Chapter 3.6

Design and Evaluation of Embodied Conversational Agents for Educational and Advisory Software

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ABSTRACT

Embodied conversational agents may take on a diversity of roles in learning and advisory scenarios including virtual teachers, advisors, learning companions, and autonomous actors in educational role play. They promote learner motivation, engagement, and self-confidence, and may help prevent and overcome negative affective states of learners, such as frustration and fear of failure. The chapter will provide guidelines and approved methods for the development of animated pedagogical agents including the extraction of multimodal tutorial strategies from human-human teaching dialogues as well as the simulation and evaluation of such strategies in computer-mediated learning environments.

INTRODUCTION

The objective to develop more human-centered, personalized and at the same time, more engaging speech-based interactive systems immediately leads to the metaphor of an embodied conversational agent (ECA) that employs gestures, mimics, and speech to communicate with the human user. During the last decade research groups as well as a number of commercial software developers have started to deploy embodied conversational characters in the user interface, especially in those application areas where a close emulation

of multimodal human-human communication is needed. In this chapter, the potential of embodied conversational agents for educational software is investigated. In addition, advisory software is discussed, but restricted to applications which aim at achieving a change in people's behavior as, for example, health advisors.

Embodied conversational agents bear the advantage that they enable rich multimodal interactions with learners by employing gestures, mimics, and speech to communicate with the human user. The most obvious role of an embodied conversational agent in educational software is that of a virtual teacher. There is empirical evidence that pedagogical agents lead to an improved perception of the learning task and help to engage learners (see Mulken, André, & Müller, 1998). They promote learner motivation, engagement, and self-confidence, and may help prevent and overcome negative affective states of learners, such as frustration and fear of failure. An interesting variant of a conversational agent in a learning scenario is that of a learning companion. Learning companions ensure the availability of a collaborator and may increase the students' engagement in a task (see Craig, et al., 1999). They provide an interesting new training tool since it would be impossible to create a real classroom setting for individual students that fosters their learning progress best. Educational role-play promotes learning by enabling a learner to actively participate in a drama-based environment. It provides the student with a safe environment for experimental learning and can make learning a more engaging and enjoyable experience.

This chapter will provide guidelines and approved methods for the development of animated pedagogical agents including the extraction of multimodal tutorial strategies from human-human teaching dialogues as well as the simulation and evaluation of such strategies in computer-mediated learning environments. The second section will present prominent educational environments that make use of a diversity of embodied conversational agents including pedagogical agents, virtual helpers, and actors in educational drama. In the third section, empirical studies that investigate the potential benefits of embodied conversational agents for educational or advisory software are reported on. After that, the design and implementation of pedagogical agents are addressed. In the fourth section, how to make use of multimodal corpora to guide the design of tutoring agents is explained. The fifth section describes how to realize different educational settings ranging from face-to-face communication with a single pedagogical agent to educational role play with several autonomous actors. In the sixth section, technology that is used to enable the user to engage in multimodal dialogue with the tutoring system is reported on. First attempts towards the development of perceptive agents which are able to perceive and interpret communicative signals from the learner, for example, to monitor his or her level of interest, are also reported on. The seventh section provides an overview of techniques to recognize the user's emotional state and to respond to it accordingly. How to use affective non-verbal signals, such as facial expressions and mimics, to provide pedagogically effective and conversationally appropriate responses to contributions received from the students, are discussed. Embodied conversational agents in learning environments need a great deal of social competence that manifests itself in a number of different abilities. In the eighth section, various attempts to enhance pedagogical agents by social competence including the use of strategies of politeness and relational strategies are reported on. The ninth section sketches some future research trends.

Roles of Embodied Conversational Agents in Educational and Advisory Software

There is growing number of learning environments that make use of embodied conversational agents. In the following, some prominent examples are

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