Chapter 3
A Multi-Disciplinary Strategy for Identifying Affective Usability Aspects in Educational Geosimulation Systems

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ABSTRACT

In this article we propose a multi-disciplinary strategy for identifying affective usability design aspects in educational geosimulation systems. It is based on the association of these aspects with an architecture that defines the basic components of a geosimulation system as well as the learning strategies used in this context. Our goal is to provide design strategies that might elicit positive emotional responses from the students in learning experiences. We illustrate how these strategies have been used in a learning system by evaluating the students' emotional responses evoked during their interaction with the system.

INTRODUCTION

The human computer interface (HCI) field has often attracted considerable attention from academia and industry, and particularly the use of concepts such as usability and adaptation during software design as a salient factor for obtaining more usable systems. Traditionally, the usability of a developed system has been evaluated to assure both its effectiveness (such as the number of successful task completions) and efficiency (such as the time required to complete an interactive task). Recently, these assumptions have been revisited and broadened to embed the concepts of the affective quality theories. Affective quality is related to the users' emotional responses (such as the affect, activity, and attitude) in regard to the system that they are experiencing (Chorianopoulos & Spinellis, 2006).

We claim that the affective aspect (such as users' feeling states and their involvement with the content) is particularly relevant in the context of educational systems, since learning strongly depends on how synergistic the relationship between teacher and student is. So, the affective dimension of the user interfaces of an educational system is an issue to be considered. In other words, it is important to identify the ways in which the interactive objects of an educational system's user interfaces can be perceived by the students when manipulating, creating, visualizing, or controlling these objects in their learning experiences. In this text, these perceived ways (how the student was persuaded to do something) are evoked by affective usability design aspects that are techniques (such as persuasive techniques and personalization) and characteristics (about the look, sound, and feel) applied to the user interfaces.

Despite the aforementioned advance in HCI, affective usability aspects are still not taken into account in the interaction design of educational systems. The reasons can be the following: There is not yet a strategy that shows how the integration of usability and affective quality concepts can be done with learning strategies and how such integration can be useful to evaluate the users' satisfaction in learning experiences.

This situation can be even worse if the educational system involves complex phenomena in urban centers, whereby the interaction with geographical information is intense. In many cases, these systems are based on the combined use of Geographical Information Systems (GIS) with multiagents for simulation of social or urban environments, which characterizes a geosimulation (Benenson & Torrens, 2004) and (Billari & Prskawetz, 2003). In educational agent-based simulation systems, intelligent agents support the interaction between the simulation model and the user (Gibbons, et al., 2001). Simulation aims to represent one phenomenon via another. In educational terms, simulation is important because it allows learning through the possibility of doing (Piaget, 1976). On the other hand, social or urban environments are dynamic, nonlinear, and made of a great number of interacting entities, characterizing a complex system (Wu, 2002). Interactive aspects in these systems (such as precision and realism in simulations) can evoke different emotions from students.

In this article, we propose a multi-disciplinary strategy for associating the concepts of usability, computer education, and affective quality. In this strategy, the interaction between student and teacher is analyzed under the light of learning strategies used in educational geosimulators for defining the main emotional constructs that are involved in this process. This strategy is composed of a set of steps to be followed by developers interested in defining the affective usability design aspects that an interactive educational system must have in order to evoke students' emotional responses in learning experiences. In addition, it is useful to professionals (such as teachers and designers) interested in evaluating the students' satisfaction using an interactive system. We also present, in the final part of the paper, how we evaluated students' emotional responses in learning experiences by affective levels. For this we used an already-deployed system for training police officers.

THE MULTI-DISCIPLINARY STRATEGY

Figure 1 illustrates the multi-disciplinary strategy we developed to generate a conceptual framework from education, user interaction, and affective quality theories. The framework refers to the association of affective usability design aspects with learning strategies by affective levels. This strategy is composed of three steps. First of all, we identify the learning strategies supported by educational geosimulation systems. Afterward, we analyze the possible emotional responses of affect, activity, and attitude that the stu-