Methodology for Evaluating Collaboration Behaviour in Co-Located Environments

Kori Inkpen
Dalhousie University
Halifax, NS
B3H 1W5
inkpen@cs.dal.ca

Regan Mandryk
Simon Fraser Univ.
Burnaby, BC
V5A 1S6
rlmandry@cs.sfu.ca

Joan Morris DiMicco
MIT Media Lab
Cambridge, MA
02139
jmd@media.mit.edu

Stacey Scott
University of Calgary
Calgary, AB
T2N 1N4
sdscott@cpsc.ucalgary.ca

ABSTRACT
When evaluating co-located collaborative environments it is important to not focus solely on improving the outcome the collaborative activity. Facilitating the collaborative process itself is equally important but challenging given the lack of established methodological guidelines. The CSCW community needs to further investigate appropriate methodologies to effectively evaluate co-located collaboration, particularly in terms of the impact technology has on teamwork (group dynamics, social dynamics) and other factors that influence these results (individual personalities and choice of task). This workshop will bring together experienced researchers who have been investigating co-located collaboration in an effort to establish more reliable and robust mechanisms for evaluation in this area. The workshop will involve brief introductions, brainstorming sessions, and small-group breakout sessions.

Categories and Subject Descriptors
H.5.3 [**INFORMATION INTERFACES AND PRESENTATION**]: Group and Organization Interfaces – *collaborative computing, computer-supported cooperative work, evaluation/methodology, synchronous interaction.*

General Terms
Measurement, Experimentation.

Keywords
Co-located collaboration, methodology, evaluation, teamwork, trust, common ground, mechanics of collaboration, interpersonal interactions, tasks.

1. INTRODUCTION
The number of CSCW researchers exploring co-located collaboration had increased dramatically over the past five years. In particular, the increased availability of non-desktop computing devices (everything from small handhelds to large wall and table displays) and ubiquitous wireless networks is enabling researchers to explore many novel interaction paradigms to support co-located collaboration.

One of the major challenges researchers in this area face is the difficulty of assessing the impact that the technology has on collaborative behaviour. For example, what measures can we use to understand whether the technology has enhanced or compromised the collaboration?

Many researchers make methodological choices based on a specific configuration of an environment, or based on what resources are currently available to them. As such, many of the methods lack the reliability or robustness that would come from established, more general approaches, which could be better validated if applied across a variety of experimentations. In addition, tasks chosen to evaluate co-located collaborative environments are often selected in an ad-hoc manner, dependent on the interests of the researchers or on the appropriateness for a specific environment.

This lack of established guidelines for evaluation of co-located collaboration means that it is hard to calibrate many of the research contributions or truly understand the impact of the technology.

This workshop proposes four themes related to evaluation of co-located collaboration behaviour:

1. Impact of technology on group interactions
2. Impact of technology on social dynamics
3. Impact of individual personalities and interpersonal dynamics
4. Choice of appropriate tasks

2. WORKSHOP THEMES
This section presents four possible themes that could be explored during the workshop. Within each of these themes, several open issues are identified to illustrate the types of topics represented by that theme. The scope of the themes and topics is quite broad and it would not be appropriate to attempt to explore all of these ideas. The workshop discussion topics will be determined following review of the position papers from potential attendees.

Conference'04, Month 1–2, 2004, City, State, Country.

2.1 Impact of technology on group interactions

An essential part of co-located collaboration is the interaction among team members. The "richness" of these interactions often motivates people to walk down the hall, drive across the city, or fly across the globe to meet with someone face-to-face. The success of this interaction is fundamental to the success of any collaboration effort. As technology increasingly becomes a part of our co-located collaboration, it is important that any technology we introduce facilitate the collaboration and not hinder interpersonal interactions.

To help evaluate the impact of technology on group interaction, it is useful to understand the various types of "interactions" that occur during teamwork. Pinelle et al. (2003) proposed a set of basic actions and interactions that team members must perform in order to work collaboratively, called the mechanics of collaboration. These mechanics consist of communication and coordination of related actions and interactions essential to teamwork, such as explicit communication (spoken, written, gestural), basic awareness, consequential communication, feedthrough, transfer of objects, obtaining and reserving resources, and so on. One approach to understanding how the overall group interaction is affected by a particular technology would be to evaluate how each individual mechanic is affected by the technology. For example, how does providing co-located collaborators with public and private displays impact communicative actions such as deictic referencing, basic awareness, and consequential communication, or coordinative actions such as obtaining or reserving resources and transferring objects?

Open issues include:

1. *"Measures" of group interaction.* The mechanics of collaboration are one possible tool that could be draw upon for evaluation, although we believe that not all of the mechanics proposed by Pinelle et al (2003) are as "operational" as others. For example, their coordination mechanics are easily observable actions (e.g., handoff of an object or obtaining a resource), while some of their communication mechanics (e.g., basic awareness, consequential communication, and overhearing) are less directly observable.

