HCI issues of dispersed public displays

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1. INTRODUCTION

Distributed display environments cover a wide range of display setups and a wide variety of usage and activity patterns. This position paper describes our research into *dispersed displays*, a new class of distributed display environment which is characterized by the spatial distribution of individual displays across a large physical area. This effort is part of and supported by the e-Campus Initiative at Lancaster University.

2. DISPERSED PUBLIC DISPLAYS

Interactive display systems have been one of the most prolific research areas in computer science and human-computer interaction. In recent years, a lot of work has centred on situated displays and on the use of large displays as public artefacts [5, 13]. For a number of projects in the area, the primary goal can best be characterized as supporting synchronous collaborative work (e. g. [15, 8]). Another focus is the support of informal social communication in community spaces (e. g. the Dynamo display system [14]). Yet other projects place greater emphasis on the more peripheral and ambient display of information at strategic points within the environment (e.g AmbientROOM [7] and UniCast [11]).

An important design variation for public display systems involves the coordinated use of multiple individual displays. Examples include RoomWizard [12], Hermes [1], the Plasma Display Network [2] and our own GAUDI system [9]. Each of these systems consists of a (potentially large) collection of networked displays placed throughout an environment. For example, in Hermes and RoomWizard small displays are located next to office doors where they function as smart door plates; in GAUDI, displays function as dynamic signs that are placed within an environment wherever there is an information need. The initial application and use of GAUDI is a public wayfinding system for the Lancaster University campus. In this application, displays provide location-dependent dynamic navigation information. In each of these systems, the information presentation of individual displays is tailored in a context or situation-dependent manner by logically binding displays to a specific location, room, or person. Although at each point in time a user may only interact with one display (and may only be able to see one display), the collection of displays functions and is perceived by users as a single coordinated display system that is available throughout the environment.

To differentiate such display systems from traditional distributed display environments we use the term *dispersed (public) display*. Dispersed displays are characterized by the spatial distribution of individual displays across a large physical area. In contrast to co-located distributed displays, dispersed displays may cover multiple rooms or buildings and involve large numbers of individual displays. Displays are typically placed at such a distance from each other that a user is only able to interact with one display at each point in time. Table 1 shows a classification of distributed display systems which differentiates between tiled displays, co-located distributed displays and dispersed displays.

3. NEW RESEARCH QUESTIONS FOR DISPERSED DISPLAYS

Dispersed display environments raise a number of new questions for HCI research. With respect to this workshop we see the following questions as relevant:

- *Coherence*: A dispersed display environment should be understood by users as a coherent resource for information and interaction, regardless of type, number and placement of individual displays. In this context we need to investigate how users perceive a dispersed display environment and how coherence is affected by hardware and interaction design.
- *Seamless interaction*: As users move throughout an environment they may encounter different parts of a dispersed display environment. How can we support interactions that involve seamless transitions between displays? In particular, how can we enable users to initiate a sequence of interactions on one display and finish it on another display? Which aspects of the interaction state need to be captured to achieve seamless interaction?
- *Adaptation models*: Previous experiences with respect to dispersed display environments suggest the usefulness of dynamic and context-dependent information presentations. For example, in GAUDI we use a simple location and time-based adaptation strategy to dy-

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Table 1: A Classification of Distributed Display Environments

	Tiled Displays	Co-located Displays	Dispersed Displays
Private Use	display grids, wideband displays [10] (personal information management)	multiple monitor setup (personal information management [3], peripheral information awareness [6])	privacy preserving public displays [4] (peripheral information awareness)
Shared Use	display walls (data visualization, command and control)	smart meeting rooms (presentations, shared editing)	
Public Use	display walls and video walls (advertisement, video streaming)	display walls and video walls (advertisement, video streaming)	situated public displays [1, 2, 9, 12] (context and situation dependent information presentation)

namically adapt generic content to the unique situation of each display. However, current adaptation models are simple, do not make use of unique aspects of dispersed display environments and have not been evaluated properly. Which alternative adaptation models (for example based on activity and movement patterns) exist and how can they improve the overall user experience of dispersed display environments?

- *Evaluation methods*: The effectiveness and usability of dispersed display environments depend to a large degree on the particular placement of individual displays. This has implications for the way these systems must be evaluated. Lab based user studies are no longer sufficient (due to the size of such a system); instead dispersed display environments will need to be evaluated in situ during actual use. In our opinion, incremental rapid deployment of prototypical systems paired with informal user surveys might constitute a promising approach to evaluate dispersed display environments.

We hope to be able to explore these and similar questions during the workshop.

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