Chapter III
Design and Evaluation of Animated Pedagogical Agents

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ABSTRACT

The area of animated pedagogical agents is related to the development of applications that aim to improve the human-computer interaction process using software agents represented by characters or human figures. Several projects are being developed in this area, and one of their concerns is the “illusion of life” effect. In order to reach the believability needed for promoting the “illusion of life,” it is important that researches be concerned with two main aspects during projects of animated pedagogical agents: the design aspect and the evaluation aspect. In this chapter, we will discuss basic guidelines for animated pedagogical agents design, and an evaluation method based on concepts provided by computer in education (CE), artificial intelligence (AI), and human-computer interaction (HCI), in order to help CE and AI researchers (to project and to develop pedagogical agents that can enhance human-agent usability) and HCI researchers and teachers (to evaluate these agents).

INTRODUCTION

The area of animated pedagogical agents is related to the development of applications that aim to improve the human-computer interaction process using software agents represented by characters or human figures. These agents have a special purpose due to their capability to help students during the execution of their tasks, giving tips and affective answers that are suitable for the learning experiences.

Several projects are being developed in this area (Ball, Linf, Kurlander, Miller, Pugh, Skelly, et al., 1997; Biswas, Leelawong, Schwartz, & Vye, 2005; Gerbhard, Kipp, Klesen, & Rist, 2003; Hayes-Roth & Doyle, 1998; Klesen, 2005; Koda,
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1996; Paiva, Dias, Sobral, Aylett, Woods, Hall, & Zoll, 2005), and one of their concerns is what Bates (1992) calls “illusion of life,” that is, animated characters have lifelike and readable behaviors in such a manner as to support an audience in suspending disbelief about their capabilities. It is not necessary that agents be intelligent, they have to seem intelligent (Bates, 1992). According to Reeves and Nass (1996), people apply social roles to computers even when they do not have an explicit anthropomorphic interface. So, the agents’ illusion of life could have a positive effect in learning experiences.

In order to reach the believability needed for promoting the “illusion of life” effect, it is important that researches be concerned with two main aspects during projects of animated pedagogical agents: the design aspect and the evaluation aspect.

Considering the design aspect, some authors, such as Ruttkay et al. (Ruttkay, Dormann, & Noot, 2004), Hayes-Roth (2003), Hayes-Roth et al. (Hayes-Roth, Maldonado, & Moraes, 2002), Johnson et al. (Johnson, Rickel, & Lester, 2000), Lester et al. (Lester, Sharolyn, Kahler, Barlow, Stone, & Bhoga, 1997), and Mateas (1997), are working on a set of requirements and qualities that ought to be considered during the design and development phases of an animated pedagogical agents project. Hayes-Roth et al. (2002) advise that agent design should expand its individual variability focus to include pursuits of cultural variability. In this sense, when designing animated agents, researchers ought to consider some key characteristic qualities such as identity, backstory, appearance, content of speech, manner of speaking, manner of gesturing, emotional dynamics, social interaction patterns, role, and role dynamics. All these qualities have to be treated with special care, when animated pedagogical agents are being designed. Besides, there are aspects related to pedagogical software design that should also be considered. Agents’ behaviors ought to be developed in order to motivate the learner to interact with the educational environment, and this interaction has to focus on the pedagogical contents and activities and not on agents’ animations.

Considering the evaluation aspect, although several projects are being developed in this area, there is not a suitable evaluation criterion for animated agents (Isbister & Doyle, 2004) in general, and animated pedagogical agents in particular. Koda (1996), Ball et al. (1997), Mulken et al. (Mulken, André, & Müller, 1998) and Craig et al. (Craig, Glohson, & Driscoll, 2002) have done some evaluations, but their evaluations focused on the impact of animated agents in users’ motivation and anxiety during the use of a computer program. Hayes-Roth and Doyle (1998), Hayes-Roth et al. (2002), Lester et al. (1997) and Johnson et al. (2000) have raised some considerations about animated agent evaluations focusing on the domain aspects incorporated in the agents. The evaluations of Hartmann et al. (Hartmann, Mancini, Buisine, & Pelachaud, 2005) focus the agent gesture model of expressiveness and Prendinger et al. (Prendinger, Ma, Yingzi, Kazutaka, & Ishizuka, 2005) analyses the user focus of attention.

In this way, here we will discuss basic guidelines for animated pedagogical agents design and an evaluation method based on concepts provided by computer education (CE), artificial intelligence (AI) and human-computer interaction (HCI), in order to help CE and AI researchers (to project and to develop pedagogical agents that can enhance human-agent usability) and HCI researchers and teachers (to evaluate these agents).

This chapter is organized in the following way. The section Background presents the necessary knowledge to demonstrate the state of the art in animated pedagogical agent design and evaluation, and serve as a reference to base our proposal guidelines and evaluation method. The section Motivation discusses the issues, limitations, and problems in the area that motivate our proposal. The section Designing Animated Pedagogical Agents presents our proposed guidelines. Section
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