

# Interactive Virtual Client for Teaching Occupational Therapy Evaluative Processes

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## ABSTRACT

In this paper, we describe our current work in developing a computer-based educational tool for Occupational Therapy students learning client evaluation techniques. The software is dialog-based and allows the student to interact with a virtual client. Students carry out an evaluation, following the appropriate procedures and assessing both the client's physical and emotional state as they proceed. Students' actions are saved to a file for instructor and self evaluation of their performance. The software is being developed using the Source® game engine SDK developed by Valve™.

## Categories and Subject Descriptors

K.3.1 [Computer Uses in Education]: *Computer-assisted Instruction.*

## General Terms

None.

## Keywords

Virtual patient, Occupational Therapy assessment, interactive educational tool.

## 1. INTRODUCTION

Occupational therapy (OT) is defined as a type of rehabilitation therapy that uses real life activities to help clients prevent, lessen, or overcome physical, cognitive, and psychosocial disabilities. Occupational therapy addresses a variety of conditions including upper extremity and hand injuries, neurological disorders and arthritis. Students earning a degree in Occupational Therapy normally take an evaluative processes course in preparation for their first Level I field experience. The purpose of this course is to teach the client interview and assessment procedures used to evaluate the extent of disability prior to designing a course of therapy. Such procedures are specified, for example, in the Canadian Occupational Performance Measure (COPM) [5]. The student must learn not only to assess the physical state of a patient, but also his/her emotional state. In addition, interview

skills must be acquired that will lead to the establishment of a beneficial client-therapist relationship. Typically, a course in evaluative processes will consist of a lecture component, including reading materials and videos showing the proper assessment procedure. This component is often augmented with a lab session where students practice with each other, with family and friends, and with the instructor. Because students do not have access to actual clients, however, the process is somewhat lacking in realism. We are developing an interactive, computer-based system intended to address this shortcoming. We have implemented a virtual OT client to be used in training assessment procedures.

The use of computer-based educational tools is gaining popularity within the medical community. For example, Mathers [6] uses multimedia to permit students to evaluate the procedures carried out by a nurse. Video clips of real nurses interacting with real patients are shown, and students are asked to evaluate the performance of these "virtual" nurses. The Interactive Virtual Patient [3] developed at Marshal University uses text, images and a 2D graphical user interface delivered via the web to permit students to interactively proceed through a patient history, physical, and diagnosis. Several research efforts have addressed the development of more realistic and interactive virtual reality systems for training medical assessment and communication skills. Caudell, et al [1] and Stansfield, et al [7] focus on assessment of trauma patients during the triage stage of emergency medical care. Johnsen, et al [4] addresses the teaching of medical communication skills (bedside manner.) Hubal, et al [2] use 3D graphics and natural language to teach medical interview skills, such as taking a patient history.

## 2. INTERACTIVE OT CLIENT

Our software is PC-based and utilizes the Source® game engine SDK developed by Valve™ and used in their popular Half-Life 2 video game. The Source® SDK is written in C++ and is free under a license agreement with the purchase of the Valve™ game. Users may modify the code for non-commercial purposes (with the exception of the graphics engine, which is proprietary.) Although the Source® code is not well documented, it is very powerful, providing virtual humans that may be programmed for both body and facial movements. Tools are also available to create and view models, to manipulate and program facial expressions, to interactively trigger behaviors of characters based on user actions, and to create 2D graphical interface components

such as menus. Graphical models and skeletal animations may also be developed using software such as Discreet™ 3DSMAX® and imported into system.

We have used these tools to create a virtual client within an OT clinic environment. Figure 1 shows the virtual OT client. The virtual human model used was included with Half-Life 2. Using this figure as our base model, we have implemented an OT client who has suffered a stroke that has impaired movement on his right side (an L-CVA.) This impairment includes partial facial paralysis. Such facial paralysis can make it more difficult for therapists to read a client's emotional state – for example, a smile may look more like a grimace when part of the face does not move.



**Figure 1. Virtual OT client**

To date, we have implemented the initial client interview portion of the evaluation. The student is presented with menu of choices for interacting with the virtual client. For example, choices for initiating the interview might be

- Good morning, are you Mr. Grant?
- Good morning, Vance. Are you ready to go?
- Hey, man, how's the morning going?
- Hope you need coffee as much as I do !

When the student has made a selection, his choice is saved to file and the virtual client responds. Client responses are animated and vocal – the Source® engine supports synchronization of the virtual human's lips and face with playback of stored sound files. We have extended the Source® code to permit all behaviors to be read from a file when the system is initialized. Behaviors are

then dynamically chosen and played based on the selection made by the student. This permits the virtual patient to respond differently, depending on what the student chooses to do.

We are in the process of developing the remaining components of the evaluation. This includes implementing the behaviors of the virtual client as he performs requested tasks as specified in the COPM, as well as creating the appropriate dialog-based interactions for the student. Once this is completed, we plan to evaluate its potential by fielding it in the evaluative processes course taught in the OT Department at Ithaca College. Based on the outcome of this evaluation, future work will include developing virtual clients with other impairments and moving to more natural forms of interaction, such as speech recognition.

### **3. ACKNOWLEDGMENTS**

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### **4. REFERENCES**

- [1] Caudell, T.,P., Summers, K.,L., Holten, J, Hakamata, T., Mowafi, M., Jacobs, J., , K., Lozanoff, B., ,Lozanoff, S., Wilks, D., Keep, M.,F., Saiki, S., and Alverson, D., Virtual Patient Simulator for Distributed Collaborative Medical Education. The Anatomical Record (Part B: New Anat.) 270B:23. Wiley-Liss,Inc. 2003.
- [2] Hubal, R.C., Kizakevich, P.N., Guinn, C.I., Merino, K.D., and West, S.L. The Virtual Standardized Patient -- Simulated Patient-Practitioner Dialogue for Patient Interview Training. *Envisioning Healing: Interactive Technology and the Patient-Practitioner Dialogue*. J.D. Westwood, H.M., Hoffman, G.T. Mogel, R.A. Robb, and D. Stredney (Eds.), IOS Press: Amsterdam.
- [3] Interactive Virtual Patient. Marshall University. Available at <http://medicus.marshall.edu>.
- [4] Johnsen, K., Dickerson, R., Raij, A., Lok, B., Jackson, J., .Shin, M., Hernandez, J., Stevens, A., and Lind, A. Experiences in Using Immersive Virtual Characters to Educate Medical Communication Skills. *Proceedings of IEEE Virtual Reality Conference* (Bonn Germany, March 2005) IEEE Press.
- [5] Law, M., Baptiste, S., Carswell, A., McColl, M., Polatajko, H., and Pollock, N. *Canadian Occupational Performance Measure*. CAOT Publications, Inc. Ottawa, Canada. 1998.
- [6] Mathers, D. *Virtual Clinical Excursions – Medical Surgical*. Elsevier Mosby. St. Louis, MO. 2005.
- [7] Stansfield, S., Shawver, D., Sobel, A., Prasad, M., and Tapia, L. Design and Implementation of a Virtual Reality System and Its Application to Training Medical First Responders *Presence: Teleoperators and Virtual Environments*, pp. 524-556. 9:6, MIT Press Journals. 2000