Building Virtual Humans with Back Stories: Training Interpersonal Communication Skills in Medical Students

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Abstract. We conducted a study which investigated if we could overcome challenges associated with interpersonal communication skills training by building a virtual human with back story. Eighteen students interacted with a virtual human who provided back story, and seventeen students interacted with the same virtual human who did not provide back story. Back story was achieved through the use of cutscenes which played throughout the virtual human interaction. Cutscenes were created with The Sims 3 and depicted short moments that occurred in the virtual human's life. We found medical students who interacted with a virtual human with a back story, when interacting with a standardized patient, were perceived by the standardized patient as more empathetic compared to the students who interacted with the virtual human without a back story. The results have practical implications for building virtual human experiences to train interpersonal skills. Providing back story appears to be an effective method to overcome challenges associated with training interpersonal skills with virtual humans.

Keywords: virtual humans, back story, cutscenes, empathy.

1 Introduction

Virtual human experiences can be a useful tool for training interpersonal communication skills. An important component of interpersonal skills is empathy, which is the ability to understand the feelings of another and be able to communicate that understanding. Empathy plays an important role in medical education and is considered a core learning objective in a student's medical education [1]. Encouraging empathy with virtual humans is challenging. Prior research has shown that medical students empathize with virtual humans with less sincerity and frequency than with a real human [2].

In the medical field, one approach to foster empathy in medical students' is through Patient Shadowing: a technique in which medical students follow patients through their clinical visits [3]. Patient Shadowing provides context to a patient's daily life typically not seen by medical students. Shadowing is a powerful tool; however, it requires patient consent and willingness to share private experiences.

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Informed by Patient Shadowing in the medical field, we wanted to apply this concept to virtual humans. If virtual humans were given context to their personal life, would this improve interpersonal communication skills? To investigate this, we added back story to our virtual human. Back story was added to our virtual human through cutscenes. Cutscenes, created with *The Sims 3,* are user-triggered and depict short moments that occurred in the virtual human's life.

We conducted a study in which 35 1st year medical students interviewed a virtual human depression followed by interviewing a standardized patient actor with depression. Eighteen students interacted with a virtual human with a back story (VH-Backstory), and seventeen students interacted with the same virtual human without a back story (VH-Control). The results show students in VH-Backstory group, when interacting with the standardized patient, were perceived by the standardized patient as more empathetic compared to the students in the VH-Control group.

While the research presented in this paper considers only virtual patients with back stories, the results presented have practical implications for building any type of virtual human experience to train interpersonal skills. Providing back story appears to be an effective way to overcome challenges associated with training interpersonal skills with virtual humans.

2 Related Work

2.1 Patient Shadowing

Patient shadowing is an initiative by Patient and Family Centered Care Innovation Center to produce a low-cost and effective way to follow (or shadow) patients as they receive medical care [3].

The advantage of shadowing is that the shadowers see a side of patient care they do not often see: the perspective of the patient in real-time. Patient shadowing is very powerful because medical students have the opportunity to see patients as more than just a diagnosis. Shadowing is the closest real-world counterpart to our approach of providing back story through the use of cutscenes.

2.2 Virtual Humans with Back Story

Bickmore et al developed virtual humans with back story to increase user engagement [4]. Participants were found to be more engaged with the virtual human when the virtual human told a story in the first-person as opposed the story being told in third-person. Back story was generated through text-based dialog and the study investigated more into user reaction to virtual humans with back story.

2.3 Cutscenes

Cutscenes are heavily used in video games as a way to drive the narrative forward. Cutscenes are almost always non-interactive, and just as in our system, are always

triggered by the user in some way. Cutscenes in our virtual human interactions are triggered when the user elicits a response from the virtual human that is also associated with a cutscene. In video games, cutscenes can be triggered in many ways: starting/finishing a level, reaching a checkpoint, or initiating a conversation with a non-playable character.

2.4 Virtual to Real Behavioral Change

Another area of research looks at improving pro-social behavior through virtual experiences. Rosenberg et al looked at how giving participants virtual "super powers" would affect real world behavior [5]. Participants traversed a virtual city either flying in a helicopter or having the power of flight. Participants were assigned to either help a virtual diabetic child or just tour the city. Rosenberg found that participants who were given the power of flight were more likely to help the experimenter in the real world pick up spilled pens than participants who did not receive the power of flight.

