Conflict Resolution in Paper and Digital Worlds: Two Surveys of User Expectations

Meredith Ringel Morris, Clifton Forlines, Kathy Ryall, Chia Shen

Abstract

We discuss the findings of two surveys, which presented respondents with a hypothetical situation regarding a conflict over either a paper or a digital document and solicited their free-form responses regarding possible outcomes of the situation. The results suggest conditions under which mechanisms to coordinate the outcome of such conflicts might be useful to include in groupware, as well as offering possibilities for what these mechanisms might be.

CSCW

ACM Conference on Computer Supported Cooperative Work (CSCW)

Conflict Resolution in Paper and Digital Worlds: Two Surveys of User Expectations

Meredith Ringel Morris
Stanford University
353 Serra Mall
Stanford, CA, USA

merrie@cs.stanford.edu

Clifton Forlines, Kathy Ryall, Chia Shen
Mitsubishi Electric Research Laboratories
201 Broadway
Cambridge, MA, USA

{forlines, ryall, shen}@merl.com

ABSTRACT
We discuss the findings of two surveys, which presented respondents with a hypothetical situation regarding a conflict over either a paper or a digital document and solicited their free-form responses regarding possible outcomes of the situation. The results suggest conditions under which mechanisms to coordinate the outcome of such conflicts might be useful to include in groupware, as well as offering possibilities for what these mechanisms might be.

Categories and Subject Descriptors
H.5.3 [**Information Interfaces and Presentation (e.g., HCI)**]: Group and Organization Interfaces – *computer-supported cooperative work.*

General Terms
Design, Human Factors.

Keywords
Conflict resolution, multi-user coordination, social protocols.

1. INTRODUCTION
While observing multiple, co-located users interacting with a DiamondTouch table [1], we noticed several conflicts between users, such as one user taking a digital document (such as a text file, image, or web page) away from another user who was actively using it [3]. These observations motivated us to propose *coordination policies* – software-level support to provide deterministic outcomes to multi-user conflicts in co-located groupware [3, 4]. To aid us in designing coordination policies that were "natural" to users, we administered two surveys to gather data on user expectations regarding the outcome of conflicts between users over documents. The first survey assessed current coordination practices with paper, and the second ascertained user expectations regarding coordination when using a multi-user interactive table. Twenty people from our lab completed the first survey, and twenty-seven completed the second.

2. SURVEY 1 – PAPER DOCUMENTS
The first survey presented people with two generic, open-ended scenarios familiar from the world of paper documents. Both scenarios concerned two users, A and B, who were sitting across from each other at a table. One was a "take" scenario: A is holding a paper document, and B grabs hold of it. The other was a "give" scenario: A and B are sitting at a table, and A wants to share a paper document with B. Respondents were asked to

describe all the potential ways they could think of for how A and B could resolve each situation.

Despite the free-form nature of the responses, there was a large overlap among the answers. The following were the most popular proposed methods for A and B to coordinate shared access to the single paper document:

- Giving the document to the other person/allowing the other person to take it. (*16 of 20 surveys)*

- Moving the document across the table in order to indicate willingness to share it. (*15 of 20 surveys*)

- Choosing not to share the document/not to allow others to take it away. (*13 of 20 surveys)*

- Resolving the issue verbally (e.g., arguing, formal negotiation, use of phrases such as "please"). (*13 of 20 surveys*)

- Reading the document out loud to the other person. (*11 of 20 surveys*)

- Rearranging the chairs in order to sit next to the other person. (*11 of 20 surveys*)

- Turning the document so that it is properly oriented for the other person. (*10 of 20 surveys*)

- Using a photocopy machine to duplicate the document. (*9 of 20 surveys*)

- Tearing the document in half (purposely or accidentally). (*8 of 20 surveys*)

3. SURVEY 2 – DIGITAL DOCUMENTS
The second survey presented questions analogous to those in the first survey, but rather than the world of paper documents, these questions involved contention over a digital document (text, image, html, etc.) on a touch-sensitive interactive table. A photo of two people touching the same digital document on a DiamondTouch table was shown at the top of the survey so that respondents could better envision the scenario in case they were unfamiliar with the concept of a computationally-enhanced table.

