

Mediation System for cooperative activities: knowledge system design

VICTORIA EUGENIA OSPINA BECERRA, ALAIN-JÉRÔME FOUGÈRES

Laboratory M3M

University of Technology Belfort-Montbéliard

Rue du Château Sévenans – 90010 Belfort

FRANCE

Abstract: - In this article we present the use of the knowledge for a *Mediation System*, developed to give support to mechanical system designer activities. The use of cooperative systems must contain a sufficient level of assistance to facilitate and coordinate the actor's activities. To accomplish this goal we introduce an artificial actor: the Mediator. To illustrate our approach we will present the specification of the knowledge of the *Mediation System*.

Key-Words: - Mediation's system, Cooperation's assistance, Cooperative system, CSCW.

1 Introduction

The use of cooperative, strongly interactive and often distributed systems must be accompanied by sufficient assistance levels. The identification and implementation of these levels of assistance can result in designing a real Mediation System. [6]. Such a Mediation System must be used as intermediary of cooperation, not only between the users and the system, but between the users themselves (called actors from now on). Indeed, the system cannot carry out the tasks which are affected to him without the cooperation of the actors. The dynamic, cooperative and autonomous processes, necessary to this interaction, must integrate a representation of the actor knowledge and behaviors, as well as a real capacity to communicate.

The objective of this article is to present the utilization context of the knowledge induced by the introduction of a mediator actor in a group of actors that cooperates distantly with the help of a cooperative system.

This article will be structured as follows: section 2 introduces the *Mediation System* notions of our work. The following section describes the Design of the knowledge base for the technical functional analysis workspace mediator. The following section describes the example of the integration of mediator in a cooperative workspace of technical functional analysis, we will illustrate the cooperative and mediated use of μ -tools supported by the platform PLACID. Finally, in section 6, we evoke the conclusions and the work prospects. We especially propose the increase of the actor mediator capacities with the use of his knowledge.

2 Mediation system notions

The interdependences between the knowledge and the activity are approached very often for the design of knowledge systems. They take in consideration the knowledge and the activity as the scientific particular criteria, for which it is necessary to develop practices and appliances to give assistance to the activity.

The knowledge and the action are naturally linked in the human activities in organizations. The devices of collective actions are particularly interesting to observe the processes of creation, transformation and utilization of knowledge.

Several concepts of *Mediation* exist. We are going to try to delimit the problematic of the *Mediation* taking different works of assistance as: [3][12][13].

There are several mediation conceptions, and as they are not uniform we are going to do a small description of mediation examples. The concepts are more or less nearby; this translates a diversity in the concept of *Mediation*.

The majority of the systems developed in the domain of the CSCW support relatively well the cooperative activities of actors who work with a common purpose, but they are not sufficient for a management of activities, knowledge and interactions. It is necessary to give assistance to these interactions (actor - actor and actor - application) to capitalize the cooperative knowledge, to manage to produce by these means *Mediation*.

We want to take a look at *Mediation* from different cooperation points of view, looking forward to find the deficiencies in *Mediation* that will be considered for the conception of the *Mediation System*. We can actually, distinguish two major strongly different options for assistance in the domain of the assistance to cooperative work: the assistance for the prescriptive regulation and the assistance for the emergent regulation [8].

The role of the *Mediator*, is as to be an intermediary of cooperation. This role is revealed more pertinent when the actors are compromised in distant situations of work with the cooperative system (Fig.1). To illustrate our approach, we present the design of the μ -tools and the *Mediation System* that we integrate in a cooperative workshop of technique functional analysis (the workspace *WS-TFA*).

The cooperative systems (or cooperative applications) that we consider in this article are destined for the collaborative conception of products, in distributed conception or co-conception. In such systems, the main collective practices of actors are: the tasks assignment according to the actor's skills, the synchronization actions, the cognitive synchronization to share knowledge, the problems management, and the multiple communication actions. The cooperative system has to offer the functionalities for the development of the collective activity and to allow the partners of conception to cooperate in order to identify the objectives and to share their definitions. It should determine and distribute the sub-goals, to distribute the

tasks, to follow the activity evolution, to evaluate the results of the collective conception; and to have the support of the mediating actor.

