Chapter 8.2
Towards a Taxonomy of Display Styles for Ubiquitous Multimedia

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ABSTRACT

In this chapter, a domain independent taxonomy of sign functions rooted in an analysis of physical signs found in public space is presented. This knowledge is necessary for the construction of future multimedia systems that are capable of automatically generating complex yet legible graphical responses from an underlying abstract information space such as a semantic network. The authors take the presence of a sign in the real world as indication for a demand for the information encoded in that sign, and identify the fundamental types of information that are needed to fulfill various tasks. For the information types listed in the taxonomy, strategies for rendering the information to the user in digital mobile multimedia systems are discussed.

INTRODUCTION

Future mobile and ubiquitous multimedia systems will be even more an integrated part of our everyday reality than it is the case today. A digital layer of information will be available in everyday situations and tasks, displayed on mobile devices, blended with existing contents of the real, physical world. Such an "augmented reality" (Azuma et al., 2001) will put into practice recent developments in the area of mobile devices, wireless networking, and ubiquitous information spaces, to be able to provide the right information to the right person at the right time.

The envisioned applications for these kinds of systems are manifold; the scenarios we are thinking of are based on a dense, spatially distributed information space which can be browsed by the user either explicitly (by using

navigation interfaces provided by hardware or software) or implicitly (by moving through space or changing one's intentions, triggering changes in the application's model of the user's *context*). Examples for the information stored in such an information space would be historical anecdotes, routes, and wayfinding information for a tourist guide or road and building information for wayfinding applications. The question of how to encode this information in a suitable and universal way is the subject of ongoing research in the area of semantic modeling (Chen, Perich, Finin, & Joshi, 2004; Reitmayr & Schmalstieg, 2005). For the applications we envision, we will require the information space not only to carry suitable abstract metainformation, but also multimedia content in various forms (images, videos, 3D-models, text, sound) that can be rendered to the user on demand.

Besides solving the remaining technical problems of storage, querying, distribution, and display of that information, which are the subject of some of the other chapters in this book, we have to investigate the consequences of such an omnipresent, ubiquitous computing scenario for the user interfaces of future multimedia applications. Up to now, most research applications have been mainly prototypes targeted towards a specific technical problem or use case; commercial applications mostly focus on and present an interface optimized for a single task (for example, wayfinding). In the mobile and ubiquitous multimedia applications we envision, the user's task and therefore the information that should be displayed cannot be determined in advance, but will be inferred at runtime from various aspects of the user's spatio-temporal context, selecting information and media content from the underlying information space dynamically. To communicate relevant data to the user, determined by her profile, task, and spatio-temporal context, we have to create legible representations of the abstract data retrieved from the information space. A fundamental problem here is that little applicable systematic knowledge exists about the automatic generation of graphical representations of abstract information.

If we want to take the opportunity and clarify rather than obscure by adding another layer of information, the following questions arise: Can we find ways to render the vast amounts of abstract data potentially available in an understandable, meaningful way, without the possibility of designing each possible response or state of such a system individually? Can we replace a part of existing signs in the real world, already leading to "semiotic pollution" (Posner & Schmauks, 1998) in today's cities, with adaptive displays that deliver the information the user needs or might want to have? Can we create systems that will work across a broad range of users, diverse in age, gender, cultural and socio-economical background?

A first step towards versatile systems that can display a broad range of context-sensitive information is to get an overview of which types of information could possibly be communicated. Up to now, researchers focused on single aspects of applications and user interfaces, as for example navigation, but to our knowledge there is no comprehensive overview of what kinds of information can generally occur in mobile information systems. In this article, we present a study that yields such an overview. This overview results in a *taxonomy* that can be used in various ways:

- It can be formalized as a schema for implementing underlying databases or semantic networks
- It can be used by designers to create representative use case scenarios for mobile and ubiquitous multimedia applications
- It can be used by programmers implementing these systems as a list of possible requirements.
- It can be used to systematically search the literature and conduct further research to compile a catalog of display techniques that satisfy the information needs identified.