EVALUATION OF A SPEECH-DRIVEN, ANTHROPOMORPHIC AGENT IN THE INTERFACE OF A WEB-BASED INTELLIGENT TUTORING SYSTEM

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Abstract — This paper describes the evaluation of a speech-driven anthropomorphic agent that has been embodied in the interface of an Intelligent Tutoring System (ITS). The agent was evaluated during an experiment in terms of the effect that it could have on students' learning and motivation. The participants in the experiment were divided into two groups: half of them worked with a version of the ITS which embodied the agent and the rest worked with an agent-less version. The results from this study seem to confirm the hypothesis that a pedagogical agent incorporated in an ITS can enhance students' learning and motivation.

Index Terms — Intelligent Tutoring System, pedagogical agents.

OVERVIEW

In this paper we are presenting the evaluation of a speech-driven anthropomorphic agent that has been embodied in the interface of an ITS. The agent was evaluated during an experiment in terms of the effect that it could have on students' learning and motivation. The learning environment used as a testbed in this experiment is an ITS generated by WEAR, a Web-based authoring tool for the construction of ITSs in Algebra related domains, such as physics, economics, etc. [2]. WEAR's student interface uses a talking head [3]. This speech-driven agent is responsible for guiding students to the environment and providing feedback messages to them while they are solving problems. The talking head component of the system uses speech synthesis to automatically produce speech output from text using MBROLA, a freely available speech synthesiser.

Animated characters have often been used in the interfaces of systems. Such an interface makes a system more appealing and attractive to the user. Especially, in an educational application it may also promote the learning objectives. Previous studies have revealed the persona effect, which is that "the presence of a lifelike character in an interactive learning environment – even one that is not expressive – can have a strong positive effect on student's perception of the learning experience" [1]. Our aim in this study described here was to verify the validity of those promising findings in the case of WEAR too.

The participants in the experiment were 19 college students from the University of Piraeus. Twelve of them were studying Informatics and the rest Economics. The students were randomly divided into two groups: the Agent group (group A) consisting of 10 subjects and the Non-Agent group (group NA) consisting of 9 subjects. Both groups participated in the experiment in the same way. The difference between them was the version of the ITS they interacted with: the version used by group A embodied the talking head, whereas group NA worked with an agent-less version. To be able to explore the agent's effect on students' learning, the information that both versions of the ITS passed to students (feedback messages, guidance to the environment, etc.) was completely identical. To generate the ITS that we used as testbed, we fed WEAR with several math problems. The experiment started with a pre-test, consisting of five problems. After completing the pre-test, the students worked with the system to solve similar problems with respect to their difficulty level. While working with the system, the students' actions were logged. The post-test that followed consisted again of five similar problems. Students were finally asked to complete a questionnaire concerning their experience from interacting with the system.

When comparing the pre-and post-tests results we came up with the following findings: Both groups scored similarly in the pre-test and needed about the same time to complete it. In addition, both groups improved their time and scores in the post-test. However, their improvement differed a lot. In average group A spent 27% less time to complete the post-test and achieved 15% higher grade than the pre-test. In contrast to group A, the improvement of group NA's average time and grade was 14% and 4% respectively. In addition, group A spent more time working with the system, and they enjoyed it more than group NA. As for the usability of the system, group A found it easier to use than group NA.

The results from this study seem to be in favor of the agent version of the system since students belonging to group A did better in the post-test, spent more time with the system and gave higher rates to it in the questionnaire. In other words, the hypothesis that a pedagogical agent incorporated in an ITS can enhance students' learning and motivation seems to be confirmed in our case study.

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