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Instrumental mediation in a collaborative design process

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Introduction

It is a quite common practice, for a few years, to study the design activity through its collective aspect (Bocquet, 1998; Bossard *et al.*, 1997; Caelen et Zreik, 1995; Cross *et al.*, 1996; Darses, 1997; Flichy, 1995; Garro, 1996; de Terssac et Friedberg, 1996). It is justified by the fact that the collective models of design fit the concerned cognitive process (Darses, 1997). This practice belongs to the paradigm of so called 'situated and distributed cognition' (Brassac et Stewart, 1996; Conein et Jacopin, 1994; Hutchins, 1995; Suchman, 1987, for instance). Thus it's not amazing that the design 'with several' gives rise to a lot of research in the domain of social and human sciences and in the engineering field.

As psychologists of the interactional mechanisms, we are interested to work on the collective activity of design for the following reasons:

- concerns a small group of human beings
- has an aim, which is to design a product from sometimes divergent individual purposes
- happens around a design product
- has practical constraints, i.e. it has to meet professional requirements.

All these reasons lead us to set up different types of design situations. The main point is to focus on a double aspect: to favour the face-to-face interaction and to put the object on the very heart of the device. Thus our research is about the analysis of collaboration mechanisms which occur in these collective activities of design. We develop such a methodology in plans relating to the design of manufactured goods (mechanical products), of symbolic goods (working documents, software), of services (planning devices, documents of exploitation), or of technical drawings.

The paper starts by presenting a situation of design we have already sharply studied (Grégori, 1999). We describe the methodology we have used for locating the key-sequences and for analysing them. Then, we lay out a brief analyse of an extract of the corpus to give prominence to the cognitive, social and instrumental aspects of the design. Finally we conclude.

A situation of distributed design

The situation

The situation we talk about concerns the design of a mechanical device. Experts of three different crafts are gathered round a table during six hours divided into two half-days. Each of them is a specialist in the skill he represents. Two of them represent the functional module (the research unit), they are called FON1 and FON2; another one represents the structural module (the method unit), he is called STR; the two last ones represent the manufacturing (the production unit), they are called FAB1 et FAB2. These designers have a lot of A3 sheets and a paperboard at their disposal. The session has been recorded with a video camera.

The product to design is a mechanical device which should allow to keep planks in position on a machine tool. The planks should adhere by suction on the table of the machine tool.

Building and analysing the corpus

The six hours of the design session can be divided into three main stages. During the first stage (forty minutes), the actors appropriate the problem; they define the aim of their work and roughly describe the kind of product they have to design. Then, they begin a process that we can retrospectively call a 'decision process about a solution' (eighty minutes). During the last stage, they precisely define and sharply describe the characteristics of the 'technological solution'. In this paper we only study the two last stages because the solution is built during this time. (object 8, drawing 8e-8f-8h, figure 1)

Figure 1. Solution technologique de principe (Ajouter objet 8a-b-c).

In order to bring out the sequences of this design process, we have started from the technical solution. Then we have marked out all the sequences where the representation of the product is effectively transformed and actually modified. So, we have brought out six sequences which are key-stages of the design process.

Here is the analysis method we apply on the corpus. To speak briefly, the so-called interlocutionary logic (Brassac, 1992; Ghiglione et Trognon, 1993; Trognon et Brassac, 1992) is an extension of the illocutionary logic (Searle et Vanderveken, 1985; Vanderveken, 1988). The latter is grounded on the speech act theory. The former account the dynamics of the chaining of the speech acts in conversation. Further, we combine this interlocutionary logic with the structural and hierarchical model developed par the 'geneva school' (Roulet *el al.*, 1985). The notion of speech act directly leads to the socio-cognitive aspect of the interlocution. Actually, it corresponds to the application of an illocutionary force which define a type of action (to assert, to request for instance), on a propositional content (a cognition). From this notion, the speech act, we can define turn takings, exchanges, structures and, at the macro level, transactions.

Our purpose is then to sharply describe the generation of socio-cognitive events which are performed through the succession of local actions. In this aim, we analyse the relations between the illocutionary components and the propositional one.

Analysis of a séquence

Contexte de la séquence

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Analyse de la médiation réalisée au cours de la séquence

Cette

Tableau 1. Dimensions cognitive, sociale et objectale de la médiation réalisée.

Transaction	Interv.	Médiation cognitive	Médiation sociale	Médiation objectale
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Impasse cognitive	FON1 01 STR 02 (...) FON1 06 STR 07 FON1 08 STR 09	Demande satisfaisante q S'engage satisfaisante q FON1 q nécessaire STR q non nécessaire	Statut autorité Statut exécutant Conflit entre FON1 et STR	Dessin 8a acteur cognitif, extrémise la position de STR
Temps initial	FON2 10 STR 11 (...) FON1 19 (...) FON1 24	FON2 permet l'expression FON1 q t STR (q t)	Statut médiateur FON1 instaure FON1 = suiveur STR = décideur	
Temps Interméd.	STR 25 (...) STR 32	(q t) (q t) [donc q]	STR instaure FON1 et STR égalitaires	
Temps terminal	FON1 33 (...) FON1 36	(q t) Exprime d	FON1 et STR égalitaires	

q les commandes d'aspiration sont séparées.

t l'ensemble système/pièce bouge.

d pour que l'ensemble système/planche ne bouge pas, il faut séparer les commandes d'aspiration.

Dimension cognitive

Sur

Dimension sociale

Voyons

Dimension objectale

Voyons

Conclusion

The important point is that this distributed et situated design is analysed as a process, as a cognitive dynamics. We have tried to understand how the design activity is performed along the interactional interaction between the actors. We have observed how the cognitive, social and instrumental aspects

of the process emerge and structure the collective action. This observation has allowed us to bring out the mechanisms of mediation and rupture in the conversational dynamics. We deliberately have focused on these points for the following reasons:

-They enlighten the fact that the design activity is *distributed* (according to the constructivist meaning of the word) and *opportunistic* (i.e. non pre-determined);

-They refer to the three aspects (cognitive, social and instrumental) which are crucial in the collective process;

-They point up the way designers succeed in integrating of their point of view

Nevertheless there is still much to do in order to precisely characterise this collective activity of design as a language game which occurs in a communication arena according to Dodier (1993).

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