social borders: mediating group dynamics through interface design

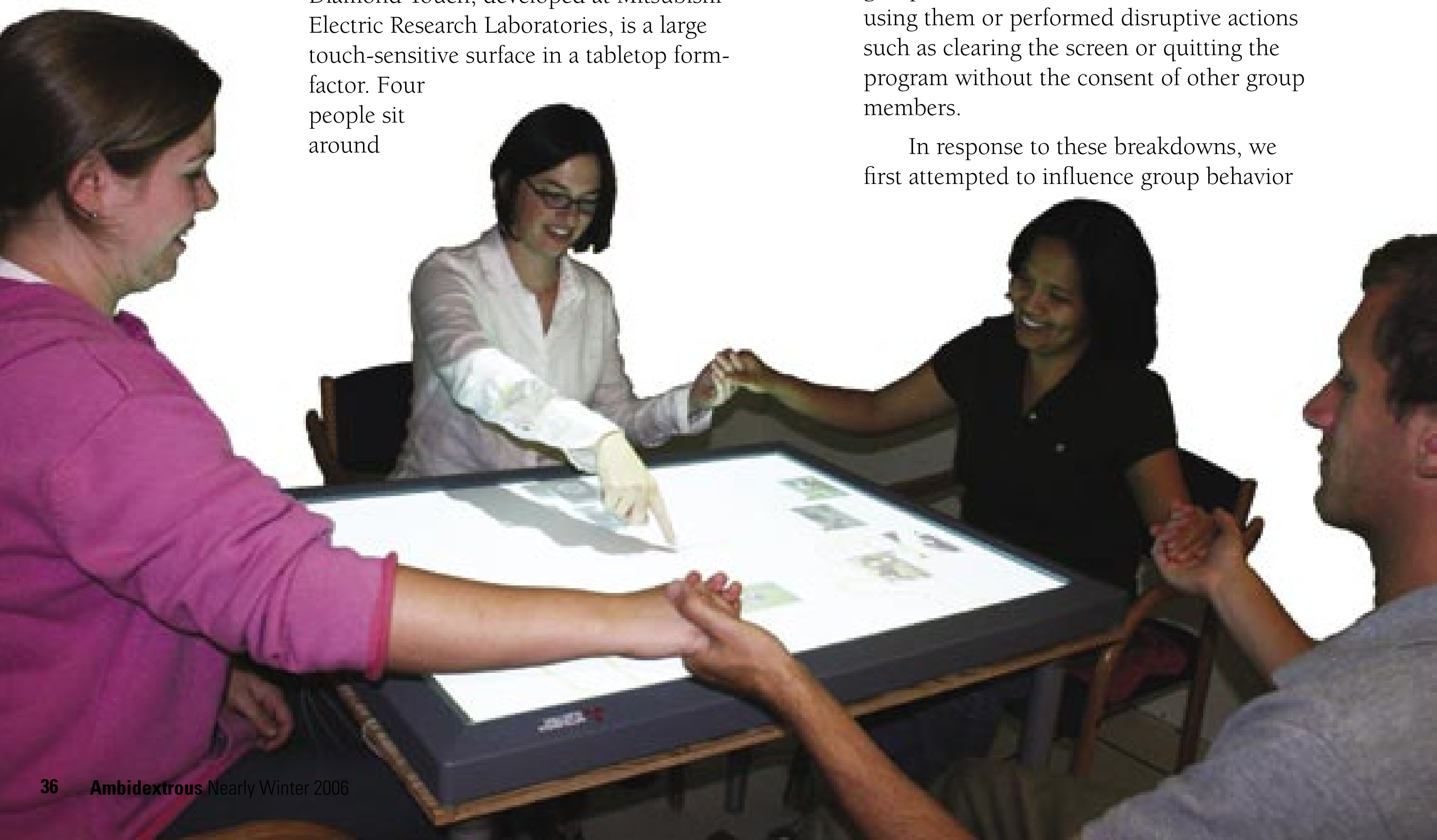
by Meredith Ringel Morris

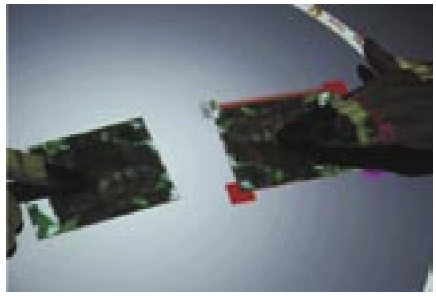
Can we design workspaces to improve the interplay of people working in groups? Although stereotypes suggest that computer scientists give little thought to social affairs, our group has been giving a lot of thought to interpersonal interactions. In our research on co-located group work, we noticed that many people who user-tested our systems did not "play well with others." As a result, we began exploring ways to design our software to mitigate groups' bad behavior, then started expanding to interfaces designed to promote desirable patterns of group interaction.

