Virtual Game Show Host - Dr. Chestr

Raghi Sakpal*  
University of North Carolina, Charlotte

Dale-Marie Wilson†  
University of North Carolina, Charlotte

ABSTRACT
This paper describes the design, implementation and evaluation of an interactive virtual human Dr. Chestr: Computerized Host Encouraging Students to Review. Game show hosts exert a unique personality that becomes the trademark of their respective game shows. Our aim is to create virtual humans that can interact naturally and spontaneously using speech, emotions and gesture. Dr. Chestr is our virtual game show host that exhibits a personality designed to increase user engagement. Dr. Chestr is designed to test users with questions about the C++ programming language and allows the user to communicate with the most natural form of interaction, speech. We present the architecture and user evaluations of the Dr. Chestr Game Show.

Index Terms: K.3.1 [Computers and Education]: Computer Uses in Education—Computer-assisted instruction (CAI); K.8.0 [Personal Computing]: General—Games

1 INTRODUCTION
In this paper we present Dr. Chestr see Figure 1 who is the virtual game show host of the Dr. Chestr game show. Dr. Chestr is an embodied virtual agent that allows users to communicate and interact with him via speech. Similar to popular game show hosts, Dr. Chestr is infused with a unique personality to promote user engagement and enjoyment. His game show questions are based on the C++ programming language and are geared towards providing a study tool for immature CS students learning basic programming concepts. Our main research goal is to determine the feasibility of developing a virtual human with a unique personality that is identifiable and entertaining.

Figure 1: Dr. Chestr

Research has shown that the presence of an animated agent is a contributing factor in user satisfaction in pedagogical applications. This research investigates the effects of a virtual human with a distinct personality on user performance and satisfaction within an educational application, specifically a study tool. In this paper we will discuss the design and implementation of Dr. Chestr and the Dr. Chestr Show. This will be followed by a description of the user study and analysis of the results. The study evaluates user satisfaction and experience. Future work will investigate Dr. Chestr's affect on user performance in a C++ programming course.

2 RELATED WORK
Virtual Humans are animated humans that engage in face-to-face communication with users using facial expressions, gestures and speech [6]. Rea, built by Cassell, et al., is an example of virtual real estate agent which is capable of both multimodal input understanding and output generation through gesture recognition, speech recognition, discourse, speech planning and synthesis [2]. Research has shown that users reaction to virtual agents are similar to their reaction to other people [8]. Users interactions with virtual agents are based on perceived human characteristics such as the agents helpfulness, expertise and friendliness [3]. Along these lines, the focus has now shifted from modeling and animation to imparting personalites to make virtual humans more believable or realistic [5]. The believability of virtual humans is considered a main factor for their success [4]. Hence our focus is on personality and emotions as they influence the behavior of human characteristics.

3 OVERVIEW OF THE SYSTEM
Dr. Chestr is our computerized virtual game show host that provides a study tool for students learning programming concepts in the C++ programming language via a game show. The host quizzes the participants on concepts covered in the lecture and lab sessions of the Introductory course of Computer Science. The questions are posed in multiple choice or (T) rue/ (F) alse format. The users interact with Dr. Chestr via two modes, speech and mouse clicks.

3.1 Modeling Emotion and Personality
An emotion is a state of mind that is depicted by expressions of feelings and changes in the body state [6]. To model Dr. Chestr’s emotions, we make use of the OCC model proposed by Ortony, Clore and Collins [1]. The OCC model proposes 22 emotion types defined in two cognitive state categories, namely positive and negative based on the appraisal and cognitive structure of emotion. Various emotions were chosen from this model to match Dr. Chestr’s personality.

