Metamouse: Multiple Mice for Legacy Applications

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***Abstract*—Traditional Single Display Groupware (SDG) solutions have been used to create software for developing regions. SDG allows for greater utilization of the limited infrastructure available in such areas. This technology is particularly appropriate in classrooms where groups of children often use educational software on a single computer. However, SDG has faced several challenges working with legacy applications. Our technology, called *metamouse*, takes a step toward an integrated multi-user application by allowing users to collaborate within unmodified legacy educational software.**

I. Problem Statement

Several million children, especially in the developing world, never use a computer without a partner sharing the mouse and keyboard [2]. Single Display Groupware techniques [4] are particularly relevant to this scenario, allowing for users to more effectively share computing resources by using multiple mice. Existing research has shown that these techniques are intuitive, usable, and beneficial in the developing world [3].

Despite these encouraging early findings, two important barriers remain in deploying shared input technologies in real world settings. First, most legacy software would have to be significantly modified to effectively use multiple mice, and among other issues, many business challenges exist in doing this. The second barrier, potentially of great interest from the HCI perspective, is that of efficiently encouraging coordinated on-screen decision-making using the multiple mice. Most trials of multimouse, while emphasizing the importance of collaboration, have been impeded by working within a "fastest-finger-first" race-clicking, or repetitive click modes which require all users to click on the same link for the function to continue. Our challenge was to work with legacy software, and yet provide an alternate way for allowing coordinated clicking to capture the proven learning gains of collaboration.

II. Solution

To solve these problems, we developed the *metamouse*. The metamouse does two things. First, it maps multiple user mice and cursors down to one *metacursor* that interacts with the application. This allows for the use of unmodified legacy applications. Secondly, we have to make sure that this mapping is intuitive and encourages collaboration among users.

We began by trying to create an effective mapping for point-and-click applications. Tackling other tasks is left as future work. To do this mapping effectively, we have to map mouse movements as well as mouse clicks.

A. Movement

To map the many cursors down to one, we use a well known SDG technique. We average the mouse locations, and display a *metacursor* in that location. With this, each user's actions have a small, but noticeable, impact on the metacursor's location. Likewise, if all of the users agree on the location of the cursor, the metacursor will be at the same location. This encourages collaboration, as the users must discuss and agree to place the metacursor where they want it.

B. Clicking

We can't allow the users to click at any time, as the metacursor may be at an inappropriate location. To solve this, we only allow clicking when the mice are in close proximity to each other. When distant, all of the clicks are ignored. The intuition is that if the mice are close to each other, then the users have agreed on the correct location to make progress, and clicking should proceed. This encourages collaboration; all users must agree on a location before making progress.

III. Demonstration

We are going to demonstrate the point-and-click metamouse system running on Microsoft Windows XP. We will run a set of educational games using the metamouse and four individual mice. This set will consist of:

- The Azim Premji Foundation's [1] educational games
- Disney online educational games
- Other educational games

References

[1] Azim Premji Foundation. http://www.azimpremjifoundation.org.

[2] J. Pal, U. S. Pawar, E. A. Brewer, and K. Toyama. The case for multi-user design for computer aided learning in developing regions. In *WWW '06: Proceedings of the 15th international conference on World Wide Web*, pages 781–789, New York, NY, USA, 2006. ACM.

[3] U. S. Pawar, J. Pal, and K. Toyama. Multiple mice for computers in education in developing countries. In *IEEE/ACM Intl Conf. on Information and Communication Technologies for Development*, 2006.

[4] J. Stewart, B. B. Bederson, and A. Druin. Single display groupware: a model for co-present collaboration. In *CHI '99: Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 286–293, New York, NY, USA, 1999. ACM.