Overcoming Mode-Changes on Multi-User Large Displays with Bi-Manual Interaction

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ABSTRACT

In this position paper we present a preliminary concept of a new interaction style called *personalized interfaces* for multi-user, multi-display systems. Focusing on supporting co-located and collaborative interaction, based on bi-manual direct manipulation interfaces.

Keywords

ubiquitous computing, multi-user, multi-display interfaces

1. INTRODUCTION

Along with the introduction of ubiquitous technology in our everyday live, an increasing mismatch of requirements and availability of interaction styles and techniques can be observed. While display and sensor techniques develop further away from the desktop settings, the interaction techniques frequently used are merely adaptations of the traditional WIMP paradigm. A different style of thinking about systems that are embedded in our environment is needed to come up with interaction styles that match the requirements implied by such systems. In this position paper we want to outline our approach to a mental model for instrumented environments and their perception by users. According to the presented mental model we propose an interaction style that we think bears potential to bridge the mismatches between available display and interaction techniques.

2. A MENTAL MODEL FOR INTERACTION IN INSTRUMENTED ENVIRONMENTS

In Instrumented Environments such as the FLUIDUM instrumented room [3] a large number of displays in various dimensions and resolutions are built into the fabric of the users' surroundings. Among them table-top, wall-mounted and projection based displays. In addition, different mobile devices such as handheld computers or tablet PCs are used frequently.

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Setups like this require a different approach to present, access and manipulate information than conventional desktop setups do. Not only the size and amount of displays differ, but also the way they are related to each other and how they are used.

We no longer consider each display as a standalone output device but rather think of the whole room as one continuous information space, as seen in Figure 1, that can be observed and manipulated by its users.

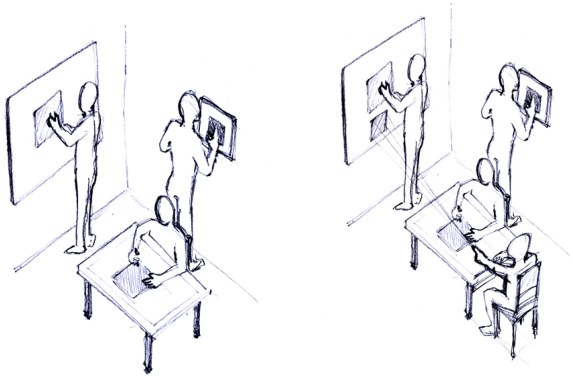

Figure 1: The continous information space. Left: Three users working co-located on a shared set of continuous data. Right: Four users working collaboratively on the same set of data. Each user utilizes her own *personalized interface* to access information.

Some of the main issues that make it difficult to utilize the traditional paradigm of WIMP interactions in such a setting are the following:

1. Information stretching over the boundaries of the constituting displays and being viewed by several users simultaneously, makes it very hard or even impossible to find an ideal placement for rigid GUI items, such as menus, in a way that they are accessible in an efficient and meaningful way from the users current position.
2. Since the information and the interface are shared by multiple users, the WIMP assumption that interactions occur sequentially does not hold any longer. In such settings the presentation of the information can not be changed or even manipulated on a global scope by one user without potential interference with the interests of other users. Hence changes in information

representation and the manipulation of it should be limited to a local scope without restricting collaboration amongst users.

3. The amount of data that is displayed in instrumented environments either in office settings (e.g. scientific data) or the domestic space (e.g. media collections) is increasingly growing. But humans only have limited focus, attention and perceptual capabilities so that a person surrounded by several displays can easily become a victim of information overload.

We try to address these issues by utilizing *personalized interfaces* as views onto shared information landscapes. These interfaces are portable and can be freely positioned by each user. Thus they serve as a reference point both for perception and cognition as well as for interaction. Further do they function as reference point for communication too, because it becomes instantly clear on what part of the data a user is currently working.

