Sorting Out the Virtual Patient: How to Exploit Artificial Intelligence, Game Technology and Sound Educational Practices to Create Engaging Role-Playing Simulations

Thomas B. Talbot, Institute for Creative Technologies, University of Southern California, Playa Vista, CA, & Telemedicine and Advanced Technology Research Center, Fort Detrick, MD, USA

Kenji Sagae, Institute for Creative Technologies, University of Southern California, Playa Vista, CA, USA

Bruce John, Institute for Creative Technologies, University of Southern California, Playa Vista, CA, USA

Albert A. Rizzo, Institute for Creative Technologies, University of Southern California, Playa Vista, CA, USA

ABSTRACT

Since Dr. Howard Barrows (1964) introduced the human standardized patient in 1963, there have been attempts to game a computer-based simulacrum of a patient encounter; the first being a heart attack simulation using the online PLATO system (Bitzer, 1966). With the now ubiquitous use of computers in medicine, interest and effort have expended in the area of Virtual Patients (VPs). One problem in trying to understand VPs is that there are several quite distinct educational approaches that are all called a ‘virtual patient.’ This article is not a general review of virtual patients as current reviews of excellent quality exist (Poulton & Balasubramaniam, 2011; Cook & Triola, 2009). Also, research that demonstrates the efficacy of virtual patients is ample (Triola, et al., 2006). This article assesses the different kinds of things the authors call “virtual patients”, which are often mutually exclusive approaches, then analyzes their interaction structure or ‘game-play’, and considers the best use scenarios for that design strategy. This article also explores dialogue-based conversational agents as virtual patients and the technology approaches to creating them. Finally, the authors offer a theoretical approach that synthesizes several educational approaches over the course of a medical encounter and recommend the optimal technology for the type of encounter desired.

Keywords: Medical Education, Medical Games, Medical Simulation, Serious Games, Virtual Patient, Virtual Standardized Patient

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A WHIRLWIND TOUR OF VIRTUAL PATIENTS

As previously stated, many different entities with unique approaches and attributes are all often called virtual patients. Such approaches include case presentations, interactive patient scenarios, virtual patient games, human standardized patients, high fidelity software simulations, high fidelity manikins and virtual human conversational agents. Salient features of these virtual patient approaches are summarized in Table 1.

The Case Presentation

Case Presentations are a staple of medical education and are widely employed in both multimedia and print. They consist of a paragraph of text that summarizes a patient presentation and findings followed by a series of multiple-choice questions (Figure 1). They are often employed to test or reinforce basic medical knowledge regarding a specific type of case and are also used to evaluate clinical reasoning. Case presentations may not even be interactive, but may simply record learner responses for testing purposes. With multimedia case presentations, some at least try to provide feedback regarding the learner’s choice of responses (Talbot, 1997). This level of interaction is fairly limited and really can’t be considered as game play. Some online and multimedia versions of case presentations have been labeled as virtual patients simply because they are presented on a computer. These flat constructs test core medical knowledge and clinical reasoning skills. They can be useful educational adjuncts for teaching knowledge items and clinical reasoning if they are built in a way that offers some type of useful feedback. Providing scores that tally correct and incorrect responses, a typical approach, may be worthwhile for assessment but they are not useful for didactic purposes because numeric scores contain no educational content. The primary reason for the ubiquity of case presentations is that they are very easy to author. They can be written by a typical medical educator who need only provide a medical history, several questions and hopefully useful responses to user input.

Interactive Patient Scenarios

Interactive patient scenarios (IPSs) represent a very common form of virtual patient. When the term “Virtual Patient” is employed, this is the type of learning tool typically referred to. Interactive patient scenarios, which are usually text-based multimedia, build upon the case presentation with a few novel features; they may advance the progress of the patient over time, they employ substantial multimedia and they may have a branching structure that allows for considerable variation of the encounter experience.

Interactive patient scenarios are typically generated online and contain considerable multimedia in the form of photographs of patient findings, radiographs and auscultation sounds. The case history and progression may be presented through text or voice narration. They may advance a case to show ongoing symptom progression or response to treatment. If the interactive scenario does not allow the user to control the patient, it is called a linear case scenario. If it alters the progress of the case based upon the learner’s decisions (typically multiple choice), it is called a branching scenario. Branching scenarios allow for considerably different patient outcomes based upon learner choices and they permit a richer experience. The main drawback to branching scenarios is complexity and effort to author them. Each branch represents a potential geometric increase in authoring effort unless the branching is tied back to one or a few linear narratives. Branching IPSs are often employed for teaching clinical reasoning skills and will often include both the diagnostic phase (interview, physical exam & test data) as well as the treatment phase of the patient encounter.

Branching interactive scenarios provide a good deal of game-play if the author creates interesting, mutually exclusive choices to the learner. They also can be interesting for repeat
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