Jean-François Boujut, Stefania Castellani, David Martin, Frédéric Roulland, Jutta Willamowski (2010):
Workshop The Mediation Role of Shared Representations in Cooperative Activities.
In Gunnar Stevens (Eds.),
International Reports on Socio-Informatics (IRSI),
Workshop Proceedings of 9th International Conference on the Design of Cooperative Systems - COOP 2010, Aix-en-Provence, France, May 2010
(Vol. 7, Iss. 1, pp. 170-176)

The Mediation Role of Shared Representations in Cooperative Activities: A Workshop Report

Jean-François Boujut
G-SCOP-Grenoble INP-CNRS, France
jean-francois.boujut@grenoble-inp.fr

Stefania Castellani
David Martin
Frédéric Roulland
Jutta Willamowski
Xerox Research Centre Europe (XRCE), Grenoble, France
{firstname.lastname}@xrce.xerox.com

Abstract. The notion of boundary objects has been a significant topic within the field of Computer-Supported Cooperative Work for some time. The idea that certain shared objects, artefacts, or representations may mediate between or serve the purposes of different communities of practice has been a powerful notion and has been useful in understanding discovered phenomena in field and case studies and in designing technologies and applications. *Boundary objects* has travelled far and wide as a concept. However, its success in its mobility has also been its problem – inexactitude. Boundary objects may be digital, textual or material, they may be static or dynamic, they may be shared amongst local or distal practitioners, they may be used by distinct groups or simply collaborators with different perspectives or access to information, and they may be used for distinct activities or be part of a workflow. Their range is large. Other concepts like mediating or intermediary objects also occupy this territory. In light of this background a workshop was held at Coop 2010 in order to examine the territory covered by these concepts and to see whether we could loosely classify such research under different dimensions or whether it was important to refine or discard these concepts. The workshop

had empirical, theoretical and technology contributions and was productive in mapping out the territory and finding ways to compare and contrast a diverse range of work within this domain.

1 Introduction

In a globalized world, where cooperation happens more and more across boundaries, the need for mediation in cooperative work is growing. In focusing on mediation we are highlighting the fact that cooperative work takes place in contexts where the different collaborators have different access to context and resources, different perspectives, different knowledge and skills and often different priorities. In carrying out an activity, aligning elements of a workflow or providing a customer service, often there is considerable human effort involved to reach a shared orientation and understanding. The question that this raises is that of whether alignment between participants and support for the shared activity can be facilitated by digital, material or textual artefacts? In the field of Computer Supported Cooperative Work (CSCW) there has been a tradition of research that speaks to this topic – that around boundary objects. This term was coined in the writings of Star and Greismer (cf. Star and Greimer, 1989; Star 1989). They originally described a museum classification scheme as a boundary object in that it was used successfully by different groups to carry out their work and to communicate around even though they had quite different perspectives and priorities. Since then it has proved a fruitful concept in CSCW and related disciplines in terms of empirical research and design work (e.g. Bowker and Star 1999; Lee 2005; Lutters et al., 2007; Phelps and Reddy 2009; Trompette and Vinck, 2009). Other work in CSCW and related disciplines has discussed similar types of digital objects or representations in terms of the *mediation* they can provide in assisting organisations and customers in achieving service encounters (Castellani et al., 2009; this issue) and for cooperating (but often not collocated) designers and engineers in managing and developing *intermediary* (design) *objects* (Boujut and Blanco, 2003). In relation to this rich and somewhat diverse background we believe that there is an opportunity as well as a challenge to think about the design of (inter)mediation support or of boundary objects, particularly as objects instantiated in CSCW systems. It seems a propitious moment to reflect on the topic of study and consider the landscape of studies and systems that broadly fall under this topic – are there useful ways in which we can map out this landscape in terms of dimensions? Should we draw distinctions between types of boundary objects or boundary objects and mediating and intermediating objects? Our personal interest was very much about digital objects or representations that had active components and functions that facilitated better sharing of orientations, assistance, translation, clarification, explanations and so forth and as such we

wondered whether this made these systems distinct from a more general idea of boundary objects. The workshop was the perfect opportunity to explore these ideas with a wide range of practitioners however our theme necessarily spoke more directly to our interests than boundary objects in the widest sense.