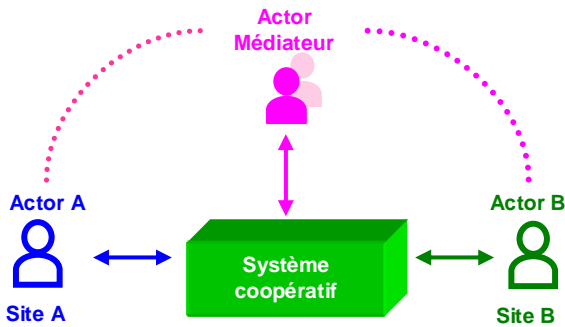


Fig 1. Le schéma conceptuel du Médiateur

The design of the cooperative application is not the object of this communication, nevertheless, for a better distinction of the constitutive elements of the application and its *Mediation System*.

We evocate that it have to translate the proposed model by Malone [16]. He defines a cooperative system in function of three types of cooperative works: the communication, co-production and coordination.

2.1 Cooperate Aptitude

The Mediator is an artificial actor; he forms part of a group of actors who cooperate to make a cooperative activity, with the help of a computing tool (ie, a system or a cooperative application). The role of the *Mediator* is to facilitate and to help to the cooperative activity.

The role of assistance, differentiate the from other actors. This one is endowed with specific skills of cooperation (communication; awareness, coordination, co memorization, and reparation knowledge), requiring some acquired knowledge, which allow them to give assistance to the human actors.

2.2 Use knowledge Aptitude

The aptitude to use knowledge is generally alike to the one of knowledge systems or expert systems. The Mediator exploits different types of knowledge: knowledge of skill and domain, users and group knowledge, the knowledge on the specific application, and the knowledge for assistance.

In this case the system based on knowledge directly is not accessed by the actor but by the Mediator, the following figure illustrates these differences.

The *Mediation System* design, is based on the experience of a general domain, needs to design the knowledge process used by the actor in the moment of activity [2][7]. During the accomplishment of cooperative activities, the actors produce knowledge that they will be useful for the continuation of the project, or to serve for others actors in future similar works. These propositions suppose, on the part of the different actors, the respect of minimal rules of cooperation.

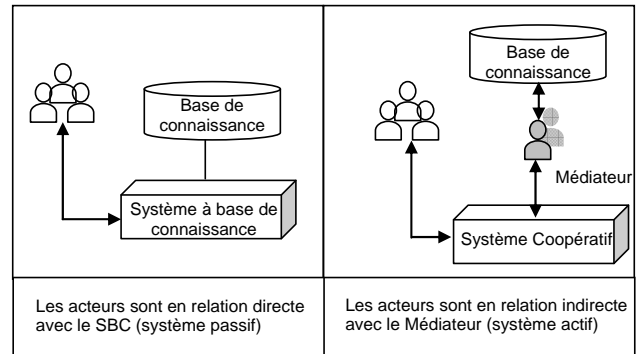


Fig 2. Direct interaction of the actors with a knowledge system (a), and hint (b) with Mediator.

3 Model of knowledge

The knowledge necessary for interacting with other actors is described in our knowledge model, which is divided in two parts: the first one concerns the initial knowledge which its composed by the assistance and the domain knowledge. The second part concerns the knowledge acquired when interactions between the cooperative systems and the interaction with Mediator take place – It concerns in particular the memory of the activities and the resolutions of assisted problems.

3.1 Knowledge for assistance

The domain knowledge is the base of the *Mediator* assistance in a given application. The assistance knowledge, such us advices or typical cases, are more specific. As for the knowledge to assist cooperation, it is quasi- generic.

Our initial work concern the analysis and design of cooperative activities, induced by intellectual tasks which are meditated by the new technologies of information and communication. The goal was to better understand the functioning and the conditions of development of a collective and distributed cognition in the user activities, in order to identify the principal criteria needed while conceiving assistance.

3.1 Knowledge for cooperation

For the design of the knowledge acquired, we were inspired by the model of project memory proposed by [5] and in the case based reasoning [1]. This different experience knowledge allows the improvement of assistance relevancy contributing to future cooperative activities.

