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Effective Tutoring with Affective Embodied Conversational Agents

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Abstract. This PhD project aims to investigate the impact of affective embodied conversational agents (ECAs) on the learning of pupils. Based on the idea that there is a link between emotions and learning, we are developing an affective tutoring system in two domains: Information Technology and Business Studies. We will evaluate the system in a classroom setting over several weeks, with each student being assigned to one of the following two conditions: ECA with cognitive strategy only versus ECA with combined affective and cognitive strategy.

Keywords. Feedback, Affect, Embodied Conversational Agents

Introduction

We are investigating the use of Embodied Conversational Agents (ECAs) as tutoring systems. Extensive research has led to some progress in this field by identifying motivational gains [1], although further research is required to establish the impact of these gains on pupil learning outcomes where agent intervention is over several weeks [2]. We are particularly interested in determining whether ECAs that employ affective strategies [3] can have a positive effect on learning outcomes when used over longer periods of time, and, if so, what factors may influence the positive impact.

1. Problem Domain

We are developing an ECA that is intended for use with 13-15 year old pupils in a UK school who are studying materials in one of two domains: Information Technology or Business Studies. The system allows the students to rehearse the course materials by taking quizzes at various levels of difficulty. The ECA guides the student through the quizzes and provides both verbal and non-verbal feedback, with the non-verbal feedback consisting of gestures, changes of posture and facial expressions.

2. Aims & Objectives

The aim of our research is to establish whether ECAs that use an affective strategy for teaching [4] (i.e., taking into account the student's emotional state obtained from self-

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report buttons labeled with a range of affective states including excitement, frustration and confusion [5]) can have a positive impact on student learning when used over a longer period of time, and whether there are any factors that may influence this impact.

3. Methodology

To achieve the aim we are developing an affective ECA, drawing on work in the Natural Language Generation (NLG) community and research on Multimodal Generation. The affective ECA will integrate verbal and non-verbal communication into adaptive feedback given to users completing questions in a quiz [5]. We will carry out a pilot study followed by a more extensive main study in order to investigate whether affective ECAs are effective as tutoring systems. The main independent variable that will be manipulated in both studies is the nature of the pedagogical strategies employed by the ECA tutoring system: either strictly cognitive or both cognitive and affective. We intend to determine whether a combined affective and cognitive strategy can lead to improved learning outcomes. The pilot study will also serve to identify any factors that may interact with the use of an affective strategy (e.g., pupil gender or ability). Such factors will be studied more extensively and systematically in the main study. We will measure differences between the two conditions using various instruments including pre and post learning tests and student interviews.

4. Contribution to Research

This research will result in a systematic comparison between purely cognitive and combined cognitive/affective pedagogical strategies for ECAs as tutoring systems. The empirical studies that we will carry out will look at long term repeated use of ECAs in a formal educational setting (as opposed to short term studies which are often limited to one or more sessions on a single day). The research aims to uncover new insights into the factors that influence effectiveness of affective embodied pedagogical agents, thus yielding helpful guidelines for future educational applications of ECAs.

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