Chapter 14

Programming a User Model with Data Gathered from a User Profile

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ABSTRACT

In order to prevent human error, it is essential to understand the nature of the user’s behaviour. This chapter proposes a combined approach to increase knowledge of user behaviour by instantiating a programmable user model with data gathered from a user profile. Together, the user profile and user model represent, respectively, the static and dynamic characteristics of user behaviour. Typically, user models have been employed by system designers to explore the user decision-making process and its implications, since user profiles do not account for the dynamic aspects of a user interaction. In this chapter, the user profile and model are employed to study human errors—supporting an investigation of the relationship between user errors and user characteristics. The chapter reviews the literature on user profiles and models and presents the proposed user profile and model. It concludes by discussing the application of the proposed approach in the context of electrical systems’ operation.

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INTRODUCTION

Traditionally, software design and development are focused on system features. More recently, design methods and processes have evolved in the pursuit of user satisfaction, resulting in user centred practices. These user-centred development practices consider the user characteristics and the context of use. In spite of the general acceptance of the relevance of user characteristics for design, there are no clear specifications on how to account for these.

Some user interface conception methods, such as: ADEPT (Markopoulos, Pycock, Wilson, & Johnson, 1992), TRIDENT (Bodart, Hennebert, Leheureux, & Vanderdonckt, 1994), and MCIE (Turnell, 2004) recommend the construction of a user profile and the modelling of the task as part of the requirement gathering phase; placing user profiles at the centre of the user interface conception process.

A user profile consists of a set of user characteristics such as: age, gender, user skills and knowledge, among others, that do not take into account the dynamics of the interaction between the user and system, nor the errors that might occur during this interaction. It is important to note that a static profile may be sufficient to support the conception of a variety of systems. For systems that require a high level of reliability and low level of error incidence, knowledge of the user behaviour becomes a key requirement for the interface design. Acquiring this knowledge requires a research foundation in areas such as ergonomics and psychology, as illustrated in the following brief literature review.

In ergonomics, work analysis (Guérin, Laville, Daniellou, Duraffourg, & Kerguelen, 2001) is employed to support the building of user cognitive behaviour models, such as those proposed by Leplat and Cuny (1977), Rasmussen, Pejtersen, and Goodstein (1994), and Card, Moran, and Newell (1983). In turn, the current understanding of user behaviour supports the study of the human error (Reason, 1990).

In cognitive psychology there are various studies that focus on building user models (Leuchter, Niessen, Eyferth, & Bierwagen, 1997; Niessen & Eyferth, 2001). These studies differ in purpose from the research reported here although they do share common objectives such as observing and understanding human behaviour during task activity. Some of the studies address the human behaviour from the task effort point of view, considering the mental and physical effort, psychological stress and time constraints involved when performing a task (Weinger, et al., 2000; Wiebe, Roberts, & Behrend, 2010; DiDomenico & Nussbaum, 2008). Others try to establish the workload as perceived by the user and through its relation with parameters of the Autonomic Nervous System (ANS) (Kreibig, 2010). Yet other authors address the relationship between human behaviour and the body’s physiological reactions (Huey & Wickens, 1993; Wittmann & Paulus, 2007; Baldauf, Brugard, & Wittmann, 2009). Finally, Tenenbaum and Connolly (2008) and Jung and Jung (2001) proposed models based on the NASA model Task Load Index (TLX), with similar objectives.

As previously stated, an important step in the user centred design approach consists of understanding the two-fold implications of the user-system interaction. In this investigation programmable user models, through simulations, are used to reach this goal.

According to Niessen, Leuchter, and Eyferth (1998), if the programmable user model has psychological assumptions built-in, it is possible to:

- Arrive at a more explicit and detailed description of the cognitive process during interaction than would be possible with a textual description;
- Explore a theoretical framework by reproducing anticipated effects of the user behaviour;
- Extract hypothesis from empirical work;
- Anticipate and analyze, the effect of technological changes on interaction with a
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