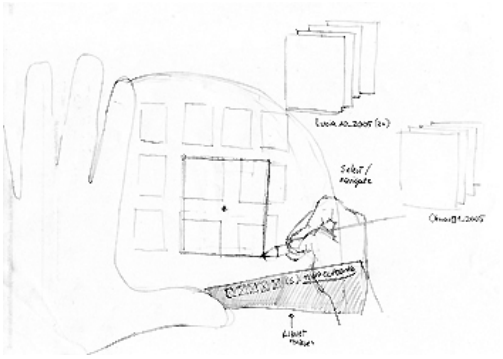

Figure 2: Mock-up of the personalized interface for shared media collections.

The personalized interfaces concept incorporates different aspects from the toolglasses [2], peepholes [7] and fluid menus [5] metaphors.

It is a bi-manual interaction technique utilizing the non-dominant hand to position the workspace (see Figure 2). The workspace functions both as a peephole into the information space, rendering information in the wanted presentation form, possibly revealing, previously hidden, private data and filtering unwanted information. And as an interaction interface to carry out operations on objects underneath it.

Operations are applied using the dominant hand and clicking through the menu parts of the transparent workspace area. Rendering a set of central, application wide controls unnecessary and avoiding the need to change the mode of the user interface globally and temporally as usual in the WIMP paradigm.

3. BI-MANUAL DIRECT INTERACTION

The idea of two-handed input is nothing new and has been studied extensively [6, 1] in past years. The central idea is to exploit users' natural two-handed motoric skills that are rooted in the bi-manual nature of most everyday live tasks. The best known application are 'Toolglasses and Magic Lenses' [2].

While the technical part is rather mature, we hope that we can contribute with adding some new ideas to the concept and applying it to multi-user, multi-display environments.

Based on the model of the kinematic chain [4] users utilize the macro-metric skilled hand to serve as a reference frame for more precise interactions carried out by the micro-metric skilled hand. Thus positioning the context and defining the current workspace on the continuous information space. Thereby we hope to gain different benefits.

First of all can we address the spatial limitations that traditional menus have to bear with. Since every user has her own personalized view all controls she needs are always in place and the actions can be applied in a fluid manner. In contrast to WIMP controls no additional movement of the hand (to and from a menu) is necessary. Also the positioning, orientation and order of access problems can be addressed by personalizing the controls instead of having a centralized menu. Even more important is that the current task does not have to be interrupted in cognitive aspects by changing the mode of the application, but instead every action is carried out in place by clicking through the control. Thus making the action more integrated and coherent.

Second, the concept of personalized interfaces can support collaboration by offering explicit ways of communication. In the same manner as the one hand is a reference frame for the other, the personalized interface can serve as a reference frame for communication as well. The position of one's workspace gives clues to others what the current task is, and also helps them understand which parts of the information are currently being discussed.

Third, one can observe that participants of discussions frequently hand over chunks of information to other participants, on the one hand to support their line of argumentation with additional data or to provide more information on their topic. And on the other hand to socially engage others in the discussion and to control turn taking in the communication. These observations have lead us to the idea to support communication amongst users with the *card game* interaction. The tray in the lower part of the personalized interface (see Figue 2) can be used to temporally store chunks of information, e.g. pictures, and bring them to other users just like playing cards on a poker table.

4. DISCUSSION TOPICS

The outlined concepts are currently in a very early, pre-implementation stage therefore we only have discussed design issues and no implementation details at this point. However we identified several technical issues, mainly regarding tracking multiple simultaneous inputs over several devices. Also we need to explore further how to deal with different resolutions and display sizes in the instrumented environment.

On the design point of view we would like to discuss what measurements can be taken to explicitly support human capabilities in visual search, reasoning and sense making utilizing the concept of personalized interfaces.

Also the question of how to point onto vertical distant displays, and whether that is desirable and/or needed has to be discussed.

Furthermore we would like to explore the potential of such interfaces to foster social communication and collaboration, both in the office and the domestic space.

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