3 Background

This research enhances pre-existing virtual human technology with cutscenes made from the video game *The Sims 3*. There are many forms of virtual humans; however, we use what are known as virtual patients.

The goal of this enhancement was to improve interpersonal communication skills in medical students. In particular, empathy was the most important targeted skill.

Cutscenes were made to depict various moments from the virtual patient's daily life in order to properly convey how the patient's medical condition was affecting them. The following sections will discuss virtual patients, empathy, and *The Sims*.

3.1 Empathy

Empathy, in the context of patient care, is defined as "a predominantly cognitive (rather than emotional) attribute that involves an understanding (rather than feeling) of experience, concerns and perspectives of the patient combined with a capacity to communicate this understanding" [6].

Empathy is a very important interpersonal skill for everyone to have; however, it is especially important for medical students to have strong empathy skills by the time they begin their medical profession. A key motivator for doctors to have strong empathy skills is that empathy is considered one of the best ways to improve patient compliance as well as reduce medical malpractice lawsuits [7].

3.2 The Sims

The Sims is a life-simulation game in which the player creates and maintains a family of Sims [8]. *The Sims* has various needs that reflect what humans need in the real world. They need to eat, go to the bathroom, get a job, etc. *The Sims* features robust

character creation allowing users to create virtual humans of different age, weight, height, etc. In addition to the game component of *The Sims,* the game features a movie making component in which players can record Sims living their virtual life. The movie making tool was used to create the cutscenes for the virtual human.

4 Study

We conducted the use of cutscenes in virtual human interactions as part of a study involving 35 first year medical students. As seen in Figure 1, eighteen of the students interacted with a virtual human suffering depression with a back story provided by cutscenes and seventeen interacted with the same virtual human without a backstory. All 35 medical students, immediately after interacting with a virtual human, interacted with a human standardized patient actor who also suffered from depression. Because the study involves both a virtual and real component, the following sections will discuss each component.

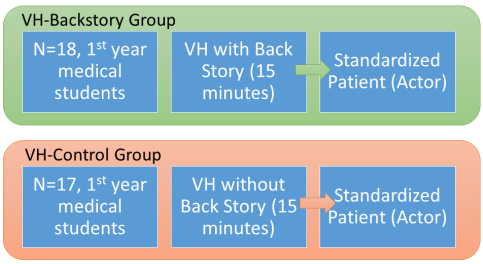

Fig. 1. Study Flow

4.1 Scenarios

Virtual. All students interacted with the same virtual patient suffering from depression. The virtual patient's name is Cynthia Young. Cynthia is a 21 year old college student whose depression has been affecting her life. Her cousin had recently passed 8 months ago. Cynthia Young has been used as a virtual patient in prior research [9].

All students were instructed to spend 15 minutes interacting with Cynthia and use their best communication skills to obtain a patient history. Students interacted with Cynthia using an online text-based interface. They conduct interviews as they normally would; however, they type want they want to say rather than speak it. The virtual patient built for this study had approximately 500 unique character speeches and approximately 4500 speech triggers for the speech matching algorithm to process user input.

Students were randomly assigned to one of two groups: a virtual patient interaction enhanced with backstory (VH-Backstory) or a virtual patient interaction without backstory (VH-Control).

Real. After interacting with Cynthia Young, all 35 students interacted with Ryan Higgins, a standardized patient actor. Ryan Higgins is a 25 year old soldier who has been experiencing symptoms of major depression. His sister had recently died 3 months ago.

4.2 Cutscenes

Four cutscenes were incorporated with the virtual human and are listed below:

- Introduction: This cutscenes serves as an introduction to Cynthia Young. It opens with Cynthia struggling to get out of bed in the morning. She is clearly sad and does not really want to get ready for class. The introduction cutscene is 46 seconds long and is played at the beginning of every cutscene enhanced virtual patient interaction.
- Weight Gain: Cynthia is shown getting ice cream from the refrigerator to eat, and after, she decides to take a nap. This cutscene is 14 seconds long and is played when students ask about her eating habits or whether she has been gaining weight.
- Watching TV: In this cutscene, Cynthia is shown watching TV and eventually falling asleep while the TV is still on. This cutscene is 12 seconds long and is shown when students ask Cynthia about what she does when she wakes up or what she does during the day.
- Crying: In this cutscene, Cynthia is in the kitchen washing her hands. After washing her hands, she sits at the kitchen table crying. This video is 15 seconds long and is shown when students ask about her general mood.

