Chapter 7
Two Frameworks for the Adaptive Multimodal Presentation of Information

Yacine Bellik
Université d'Orsay, Paris-Sud, France

Christophe Jacquet
SUPELEC, France

Cyril Rousseau
Université d'Orsay, Paris-Sud, France

ABSTRACT

Our work aims at developing models and software tools that can exploit intelligently all modalities available to the system at a given moment, in order to communicate information to the user. In this chapter, we present the outcome of two research projects addressing this problem in two different areas: the first one is relative to the contextual presentation of information in a "classical" interaction situation, while the second one deals with the opportunistic presentation of information in an ambient environment. The first research work described in this chapter proposes a conceptual model for intelligent multimodal presentation of information. This model called WWHT is based on four concepts: "What," "Which," "How," and "Then." The first three concepts are about the initial presentation design while the last concept is relative to the presentation evolution. On the basis of this model, we present the ELOQUENCE software platform for the specification, the simulation and the execution of output multimodal systems. The second research work deals with the design of multimodal information systems in the framework of ambient intelligence. We propose an ubiquitous information system that is capable of providing personalized information to mobile users. Furthermore, we focus on multimodal information presentation. The proposed system architecture is based on KUP, an alternative to traditional software architecture models for human-computer interaction. The KUP model takes three logical entities into

DOI: 10.4018/978-1-60566-978-6.ch007

account: Knowledge, Users, and Presentation devices. It is accompanied by algorithms for choosing and instantiating dynamically interaction modalities. The model and the algorithms have been implemented within a platform called PRIAM (PResentation of Information in AMbient environment), with which we have performed experiments in pseudo-real scale. After comparing the results of both projects, we define the characteristics of an ideal multimodal output system and discuss some perspectives relative to the intelligent multimodal presentation of information.

INTRODUCTION

For a few years, access to computers has become possible to a large variety of users (kids, adolescents, adults, seniors, novices, experts, disabled people, etc.). At the same time, advances in the miniaturization of electronic components have allowed the development of a large variety of portable devices (laptops, mobile phones, portable media players, personnel digital assistants (PDA), etc.). New interaction situations have started to appear due to users' mobility enabled by this evolution. It is nowadays commonplace to make a phone call on the street, to work while commuting in public transportation, or to read e-mails at a fast-food. The interaction environment which was static and closed has become open and dynamic. This variety of users, systems and physical environments leads to a more complex interaction context. The interface has to adapt itself to preserve its utility and usability. Our work aims at exploiting the interaction richness allowed by multimodality as a means to adapt the interface to new interaction contexts. More precisely we focus on the output side of the interface. Our objective is to exploit intelligently all modalities available to the system at a given moment, to communicate information to the user. In this chapter, we start by presenting related work. Then we present a first framework which addresses the problem in a "classical" interaction situation. A second framework addresses the same problem in a different situation: ambient environments. After comparing the results of both projects we conclude by presenting some future research directions.

RELATED WORK

At first, multimodality was explored from the input side (user to system). The first multimodal interface was developed in 1980 by Richard Bolt (Bolt, 1980). He introduced the famous "*Put That There*" paradigm which showed some of the power of multimodal interaction. Research work on output multimodality is more recent (Elting, 2001-2003). Hence, the contextualization of interaction requires new concepts and new mechanisms to build multimodal presentations well adapted to the user, the system and the environment.

Output Multimodality Concepts

Presentation Means

When designing presentation as an output of a system, one has to choose which modalities will be used, and how they will convey information. The concept of *presentation means* represents the physical or logical system communication capacities. There are three types of presentation means: mode, modality and medium. Depending on authors, these three terms may have different meanings (Frohlich, 1991; Bernsen, 1994; Nigay, 1995; Bordegoni, 1997; Martin, 1998). In our case we adopt user-oriented definitions (Bellik, 1995; Teil, 2000). A mode refers to the human sensory system used to perceive a given presentation[1] (visual, auditory, tactile, etc.). A modality is defined by the information structure that is perceived by the user (text, ring, vibration, etc.) and not the structure used by the system[2]. Finally, a medium