Toward a View Coordination Methodology for Collaborative Shared Large-display Environments

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Abstract. Allowing multiple users to explore data together on the same large display has great potential to help people to work together and solve problems in a more effective and amiable manner. This paper looks at how we can coordinate views between multiple users on a large-display for a simple collaborative task. We compare split-screen and shared-screen methods in order to develop a better understanding of the relative advantages and disadvantages of these methods and outline a new view coordination method that could combine the advantages of both.

Keywords: Information Visualization, Collaborative Visualization.

1 Introduction

People often benefit from being able to work-together to explore data in the same place and at the same time. For example, a group of friends may want to search tourist map to plan the holidays in a café, or a group of students might want to analyze financial data together in the library. Here, people work together on a common task to achieve their goal, and a co-located environment has the power to better facilitate information exchange and accelerate the pace of problem solving [1-3].

Large displays have become more affordable, more interactive and easier to connect to other devices. As a result researchers are now using this technology to support more collaborative activities [4, 5] and results indicate that multi-user large-display interfaces have great potential in this area. There are, however, issues that impede their adoption. One major issue we identified, in a short observational study looking at how people collaborated using mobile devices, was that users would often switch between individual and team-work during a collaborative task. This study explores further how people work this way and how split-screen and shared view interfaces accommodate this type of working.

2 Related work

Previous work has proposed some solutions to the problem of managing multiple users have control over the same device. It has been suggested ranking users, which

means the system would give privilege to some users and limit some users' access [6]. However, this method can only be used in very confined situations where there are clearly stratified groups like teachers and students or group leaders and other members. It also does not solve the problem of conflict between users of the same class.

Multiple view systems, using two or more different views to investigate data are also found to be quite powerful [7, 8]. These bring many benefits, including improving user performance and allowing users to discover unpredicted relationships in data [9] and have been widely used in many fields such as movie editing, TV and video surveillance as well as scientific research [7, 10, 11]. For example, they can be used to combine documentation of different scales, like a broad view of basic framework and a precise view of part of screen, reunifying them in a unique and synchronized view [9]. In this study we focus on view coordination for information visualization in a large display by conducting an observation study, in which two basic view coordination are tested

3 Case Study

As a case study to test spit-screen and shared-screen displays and better understand how people explore data collaboratively in large display centric multi-device environment we conduct an observation study looking an interface for two users planning a trip around the world. This helps us to have a deeper understanding on how different users' attention shift between different screens, and each other, when they explore the data.

Our focus group for the study consisted of twenty participants all aged from eighteen to twenty-four. We used interactive world map application, which runs on a large wall mounted display and two mobile phones used for control. Groups of two users each are asked to explore the different parts of map based on their interests and where they want to plan their trip. Participants worked together with a partner to plan a trip around the world according to a certain theme and within a certain budget. The interface was operated in either split-screen mode or shares-screen mode with slightly different travel requirements (to visit natural wonders, landmarks, big cities etc.).

The shared-screen mode for the large display (see figure 1) presents the combination of the selections made by users. In particular, the combination is the smallest rectangle viewport which contains all the selections' areas. In split-screen mode (see figure 2) users have different views and the large display space is split in half using equal space for each view.

Based observations of ten pairs of users using each interface configuration for approximately ten minutes, we found that participants worked independently for approximately seventy-three percent of their time and together twenty-seven percent of their time. Unsurprisingly the shared-screen gained positive feedback for aspects related to teamwork, whereas the users considered that the split-screen worked better for independent working. The shared screen mode tended to work well when there was a significant overlap between the areas of interest of each user whereas the split-screen worked better when they looked at different areas on the map. So both types of display appeared to have its own unique advantage over the other.

Figure 2: The interface running in shared-screen mode. The red area is selected by one user and the green area is selected by another user.

Figure 3: The interface running in split-screen mode.

4 Conclusion and Future work

We have developed and performed preliminary tests on interfaces with split-screens and shared-screens for information visualization. This used the scenario of users planning a trip around the world with a limited budget. Approximately seventy-three percent of the users' time was spent on independent working, where they preferred the split screen. Twenty three percent of the users' time was spent working together, where they preferred the shared view. Each of these views was found to have distinct advantages and disadvantages. Future work will involve the development of a new view coordination method that shifts between split and shared views according to the users' selections to facilitate the users moving between independent working and working together during collaborative activities.

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