

# Exploring Teamwork and Taskwork in Multi-Display Groupware

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## 1 INTRODUCTION

Advances in large display technologies have fostered interest in the design of computer systems when supporting co-located group work. Development of large display systems is also fuelled by knowledge that physically sharing a workspace can provide collaborative benefits such as improved awareness and coordination, improved communication efficiency enabled by deixis, and a shared visual reference that facilitates grounding in communication. These advantages, and the increased availability of large display systems, have renewed interest in the development of single display groupware (SDG) applications.

However, SDG systems have known drawbacks. For example, prolonged interaction with large, touch-based systems can lead to fatigue and physical discomfort, and adults tend to be uncomfortable interacting in close physical proximity to others. The proliferation of wirelessly networked and mobile personal displays (e.g., laptops, cell phones) creates an opportunity to resolve some common SDG system issues through the development of multi-display groupware (MDG) [1, 2, 4] (also known as multi-display environments (MDEs)).

As Gutwin and Greenberg [3] assert, there is a fundamental tension in groupware systems between supporting the *taskwork* individuals need to accomplish during shared work and supporting the overall group process, or *teamwork*. For example, while the ability to perform individual actions on a laptop in an MDG system may decrease distractions caused by other's activities, and therefore improve taskwork, it can also decrease the ability of group members to monitor others' activities. This reduced monitoring can decrease awareness and interfere with teamwork. Since different group tasks are likely to require different levels of teamwork and taskwork support, it is important for system designers to understand the tradeoffs to be made when considering SDG and MDG systems for particular collaboration contexts. To address this need, we conducted a study to explore these design tradeoffs through an investigation of common, co-located groupware design considerations.

## 2 THE STUDY

The study investigated the effect of display configuration and

resource allocation strategies on the taskwork and teamwork performed during a Job Shop Scheduling (JSS) task [5]. Two display configurations were investigated: single- and multi-display environments (Figure 1). Additionally, three resource allocation methods were explored; *shared allocations* for all resources, *negotiated allocations* in which participants could trade responsibilities, and *fixed allocations* where computer-assigned responsibilities were used.

This poster will present results from preliminary qualitative and quantitative data analyses from this study. These results indicate that while there were little performance differences between conditions, differences in collaboration process were observed. For example, groups' communication protocols appeared to be affected by changes in both display configuration and resource allocation. Also, a conversation analysis revealed differences in group- and individual-level communication between conditions.

Overall, groups tended to exhibit more efficient communication in MDG conditions. Individual participants with low-levels of conversation contributions across conditions tended to be more enthusiastic in multi-display conditions, whereas the most involved participants tended to contribute consistently across conditions. Gender effects were also observed; females generally contributed the least, but were more involved in MDG conditions. In general, participants preferred the MDG conditions, citing that they were better able to focus on the task when a personal display was present. These results suggest design considerations for future SDG and MDG systems relating to comfort, facilitating communication, and the importance of personal displays.

## 3 REFERENCES

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Figure 1. Participants completed the study in both multi- (left) and single-display (right) configurations.