Chapter X
Multi-Facet Design of Interactive Systems through Visual Languages

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ABSTRACT

In this chapter, it is recognized that the knowledge relevant to the design of an interactive system is distributed among several stakeholders: domain experts, software engineers, and human-computer interaction experts. Hence, the design of an interactive system is a multi-facet activity requiring the collaboration of experts from these communities. Each community describes an interactive system through visual sentences of a visual language (VL). A first VL allows domain experts to reason on the system usage in their specific activities. A second VL, the state-chart language, is used to specify the system behavior for software engineers’ purposes. A communication gap exists among the two communities in that domain experts do not understand software engineers jargon and vice versa. To overcome this gap, a third VL permits human-computer interaction experts to translate the user view of the system embedded in their visual language into a specification in the software engineering visual language.
INTRODUCTION

In this chapter, “visual language” (VL) denotes a language whose alphabet consists of visual entities, which can be combined to be used in communications among humans and in human reasoning (Bianchi, Bottini, Mussio, & Protti, 1993; Naranayan & Hubscher, 1998). Visual languages are seen as a means for communication, interaction, and reasoning in the design and use of visual interactive systems (VISs). VISs are designed to support users in performing their daily work and activities, not hindering them in doing their job and not requiring them to be aware of the complex hardware and software technology they are using (Buschmann, 2001). To reach this goal, the interaction style through which a VIS is used should fit the user culture and capabilities, the context of use, and the task being performed (Kuutti, 1995). Unluckily, a communication gap exists in that users do not understand designers and developers’ jargon and designers and developers in general do not understand the user jargon (Borchers, 2001; Lauesen, 2005; Majhew, 1992). Designers are often not aware of the gap and develop VIS interaction styles, which usually reflect their own culture, skills, and articulatory abilities rather than culture, skills, and articulatory abilities of the users. As a consequence, users are forced to adopt interaction styles that are different to their culture, and are often charged with housekeeping tasks in which they are not interested and divert their attention from the activity they are performing. The use of the VIS in the execution of real tasks may reveal difficult or impossible, and systems of great technological value have failed because of these hurdles (Carrara, Fogli, Fresta, & Mussio, 2002; Folmer, van Welie, & Bosch, 2005).

This chapter organizes some recent proposals to overcome the communication gap and to design usable interactive systems (Borchers, 2001; Costabile, Fogli, Mussio, & Piccinno, 2006a; Horrocks, 1998) into a unique frame. The frame explicitly recognizes the existence of different cultures and of the communication gap between the members of the communities of users and system designers. Moreover, it admits that the human-system interaction style must fit and enhance the user culture and capabilities. It also recognizes that to overcome the gap, the collaboration of experts of different cultures is necessary (Borchers, Fincher, Griffiths, Pemberton, & Siemon, 2001). Namely, software engineers have to collaborate with domain experts—representatives of the users—but in order to make it possible, the collaboration must be mediated by human-computer interaction (HCI) experts. The design and implementation of VISs is thus recognized as a complex activity, which requires collaborative and participatory approaches (Costabile et al., 2006a, Schuler & Namioka 1993). Being a complex activity, it requires more knowledge than any single member of the community of experts possesses because the knowledge relevant to the design problem is distributed among such experts (Arias, Eden, Fischer, Gorman, & Scharff, 2000). For this reason, design and implementation of a VIS have become a multi-facet activity, in that each expert is a stakeholder who evaluates the system and proposes solutions from his or her point of view, but discusses his or her insights with the other experts to reach a common agreed solution. This view results into an approach to VIS design based on the definition and use of three visual languages. Each VL permits to specify the process of user-system interaction from a different point of view and for a different audience. The pictorial parts of the three languages can be regarded as boundary objects (i.e., shared objects to talk about and to think with) (Arias et al., 2000, p. 87). Therefore, they are not independent: the system of three languages links the user views and jargons to the software engineer views and jargons and bridges the communication gap.

The first VL, the set VC of visual commands, is designed to specify the VIS to users and to allow them to reason on VIS usage. Its definition