The model that we develop [6] integrates the following categories of knowledge: user, context, group of work and domain knowledge, as well as application and content of work memory:

- The user knowledge and its context of utilization are personal information; for example, the set of the specific tasks that a user makes according to the application.
- The group knowledge concerning collaboration activities: every negotiation, decision, or collaboration group task achieved, thanks to the application resources.
- The domain knowledge is essential to construct a precise context of the relations, actions and communications that can take place between the users and the application.

- The application knowledge (cooperative system) is fundamental to supply help and advices to users with a maximum of efficiency and relevancy.

- The treatment of their content allows the *Mediation System* to intelligently guide the users.

To summarize, we can enunciate that *Mediation Systems* (as knowledge base based systems) are strongly structured by the exchanged knowledge and stored in their knowledge bases, and by a knowledge engineering process which is considered in a continuous conception.

4 Design of the knowledge base for the technical functional analysis workspace

In this section, we illustrate our works on *Mediation System* design, by a *TFA* workspace composed of μ -tools (*WS-TFA*) [6]. The design of μ -tools is proposed for instrumenting collaborative activities of conception (or co-conception). The concept of μ -tool [12] corresponds to light, easy to use software applications, than can be inserted in a shared environment.

An agent platform (PLACID: Platform Help software for the Innovative and distributed Conception for Plate-forme Logiciel d'Aide à la Conception Innovante et Distribuée) [2] was developed to support the usage of μ -tools. This software platform offers services for the use of a virtual environment of co-design (objects sharing, management tasks services, communications services).

The conception of the Mediator target the modelling of its knowledge base to facilitate its role and the accomplishment of its tasks.

The design of knowledge necessary for the *Mediation* proposed within the framework of the workspace of *TFA* are two natures: initial knowledge concerning the domain of the activity and the knowledge acquired through the activities assisted by the tool.

The Mediator design is oriented to knowledge base modelling in order to facilitate its role and to use its advantages.

To assist the first cooperative uses, the *Mediation System* has to refer to a set of stable and expert knowledge, resulting from a conceptualization of the activity context (here, the *Technical Functional Analysis*). The domain knowledge such as: component standard libraries, typical contacts and predefined streams.

The domain knowledge includes the knowledge of the *TFA* definition and the activities knowledge associated with: define the components list, define the contacts and draw streams.

The figure 3. represent the general scheme of knowledge memorization under the form of case, realized by the *Mediation System*. The activity memorization process, which leads to the evaluation, is guided by a design of the activities (Activity i). The cases base enriched this way, increases the assistance capacity of the *Mediation System* for uses and future users.

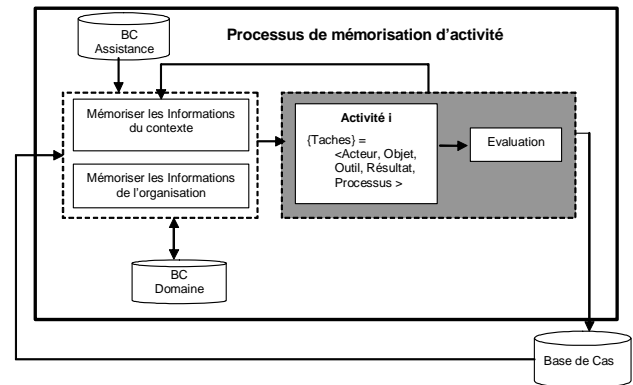


Fig 3. Scheme of knowledge utilization

5. The use of knowledge illustration

Figure 4 presents a screen shot of the usage by designer "AJF" of the functional analysis workspace for the cooperative task "define component list" in the project "Complete Stove". Three μ -tools are opened in the activity desk:

- NOMEN define the components list (name, attributes),
- PAPOT allows to communicate with the various designers; in this case we notice that three participants have for role to define the components list;

- INFO supplies to the participants information concerning its individual activity, as well as those produced by the mediator on the tab "Med". The designers can communicate to define the components list; in this case the *Mediator* can make communication visible, under the shape of a discussion report to the designer "AJF".

