

HCII 2003 - Summary

Thematic track: User Interfaces for the Age of Disappearing Computer

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Title: the re-appearing interfaces of objects

The last few years there has been a growing interest in ubiquitous computing environments. Although ubiquitous computing is not a new notion (ref. Weiser), in the light of two European funded FET initiatives of the Disappearing Computer (DC and DC2), in the last few years there has been an interest and acceleration in the technological as well as human side of the research in the area of the Disappearing Computer.

The view of the most of the disappearing computer artefacts stretches further than information appliances, as they involve interfaces that differ from the traditional area of computer, as we know it. The computer is no longer treated as single powerful processing object, but instead, as a collection of tangible objects. These objects maybe varied in shape, materials, capabilities, but they are able to communicate with each other through an invisible network, and share the processing capabilities they may individually have. Collective functionality emerges within a group of such artifacts that can work synergistically together in an environment, through invisible links. Such artefacts have a dual nature: a tangible self and a software self; they may be enhanced, additionally to processing, with sensing or actuating capabilities of their own.

This paper describes a set of issues that we were confronted with when trying to specify people's interaction with a ubiquitous computing application. In such an application, the computer "disappears" and computing services are made available to users throughout their physical environment. Issues here are presented from the usage level.

People can then act upon their environments, be it physical or enhanced Ubiquitous Computing environments, by setting goals, forming plans and perceiving results. At the cognitive level, the disappearance of the computer forces people to form new mental models about their tasks that involve objects and environments (that now may start to involve using hidden IT capabilities). On the other hand, if the appearance and function of everyday objects / environments change (or new objects appear into our everyday life), then people will have to adapt or form new models of tasks involving these objects.

Interaction in a ubiquitous computing environment takes place in two levels:

- Device-to-device
- User-to-environment. The user interacts a) With any single device b) With a collection of co-operating devices.

Usage issues

Each object that participates in our everyday world has been designed with certain tasks in mind. The ways that we can use an ordinary object (sometimes implied by the "object's affordances") are a

direct consequence of the anticipated uses that object designers “embed” into the object’s physical properties. This association is in fact bi-directional: not only the objects have been designed to be suitable for certain tasks, but also their physical properties constrain the tasks people use them for. As everyday objects are “enhanced” with computing and communication capability, the user has to learn the new ways that they can be used (indicated by designing new affordances) and the tasks they can participate in.

Thus, the ubiquitous computing paradigm introduces several challenges for human-computer interaction. Firstly, users will have to update their task models, as they will no longer interact with a computer but with a computationally enabled object. Secondly, people will have to change their habits and form new models about the everyday objects they use.

The human-computer interface will transcend the limits of the computer and enter the physical world, as computing starts being distributed in objects around us. In such a world, the direct manipulation paradigm will have to include metaphors describing interaction with tangible objects. Unlike Weiser’s vision it may not be appropriate to the nature of many artefacts to have screens added to them. Such interface approach applies to the more specific category of information appliances, and although convenient for interaction it is not always fit in the nature of objects and environments of the disappearing computer. The design of the object’s form and physical properties will also affect the interaction. In fact the design of objects, -which constitutes their interface-, may have to be reconsidered so that their new capabilities can be promoted to the user (indicated by *appropriate* elements for the nature of each object). In this broad picture, information appliances as we know them are only a subset of these objects.

A result of the disappearance of the computer into everyday objects is that the conceptual models people have of these objects will have to evolve. In fact, they will have to:

- Remove the computer as a physical object from several task models
- Replace the computer in other task models with a new object
- Update the usage models and redesign the physical affordances of several objects to include the new possible use/functions

Objects will be able to process and/or gather data and to communicate with each other. People will interact at the same time with individual objects and with their configuration. This may be complex initially, but it also enables them to carry out more complex tasks that involving such enhanced objects and environments.

In terms of people’s interactions with DC artefacts, the following issues will be addressed in more detail:

- How can the user tell whether an object has additional processing/communication capabilities?
- How can the user understand the state of the object?
- For how long will the people have to think explicitly about the objects, before they adopt them in their task models?
- In addition to existing skills for physically using objects, would people will have to develop skills for explicitly use the computing properties of their new environments as well?
- What are the motivating factors to make people willing to take all this trouble this vision entails?