To model Dr. Chestr’s personality we have utilized The Five Factor Model by Robert McCrae and Oliver John [7]. The five basic traits defined in this model are Extraversion (extrovert vs. introvert), Agreeableness (cooperative vs. antagonistic), Conscientiousness (self-discipline), Neuroticism (anger, depression) and Openness (learn, appreciate and experience new things) [7]. We have assigned weights to each factor on a scale of 0-1 depending upon their significance in the definition of Dr. Chestr’s specific personality. Dr. Chestr is designed to represent a young, dynamic male who is a professional and has a warm, outgoing and engaging persona. The weightings that define Dr. Chestr’s personality were chosen based on the following factors inclusive in Dr. Chestr’s personality:

- talkative, skilled in humor, aggressive, facially and gesturally expressive but not gregarious 0.9
- skeptical, critical, not overly trusting and agreeable 0.3
- self-indulgent and slightly unethical in responses 0.2
- responses unconventional, original 0.4
- no depression and anger 0.0
To each factor, we created a sliding scale that maps the adjectives and definers to a value. Dr. Chestr’s personality definition was then mapped to the corresponding weights in each factor. The gestures and facial expression that corresponded to the weighted factors were then added to Dr. Chestr. They include winking, pointing finger, clapping, smiling and a sad nod. Emotions like pleasure, surprise, sadness and anticipation from the OCC model were incorporated into Dr. Chestr’s facial expressions. The development of an extroverted, personable, intelligent, slightly conceited and sarcastic virtual human in Dr. Chestr was accomplished through the combination of the afore-mentioned personality, emotions, facial expressions and gestures. We represent Dr. Chestr’s personality as a combination of these factors.

\[ E(0.9) + A(0.3) + C(0.2) + O(0.4) + N(0.0) \]  

4 Evaluation Study

A usability study was conducted, 250 students enrolled in the introductory computing course were recruited as subjects. A controlled experiment was conducted in which each subject interacted with the Dr. Chestr show for one game segment (10 questions). In this study, we have focused on Dr. Chestr’s interaction with the users - Dr. Chestr’s ability to understand users speech accurately, and how quickly he responds to the user (responsiveness). We also measured users perception of Dr. Chestr’s human-like characteristics, including appearance, behavior, voice, personality, facial expressions and gestures.

4.1 Test of Positive and Negative Affect

Participants positive and negative affect were measured prior to the experiment session and also immediately after the experiment session using the Watson, Clark and Tellegen Positive and Negative Affect Test [Watson et al. 2000]. The test consisted of 10 positive affect questions and 10 negative affect questions, measured on a Likert Scale (1 = very slightly or not at all, 5 = extremely).

Analysis of the PANAS positive score revealed that overall positive affect increased from the pre-experiment sessions (M = 32.44, SD = 6.75) to the post-experiment sessions (M = 33.96, SD = 8.48), though the effect size was small (see Figure 2). Analysis of the PANAS negative score revealed that there was a notable decrease from the pre-experiment sessions (M = 13.57, SD = 3.63) to the post-experiment sessions (M = 12.19, SD = 3.32) (see Figure 3).

4.2 Virtual Human Evaluation

A qualitative evaluation of Dr. Chestr was done post-experiment. Overall, the evaluation scores were quite high. Majority 78% of the users found Dr. Chestr’s appearance realistic and his personality identifiable. They thought that Dr. Chestr was outgoing, approachable and engaging (M = 19.92, SD = 4.61). 22% of the users found Dr. Chestr to be funny, witty and entertaining. Users indicated that they found interacting with Dr. Chestr intuitive, and his response fast and clear (M = 17.53, SD = 2.46).

Users indicated that Dr. Chestr would be a useful study tool for Introductory Courses in Computer Science and they would like to use Dr. Chestr again (M = 8.22, SD = 1.71). When asked whether they would have performed worse or same with another method of practice 43% users felt they would have done the same, while 57% of the users indicated that they would have done worse. Finally, 80% users enjoyed interacting with Dr. Chestr and would use it again, if made available.

5 Conclusion

Results show that users were able to identify Dr. Chestr’s personality. The virtual game show host enhanced the users experience and made the interaction more enjoyable. Though not statistically significant, the increase in users PANAS scores after interactions with Dr. Chestr have significant implications in the recruitment and retention of computer science students. The successful development of a virtual human with an identifiable personality provides the foundation for the development of virtual humans that represent a specific culture.

References