Single and Multi-User Virtual Patient Design in the Virtual World

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Abstract. This research addresses the need for the flexible creation of immersive clinical training simulations for multiple interacting participants and virtual patients by using scalable open source virtual world technologies. Initial development of single-user surgical virtual patients has been followed by that of multi-user multiple casualties in a field environment and an acute hospital emergency department. The authors aim to validate and extend their reproducible framework for eventual application of virtual worlds to whole hospital major incident response simulation and to multi-agency, pan-geographic mass casualty exercises.

Keywords. Virtual Patient, Virtual Worlds, Medical Training, eTraining, Major Incident Response, Simulation, Mass Casualty, Trauma, Emergency Response

Background

Virtual Patients are computer simulations designed to train or assess clinicians in information gathering, diagnostic reasoning and management of individual patients[1]. The majority of online Virtual Patient designs have focused on a single user or group interaction with a single patient.

The aim of this research was to develop a series of complex Virtual Patients for both single and multi-user simulations, using a reproducible design methodology and subsequently to validate their use in clinician and emergency responder training and assessment.


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2 Acknowledgements: Phase 1 was supported by the London Deanery under their Simulation Technology-enhanced Learning Initiative (STeLi). Phase 2 was supported by funding from the Health Protection Agency. Aggarwal and Sevdalis are supported by the UK’s National Institute for Health Research through a Clinician Scientist award and the Imperial Centre for Patient Safety and Service Quality, respectively.
1. Method

The development of the Virtual Patients was undertaken in two phases. Phase 1 involved the development of a series of single Virtual Patients (Figure 1) for postgraduate surgical trainees to individually assess and manage. Phase 2 focused on the development of mass casualty scenarios for multiple simultaneous emergency responders and multi-disciplinary teams to assess and treat.

Clinical decision trees to control Virtual Patients’ responses were modelled using an editor based on an open source framework and subsequently compiled to a web player that was developed to maintain the state of multiple Virtual Patients in an open source and scalable architecture. A message broker was developed to communicate between the virtual world (flexibly Second Life or the open source equivalent, Opensim) and the web player (Figure 2).

In the second phase, 3 existing modalities of training were studied: field training for HART paramedics[3] responding to an incident involving hazardous materials, an Emergo Train tabletop[4] exercise for hospital emergency departments – approved by the Department of Health as an acceptable alternative to a live exercise, and a desktop mass casualty exercise involving multiple agencies.

A training needs analysis was undertaken through semi-structured interviews with trainers and users who had experienced 1 or more of the 3 exercise types. Subsequently an integrated exercise scenario was conceptualised by a multi-disciplinary team so as to meet the identified training needs, particularly those that were not adequately or cost-effectively met by the 3 existing exercise modalities.
2. Results

For the first phase, 3 general surgical Virtual Patients in 3 different ward settings (Figure 1) at 3 training levels were created. These are undergoing face and construct validity testing with both junior and Consultant grade surgeons [3].

For the second phase, 3 aspects of the scenario (referred to as vignettes) were designed and implemented and their face and content validity assessment is now being undertaken with paramedics and hospital practitioners. The 1st vignette is set in a simulated field environment involving hazardous materials (Figures 3 and 4), where paramedics and other first responders could undergo concurrent training and assessment. The other 2 vignettes are set in a simulated emergency department receiving multiple casualties.

3. Discussion

A reproducible framework for both single and multi-user virtual patient development was achieved.

Face and content validity testing is being carried out separately for each phase 2 vignette but it is clear that the technology could support multiple teams at different virtual sites exercising at the same time in a fully integrated exercise. This might include multiple agencies and teams at the site of the incident, several hospitals and regional control centres, each managing their resources as in a real mass casualty event.

References