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# The Aachen Media Space: Multiple Displays in Collaborative Interactive Environments

## **Jan Borchers**

Media Computing Group  
RWTH Aachen University  
52056 Aachen, Germany  
borchers@cs.rwth-aachen.de

## **Abstract**

The Aachen Media Space is an interactive room to support collaborative work that involves static as well as time-based media on multiple displays. Its physical design is optimized for flexibility. Interactive mobile Media Boards offer display space as a commodity. Its software infrastructure, combined with a physical user interface prototyping toolkit, allows us to quickly evaluate new user interface design ideas that include multiple users, multiple custom or standard devices (such as phonecams), multiple applications, modalities, computers, and displays. HCI Design Patterns are proposed as a format to capture the lessons learned from this research that is carried out in collaboration with an international network.

## **Keywords**

Interactive rooms, prototyping, tangible interfaces, HCI design patterns

## **ACM Classification Keywords**

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## **Introduction: Ubicomp meets multimedia**

The Media Computing Group looks at two particular areas of HCI: interaction beyond the desktop, such as

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mobile interfaces and UIs for Ubicomp, and interaction with time-based media, such as audio and video (exemplified in a series of public interactive exhibits for museums and similar centers). These two areas have recently been coming together in the Aachen Media Space. In this new multiple-display environment (MDE), we aim to support groups to work together on a common task, from brainstorming, to presentation, to holding meetings—but including interaction not just with static documents such as text and graphics, but also with time-based media, such as movie material, audio clips, animated simulations, etc. A good sample scenario that we would like to support in the future is the CNN team poring over collections of short video clips in order to puzzle together the 8 o'clock news.

### Contributions and goals for the workshop

For the CHI 2006 workshop, we hope to provide the following helpful contributions to the group:

- Insight into the physical design, the devices (such as our *Media Boards*), hardware and software infrastructure that we are putting together to create the *Aachen Media Space* as a testbed for collaborative MDEs;
- Introduction to *TeamSpot2*, the commercial descendant of an earlier work we were involved in at Stanford, that provides useful services for users to fluidly collaborate and exchange information in an MDE;
- *iStuff*, an open-source software framework we developed that allows researchers and designers to rapidly explore new ideas for non-standard distributed physical user interfaces that let multiple users interact with an entire MDE;

- Sample new interaction ideas for displays (in rooms or in public spaces) that are based on ubiquitous technology such as phonecams;
- HCI Design Patterns as a possibly useful format to capture some of the design recommendations and lessons learned in the creation of MDEs;
- Introduction of an existing network called *RUF AE* that combines several research institutions involved in the design of MDEs.

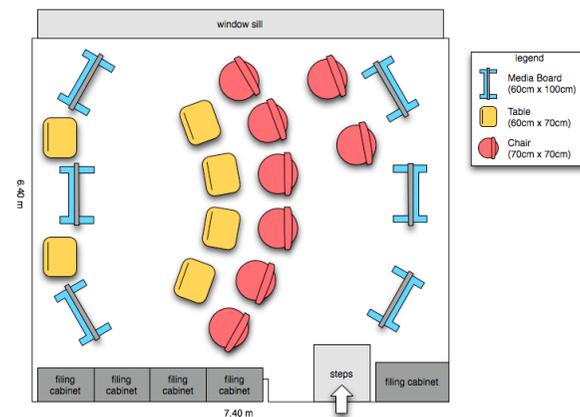
Our goals for this workshop are to share the above findings, to learn what others have been able to achieve concerning MDEs, and to establish additional connections between our various research groups for future work.

### The Aachen Media Space



**Figure 1:** The Aachen Media Space.

Fig. 1 shows the Aachen Media space in a typical state. Visible are three of our mobile Media Boards, three of the eight speakers to make up the surround-sound *AudioSpace*, and seven mobile tables with several chairs. Some of the primary considerations, or *Design Patterns* [1], for the physical room were to provide CONTROLLABLE DAYLIGHT, ALL FURNITURE ON WHEELS, and MOVEABLE FLOORBOXES with power and network.



**Figure 2:** Floor plan of the Aachen Media Space, in a different physical configuration, to provide a better sense of the space and its flexibility.

Our *Media Boards* are based on an NEC 40" LCD display equipped with a DVI-T touchscreen overlay by SMART Technologies. They are mounted on a PETA moveable stand and can be equipped with a laptop to serve as interactive whiteboards wherever they are needed. One of the boards was turned into a mobile videoconferencing unit by adding a PolyCom ViewStation FX and speakers to it.

Overall, the flexibility of the room has paid off; when meetings begin, the occupants often come in and grab a chair, table, etc. to arrange them as they feel for the upcoming activity.

A software package called *AudioSpace* was developed by Stefan Werner, a former member of our group, and serves to allow any computer in the room to redirect their audio via the local area network to the surround audio speakers in the room.

More information about the Media Space setup can be found at <http://media.informatik.rwth-aachen.de/msp.html>.

### Software Infrastructure

To fluidly exchange information between users in the room, we have been using the software developed originally in the Stanford Interactive Workspaces project [2] in which several members of our team had been involved. Put simply, it creates a central server for "room events" that applications can send events to or receive events from. Sample applications written for this infrastructure allow us, for example, to copy information between clipboards of different machines without changing the user interface for cut&paste for the user, to move our mouse cursor from our own laptop display onto a large display to control it with our own mouse and keyboard, or to send URLs, files, and other content to other users in the MDE.

The technology we have been using as of this writing is a research prototype and has not been deployed too widely; however, two key members of the Stanford group have commercialized the software under the name *TideBreak TeamSpot2* ([www.tidebreak.com](http://www.tidebreak.com)), and

we will begin working with that package in January 2006. This software package has shown to be quite useful for shared display use, and we have suggested to TideBreak to provide us with a demo license for the CHI 2006 workshop.

### **iStuff: Rapid Physical UI Prototyping**

Collaborative use of large displays requires us to think about new peripheral devices and user interfaces. To speed up the prototyping of such devices without getting bogged down in low-level activities such as soldering, driver development, or running cables across the room, we have developed the *iStuff* toolkit [3], that has been refined considerably, notably by Rafael Ballages of our group, since that publication. The software is available as open source, see <http://istuff.berlios.de/>.

One particularly promising device for interactions with shared displays is the now nearly ubiquitous mobile phone. We have developed several techniques to let phonecam users interact directly with large, possibly public, displays using optical flow techniques with the built-in camera and a Bluetooth link to the display [4].

### **HCI Design Patterns for MDEs**

The format proposed in [1] has turned out to be a very useful way to capture what has been learned in the design of an interactive system. Since design patterns originated in architecture, they are especially useful as HCI begins to touch more directly on real-world, physical design and configuration issues, as is clearly the case with displays shared by multiple users. See <http://www.hcipatterns.org/> for details.

We have also previously studied the behavior of groups in front of shared displays with some interesting findings, see [5].

Finally, we'd like to share with the workshop what we have learned by being part of *RUF AE*, an international network of research institutions in Sweden, France, Germany, the U.S., Russia, and elsewhere. All of the participating institutions have in common that they have working interactive rooms or are in the process of building them; and our monthly meetings via multi-point videoconferencing have (after about two years) finally become technically robust enough to actually enjoy the research talks we take rounds to present. For more information, see <http://www.rufae.net/>.

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