Interacting in Instrumented Environments

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Abstract. This work focuses on interaction techniques supporting users of instrumented environments to interact with virtual information embedded in the real world, in a continuous display of information.

1 Introduction

Instrumented environments in ubiquitous computing define spaces where technology is embedded so as to display and sense information in objects of everyday life. In this sense we have the chance to interact in a continuous display of information by moving in the real space and handling physical objects that are invisibly correlated to virtual information. The lack of visibility and feedback bears the risk of a loss of control and awareness of interaction, and raises the need for new conceptual models.

My research develops within the FLUIDUM project [1], and investigates interaction techniques for instrumented environments, in the attempt to design and specify user interfaces that allow users to develop a consistent conceptual model, enabling them to interact with such environments.

2 Direct Manipulation for Instrumented Environments

Direct manipulation is the basis for the dominant WIMP paradigm (Windows, Icons, Menu, Pointer), with which we manage different applications in the Personal Computer environment; according to the activities they support, applications rely on different metaphors. While the metaphor varies according to the domain (which translated to instrumented environments could be office, living room, kitchen, etc.), the general paradigm remains consistent.

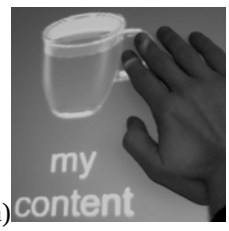
My investigation focuses on the definition of general laws for interaction that can be applied in different domains and be supported by different displays. This application-independent (in this case *appliance-independent*) metaphoric system aims at the definition of a general paradigm for interaction, that like the WIMP one allows the interaction with different domain-specific appliances, but better suits the ubiquitous computing settings.

Although talking about direct manipulation, in the desktop environment we mostly need indirect input devices, such as the mouse, to interact with the system. I am work-

ing on a novel interaction paradigm, aiming at direct manipulation of units of information across different displays and contexts, avoiding the use of mouse. In such a paradigm, surfaces play as interfaces, and hands as control devices. The mouse has a limited manipulation vocabulary (e.g. click, double click, click and drag, right click) while hands and gestures provide a much more varied one (e.g. press, draw a circle, point, rotate, grasp, wipe, etc.). My intent, therefore, is to design affordances for the representation of digital information which can suggest hand gestures.

2.1 Design of a Metaphor for Affordable Gesture-Based Interaction

Metaphors have long been used in GUIs for providing an intuition of how things work using people's world's knowledge. While the desktop metaphor suits the type of environment in which the computing capabilities have been mostly applied so far, it runs short in scenarios of ubiquitous computing. Furthermore the visual affordances of the metaphoric items (e.g. folders and 2D icons) are suitable for the mouse-based manipulation vocabulary, but not for a hands-based one. Building on these assumptions I am working on the design of a metaphor that suits different environments and is affordable for hands-based manipulation. A first idea is to rely on the affordances provided by a mug, and to metaphorically represent it as a container of information. When manipulating a real mug we know we can move it around by holding its handle, and incline it to pour its content; besides, a mug is an everyday life object which we use in different environments, e.g., in the office, in a living room, in a kitchen. A first prototype of such a *mug metaphor* interface has been built (see Fig.1) in order to investigate the possibility to map the affordances of real world objects to gestures.

a) 

b) 

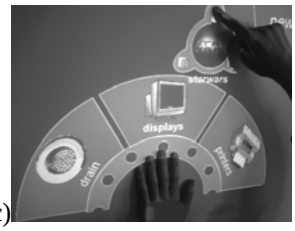
c) 

Fig.1. The *mug metaphor* interface. a) To move the mug/information container, the user touches its handle and drags it on the screen surface. b) To explore its content the user turns the mug. c) To cancel a unit of information, the user can drag it with the right hand to the drain displayed on the pie menu invocated with the left hand.

References

1. FLUIDUM, Flexible User Interfaces for Distributed Ubiquitous Machinery, http:/www.fluidum.org, project funded by Deutsche Forschungsgemeinschaft.