2. *Baselines for these measures.* What constitutes sufficient workspace awareness? When is more or less awareness necessary? When evaluating group coordination during collaboration, what constitutes effective transfer of objects or obtaining of resources?

3. *Enhancing vs. hindering group interaction.* What are the tradeoffs between supporting or even enhancing some group interactions and hindering others by introduction of technology? For example, we may be trying to enhance certain group interactions to "improve" collaboration, such as by providing multiple copies of an object on a tabletop display to provide each group member with a personalized view of the object. While this could potentially improve access to the object, it could decrease basic awareness, which may hinder coordination of activities. It is important to understand the interplay between the various types of communication and coordination actions in terms of the group's overall ability to work together.

2.2 Impact of technology on social dynamics

When collaborating over distance, groups encounter challenges in establishing trust and common ground. These problems can be mitigated if the group has some initial face-to-face interaction, and this finding reinforces our belief that the richness of face-to-face interaction has inherent benefits (Rocco, 1998). But what happens when technology is used during face-to-face interactions? As designers of technology for co-located collaboration, it is important for us to consider how our interfaces impact group social dynamics, in particular, in areas such as trust and common ground.

Open issues include:

1. *Private vs. public interfaces*. Technology for co-located collaboration often involves an integration of private and public displays. Providing information privately to each user allows for complete control of the information, yet it may detract from the collaborative activities of the group. Conversely, providing information publicly to the group may encourage more interaction yet hinder individual comfort levels. How do you develop guidelines to determining the right mix of private and public interfaces given a particular group and task?

2. *Social information vs. task information*. When you reveal information to the group about other group members -- what they are doing, what they are reading, how they are feeling -- there is the potential for making individuals uncomfortable both with the technology and with the other group members. How do you build socially sensitive interfaces that do not destroy group trust?

3. *Back-channel communication*. Secondary channels of communication are becoming more common in face-to-face meetings with the proliferation of laptops in use during meetings. Whether the communication is through open IRC channels or instant messaging between individuals, how this secondary level of communications impact group dynamics? How do we build methods for evaluating the impact this communication has on group interaction?

2.3 Impact of individual personalities and interpersonal dynamics

When evaluating collaborative systems, the choice of participants can impact the outcome of the experiment far more than in single user applications. As researchers in collaborative technologies, we are concerned with how our design decisions affect not only the result of the collaboration, but the act of collaboration itself. Since interpersonal dynamics can have as much or more of an impact on teamwork than the technologies or the application, we need to address and reduce the confounding factors of individual personality and interpersonal dynamics on collaboration.

When designing an evaluation, we make many choices related to the participants that affect the outcome of the experiment. Some of these choices include:

1. Whether to test participants who are friends with each other, colleagues of each other, or strangers.
2. Whether to assign roles to the participants (e.g. leader, information recorder), or whether we let these roles develop naturally.
3. Whether to create demographically homogenous or heterogeneous groups. Demographic information may include details such as participants' sex, age, experience, education.
4. Whether to use a confederate to manipulate or control the group interactions.
5. How to handle individual differences in terms of introversion and extroversion.

As co-located collaboration research become more prevalent, a systematic study of the effects of participant choices on evaluation is necessary. Until such a time, we need to identify all participant choices that could impact results. In addition, we should draw from our experiences on how participant choices have impacted past evaluations, and how other researchers have previously minimized, utilized, or simply acknowledged individual personalities and interpersonal dynamics. As a result, we may be able to attribute experimental results to the manipulations in the collaborative environments rather than to the choice of participants.

2.4 Choice of tasks

The collaborative tasks researchers choose to utilize in an experimental design have a significant impact on individual, group, and social dynamics. Often, tasks to evaluate co-located collaborative systems have been chosen in a fairly ad-hoc manner. The choice may be related to a perceived inherent suitability for a specific environment (i.e. architectural design is typically done on a horizontal surface so it should be investigated for tabletop displays), based on an activity preference of the researchers (i.e. interest in problem-solving types of activities or in supporting a specific type of user such as lawyers), or because of convenience (i.e. already have access to particular colleagues or software).

Open issues related to task choice include:

1. *General classifications of tasks*. If each researcher selects (and designs) a unique task, it is difficult to calibrate those research results from other work that involves significantly different tasks. If more general categories of tasks could be established it would enable better comparison across studies. In addition, a strong classification could be used to help researchers choose appropriate tasks.
2. *Realism vs. Precision*. The classic tradeoff of realism versus precision is clearly evident in this domain. Contrived tasks can be used in a more controlled environments and provide more precision however lack realism.
3. *Impact of task on collaboration*. It is important to understand how different tasks impact interpersonal interactions so that we can more accurately attribute variations beyond this to the experimental conditions being investigated.

