Chapter 15
Affective E-Learning System:
Analysis of Learners' State

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ABSTRACT

Learning systems provide adaptation to the learners' preferences without taking under consideration the learners' current status. The more a learning system exchanges relevant fragments of information about the learner's affective status the more it adapts to it. Following this direction, we propose an integrated learning system taking under consideration learners' emotional state in order to provide a personalized e-learning system. An extended version of the IEEE Reference Model (WG) LTSA (IEEE 2003) is used for this purpose. The proposed approach is based on the automatic analysis of the learners' emotional state providing different learners' profiles which are built and maintained by "observing" each learner behavior. As a learner is strongly positively affected to the learning procedure in the presence of an agent, the proposed system has adopted an expressive ECA (Embodied Conversational Agent) which is adapted to the learner's emotional states in the duration of the learning procedure.

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INTRODUCTION

Nowadays, it is widely accepted that information technology improves the learning experience. Learning methods are becoming more and more portable, flexible, and adaptive. The WWW has been broadly adopted as a medium for network-enabled transfer of skills, information and knowledge and plays a significant role in all fields of education (Commission of European Communities, 2000). Web-oriented applications try to satisfy current educational needs, closing the gap between traditional educational techniques and future trends in technology-blended education. Towards this goal, various e-learning systems have been developed missing functionalities like educational multimedia environments, personalized capabilities and tracking of learners' input and relevance feedback (Karagiannidis, 2002). Though, tracking and grasping user behavior in real time remains the most challenging task to retrieve an appropriate and fine-grained user profile as well as to provide personalized learning content.

In this direction, we have adopted the IEEE Reference Model (WG) of the Learning Technology Standards Committee and especially an extension of it. In particular, this extension includes an analysis of learners' state as well as a profiling procedure. Moreover, concerning learner's emotional state, human computer interaction techniques are being employed. Sometimes, a simple facial expression or hand gesture, such as placing a person's hands over his ears, can pass on the message that he has had enough of what he is hearing; this is conveyed more expressively than with any other spoken phrase.

On one hand, application design must take into account the ability of humans to provide multimodal input to computers, thus moving away from the monolithic window-mouse-pointer interface paradigm and utilizing more intuitive concepts, closer to human niches (Jaimes, 2006; Petland, 2005). A large part of this naturalistic interaction concept is expressivity (Picard, 2000), both in terms of interpreting the reaction of the user to a particular event or taking into account their emotional state and adapting learning procedure to it, even for less technology-savvy users.

Since the early 1970s, Paul Ekman and his colleagues have performed extensive studies of human facial expressions. They found evidence to support universality in facial expressions. These "universal facial expressions" are those representing happiness, sadness, anger, fear, surprise, and disgust. They studied facial expressions in different cultures, including preliterate cultures, and found much commonality in the expression and recognition of emotions on the face. However, they observed differences in expressions as well, and proposed that facial expressions are governed by "display rules" in different social contexts. Additionally, the vocal aspect of a communicative message carries various kinds of information. If we disregard the manner in which the message was spoken and consider the verbal part (e.g., words) only, we might miss the important aspects of the pertinent utterance and we might even completely misunderstand what was the meaning of the message. Nevertheless, in contrast to spoken language processing, which has recently witnessed significant advances, the processing of emotional speech has not been widely explored. Finally, emotion consists of more than outward physical expression; it also consists of internal feelings and thoughts, as well as other internal processes of which the person having the emotion may not be aware. Still, these physiological processes can be naturally recognized by people. A stranger shaking your hand can feel its clamminess (related to skin conductivity); a friend leaning next to you may sense your heart pounding, etc.

On the other hand, the captivating presence of the agents can motivate learners to interact more frequently with agent-based educational software (Raouzaiou, 2002). To design the most effective agent-based learning environment, it is essential to understand how students perceive an animated pedagogical agent with regard to