A Treasure Hunt With An Empathic Virtual Tutor (Demonstration)

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ABSTRACT

We present a demonstration of a Treasure Hunt Application with an Empathic Virtual Tutor. During the treasure hunt, this empathic agent adapts its interaction based on the affective state of the user to improve learning experience. We demonstrate the application domain; the technology used; and the app focusing on the empathic strategies applied.

Keywords

Treasure Hunt; Empathic Agent; Arousal; Valence; Human-Agent Interaction

1. INTRODUCTION

A central concept in learning is empathy and emotion. Emotions are a part of human essence [2]. On the other hand, empathy is often seen as the capability for perceiving, understanding and experiencing another person's emotions [3]. For empathy to occur in learning, a tutor needs to be able to perceive, model and reason about the affective state experienced by learners and consequently adapt its interaction accordingly [1].

In this demonstration, we present a Treasure Hunt Application (THA) developed for the Heriot-Watt University (HWU) Edinburgh campus[1] with a Halloween Theme, initially based on a local school's annual treasure hunt activity, which forms part of the Geography curriculum [4]. A user has to apply his/her map reading skills while following clues presented by an empathic virtual agent called Emys, to unlock Halloween related treasures (please refer to Figure 2). During the quest, Emys offers advice under different circumstances and these interventions are adapted based on the user's affect determined by valence and arousal [6].

2. TECHNOLOGY USED

The original THA was developed to run on Android tablets for outdoor environment with GPS tracking. However, for the purpose of this demonstration, a Samsung SIII phone and NFC technology [7] are used as shown in Figure 1.

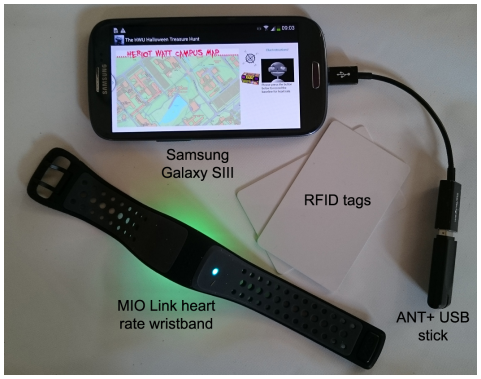

Figure 1: The THA Components

Each treasure point has been replaced by a passive RFID [5] tag which will be picked up by the mobile phone as it is being moved along the paper map. To estimate the user's arousal, his/her heart rate is monitored using a MIO Link heart rate sensor[2]. ANT+[3] device profile is used for sending data between the sensor and the app. Emys voice is from Cereproc[4].

This interactive demo will allow attendees (one user at a time) to try out the treasure hunt by moving the mobile phone on the paper map and tapping on the correct treasure point which is analogous to moving in the real environment. Meanwhile his/her heart rate (which changes as he/she carries out some physical activities) and performance in navigating and unlocking treasures will be monitored so that Emys can offer appropriate advice when necessary (please refer to Section 3.1 for the empathic strategies).

3. THE TREASURE HUNT APPLICATION

The THA displays the empathic agent, Emys; a compass; and a digital map of HWU Edinburgh campus. At each step, Emys presents the directional information and clues to

[1]http://www.hw.ac.uk/student-life/campus-life/edinburgh.htm

[2]http://www.mioglobal.com/en-uk/Mio-Link-heart-rate-monitor-wristband/Product.aspx

[3]https://www.thisisant.com/developer/ant-plus/ant-plus-basics

[4]https://www.cereproc.com/

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a treasure. While the user is on the quest, interventions can occur under 5 circumstances: 1) after a clue has been presented and the user does not start moving - assumes that the user is confused; 2) when the user heads in the wrong direction; 3) when the user has passed the destination; 4) when the user is at the destination but does not start answering questions - assumes that the user can't find the treasure; and 5) when the user thinks s/he is at the destination but is actually not.

When the user thinks s/he has found a treasure, s/he has to press the "Got there!" button shown in Figure 2. Emys either confirms by posing questions related to the newly found treasure or intervenes by telling the user that s/he is not at the destination yet. Emys also provides the user with feedback on the correctness of answers to the questions. Treasures will appear on screen when the user answers all questions correctly.

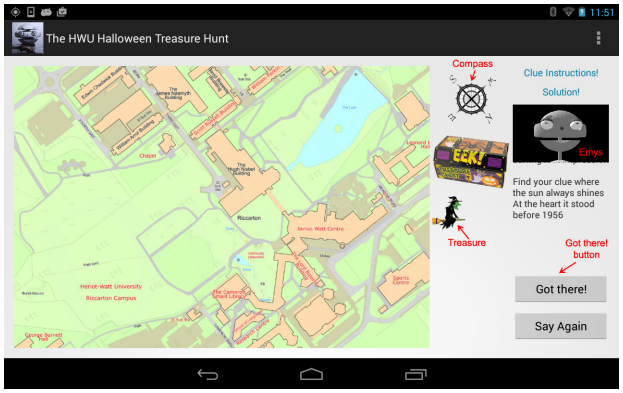

Figure 2: The THA User Interface

3.1 Empathic strategies

Arousal is based on the user's heart rate while valence is based on the user's performances. They are categorised into 3 different levels: low, medium, high and negative, neutral, positive respectively.

Prior to the treasure hunt, the user's baseline heart rate is recorded. As the user walks from one point to another, his/her heart rate is being monitored continuously. When Emys needs to intervene, it will compare the user's current heart rate taking into consideration the baseline to an average range (recorded with 8 people walking the same route). If the resulting range is higher than the average range, then it falls into the category high while if it is less than half of the average range, it falls into the category low. Anything that falls in-between is considered as medium arousal. The same rules apply for categorisation of arousal when the user is stationary (a different average comparison range is used here based on recording 8 people while they are stationary).

Valence is estimated using the user's performance where 3 scores are taken into account: percentage of questions answered correctly, percentage of treasures unlocked and an intervention score. If the user completes a step without any intervention, they will score 5 points while each intervention incurs a penalty point. For example at step 3, the total collectable points would be 15 and if 6 interventions have occurred, the intervention score will be $(15\text{-}6)/15 = 0.6$. Please note that it is possible to have a negative intervention score. Valence is the average of these 3 scores, for example, a user who has answered 3 out of 5 questions correctly, unlocked 2 out of 3 treasures and has the above intervention score is assigned a valence of $(0.6+0.67+0.6)/3 = 0.623$. Any value above 0.7 is categorised as positive valence while any value below 0.3 is categorised as negative valence. Any value in between is considered as neutral.

The intervention utterances change under 4 different affective states: 1) frustration: high arousal, negative valence; 2) excitement: high arousal, positive valence; 3) boredom: low arousal, negative valence; and 4) neutral: neutral valence. Example of utterances under different affective states for when the user is going astray is as below:

- Neutral: You are heading off the path, please use the compass to guide you.
- Frustration: I am sorry to tell you that you are heading off the path. Please use the compass to guide you.
- Boredom: Hmm... looks like you are heading off the path. Don't give up, use the compass to guide you.
- Excitement: Wait a minute... you are heading off the path!

4. CONCLUSION

We are currently running an evaluation to explore the effect of these empathic strategies on perception of the virtual agent Emys as well as the overall performance and experience of users carrying out the treasure hunt activity.

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