INVESTIGATING THE ROLE OF SOCIAL ASPECTS IN COLLABORATIVE DESIGN

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Abstract. This paper basically describes part of our current research on the role of social aspects in collaborative design. Most part of this research, up until this stage, is theoretical research, which is our attempt to imply theories in social psychology in collaborative design. In order to step further towards empirical research we need tool for the investigation. Discussion on this paper is built upon our attempt to develop this tool. Considering this context the discussion can be observed into two sections. First part is basically summary of our theoretical research to this point. Based on these theoretical backgrounds we discuss our research on defining and developing the tool in the second part. The tool is basically a prototype of design process representation system which is expected to be used as our tool for next stages of this research, investigating the role of social aspect in the real practice of collaborative design.

1. Introduction

Current research on collaborative design mostly deals with problems of how to facilitate the interaction among the participants through some computer-mediated system. The increasing efficiency and growing bandwidth of communication has compressed the time between design iterations, and increased the amount of information available to the participants. At the same time, it has created problems that are a direct consequence of these gains: while attention has been focused on improving the communication process, problems arising from increased, yet compressed, social interaction facilitated by improved communication, have been exacerbated. The research reported in this paper explores the nature of human interaction during collaborative design, not on the utilitarian, mechanistic processes supported by current collaboration systems. It views the process of collaboration as a
social setting, rather than a problem of communication. As such, it involves—and is impacted by—social, non-technical aspects, such as lack of shared understanding, conflict, conflict resolution methods, availability and motivation of the participants, their social stature, charisma, and other factors that can facilitate or impede the goals of the collaborative enterprise. These aspects form the basis of the social interaction between and among the actors, or social context of collaborative design, and are more apparent in creative collaborations (Kalay, 2004; Kvan, 2000), which are therefore the focus of our work.

2. Theoretical Background

It has been widely recognized that designing is a social process. This phenomenon should be easily identified in architectural design setting. There are many different kinds of participants involved with a major building project. The various numbers of participants will be getting higher as the size and complexity of the project are getting bigger. In line with the project complexity, the context complexity will also contribute to the level of complexity for the project as whole. What is meant by context here is not the context of the building where it will be located but rather the context where participants perform their design tasks according to their own role. It could be distributed location in term of geographic context, as it usually happens, but at the same time it could also be collocated.

SOCIAL ASPECTS IN COLLABORATION

Social interaction between and among the actors in collaboration indicates essential role. It’s highly relevant to identify how far social factors play as determinant factor in a successful collaboration.

Berger and Luckmann (1967) argue that reality is not an objective, value-less, fixed phenomenon, shared by everyone. Rather, it is a product of social system through which human knowledge is developed, transmitted and maintained. In a collaborative environment this could bring essential consequence. In order to have a successful collaboration, each participant should understand, to a certain extent, the social construction of their counterpart collaborators in dealing with such kind of project where they collaborate on.

PROBLEMS ON COMMUNICATION

Design as social process has also been well acknowledged by engineers (Bucciarelli, 1988). However, as Donald Schön (1988) has criticized, its
approach tends to be more focused on the character and consequence than the impact of particular social arrangements. Research on problems of implementing collaborative design tends to focus on the technical or mechanical aspects of the collaboration. Following are few examples of scope of problems that were defined by some research groups working on collaborative design area. In virtual environment of collaborative design, understanding distributed knowledge among participants is interpreted as part of attempts in supporting geographical, temporal and functional dispersion of human knowledge and information that is required during the collaboration process (Tormey et al, 2003). Communication looks liked something that has been paid more attention as a source of problem in collaborative design: such as a CAD system, which is proposed a so-called discourse model to bridge the communication gap among participants (Case and Lu, 1996); or, viewing participation as specific problem in communication, using the computer system to record communication in order to identify participation (Simoff and Maher, 2000); or a further research on communication which defines the lack of design guidance to complete communication solution in collaborative design (Chiu, 1998).