Fig. 2. Scenes from four cutscenes created

With the exception of the introduction, all cutscenes were triggered when the student asked a question that had an associated cutscene to accompany the response. 32 of Cynthia's responses had one of the three other cutscenes associated with it. 22 of those 32 responses would play the "Crying" cutscene, 8 responses would play the "Weight Gain" cutscene, and 2 responses would play the "Watching TV" cutscene.

For example, a user could ask “Have you been gaining weight recently?” in which Cynthia responds: “It feels like all I do is eat and sleep.” The weight gain cutscene plays along with her response. This example is shown in Figure 3.

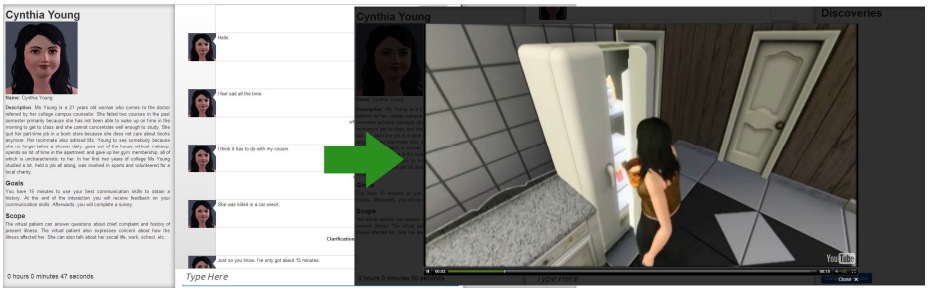

Fig. 3. Chat Interface (Left) and Cutscene triggering during interaction (Right)

4.3 Evaluation

Empathy Rating. All students’ empathic responses to opportunities from patient interactions (virtual and real) were rated with the Empathic Communication Coding System (ECCS) [10]. Raters achieved an inter-rater reliability greater than 0.8 and all interaction transcripts were blinded before rating began. The ECCS scale is a 0-6 scale in which 0 is a denial of patient perspective and 6 is a statement of shared feeling or experience.

It is important to note that these empathy ratings were obtained from text-based transcripts only. No non-verbal component was considered when rating students’ empathy.

Standardized Patient Communication Checklist. The standardized patients completed a communication checklist for all students which contained fourteen items rating the medical students’ professional appearance, behavior, empathy, and rapport. Checklists are a common way of evaluating medical students’ performance in an interview setting, and some have become a part of the US Medical Licensing Examination [11]. Elements of this checklist were based on the Medical Student Interviewing Performance Questionnaire which is a valid questionnaire for assessing medical student performance in psychiatric patient interviews [12].

5 Results

All results are based on ECCS scores and the communication checklist. For ECCS data, we ran a t-test between the 2 groups to compare means. For the checklist, Fisher’s exact and the Mann-Whitney U tests were performed.

5.1 Standardized Patient Communication Checklist

There was statistical significance on two items of the communication checklist, and both items were related to interpersonal communication skills. The checklist items are as follows:

- The examinee offered encouraging, supportive, and/or empathetic statements.
- The students appeared warm and caring.

Although not statistically significant, there was also a difference for the item: "The examinee developed a good rapport with me."

The Examinee Offered Encouraging, Supportive, and/or Empathetic Statements. There was statistical significance ($p < 0.05$) for this checklist item. Medical students in the VH-Backstory group were more likely to offer encouraging, supportive, and/or empathetic statements.

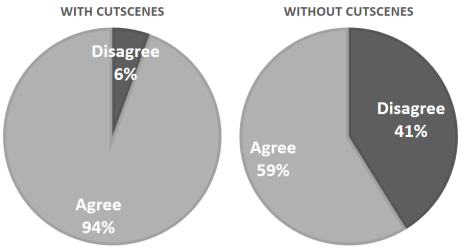

Fig. 4. Results for "The examinee offered encouraging, supportive, and/or empathetic statements"

As seen in Figure 4, approximately 94% of students in the VH-Backstory group offered empathetic statements as opposed to only approximately 59% of students in VH-Control. Additionally, only one participant did not offer empathetic statements in the VH-Backstory group. Seven participants in the other group did not offer empathetic statements.