2 Workshop Theme

In many cooperative activities related to problem framing or solving, shared representations of the object of the work are manipulated by the participants. Status and history information is often central to the activities. Examples of such cooperative activities include remote troubleshooting, collaborative product design or diagnostics in healthcare. In a remote device troubleshooting context, the participants may for instance collaborate using a virtual 3D shared representation of the broken device. In a collaborative product design environment, designers can interact through CAD models of the product during distant design meetings. Many other examples can be found in every domain where an activity can be carried out remotely and collectively.

Shared representations not only represent the problem to be solved but they also constitute the medium for building the solution through cooperation among actors that may have different points of view and may be separated across location, time, organisation and expertise. Thus the design of the shared representations strongly affects the way in which the cooperation will take place. A good design of a cooperative system should therefore carefully consider the mediation role of shared representations in supporting the interaction among users. We believe that this dimension is often neglected or underestimated in system design. The design of a cooperative system centred on cooperative interactions through objects goes beyond a usual HCI design where the designers only consider the interactions between the system and the user. Here the user/system interaction is considered as part of a wider activity where HCI is only one element among others and therefore the interactions between remote users must be primarily considered and therefore the form, the status, and the role of the medium should be carefully studied. We think the CSCW community is the relevant community to discuss these points.

This workshop was aimed at contributing to characterize the dimensions related to mediation that should be considered when designing new cooperative systems involving representations of shared objects. One example of a dimension related to mediation could be the degree of guidance offered through the shared representation to the users to perform a task.

We were therefore interested in gathering a wide number of points of view and interdisciplinary approaches related to the study of mediation needs or roles in cooperative systems.

Consequently our guidance on topics was for the following:

- Discussions and theoretical speculations on the concepts of shared representation, boundary objects, intermediary objects, etc.
- Ethnographic work on team interactions through objects
- Case studies or applications of new forms of representations for interacting (3D, annotations, voice, etc.)
- Case studies or applications of new media for interacting (touch tables/screens, haptic devices, etc.)
- Cognitive studies on the role of objects as shared representations

3 Workshop Course and Results

The workshop attracted around 20 researchers from across Europe coming from diverse domains such as Computer Supported Cooperative Work, Design Studies, Human-Computer Interaction, Computer Science, Cognitive Ergonomics and so forth. We had a broad range of contributions; from ethnographic studies to theoretical perspectives, and from assessments of mediating or boundary objects to novel systems and design inspirations within this field. There was a lot of interesting work and perspectives.

It was interesting to revisit the field of air traffic control (ATC) and to get a novel perspective that particularly looked at how personnel in different locations with different jobs within an airport tightly coordinated their separate tasks through a series of shared representations or boundary objects (Nellani and Fields). Another paper provided a case study looking at an engineering education 'game' and a semiotic take on the topic of shared representations involved in collaborative engineering design work (De Vries and Masclet). A series of papers looked at the use of annotations and annotation systems in the work of engineering and design pointing out the dialogic dimension of design and the need for specific open mediating supports (Boujut, Vyas & Nijholt, Elsen & Leclercq). Another paper (Krogstie) looked at the construction and use of timeline representations to aid participants in software development projects to reflect upon and refocus their efforts. The work presented by Pär-Ola Zander provided an interesting turn in that it was based on trying to classify different types of citizen-government interaction around shared artefacts – it pointed out that collaboration can have different forms and that mediation, too, can be for many different purposes from simple clarification to negotiation over contrasting positions. The work of Bottoni, Kanev and Mirenkov presented various innovative tagging technologies that could be layered on top of web pages and then could enable paper-digital interactions via links embedded in machine readable barcodes. Bugeaud, Giboin and Soulier focused on the efforts to provide shared representations to foster teamwork in the innovation process within two different projects – the first, taking a service

