cMotion: A New Game Design to Teach Emotion Recognition and Programming Logic to Children using Virtual Humans

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ABSTRACT

This paper presents the design of the final stage of a new game currently in development, entitled cMotion, which will use virtual humans to teach emotion recognition and programming concepts to children. Having multiple facets, cMotion is designed to teach the intended users how to recognize facial expressions and manipulate an interactive virtual character using a visual drag-and-drop programming interface. By creating a game which contextualizes emotions, we hope to foster learning of both emotions in a cultural context and computer programming concepts in children. The game will be completed in three stages which will each be tested separately: a playable introduction which focuses on social skills and emotion recognition, an interactive interface which focuses on computer programming, and a full game which combines the first two stages into one activity.

Index Terms: K.3.1 [Computers and Education]: Computer Uses in Education—Computer-assisted instruction (CAI); K.3.2 [Computers and Education]: Computer and Information Science Education—Computer science education

Keywords: virtual humans, serious games, emotion recognition

1 INTRODUCTION

Our motivation for this game was originally focused on children with autism. Children with autism are recognized by Johnson's identification of psychiatric disorders as having problems understanding social situations [6]. High-functioning children with autism have an obsessive interest with certain objects or concepts and average or above-average intelligence [1]. While we are still intending to study this population, we have broadened our intended audience to encompass typically developed children as well.

The game is intended to reinforce the recognition of facial expressions as a representation of emotion. By providing context for each emotion, we hope to facilitate the transfer of this knowledge into a real-life setting. Additionally, the facial expressions of the virtual character will be manipulated using an interactive drag-and-drop programming interface, which will introduce children to logical problem solving.

This game is based on Culturally Situated Design Tools (CSDTs), which were developed by Ron Eglash to teach mathematics and computer science concepts to students using culture as a tool [3]. We would like to improve on the current design of CSDTs, which present the bulk of information as text on a help screen. Instead, we present instructions and information through an interactive, playable game, which we believe will make the information more accessible and increase user interest. Similarly to CSDTs, after the user has been given instructions, they will use what they have learned to create something new or solve a problem. For the purposes of this study, we plan to use the efficiency and accurateness of these end projects to test how much the user has learned, the advantages of adaptability within games, and the benefits of a playable introduction.

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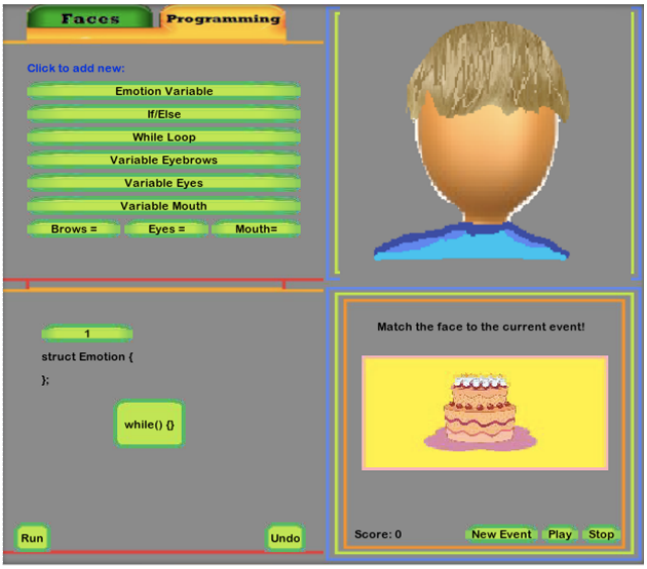

Figure 1: The visual drag-and-drop programming interface which allows the user to manipulate the virtual character's facial expressions.

2 RELATED WORK

Virtual humans have previously been shown to be effective in teaching concepts. Babu et al. showed that virtual humans could be used to teach social conversational protocols associated with a specific culture [2]. Zanbaka et al. demonstrated that virtual characters can persuade users just as much as a real person, regardless of how realistic the character was [9].

