Designing Awareness Support for Distributed Cooperative Design Teams

Dhaval Vyas
Human Media Interaction Group
University of Twente
Drienerlolaan 5, 7522 NB,
Enschede, the Netherlands
d.m.vyas@ewi.utwente.nl

Dirk Heylen & **Anton Nijholt**
Human Media Interaction Group
University of Twente
Drienerlolaan 5, 7522 NB,
Enschede, the Netherlands
d.k.j.heylen | a.nijholt@ewi.utwente.nl

Gerrit C. van der Veer
School of Computer Science
Open University,
Valkenburgerweg 177, 6419 AT
the Netherlands
gerrit@acm.org

ABSTRACT

Motivation – Awareness is an integral part of remote collaborative work and has been an important theme within the CSCW research. Our project aims at understanding and mediating non-verbal cues between remote participants involved in a design project.

Research approach – Within the AMIDA[1] project we focus on distributed 'cooperative design' teams. We especially focus on the 'material' signals – signals in which people communicate through material artefacts, locations and their embodied actions. We apply an ethnographic approach to understand the role of physical artefacts in co-located naturalistic design setting. Based on the results we will generate important implications to support remote design work. We plan to develop a mixed-reality interface supported by a shared awareness display. This awareness display will provide information about the activities happening in the design room to remotely located participants.

Findings/Design – Our preliminary investigation with real-world design teams suggests that both the materiality of designers' work settings and their social practices play an important role in understanding these material signals that are at play.

Originality/Value – Most research supporting computer mediated communication have focused on either face-to-face or linguistically oriented communication paradigms. Our research focuses on mediating the non-verbal, material cues for supporting collaborative activities without impoverishing what designers do in their day to day working lives.

Take away message – An ethnographic approach allows us to understand the naturalistic practices of design teams, which can lead to designing effective technologies to support group work. In that respect, the findings of our research will have a generic value beyond the application domain chosen (design teams).

Keywords

CSCW, Artefacts, Design, Mixed-Reality, Awareness

1. AMIDA is a 6th Framework Programme EU project. For more information: http://www.amiproject.org/

INTRODUCTION

Cooperative work is about supporting communication between two or more actors by establishing collective understanding about the subject of conversation (Dix 1994). Mutual awareness becomes a very important aspect here as each actor needs access to the information pertaining to the state of the work, in order to contribute purposefully to the ongoing collaboration. This mutual awareness is established and sustained via verbal and/or non-verbal communication. We believe that in the case of non-verbal communication, material signals – signals in which people communicate through material artefacts, locations and their embodied actions, for supporting cooperative work, have been under explored within the HCI and CSCW communities. More often, CSCW studies have shown a certain analytical primacy to the verbal languages and linguistic conversations in collaboration.

There are a handful of studies, which show that material aspects play an important role in coordinating co-located and distributed activities. Amongst these studies the role of paper use for supporting collaboration is well documented by many authors, including Sellen and Harper (2002), and Heath and Luff (1992, 1996). In the case of architectural practices (Schmidt and Wagner, 2002), medical hospitals (Bardram and Bossen, 2005), group design practices (Robertson, 1997; Jacucci and Wegner, 2003) and meeting rooms (Ramduny-Ellis et al. 2005), it has been shown that a considerable part of work is coordinated through material artefacts, like paper documents, notice boards, architecture plans and drawings. In a recent study, it is shown that materiality can play performative, persuasive and experiential roles in coordinating collaborative design work (Jacucci and Wegner, 2007).

We believe that an analysis of fine details of seemingly simple activities with the artefacts could have important implications for our understanding of collaborative work. This is even more relevant when teams are from domain such as design, engineering and architecture – teams that use a variety of tools, objects and artefacts to support their 'simultaneous' work. The skilled and timely use of these artefacts, their availability, exchange and manipulation, is an integral feature of the

accomplishment of the highly complex collaborative activity that these domains represent.

Within the AMIDA project, our specific focus is to view the material aspects as the mediator within distributed teams of designers involved in cooperative work. Our overall aim is to design and develop technological support for remote cooperative design, by first understanding the naturalistic scenarios of co-located design teams. In the following sections, we first describe several aspects that motivated us to pursue this research. We then describe our approach and some early findings of our preliminary studies. In the end we describe our future plans.

MOTIVATION

Our motivation behind this research is to develop an approach for augmenting artefacts with computing capabilities taking into account designers' natural practices. We believe that in order to develop efficient and effective ubiquitous technologies (Weiser, 1991) we need to have a broader understanding of the ways in which mundane artefacts are used within everyday common design practice. A large part of CSCW research has focused on the face-to-face or conversational paradigms to analyse cooperative work. However, a recent review (Whittaker, 2003) showed that mediating the visual information about work related objects (used or designed during cooperative design practice) are more important than information about the participants involved in a cooperative work. This means that the artefacts, developed or used during cooperative work, are a source of supporting and mediating interactions amongst the distributed or co-located workers.

Because of the nature of design practices, the interest in materiality in design work is obvious. Designers, whose intention is to produce tangible products, communicate through a varied set of design representations often involving different materials, modalities and scale. The total design project progresses through the use and manipulation of these representations and iterative refinements of both the conceptual and physical designs of products to be designed. In this way, in design practice, the role of materiality is not limited to providing external tool support (specialized tools used to design products) or providing the material itself that is used for designing the product. Materiality is both the product and the process that is used and produced in design. Jacucci and Wegner (2007) look at the creative and experiential side of materiality. In their work on understanding the design practices of students, they suggest that materiality stimulates designers' thinking and helps them communicate ideas that would be difficult to communicate through words alone.

