Medical Diagnosis Training with Virtual Patients and Instructors

System Highlights

Life-sized Virtual Characters:

Virtual patients naturally interact with the medical student using speech and gestures.

Virtual instructors observe interviews, judging quality and providing feedback.

Studies run on virtual patient system in the same examination rooms where medical students interact with standardized patients.

Setups at **both** University of Florida Shands Hospitals and Medical College of Georgia.

Integration into 2nd year medical student coursework

Provides:

- Frequent training
- Scenario variety
- Immediate feedback
- Quality control

Overview:

One of the ways medical schools teach patient-doctor communication skills is through interaction with standardized patients, actors trained to represent a medical condition. Unfortunately, standardized patients are a limited resource. The variety of the scenarios they can represent is limited by availability and the time and money needed to train them. It is also difficult to ensure that standardized patients interact with all students consistently.

To address these issues, we are exploring using virtual characters to help educate patient-doctor communication skills. Our current system allows medical students to interview DIANA, a virtual patient. Students interact with DIANA naturally using speech and gestures. A virtual instructor, VIC, provides immediate feedback on the student's performance.

A medical student interviews DIANA. The medical student points to DIANA and asks if it hurts where he is pointing.

Challenge:

Our goal is for interaction with DIANA to be indistinguishable from interaction with a real patient. To achieve this high level of immersion, we focus on developing virtual characters that:

- Appear life-size
- Understand a limited set of natural language
- Are able to interpret limited movement of the student

Evaluation of patient-doctor communication skills is also a difficult challenge. At a base level, the system must know if the medical student has asked the right questions and determined the possible set of diagnoses. At a higher level, the system needs to measure and interpret the student's verbal and non-verbal interpersonal communication skills.

Medical student using pointing gestures to aid in diagnosis

Approach:

Our system uses data projectors to present life-sized virtual characters to the medical student. The student speaks to DIANA using a microphone. Speech is processed and matched to appropriate responses created by teaching faculty at the University of Florida, Shands Hospitals.

A vision-based tracking system provides information about a user's head and hand position in real-time. Hand tracking allows the user to interact with the virtual characters using natural gestures such as pointing and hand shaking. Head tracking allows rendering of the virtual character from the perspective of the user, as well as approximate measurement of head and gaze behavior.

System Overview: The system uses COTS components and has a total cost of less than $10,000.

Head tracking data shows where the medical student is looking during the interview. This student looked mostly at DIANA's head and thus maintained adequate eye-contact for the scenario.

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Selected Publications

Johnsen, Kyle, Robert Dickerson, Andrew Raij, Benjamin Lok, Jonathan Jackson, Min Shin, Jonathan Hernandez, Amy Stevens, Scott Lind (2005). "Using Immersive Virtual Characters to Educate Medical Communication Skills," To appear in *Journal on Presence: Teleoperators and Virtual Environments*.

Stevens, Amy, Jonathan Hernandez, Kyle Johnsen, Robert Dickerson, Andrew Raij, Jonathan Jackson, Min Shin, Juan Cendan, Margaret Duerson, Benjamin Lok, D. Scott Lind (2005). The Use of Virtual Patients to Teach Medical Students Communication Skills. *American Journal of Surgery*.

Dickerson, Robert, Kyle Johnsen, Andrew Raij, Benjamin Lok, Thomas Bernard, Amy Stevens, D. Scott Lind (2005). "Virtual Patients: Assessment of Synthesized Versus Recorded Speech," To Appear in the Proceedings of Medicine Meets Virtual Reality 14
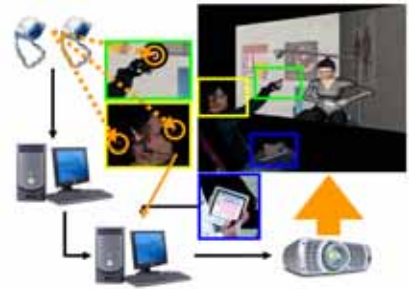
Dickerson, Robert, Kyle Johnsen, Andrew Raij, Benjamin Lok, Jonathan Hernandez, Amy Stevens, and D. Scott Lind (2005). "Evaluating a Script-Based Approach to Simulating Patient-Doctor Interaction," Proc. Of *SCS 2005 International Conference on Human-Computer Interface Advances for Modeling and Simulating*, 79-84.

Johnsen, Kyle, Robert Dickerson, Andrew Raij, Benjamin Lok, Jonathan Jackson, Min Shin, Jonathan Hernandez, Amy Stevens, Scott Lind (2005). "Experiences in Using Immersive Virtual Characters to Educate Medical Communication Skills," In *Proceedings of IEEE Virtual Reality 2005*.

Stevens, Amy, Jonathan Hernandez, Kyle Johnsen, Robert Dickerson, Andrew Raij, Jonathan Jackson, Min Shin, Juan Cendan, Margaret Duerson, Benjamin Lok, D. Scott Lind (2005). "The Use of Virtual Patients to Teach Medical Students Communication Skills," *Proceedings of the Association of Surgical Education 2005*.

Stevens, Amy, Jonathan Hernandez, Kyle Johnsen, Robert Dickerson, Andrew Raij, Jonathan Jackson, Min Shin, Juan Cendan, Margaret Duerson, Benjamin Lok, D. Scott Lind (2005). "The Use of Virtual Patients to Teach Medical Students Communication Skills," *Southern Group on Education Affairs* 2005.

Raij, Andrew, Kyle Johnsen, Robert Dickerson, Benjamin Lok, Marc Cohen, Amy Stevens, Thomas Bernard, Christopher Oxendine, Peggy Wagner, D. Scott Lind (2005). "Interpersonal Scenarios: Virtual H" Real?" Submitted for *Proceedings of VR2006*

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