In this case computer usually plays significant role in making a seamless communication exist among participants. In architectural setting we will find that most of the proposed systems as solution in implementing collaborative design are working on the advancement of CAAD (Achten, 2002). But it is still realized that to hinder misunderstanding, or more frequently critical occasion such as conflict among participants, as something unavoidable through this system.

Another distinguished characteristic of creative collaboration among other types of collaboration is in the leadership aspect, which makes it not too relying on management aspect (Kalay, 2004). The leading designer knows how to switch from the person being responsible for the result to being the one who ensures that the ‘process is right’(Jones, 1980).

Our investigation and analysis are founded on theories in social psychology as branch of sociology which deals more with the nature of interrelationship between human beings, either as individuals, groups or combination of both. For this stage of research it is still limited on theories which are considered classic in this area, such as social psychology of organizations (Katz and Kahn, 1978). Specific attention is paid to several theories that are considered relevant to understanding the social interaction in collaborative design setting. They include role theory (Biddle, 1986; Turner, 1990); reinforcement theory of conditioning (Mazur, 1998) and of social learning (Bandura, 1977); cognitive theory (Fiske & Taylor, 1991); and symbolic interaction theory (Charon, 1995; Stryker, 1987). These theories guided our investigation of the social psychological phenomena that occurred among the actors during a collaboration process.
3. Methodology

For this stage of the research we are still focusing on developing a representation system as a tool for the investigation. This is an essential part since we are optimistic that this research subject involves issues that are potentially investigated in a long-term research regarding the more complicated social context of collaboration. Consequently these series of researches should be conducted upon similar platform of investigation tool. Moreover we presume that contribution of the research findings should be conceptually open to be implied on various collaborative design systems that mostly are computer-mediated. So rather than utilizing common research tool for this kind of topic, either within quantitative or qualitative research setting method such as conventional ethnographic research, we tend to develop a representation system tool for investigating this subject. We have proposed a representation system, which is developed to support process-oriented view of design. We are expecting this representation system will enable us investigating the social nature of collaborative design process.

4. Project Description and Context of Collaboration

The research was set up to run concurrently with a course on multi-disciplinary collaborative design, where two groups of students were given the task of designing a temporary pavilion for exhibiting art, of the kind usually found in a street fairs. Design needs, design criteria and requirements have been established according to several typical aspects concerning this kind of project, i.e. architectural, structural, operational and economical.

The research investigated the social process occurred on one of two groups of students in the course. All design actions during the collaborative process were recorded using several media: sketches, design notes, and most important -- a Wiki, which also facilitated the communication among the participants.

The group that was the subject of the investigation consisted of three members; all of them PhD students who already had significant experience in architectural design in different professional settings, and had different social and cultural backgrounds. They were expected to share equally different roles which are usually found in typical architectural design project, i.e. architect, structural engineer, and mechanical engineer.

PROJECT PROFILE

Design case to be executed by the group is a pavilion for street fair. Following is a brief description of the program: movable pavilion structure;
20 paintings to be displayed; adaptable to any kind of weather; assembly/disassembly should be able to be handled by only two persons without complicated equipments; whole structure elements and paintings should be fit inside a van; project cost is part of the competition ($10,000 available budget).

COLLABORATION PROCEDURE

Procedure of collaboration employed by members of the group comprises two collaborative design processes in actions. The first one is online collaborative design process. Basically this process consists of the following steps: conducted during the week between weekly f-f meeting; all communication is made through e-mail and wiki; members make any contribution on design process by posting any ideas/opinions in the group website: sketches, graphs, comments, issues, etc; members can make feedback on any items put on the website by other members; whole design activities should be posted sequentially; design activities for each weeks will be logged in separate website.

The second procedure is a conventional design process or face-to-face (f-f) collaborative design process. This consists of the following procedures: conducted once a week after class meeting; principally f-f meeting is to have design decision based on the joint decision making; whole meeting will be recorded and logged on an f-f meeting logbook.