Virtual humans are often used in conjunction with children with autism, since they simulate real conversation without the social interaction that these children find difficult. A three-year study conducted by Grynzspan et al. describes the different ways autistic children responded to various stimuli on a computer screen, including virtual human interaction [5]. They found that autistic children who were taught by a virtual human experienced higher levels of retention than those in a traditional classroom setting. Mohamed et al. analyzed different aspects of the attention span of autistic individuals playing video games on the computer [8]. They found that the gaze of autistic individuals was more focused when they were able to customize the interface to personal learning style. The children in the study that were able to choose the background color, set of sounds, and shapes that appeared in their interface paid more attention than the individuals who were given a standard interface they could not alter. Attention span and high levels of retention are vital in a game designed to teach, and this may sometimes be hard to achieve with an audience having autism. Thus, we designed our interface to be as adaptable as possible.

Figure 2: One of the human models that the user may select to customize the interaction.

3 METHODS

3.1 Development Stages

The final game which we are presenting is broken up into two specific parts: a playable introduction and a coding interface. Both parts will be tested individually with their own, independent user study for the purposes of evaluation and will be able to stand alone if the child wants to practice either coding with facial expressions or social situations specifically. During the playable introduction, the user will accompany a virtual character who has lost all of their emotions around a village, and will learn about each emotion from the different virtual characters. The coding interface, on the other hand, will require the user to actually drag-and-drop code together to create the emotions of a virtual character depending on unambiguous stimuli they are presented with. In the final stage of our research, the user will play both of these parts together in a single cohesive game. We plan on comparing these results against the results from the individual testing, and believe that together they will create a context for both emotion recognition and computer programming that will increase user interest and levels of learning.

3.2 Adaptability

The playable introduction will be studying the affects of adaptability within games for children. By having multiple model sets of different virtual characters, we hope to catch the attention more thoroughly of the intended users. We have consulted with various experts on autism who have all stated that while every autistic child is unique, there are some obsessions that are seen very frequently among them including trains, dinosaurs, and insects. We believe that these themes will also engage normally developed children, and we plan to have sets of anthropomorphic character models for each of them, as well as a human set, and allow the user to select their favorite. Figure 2 shows an example of a model that the user may select.

3.3 Emotion Recognition

There are six houses in the playable introduction - one for each of Paul Ekman's six basic emotions: anger, disgust, fear, joy, sadness, and surprise [4]. Upon entering each house, the user will see a virtual character of their chosen set and be prompted to analyze the situation and respond appropriately. The dialogue the user chooses may either help the virtual character out of a bad mood, or push him into one. The child will learn what may cause people to look disgusted, how to identify when to console somebody, and possible ways to deal with their own frustration.

3.4 Coding Interface

The coding interface looks similar to that of MIT's Scratch [7]. In this interface, though, the user will be presented with a picture or short clip which clearly portrays a particular emotion, and the user will drag-and-drop the lines of code necessary to make the virtual character's face show the emotion they should be feeling from the clip. For children with autism and other children who can't recognize emotions well, this activity has an added difficulty. For some, the playable introduction may be vital to completing the coding interface.

4 EVALUATION

Ultimately, we will have three sets of evaluations: a playable introduction studying the user's learning of social interaction and emotion recognition, a coding interface which will study the user's learning of programming logic and simple coding ability, and a final game which will put both parts together to find if the user has increased levels of learning when the user has just learned about social interaction.

In the playable introduction, learning will be measured through dialogue choices. Conversation with their virtual comrade will gather demographic information as well as study how much they know about emotions before they learn about them within the game. In the coding interface, success will be measured by their efficiency using the programming tool and accuracy creating a certain emotion.

5 CONCLUSION

cMotion is a game that uses virtual characters to reinforce emotion recognition and logical problem solving to both normally developed children and high-functioning children with autism. The user's ability to choose the virtual character they are interacting with may also increase interest level. The game is based off of Culturally Situated Design Tools, and also involves virtual characters and a playable introduction to increase interest level and level of retention. User studies will be conducted to evaluate the individual effectiveness of each stage of the game as well as the overall game experience.

We have already prototyped this game using Microsoft XNA, and are currently creating the actual version of this game using Unity 3D. The design of each stage is completed, and we are presently working to start a test study at UNC Charlotte using the coding interface while we work on creating the playable introduction.

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