"AJF" having already accepted this addition, the decision is thus consensual.

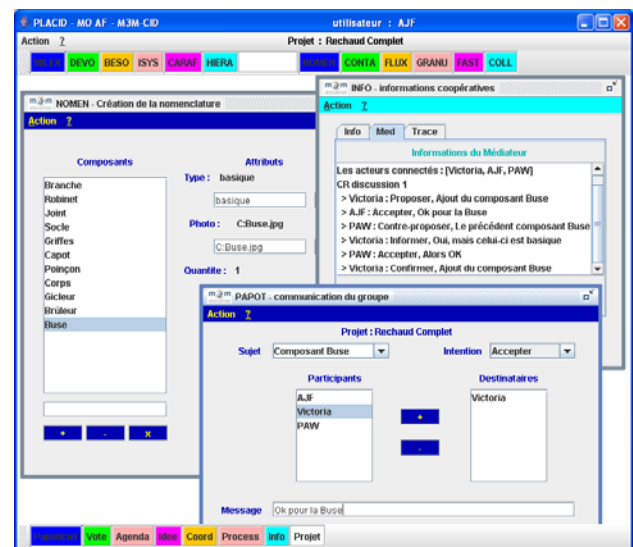


Fig 4 Collaboration Scenario to draw up the list components

The use of the knowledge acquired during the work of conception with the help of the *TFA* workshop, are available for designers request. The synthesis of the cooperative work under the shape of report, will be assisted by the *Mediator*. In this case we will show the edition of the work report.

The list of components conceived in every μ -tool is showed to the designers with a mark made by the *Mediator* which allows designers have access to conception detail.

We can make a typology of marks giving this way, more information, nevertheless at present every mark authorizes the possibility of displaying the acts of communication realized during the cooperative conception.

Figure 5. shows the knowledge structure of the *Mediator*, according to the example in figure 4.

The μ -tool NOMEN associate the defined components while the *Mediator* add work knowledge. In order to conceive the component "Stove" the designers have exchanged messages that the *Mediator* will recall during the edition of the report, if the group of designers agrees in their relevance, to include them in the report.

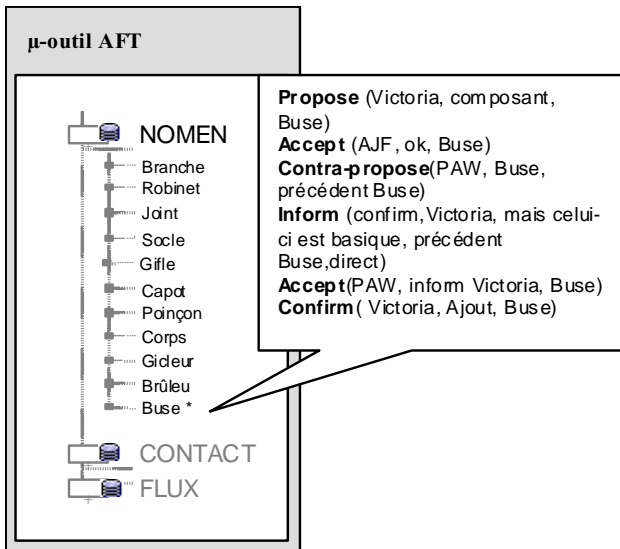


Fig 5. Knowledge's structures of the Mediator

6 Conclusion

Our work on the development of a methodology of design of mediation system (mediator actor), us resulted in specifying knowledge base. To present the utilization context of the knowledge induced by the introduction of a mediator actor in a group of actors that cooperates distantly with the help of a cooperative system.

Following the instrumentation of a co-operative activity of TFA (μ -tools oriented), we integrated a mediator actor to assure a better sharing of information in this context of collective work, and to allow to more easily establish an effective connection between an actor and the co-operative application on the one hand, and between the co-operating actors, on the other hand. This experimentation thus allowed us to validate our proposition of mediator actor integrated in the space of cooperation.

The example of drafting report staff with the intervention of the *Mediator*, in other a case was the evaluation of projects use

in students' projects as makes by the teachers is the principal use of the knowledge stoked for the *Mediator*

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