Chapter 2.4
Designing Pervasive and Multimodal Interactive Systems:
An Approach Built on the Field

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INTRODUCTION

The experiences gained from the field in the development of pervasive and multimodal interactive systems leaded the authors to the definition of a pragmatical approach to virtual systems design that considers the various phenomena characterizing the Human-Computer Interaction (HCI) process (Costabile et al., in press; Costabile, Fogli, Mussio, & Piccinno, 2006): the communication gap between designers and users, tool grain, user diversity, implicit information, tacit knowledge and co-evolution of systems and users. The approach adopts the Software Shaping Workshop (SSW) methodology introduced by Costabile, Fogli, Mussio, and Piccinno (2007). According to the SSW methodology, the design process is carried out by an interdisciplinary design team that includes different stakeholders such as software engineers, HCI experts, and domain experts (Fogli, Marcante, Mussio, & Parasiliti Provenza, 2007). The methodology provides the design team

with virtual environments that permit to study, prototype and develop the environment that will be adopted by end users. The virtual environments are tailorable, customizable and adaptive to the context of activity and to community's culture and language. The SSW methodology offers an evolutionary technique for system prototyping in which users can customize and evolve their own workshop. SSWs are virtual interactive environments, which are organized in a network, able to coordinate desktop and mobile devices to allow users to work on a shared knowledge base. The network architecture will be illustrated on the base of the experience gained from different case studies; its accessibility, adaptability, device adaptivity and localization to the specific culture and skills of users will be particularly focused. Localization is a crucial issue because people who use interactive systems for supporting their daily work have different culture, skills, languages, physical abilities and roles and they perform their activities in different contexts. The implemented multimodal interactive environment permits experts to face the problems related to their activity, to update and manage a shared knowledge base and to adapt and evolve their virtual work environment by adding tools becoming unwitting programmer. The novelty of the approach lies in the fact that it is based on practical experience gained on the operative field; this maintains a conceptual connection to real problems and emphasizes the need to support the different actors in their daily work considering the working context, the activities to be performed and the user's culture.

The chapter is organized into five sections. The first section concerns related works. The SSW methodology section presents the design approach, introducing some considerations about the phenomena affecting the HCI process. The third section deals with the system architecture. The fourth section illustrates the annotation primitive operator. The fifth section describes the experiences gained on the field by illustrating several case studies: different scenarios are introduced in which experts have to afford complex problems (e.g. diagnoses, territorial portal organization, tourist guides organization, yard management) in a collaborative asynchronous way and using different devices (e.g. desktop PC, PDAs) to access their SSW from everywhere and in different working contexts. The implemented multimodal interactive environment permits experts to face the problems related to their activity, to update and manage a shared knowledge base and to adapt and evolve their virtual work environment by adding tools becoming unwitting programmer.

RELATED WORKS

The SSW methodology has been influenced by the work performed in EUD-Net, the network of Excellence on End-User Development (EUD), funded by the European Commission during 2002 and 2003 (http://giove.cnuce.cnr.it/eud-net.htm). The term EUD indicates the active participation of end users in the software development process: this can range from providing information about requirements, use cases, and tasks, including participatory design, to activities such as customization, tailoring, and co-evolution. A system acceptable by its users should have a gentle slope of complexity: this means that it should avoid big steps in complexity and keep a reasonable trade-off between ease-of-use and functional complexity. For example, systems might offer end users different levels of complexity in performing EUD activities, going from simply setting parameters, to integrating existing components, up to extending the system by developing new components (Myers, Smith, & Horn, 1992; Wulf and Golombek, 2001). The SSW methodology encompasses all the three levels of tailoring (customization, integration, and extension) proposed by Mørch (1997). It also takes into consideration the results in Mackay (1991) and in Nardi (1993), where empirical studies are