications. We are going on with these studies especially socio-organization models to identify a representation of the relationships between interaction participants.

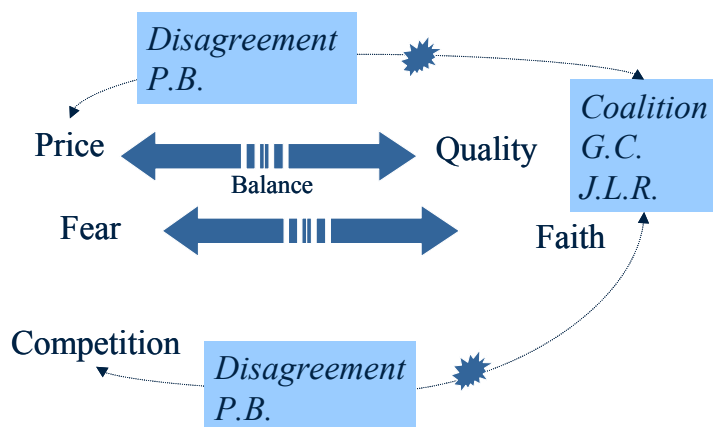


Figure 8. Relationship Representation

5 Conclusion

This pragmatic approach provides some techniques that help (a) to characterize several types of actions and (b) to study argumentation in interaction. This characterization can form a foundation stone for the modeling a discussion in order to specify questions and problems, propositions, arguments and criteria. These elements constitute part of a project memory definition.

This paper proves that the pragmatic analysis of interaction emphasizes speech roles in communication. These roles allow the identification of elements constituting a negotiation. They can be considered as key elements that reflect the evolution of negotiation.

Design-rationale approaches allow the structuring of decision making by characterizing it with some criteria. We aim to facilitate this characterization by offering some techniques inherited from linguistic analysis. The types of language roles provide a basis for the identification of negotiation criteria. We have showed in this paper, how pragmatic analysis can be used to structure interaction in a richer way than a simple discussion analysis as recommended in design-rationale approaches.

In addition, the pragmatic analysis, also provided techniques for identifying actors relationships. The influence of the negotiation in the evolution of this relationships becomes evident. We aim at studying a representation of these relationships by keeping on the one hand a link with negotiation criteria and on the other hand structuring them using socio-organizational techniques.

We have showed in this paper, a collaboration between linguistic and knowledge engineering studies that has allowed us to define some hypotheses towards a bottom-up method. We aim at developing our analysis by validating our hypotheses via a large number of data from different interaction situations.

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