Ubiquitous Computing: Transparency in Context-Aware Mobile Computing

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Ubiquitous Computing

With the increasingly distributed use of computers and the wide range of available computing devices, our society is experiencing a previously unknown level of mobile computing. The adoption of mobile communication technologies such as mobile phones and PDAs is an example of the mobility that constitute our society today and the pervasiveness that mobility contribute with, is evidence of a changing computing paradigm.

Ubiquitous computing describes a widely networked infrastructure of a multitude of computing devices. It moves the interaction beyond the desktop and into the real world with a special attention to activities of everyday life. According to Mark Weiser the vision is to get the computer "out of the way, allowing people to just go about their lives" [5]. The criteria of transparency is then fundamental to the paradigm of ubiquitous computing. The transparency imply more than just a user-friendly interface; the technology should facilitate the task in a non-intrusive way and in this way "hide" the underlying technology for the user. The questions to pose however, is how this transparency is acquired and if mobile devices at their present state are to any degree transparent?

In order to study the transparency within mobile devices I introduce the concept of context-awareness, a central aspect of ubiquitous computing. The context-aware computing describes a scenario where the computing device knows its own present context and acts accordingly. This scenario, however, is highly complex since it requires a closed community where the computing takes place, contrasting mobile computing that requires a high level of mobility. The solution at the present state of consumer information appliances and mobile devices is that of *context-dependent* devices, devices that let the user define the context and then act accordingly. One example is the mobile phone that offers profiles for high, low and soundless settings. The two concepts of context-awareness and context-dependency are close and often overlapping however, in my research they will be defined separately in order to be comparable.

Problem Statement

The main question within my research is how the user experience of transparency within a ubiquitous computing environment can be affected by context-aware mobility compared to context-dependent mobility. Context-aware mobility is defined as mobile applications that change according to context where context-dependent mobility just requires some alteration by the user. The area of ubiquitous computing in question will be limited to mobile devices and their use in a consumer context.

What I hope to accomplish with my research is to contribute to a theoretical framework of how mobile technology can acquire the status of "transparent" as people use the technology as tools for specific tasks. I will attempt to provide further knowledge into the area of user centered ubiquitous computing by demonstrating how transparency is acquired or perhaps not acquired in relation to use

of mobile technology. The theoretical framework will consider the aspect of context as one attempt to acquire transparency.

Theoretical Background

Drawing on Weiser's definition of ubiquitous computing [4], [5], I intend to use a conceptual framework that includes his definition of transparency in combination with other research conducted in the area. As for context-aware applications, there are still few, if any, outside research laboratories at the present state and moreover, most research falls into the category of location-based services [1]. The theoretical framework of context-awareness is therefore limited but researchers such as Dey, Abowd, Salber [1] as well as Schilit and Theimer [2] have all made extensive work within the area. Finally, the situated actions as defined by Lucy Suchman [3] is an area that I base my research on. The concept is relevant to the use of mobile devices in that the situations of use are difficult to specify in opposition to plans and fluctuate according to context. Thereby they create a flow of different situations where the necessary actions are not interrelated.

Planned Research

To study the transparency of context-aware and context-dependent technology, the level of transparency within specific applications should be measured. Both context-aware and context-dependent applications should be considered in order to compare these. Here, the method of a case study is proposed as one way of acquiring empirical data. The case study will provide data of the actual use of mobile devices and applications in real settings.

I am currently doing a preliminary, literary study of the two concepts transparency and context-awareness/dependency. The study will conclude on the past and current use of the terms in relation to mobile computing and an operational definition is to be developed as a foundation for my further research. I am defining the concepts in regard to other researchers' definitions as well as my own considerations, in order to define usable concepts that can be measured and thereby studied as part of my research.

There are two case studies that I intend to carry out. First, I will attempt to find if the present mobile devices are to any degree transparent in their use. The study will rely on user logs, interviews and observation in order to determine the users perception of their devices. The user group will include mobile phone user, PDA users and combined users. The goal of the study is to compare the perceived transparency (defined according to trends in ubiquitous computing) in mobile phones with that of PDAs and by this attempting to define their present level of transparency according to my definition. Second, I plan to do a large-scale case study within "Crossroads Copenhagen", a newly formed research collaboration, which includes a project of location-based mobile services and technologies. Here, the aspect of context-awareness is essential and actual large-scale implemented applications are candidates for further study. The collaboration is presently in its initial phase and I am currently attempting to structure a case study that takes place in this context.

References

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