Repurposing Social Science Theories to Design and Evaluate Co-located Collaboration Technologies

Stacey D. Scott

Department of Computer Science
University of Calgary
2500 University Dr. NW
Calgary, AB T2N 1N4 Canada
sdscott@cpsc.ucalgary.ca

Vision

Very few people in today's society go through a whole day without interacting with other either in a social, educational, or work environment. Over our lifetimes we have all learned many social norms that play a large role in orchestrating these interactions. Often these social norms vary from context to context, yet people are amazingly adept at modifying their behaviours to adapt to these different contexts.

Consider the following example: all in one day, Beverly may defend several clients in court, have lunch with an old school chum, meet with an architect to discuss plans for a new family home, and have a romantic evening with her spouse. Just as her behaviour will be perhaps markedly different in each of these situations, so too will the requirements for the technologies that may be utilized in each of these situations. In court, case evidence might be displayed to the judge and jury on a large interactive whiteboard. At lunch, photos of the kids might be shared on a handheld computer or cell phone. In the architect's office, floor plans may be discussed and modified on a digital tabletop display. At home, the couple may browse their music collection together at a home media station to pick several romantic songs to dance to.

One potential approach to understanding the technological requirements for systems being used in each of these contexts, or to evaluate these technologies to determine whether they are meeting these requirements, is to look to the fields in the social sciences which have spent considerable time and effort studying the social norms that dictate behaviour in these different contexts. I believe this body of literature can help form the theoretical underpinnings for the methodologies we develop to evaluate co-located collaborative technologies.

Experience and Challenges

Since I began my graduate work six years ago, my collaborators and I have explored issues related to many co-located technologies including: desktop single display groupware (SDG) systems, interactive wall displays, handheld computers, and digital tabletop systems. The majority of my Ph.D. work has specifically focused on developing and evaluating desktop SDG and digital tabletop systems. This work has been directed at understanding the basic requirements of small-group collaborations involving these two technologies. This has lead to the general question of *what are the fundamental issues related to collaborating in a physically shared workspace*?

I have explored this question using a variety of methods, each with their own advantages and disadvantages. One approach has been to perform formal comparative user studies,

carefully logging interaction data and recording audio and video data from the study participants. This approach has been useful for answering specific questions like "what are the impacts of requiring users to share an input device during collaboration versus providing each user with their own input devices?" However, this provides little insights, beyond interesting "suggestions" of the impact on more complex issues like the development of a shared understanding of a problem during collaboration or whether workspace awareness was enhanced or hindered by certain technological features. Another challenge of this approach is that the technology has to be in a fairly mature state to properly understand how people might actually use it or react to it.

In order to address these issues, I have explored an alternative approach that involves stepping back from the technology to conduct observational studies targeted at understanding the traditional work practices in collaboration with existing (paper-based) media as well as drawing from the social science literature to try to understand the value of these work practices. I have performed several observational studies of tabletop collaboration in both casual and formal settings. In-depth video analysis of the collaborative interactions in these settings has elucidated many of the important, subtle behaviours that enable the fluid, complex interactions that occur in these traditional environments.

To help understand these behaviours I looked to research focused on such issues as non-verbal communication [5], proxemics (i.e. the study of our use of space and how various differences in that use can make us feel more relaxed or anxious) [4, 7], human territoriality [6, 10], and environmental psychology [1, 3, 8] – all important components of the interpersonal interaction that is crucial for successful collaboration. This body of literature was useful, but I often found it difficult to help understand these behaviours in a way that would help inform technology design and evaluation.

For the most part, these fields have studied communication and interpersonal interaction from an individualistic point of view. This literature rarely discusses in detail the compromises people are willing to make for the potential benefits of collaborating with someone else. For instance, people often seem to relax their interpersonal distance zones [4] when they are discussing a shared document or interacting together at a whiteboard. In fact, this body of literature touches very little on how the use of artifacts can change our interpersonal interaction behaviour. What are the attributes of technology (or the furniture in traditional environments) that can serve to set people at ease so they feel free to concentrate on their collaborative task?

These issues are often anecdotally mentioned in this literature, without serious consideration. For instance, one article mentioned that adults, especially strangers, often perceive an increased psychological distance while conversing across a physical barrier such as a table but the authors do not discuss how large the barrier has to be or whether this feeling changes when people are working together atop the barrier (e.g., sharing documents or layout plans) [9]. However, this knowledge can help us focus our attention on people's psychological comfort level during our evaluations of technology (e.g., through interviews or questionnaires) and on their behaviours. For instance, do they *appear* socially uncomfortable while using the certain technologies, e.g. are they excessively fidgeting or are their conversations broken or confusing?

As technology becomes ubiquitous in our co-located environments, these issues become important. Can these social science theories be repurposed to inform technology design and evaluation? In my own work, I have used this literature to guide my understanding of the observations I have made of collaborative interactions, but I have also asked new questions related to the use of artifacts and the collaborative surfaces themselves that have helped me expand my understanding of collaboration in these environments. While there is still much to learn, I believe this is a useful and promising approach to understanding how people use traditional media and digital media in their collaborations.

Workshop goals

My hope for this workshop is to share experiences and ideas about methodological approaches with like-minded researchers. I am also hoping to discover new theories that can help further my understanding of collaboration involving artifacts and shape the direction of my future investigations of co-located collaboration technologies.

Bio

Stacey Scott is a Ph.D. student in the Department of Computer Science at the University of Calgary. Her research focus is on understanding the fundamental interaction behaviours underlying traditional collaboration. This work has investigated interactions around paper-based media for the purposes of developing co-located CSCW systems which facilitate small group collaboration. Specifically, her dissertation work has explored how groups make use of a shared tabletop workspace while using paper-based media. She is currently developing interaction techniques for digital tabletop displays that are based on the interaction patterns observed during her studies of traditional collaboration. Stacey has co-organized workshops on co-located collaborative technologies at UbiComp and at two prior CSCW conferences.

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