

Let’s Go for a Treasure Hunt

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Abstract. This paper presents a study designed to explore the effect of feedback on perception of an embodied agent as well as the overall performance and experience of primary school children aged 12-13 carrying out a treasure hunt activity. We use an embodied agent to compare three experimental conditions: no feedback, neutral feedback, and affective feedback. What the students think about the embodied agent and how they feel about the task under the different conditions will be elicited through a questionnaire upon completion of the treasure hunt activity. Moreover, how each condition affects the students’ performance will be analysed.

1 Introduction

Emotions play an important role in human-human interaction [1]. Agents that exhibit human-like emotions have now become a commonplace in the domain of human-computer interaction. Starting from the pioneering work of [2] and [3], emotional agents now exist in various applications to serve different purposes including but not limited to military [4], health [5], commerce [6], tourism [7], video games [8] and education [9, 10, 11, 12]. In education, emotional expressions have been incorporated into embodied teaching agents with the aim of improving learning experience in users. Although inclusion of emotional expressions into virtual tutors rarely lead to negative interaction, positive effect was not always achieved on learning experience [13]. This might be due to the fact that learning task requires concentration and if an agent offers assistance at inappropriate time, the result is more of a distraction than facilitation.

It is essential that we understand the impact of emotions in embodied agents upon users in order to establish a successful agent-human interaction. In order to investigate the impact of emotional expressions on users’ learning experience, it is not sufficient to simply ask whether emotional agents are better or worse than unemotional agents [14]. The more relevant issues are: (1) what kind of emotional expression has an effect on users; (2) what elements of the user’s attitude and/or performance are affected; and (3) what is the impact of different forms of emotional expression. In this paper, we present an experiment to investigate how feedback—none, neutral, or affective—affects a child’s perception, experience and performance in a real-world treasure hunt activity. This work takes

place in the context of the EU project EMOTE¹ (EMbOded-perceptive Tutors for Empathy-based learning) which aims to develop virtual tutors that have the perceptive and expressive capabilities to engage in empathic interactions with learners in school environments, grounded in psychological theories of emotion in social interaction and pedagogical models for learning facilitation.

2 The Treasure Hunt

2.1 The Experiment

The treasure hunt activity requires a child to apply his/her map reading skills and is aimed at primary school children aged 12-13. There will be three experimental conditions: no feedback, neutral feedback and affective feedback. In the no feedback condition, students will be given paper maps and instructions, and will not interact with an embodied agent at all during the treasure hunt. In the other two conditions, students will be given Android tablets running an application which displays a digital version of the paper map, along with an embodied agent which will present the instructions and pose the questions. This agent will also provide the students with feedback on the correctness of their answers to the questions posed during the treasure hunt; depending on the experimental condition, the feedback will be either neutral or affective.

In total, 36 students will participate in this study. They will carry out the treasure hunt in pairs, resulting in 6 groups per condition. Prior to the treasure hunt, all students will have a short interactive session with a robot called Susie. The robot will introduce the treasure hunt and conduct a short question and answer session to check the students' readiness for the activity. The robot will be controlled by a wizard in the neighbouring room, and will therefore be capable of taking a few questions from the students if necessary. The main aim of this session is to allow the students to interact and familiarise themselves with the robot, which will then appear as an embodied virtual agent on the tablet for the feedback conditions.

2.2 Objectives

Through this treasure hunt activity, we would like to explore the effect of feedback on the students' perception of an embodied agent as well as their overall experience and performance in carrying out the task at hand. Applying the two-tiered method for evaluating affective interfaces [15], we start by verifying that the students notice the expression or non-expression of emotions and that the perceived emotions are those we intended the agent to portray. Failing to effectively interpret the emotional expressions of the agent will lower the validity of our study as it would be unclear that any effects found are due to the manipulation of emotional expression. In this study we restrict the emotional display to

¹ <http://www.emote-project.eu/>

only three basic expressions (neutral, happy and sad) to ensure that the children understand the affective information being communicated.

The feedback includes both emotional facial expressions and utterances. In the affective condition, a happy expression will be displayed accompanied by utterances such as “brilliant, very good, fantastic” when students answer a question correctly, while a sad expression will be displayed accompanied by utterances such as “Oh no, I’m sorry” when they answer incorrectly; in the latter case, the correct answer will also be provided. In the neutral condition, the agent will always display a neutral expression and reply with “correct” or “incorrect” utterances. Figure 1 shows the three expressions used in this study.