DESIGN COLLABORATION STRATEGY

One central point in utilizing the collaborative process is determining the function and role of team leader of the group as well as the mechanism of choosing it among the members. There are two models of team leader role employed by the group during the design process. The first model is by employing one same person as team leader during the project. This is intended to maintain the consistency of project execution. Another model is by giving a chance for each member to be team leader. In this case the group decided to switch the team leader role in every turn of the design stage.

The role of team leader is defined as following: managing conflict; collecting and compiling ideas; generating main idea for design process during week on progress. Other members should remain active by giving advises to enrich as well as revise the design.
5. Discussion

The usage of the Wiki as a communication system enabled us to record and to analyze the entire social interactions and its corresponding design progress, as well as the products of the collaborative process among the group members. To facilitate the investigation of the social aspects of design, we have developed a representation tool to help visualize the interactions among the participants in the process (see Figure 1 to 5). This representation system is expected to enable visualizing the social aspects of collaborative design process. In the context of this research we attempted to make it as platform for analyzing the social interaction among the actors.

The representation is basically a diagram that depicts significant design steps and design decisions taken during the design process. This is quite parallel to what is called as design move and design link in the Linkograph (Goldschmidt, 1991). Based on this scheme we could identify some important findings regarding the social and psychological nature of the collaborative design process performed by the actors. These results should be followed up in future research, where the collaboration context will be more complex, closer to the real practice, and include the various backgrounds of actors as well as the case and its setting.

The representation system can be seen in the upper right part of Figure 2, 3 and 4, while Figure 5 depicts the representation system specifically as summary of whole design process executed by all members. Each color represents one member of the group. Circle nodes represent new idea. Square nodes represent development of a design idea. Lines show what kind of design ideas a node can generate for the next step of design process, whether it generates a purely new idea or a development of previous idea.

Through this representation, at least we had been able to interpret some points in the design process as the indication of social psychological nature of the interaction among group members in doing their design works within the context of collaborative design. The nodes of design idea can reflect how a particular product of design ideas has been developed differently among members according to his/her own cognitive structure and schema. This phenomenon might be attributed to the different social cognition of the members in interpreting the visualization of particular ideas (Fiske and Taylor, 1991). On the other hand this phenomenon might also be interpreted as situation of conditioning that leads to reinforcing the ideas or stimulating the emergence of new ideas (Mazur, 1998).
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Figure 1. Design progress was charted on weekly basis

Figure 2. Scheme of design process in week 2-3, at the upper right corner is representation system of design process which is very simple for this early stage

Figure 3. Scheme of design process in week 2-3, depicting dynamic interaction among members and its corresponding scheme on design representation in the upper right
6. Conclusion

Using this representation we could identify some important aspects regarding the social and psychological nature of the collaborative design process performed by the actors. It can be summarized as following:

- From social psychological perspective, the cognitive structure and schema of each participant has enriched the generation of new ideas or at least the development of existing ideas.
- Mutual reinforcements play a significant role in accelerating design process. At four significant points during the process, where design

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**Figure 4.** Scheme of design process in week 13, notice the right scheme already reflecting the complexity of the design process triggered by social interaction among group members

**Figure 5.** A collaborative design representation system, used as tool for investigating social psychological nature of members in collaborative setting
ideas were forming, we noticed the mutual stimulation and reinforcement among the actors.

- The reinforcement is enabled and encouraged by a kind of situation of conditioning among the actors. The relatively similar background of the actors makes negotiating meanings something that encourages the development of ideas, rather than source of conflict.
- We could not identify any specific findings regarding symbolic interaction approach to the social psychological context of the collaboration. Our presumption so far is that it is caused by the relatively similar design knowledge background of all the actors.

Clearly, these results need to be followed up in future research, where the collaboration context is more complex, closer to the real practice, and include the various backgrounds of actors as well as the case and its setting.

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