In our research, we run experiments with groups of four people sitting around a computationally-enhanced table. The Diamond Touch, developed at Mitsubishi Electric Research Laboratories, is a large touch-sensitive surface in a tabletop form-factor. Four people sit around the table on conductive chair pads plugged into the device; thus, when a person touches the table, he is capacitively coupled to it. The DiamondTouch accepts simultaneous touches from all four users and distinguishes which person touched where based on this coupling between unique chair pads and touch inputs.

The ability for four users to simultaneously interact with the DiamondTouch table tempts some to anti-social behavior. We observed several types of intentional and accidental social breakdowns, for example, among people using a group application for viewing and annotating digital photos and text documents. Users stole digital photos and documents from other group members who were in the midst of using them or performed disruptive actions such as clearing the screen or quitting the program without the consent of other group members.

In response to these breakdowns, we first attempted to influence group behavior





through UI design by introducing coordination policies: software-level mechanisms to prevent or provide deterministic outcomes to "breakdown" behaviors. Several policies address the issue of group members stealing documents from each other. The "relocate" policy divides the table's surface into restricted areas—personal zones and a central zone that is fair game for all users. The "duplicate" policy automatically creates a copy if a user steals another user's document. These examples illustrate different approaches—"relocate" is proactive (users can place a document in their personal zone) while "duplicate" is reactive (mitigating the potential workflow disruption of stealing).

We also wanted to try to produce desirable group interactions. For educational activities, small-group work is beneficial as a means to allow students to work with and learn from their peers. Interactive tables are an attractive platform for this, combining the benefits of face-to-face group work and digital technology. However, one drawback is the "free rider" issues which can arise if some group members are shy, underprepared, or if some members excessively dominate an activity. Our ongoing work on the ClassificationTable interface explores design variants that encourage more equitable participation.

The ClassificationTable is a generic framework for an activity in which students classify clues, facts, or vocabulary words by placing them in designated regions of the table. We have explored several design enhancements. Feedback privacy variants show whether private feedback about the correctness of classifications encourages shy users to participate more. Spatial layout variants can tell us if locating items near specific students make them feel more responsible for classifying them. Interaction visualizations are real-time graphs of individual contribution, and we are investigating whether they motivate under-participators to contribute and keep over-participators in check.

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We also wanted to explore interaction designs to support co-located activities in general. We aim to increase group awareness and coordination and enhance a sense of teamwork and social togetherness with cooperative gesturing. Cooperative gestures are interactions in which the system interprets the actions of multiple group members collectively as contributing to a single gestural command. Requiring the participation of multiple group members to perform an action can increase group awareness about important or potentially disruptive actions and can encourage participation, cooperation, and teamwork.

We have been exploring cooperative gestures in CollabDraw, a multi-user art application. For example, clearing the canvas requires all group members to simultaneously make a wiping action on the table's surface, and exiting the program requires all group members to hold hands, séance-style, while one user touches the table. We're interested in how dimensions of cooperative gestures impact their complexity and their social acceptability. These design dimensions include symmetry—if group members perform identical actions; parallelism—the relative timing of each contributor's gesture; identity-awareness—if certain gesture components must be performed by specific group members; and additivity—in which the gesture's effect is magnified by how many group members participate.

Designers of traditional, single-user computer systems focus on improving human-computer interaction; the introduction of hardware that supports simultaneous inputs from multiple, co-located users adds a new twist to that paradigm. When people work in groups, interaction with their team is the focus of the activity. Designing computer systems that support human-human interaction is an exciting challenge for this new generation of computing technology.

More details can be found at http://hci.stanford.edu/research/tables.

photo by Meredith Ringel Morris