The Student Appeared Warm and Caring. There was statistical significance ($p < 0.01$) for "The student appeared warm and caring" checklist item. Medical students in the VH-Backstory group were more likely to appear warm and caring to the standardized patient.

As seen in Figure 5, approximately 67% (twelve students) in VH-Backstory appeared warm and caring whereas approximately 35% (six students) in VH-Control appeared warm and caring.

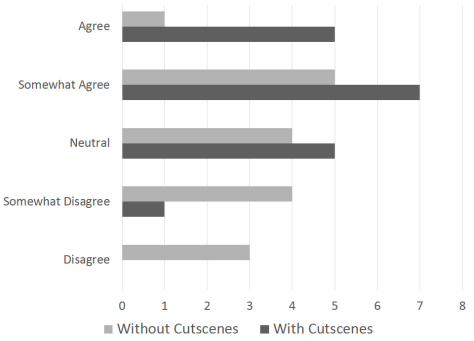

Fig. 5. Results for "The student appeared warm and caring."

The Examinee Developed a Good Rapport with Me. While not statistically significant (p=0.18), there were some differences between groups for this checklist item.

About 94% of students in VH-Backstory developed a good rapport with the standardized patient as opposed the VH-Control group where only 76% of students developed a good rapport. Again, only one student in VH-Backstory did not develop a good rapport with the standardized patient whereas 4 students in VH-Control did not develop good rapport.

5.2 ECCS

ECCS results showed no statistical significance (p=0.89) in student empathy during the standardized patient interaction. Students in VH-Backstory had a mean ECCS rating of 2.26 while students in VH-Control had a mean ECCS rating of 2.29.

6 Discussion

The standardized patients perceived the students who interacted with a virtual human with back story as more empathetic, and marginally better at developing rapport. These results suggest that using cutscenes to tell back story in a virtual setting can affect a person's perceived interpersonal skills in a real-world setting.

The standardized patient was unaware as to what condition the student belonged to. Given that the standardized patient considered the VH-Backstory group as more empathetic and was blind to the conditions, this further supports the cutscenes' efficacy in telling back story and improving interpersonal communication skills.

Since the cutscenes' total length was approximately 90 seconds, there is also evidence to suggest that this form of telling back story requires very little alteration to the original virtual experience to have a desired effect.

Students also did not know beforehand that they were going to interact with a VH who provided back story. Furthermore, students were never made directly aware that these cutscenes were depicting personal moments from the VH's life. Based on the results, this seems to indicate that students were able to use their gained insights from the back story and apply that directly in the standardized patient interaction.

Despite the lack of differences in ECCS ratings, differences in the checklist are more encouraging as medical students are typically graded in standardized patient encounters using some form of a checklist.

7 Limitation and Future Work

Our analysis found no statistical significance in ECCS ratings in the VP interaction as well as no significance in the SP interaction; however, there are possible explanations for the lack of differences. One, raters only looked at text while coding the student transcripts. The standardized patients could consider tone of voice as well as other non-verbal components such as eye contact and body language that play an important role in interpersonal communication.

We do not have any self-reported empathy of the students; however, all students were first year medical students who have received the same training. All students had taken an 8 hours "Communication skills lab" which emphasized the importance of empathy in the medical interview.

The results presented only look at the effect on interpersonal skills over a short period of time. We would also like to see how much of an impact back stories have on their interpersonal skills over time. For example, a future study could look at if whether students came back at a later for another standardized patient interaction would they still be more empathetic because of the back story provided by the virtual human.

8 Conclusion

Providing back story to virtual humans is a simple and effective way to affect students' perceived real world interpersonal communication skills. Using back story, we found that students were more likely to be empathetic with a standardized patient (a real human actor) than students who did not have back story.

Our approach of building virtual humans with back story enhances the interaction. Additionally, our method of providing back story, cutscenes, was only 90 seconds of video which does not prolong the interaction. Just as in patient shadowing, we were able to provide a way to show medical students that patients can be greatly impacted by their ailments. The virtual human is given more character with back story, and for medical students, helps convey to them that the virtual human is more than just a diagnosis or puzzle for them to solve.

Our results suggest that building virtual humans with back stories is an effective training tool for interpersonal communication skills. Skills such as empathy are essential in various domains. Virtual human training simulations that span military, education, or medicine application areas would likely benefit from virtual humans with back stories. For each domain, the context gained by back stories can help people become better communicators by applying what they learned in the virtual experience to real experiences.

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