Again, despite the open format for responses, there was a large amount of overlap in people's answers, with some choices that were particularly popular:

- The system would ignore the touches of someone trying to "steal" a document, and the original owner would keep it. (*24 of 27 surveys*)

- A copy of the document is automatically created so that both users can interact with it. (*20 of 27 surveys*)

- The system allows the person trying to "steal" the document to successfully take it away from its original owner. (*17 of 27 surveys*)

- Levels of privilege exist – if the computer detects that the "stealer" is more privileged than the owner, then the stealer gets the document. (*12 of 27 surveys*)

- If the owner of the document "lets go" of it (by lifting her hand from the table) then the system will allow the other user to take it. (*11 of 27 surveys*)

- A popup dialog box appears, asking the owner to explicitly grant or deny permission for the other user to take the document. (*10 of 27 surveys*)

4. DISCUSSION

The emergence of several popular outcomes to the paper and digital scenarios suggests that emulating these proposed behaviors in response to document-level conflicts in an actual multi-user tabletop system would be perceived as "natural" by most users. The popular response of reorienting the paper was also identified as an intuitive method of brokering document access in the work of Kruger et al. [2], who found that people use the orientation of paper documents to indicate their willingness to share them. The popularity of the proposed strategy of moving the document across the table to be closer to another user is supported by the work of Scott et al. [5], who found that people working with traditional materials on tables often treat items near the edges as "personal" regions and in the center as a "group" region.

The responses to our two surveys have informed the design of our set of multi-user coordination policies, described in [3], and our techniques for document-sharing on interactive tables, described in [4]. For example, allowing another person to take a document is supported by our software's "public" policy, while not allowing this is supported by our "private" policy. Moving a document across the table to share it is supported by our "sharing" policy using the "relocate" technique, turning a document so that it is properly oriented for another person is supported by our "reorient" method for sharing, and indicating a willingness to share by "letting go" of a document is supported by our "release" technique. Privilege levels are reflected in our "rank" policy, document copying is possible with our "duplicate" policy, and our "dialog" policy allows users to explicitly grant or deny permission for other users to take their documents. We also included a policy that allows users to tear digital documents in half, as suggested in response to the paper survey. Our multi-user coordination policies also facilitate conflict outcomes that were not among the popular responses to these surveys – it remains to be seen whether these latter policies will be regarded as being as intuitive to use as the survey-inspired ones.

It is interesting to note that some answers were essentially the same in response to both the paper and digital scenarios, while other responses were elicited only by one or the other. The concept of duplication, for instance, appeared frequently in response to both surveys, although the paper survey responses used traditional means (a photocopier) to achieve this result while the digital ones relied on electronic file-copying. Also, several of the responses concerning duplication in the digital scenario further specified the semantics of the copying (the presence or absence of "write permission"). As a result, our implementation of the "duplicate" policy for resolving conflicts over a single document offers three different semantics for duplication – creating either a read-only copy, a read-write copy, or a copy linked to the original (changes to either will be reflected in both).

Particularly noteworthy is the fact that the paper scenario elicited far more "social" responses than the digital one – rearranging the seats around the table, reading the document out loud to a partner, and explicit social negotiation were all common responses to the paper scenarios, while the concept of moving the chairs or reading out loud were not mentioned by any of the digital survey respondents, and only five of the twenty-seven digital survey responses (18.5%) mentioned some form of social negotiation (in contrast to thirteen of the twenty "paper" surveys – 65%). This might suggest that, perhaps because of the "newness" of co-located, collaborative digital media such as interactive tables, social solutions that would readily apply when interacting with traditional paper media may not come to mind in this novel technological setting. This is a possible explanation for the reason we observed conflicts (such as "stealing" documents from other people) among users of our digital tabletop system, which would have been considered rude had they occurred with traditional media (nobody would dare snatch a piece of paper out of their co-worker's hand!). Further investigation of this issue is warranted.

5. CONCLUSION AND FUTURE WORK

Administering surveys to learn about users' expectations regarding the outcome of conflicts between two people over a single document proved to be an effective technique for identifying several potential solutions to this problem, which we could implement in our interactive tabletop software. By asking about both paper-based and digital scenarios, we received more proposed solutions than we would have had we only administered one of our surveys. The next step is to investigate how users react to actual implementations of coordination policies inspired by these survey responses – we hypothesize that solutions that were mentioned by the majority of survey respondents will be perceived as more "natural" than those that were only mentioned by a few individuals.

6. REFERENCES

[1] Dietz, P, and Leigh, D. DiamondTouch: A Multi-User Touch Technology. *UIST 2001*, 219-226.

[2] Kruger, R., Carpendale, M.S.T., Scott, S.D., and Greenberg, S. How People Use Orientation on Tables: Comprehension, Coordination, and Communication. *Group 2003*, 369-378.

[3] Morris, M.R., Ryall, K., Shen, C., Forlines, C., and Vernier, F. Beyond "Social Protocols": Multi-User Coordination Strategies for Co-located Groupware. *CSCW 2004*, in press.

[4] Ringel, M., Ryall, K., Shen, C., Forlines, C., and Vernier, F. Release, Relocate, Reorient, Resize: Fluid Techniques for Document Sharing on Multi-User Interactive Tables. *CHI 2004 Extended Abstracts*, 1441-1444.

[5] Scott, S.D., Carpendale, M.S.T., and Inkpen, K. Territoriality in Collaborative Tabletop Workspaces. *CSCW 2004*, in press.