Materiality of artefacts have a wide range of physical properties such as texture (roughness or smoothness, details), geometry (size, shape, proportion, location in space), arrangement (in relation to other objects), material (weight, rigidity, plasticity), energy (temperature, moisture), as well as dynamic properties (Jacucci and Wegner, 2007). Field studies of collaborative work have shown that materiality expands communicative and collaborative resources, e.g. Sellen and Harper's (2002) work on the study of paper use in large organizations. Materiality of a physical object supports wider resources for actions compared to what current desktop metaphors support (Horneker, 2005).

Additionally, Schmidt and Wagner (2002) argue that conceptual frameworks of understanding group work (such as distributed cognition, activity theory and actor-network theory) do not adequately address the usefulness of materiality. For example, within the framework of Distributed Cognition (DCog), Hutchins (1995) shows that the information migrates from the minds of actors to artefacts and back to mind without any 'change', maintaining unity and integrity across several instances of materiality, minds and time. The DCog framework does not address how the materiality of artefacts may allow different interpretations to the actors.

RESEARCH APPROACH

Design practitioners use a plethora of material artefacts to support their work. In order to understand designers' collaborative work practices one needs to take into account how and what role these artefacts play in their work. As such, the use and manipulation of these artefacts is not a given, neither do these artefacts exist objectively in designers' everyday practices, but they are constructed in and through the process of design. Additionally, the materiality of artefacts can be seen in two different ways: materiality as a tool to support work and, materiality as representations of work. Artefacts such as a drawing board, scale, pencil and others are used as tools to support designers' work. Whereas artefacts such as a design sketch, clay or 3D model can be considered as representations of the design process.

Within the AMIDA project, we are focusing on understanding the role of physical artefacts in meeting practices and designing new ways to support remote collaboration (Vyas and Dix, 2007). We take an ethnographic approach that attempts to understand the naturalistic setting concerned with human conduct, communication and collaboration of design teams in their everyday practice. The main reason to choose ethnographically informed fieldwork is that several studies based on ethnographic approaches have shown to be vital in reconsidering and re-specifying traditional ways of implementing technologies (Luff et al. 2000). In this research, we bring together the human and non-human aspects involved in collaborative design work to explain and understand the social and technological development.

We have approached understanding the role of artefacts in cooperative design in two ways. First, we observe designers' realistic patterns of dealing with the artefacts. For this we have captured (and are still in process of capturing) video recordings of naturalistic co-located design sessions. Until now, we have mostly collaborated with industrial design students and collected data from

their design sessions. Depending on their schedule we captured their complete design process in 3 to 4 sessions. Figure 1 shows a design session. In future we also plan to do the same with professional designers. Secondly, we also want to carry out contextual interviews with professional designers to understand their everyday design work beyond the meeting rooms. Our preliminary results shows that representational, multi-modal, spatial and temporal aspects related to the artefacts that are used and produced during design practices could provide information that are very important for supporting cooperative work (Vyas et al. 2008)

Figure 1. A collaborative design session of students in an industrial design studio.

An important aspect of our ethnographic fieldwork is to elicit implications about the suitability of a technology for cooperative design work as it is practised. We intend to understand the communication practices of design via different artefacts they use for designing. We are also interested in understanding how and why designers collaboratively create, negotiate, maintain, share and review meaning associated with these artefacts. These artefacts are used extensively by designers in the execution of their own work and as a means for sharing information with others and to manage the flow of information and the design process throughout the project. We believe that these artefacts should not be seen as subsidiary tools where information is passively stored. In fact these artefacts are so woven into the work activities that the use of these artefacts actually defines the cooperative design process, e.g. paper-prototype design.

Combining the use of artefacts with awareness issues, we intend to participatively identify different types of artefact-mediated awareness information. A main reason for doing this is to support co-designers in different way which they would like to be supported to strengthen the mutual adoption of design conventions.

It is important to emphasise that our perspective throughout this research (as a designer of CSCW technology) has been framed as "how during the naturalistic field work we perceived the design process as it unfolds". Our priorities are to observe and understand how the work of cooperative design evolves over time and how designers coordinate their work within a co-located workplace. It is also important to emphasise that the various strands of our research and the issues that are investigated will be included to account for the empirical data from the field study and its implications for the design of CSCW technology.

FUTURE PLAN

Based on the requirements and implications that are generated from the ethnographic fieldwork, we plan to develop a mixed-reality interface supported by an awareness display to allow the co-workers to collaborate over distance. A display that provides information of the activities of a design team to a remote participant could benefit in supporting awareness and coordination of design practice. We believe that it would be impossible for the remote designers to perceive and feel all the aspects of a design meeting. Since many of the design decisions of this awareness display will be based on the results of the field work, the precise use of this awareness display will be defined in the near future.

CONCLUSION

We highlight that the issues that will be covered by our research will adequately point to the importance of material aspects in understanding cooperative work – a perspective different from other face-to-face or linguistically oriented approaches. We believe that in the future a take on material aspects is inevitable as the ubiquitous technologies are emerging and occupying place in our everyday lives.

In order to support efficient coordination amongst different co-workers we have to understand the real – material world and the world that we have created with our social and cultural practices. They are both the product as well as the mediator of each other. These aspects related to physicality are important to understand how co-workers make sense of each other's collaborative activities.

ACKNOWLEDGMENTS

This work is supported by the European IST Programme Project FP6-0033812 (AMIDA). This paper only reflects the authors' views and funding agencies are not liable for any use that may be made of the information contained herein.

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