Fig. 1. Neutral, Happy and Sad Expressions

Upon verifying the ability of the students in interpreting the emotional expressions correctly, we would then like to find out how different types of feedback affect the students’ interaction with the agent. In other words, if an agent praises a child when they make good progress, how does this affect the child? Hence, we seek the answers to the following questions:

- Is the affective agent being perceived as more friendly, kind, pleasant and helpful?
- Does affective feedback make them enjoy the interaction more?
- Does affective feedback improve their performance?
- Is the neutral agent more reassuring?
- Which version of the agent is rated more highly by the students as an interaction partner?
- Does the agent—whether neutral or affective—actually help the students in task performance?
- Is there a difference between boys and girls perception of the agent—neutral or affective?

2.3 Treasure Hunt Application

We have designed and implemented a treasure hunt Android application for the above study. In order to compare the three experimental conditions, we have kept the features of the application to be as close to the paper version as possible, except for the addition of the embodied character Susie. All images, fonts and

layout are comparable between the two versions. The application (Figure 2) displays a map corresponding to its paper counterpart (Figure 3) and presents a sequence of the same steps as in the paper version to be carried out by the students.

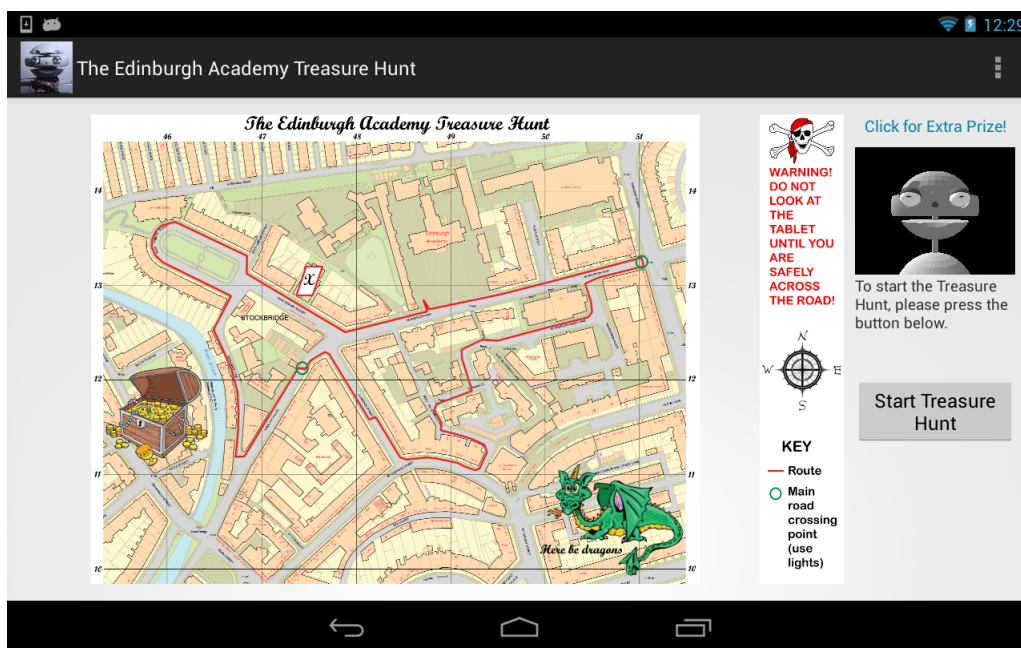


Fig. 2. The Treasure Hunt Application Start Screen

As the screen of the tablet is smaller than a piece of A4-size paper, the map comes with a drag and zoom functionalities to enable the students to explore it as they would with the paper version; note that the map cannot be zoomed to larger than 100% its actual size. Each step starts with the virtual character presenting a task and questions to the user through speech. Subtitles are displayed on screen in case the students missed what Susie was saying, and the students can also replay the speech at any point if necessary. Each task requires the students to walk a few yards making use of their map skills. At the end of each walk, the students have to confirm their arrival.