science approach provided a representation of 'the service system' for stakeholders involved in innovation projects within a French telecom company, and the second a 'unified framework' to assist business users with web 2.0 and semantic web technologies to facilitate business intelligence and technical watch. Simone and Cabitza provided a review of a some systems that have been developed at the University of Milan that are designed to enable knowledge work and knowledge sharing whether enabling cooperative problem solving in tyre design or via tagging to elaborate and share knowledge and best practice in medicine and archaeology. The final paper to discuss briefly was that presented by Castellani et al. that discussed a particular image of cooperative systems incorporating mediating helpers – mutually orienting, guiding and assisting components integrated with representations within cooperative systems designed to facilitate working across organisational boundaries in service encounters where technical understanding problems could otherwise hinder success.

As well as the presentation of papers and lively involved discussions during the workshop we asked participants to create post-it notes based upon their impressions and understandings of the work presented. It was to be our shared representation of the workshop. We decided on 4 basic dimensions for this representation 'Application/Domain', 'Type of Representation', 'Mediation Role' and 'Design (approach)'. During the workshop we collected a fair number of post-its and at the end had a brainstorming, produced more post-its and re-arranged the existing to try and agree how they fitted the dimensions. As with often in workshops the results are of an exploratory nature rather than representing any final position. However, we feel that considering the systems and studies along these dimensions has given us a richer understanding of the boundary objects/mediation landscape and hope to take this work further in the near future.

Below is a breakdown of the classificatory schema. We believe we had fewest post-its for 'Design' because we had not made clear it was 'Design Approach' but also because almost all participants came from a background where some form of participatory design, user studies or ethnography was involved in the process. Interestingly, a number of concepts were seen to fall in the middle of the two categories 'Type of Representation' and 'Mediation Role', e.g. Emerging vs Existing. Clearly this is because these can be tied together quite closely. Another interesting feature is that within the dimensions of 'type' and 'role' many concepts were presented as binary opposites. It is not the case that one opposite is 'correct' or 'better', rather it simply depends on features such as purpose, user group and other aspects of context which one is most appropriate in terms of scoping or design.

Application/Domain

Collaborative remote troubleshooting
Innovation creation
Healthcare
Archaeology

E-government
Color management workflow
Air traffic control
Product design
Collective construction of information on products
Design of truck tyres
Engineering design
Preliminary design and Creative design

Type of representation

Ontology + Animation
Representation of argumentation in design
Shared representation = external representation
Mental vs external
Traditional vs digital
Individual vs collective
Standard/local (idiosyncratic)
3D view
Univocal vs polymorphic (polyphonic??)
Open vs closed
Web document annotation
Attachable boundary objects
Design artifacts as intermediate states of a product
Static vs dynamic
Generic vs specific
Interacting with the representation

Mediation role

Support to co-design
Monosemic/polysemic and unambiguity/creativity
Role of information artifacts: intermediating global/local articulation; interpretative articulation; organising coordination
Global/local articulation; work ~ expert=local and cross expert=global?
Emergent vs existing
What is shared? (object, information, meaning, something else?)
Value of under-specification
Vehicular vs vernacular language
Shared rep => collection objectification
Clarification and elaboration
Adversarial collaboration
Constructing common understanding
Pacification/harmonization
Shared interpretation
Negotiation
Evoking knowledge
Coordination + articulation
"this community"
Roles of users? Stakeholders
Responsibility for maintaining and designing

Design

Imposed vs grass roots
Representations as a mixture of tools for design
Complexity vs availability
Participatory design and co-design
Ethnography

4 Acknowledgements

We would like to acknowledge Susan Leigh Star first of all, as she was important in inspiring much of the work presented here, and it was very sad to know she passed away this year.

We would also like to thank the organisers of Coop 2010 for assisting us ably in setting up and holding this workshop, particularly Gunnar Stevens and Myriam Lewkowicz. And of course to all the participants who helped make the workshop a fun and interesting day!

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