3. ACTIVITIES

This workshop will be run over a full day and will be structured to provide maximum time for group discussion and brainstorming. Prior to the workshop, each participant will be required to read the other participants' position statements to ensure that he/she is familiar with the experiences and goals of each attendee. The day will be divided into four sections (separated by the morning break, lunch, and the afternoon break). The first section will involve participants giving a 'very' brief introduction of themselves as well as their success and challenges related to evaluation of co-located collaboration. Following this, the group will engage in a high-level brainstorming session to outline the key discussion topics for the day. During the second and third session, the group will divide into small groups, moderated by the workshop organizers, and have focused discussions on the workshop themes. In the fourth session the large group will reconvene and summarize any directions or advances identified from the breakout discussions. Finally, the workshop will end with a short discussion to define the immediate next steps for the group.

4. PARTICIPATION

In total sixteen to twenty-two people will take part in the workshop (10-15 general participants + 2-3 student participants + 4 workshop organizers).

4.1 General Participation

Interested attendees should submit a short position paper (max. 2000 words) structured into the sections shown below: Ten to fifteen participants will be invited to participate in the workshop based on reviews of the position papers.

- **Vision:** a short description of the author's vision related to research in the area of computer support for co-located collaboration.
- **Experiences & Challenges:** a description of the author's experiences related to the evaluation of co-located collaboration, highlighting methodological strategies that have been successful as well as current barriers to this type of evaluation.
- **Workshop goals:** the author's motivation for attending the workshop and the goals he/she hopes to achieve as a result of the workshop.
- **Bio:** participant(s)' backgrounds and motivation for taking part in this workshop

The members of the workshop organizing committee will review all submitted papers and select participants.

Submissions must be in electronic form (PDF format). Submission should be emailed inkpen@cs.dal.ca and must include the name, contact, and full address of the author. Only one author per submission will be invited to attend the workshop. If additional authors would like to be considered, separate applications should be submitted. Prior to the workshop, participants will have access to all accepted proposals. Accepted submissions will be included in informal workshop proceedings. A submission template will be available for download on the Web.

4.2 Student Participation

Two to Three students (in addition to those who submit full workshop position papers) will also be invited to take part in the workshop. This will provide graduate students pursing research in this area a unique opportunity to interact with key researchers in the field and help define future directions. Students will not be required to submit a position paper but will need to submit a one-page paper describing their interest in the area of co-located collaborative tabletops and their motivation for wanting to take part in the workshop. Submissions must be in electronic form (in PDF format). Student submissions should be emailed to inkpen@cs.dal.ca and must include the name, contact, and full address of the student.

5. A/V Requirements

We would like to be able to view information from a laptop on a projection screen. We will try to find a way to bring our own LCD projector. If this isn't possible we will need to arrange to have the conference provide one (at an additional charge).

6. ORGANIZERS

Kori Inkpen, Dalhousie University

Kori Inkpen is an Associate Professor in the Faculty of Computer Science at Dalhousie University in Halifax, Nova Scotia, Canada. Her main research interests are in the area of computer support for co-located collaboration. In particular, her current projects include understanding how technology choices impact interpersonal interactions, the design of seamless interaction strategies, and exploration of novel environments to support co-located collaboration (such as tabletop displays). Kori has organized workshops at two previous CSCW conferences (2000 & 2002) and is active in the CSCW, UIST and CHI communities.

Regan Mandryk, Simon Fraser University

Regan Mandryk is a Ph.D. student in the School of Computing Science at Simon Fraser University in Vancouver, Canada. Her research projects focus on using emerging technologies to facilitate social interactions between friends and strangers. Specifically, her Ph.D. dissertation presents how to objectively evaluate collaborative play technologies and systems not only in terms of usability analysis, but also in terms of experience analysis, and support for interpersonal interaction. Regan has co-organized workshops on ubiquitous play at previous UbiCOMP and Pervasive Computing conferences and workshops on co-located collaborative technologies at two prior CSCW conferences. She was also a guest co-editor for a special issue on Ubiquitous Games in the journal Personal and Ubiquitous Computing.

Joan M. DiMicco, MIT Media Laboratory

Joan DiMicco is a Ph.D. student at the MIT Media Lab in Cambridge, Massachusetts, USA, working with the Electronic Publishing group. She holds a BS in Applied Mathematics from Brown University and an MS from the Media Lab. Her research focuses on how to use technology to improve group interaction and group processes during co-located collaborations.

Stacey Scott, University of Calgary

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.

7. REFERENCES

[1] Pinelle, D., Gutwin, C. and Greenberg, S. (2003). Task Analysis for Groupware Usability Evaluation: Modeling Shared-Workspace Tasks with the Mechanics of Collaboration. ACM Transactions on Human Computer Interaction, 10(4), December, 281-311.

[2] Rocco, E. (1998). "Trust Breaks Down in Electronic Contexts but Can be Repaired by Some Initial Face-to-Face Contact." In the Proceedings of the Conference on Human Factors in Computing Systems (CHI98), Los Angeles.