The system will then re-present relevant questions related to the task with multiple choice answers and the students are required to select an answer from the given choices (Figure 4). Depending on whether the answer is correct or not, the system responds with appropriate feedback—neutral or affective. In the paper version, the students are also presented with multiple choice answers of which they have to circle the correct one. In both the paper and the tablet conditions, the students are also given a chance to win extra prizes by answering

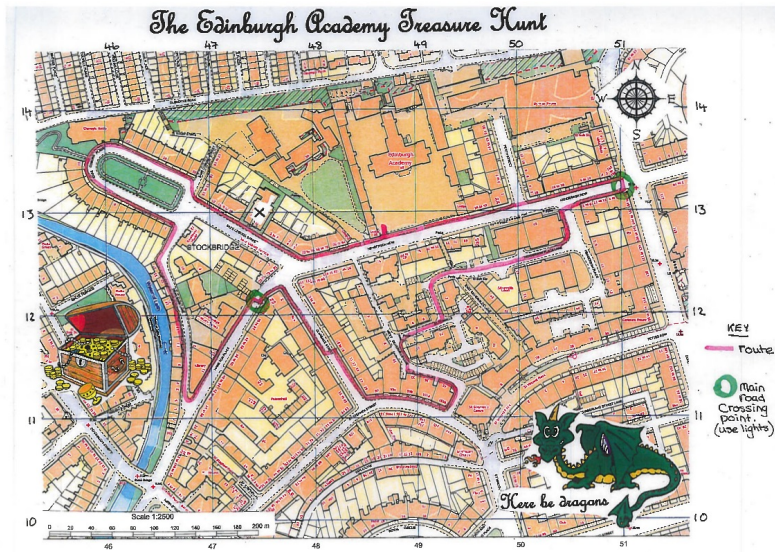


Fig. 3. The Paper Map

additional questions at the top of the paper questionnaire or through an ‘Extra Prize’ link on the top right corner of the tablet screen.

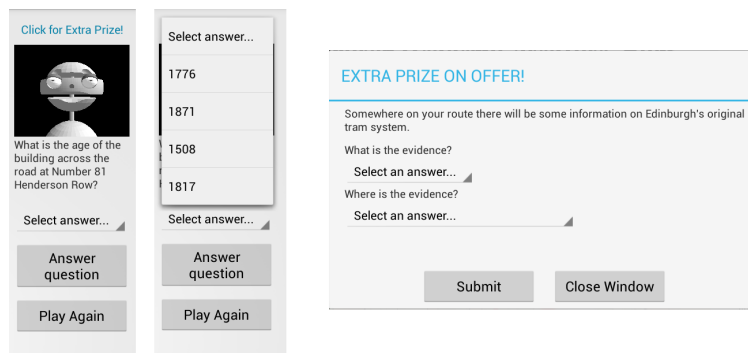


Fig. 4. Question and Answer Interface; The Extra Prize Dialog Box

2.4 Data Collection

Following the treasure hunt, the students will answer a short questionnaire. It focuses specifically on the children’s perception of the embodied agent and their

overall experience of the treasure hunt activity, applying the combination of Godspeed likeability items [16] and the Smileyometer, an instrument used to measure enjoyment and fun [17] aiming to make the task of answering the questionnaire more interesting for the target group. The Smileyometer uses pictorial representations of different kinds of happy faces to depict the diverse level of satisfaction according to 5-point Likert scale as shown in Figure 5.

The treasure hunt was ...



Fig. 5. Example Question with the Smileyometer

During the treasure hunt, as the students complete each task and answer a question in the tablet conditions, the information is logged. The information stored includes a timestamp of task completion, the task ID, the student's answer as well as the agent's feedback, enabling the teachers to discuss the students' performance when they are back in the classroom. Additionally, time stamped GPS data is also collected for all participants including those who carry out the treasure hunt on paper. This is done by running a GPS logging application on a mobile phone attached to the clipboard they are carrying. The time stamped GPS data will allow us to investigate how the use of technology in comparison to paper based version affected the overall experience and timing of solving the map reading task in addition to investigating how the use of affective and non-affective feedback strategies affected the interactions on the tablet.

3 Conclusion and Future Work

The study is scheduled for the third week of June 2014. By the time of this workshop we will have analysed and deduced reasonable answers to our research questions in section 2.2 which hopefully will provide insights to our future design of an empathic tutor.

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