Someone to Talk to; Using Automated Characters to Support Simulated Learning Activities

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Abstract: The University of the West of England (UWE) has a large number of students who will pursue subsequent careers in a wide range of professional fields such as engineering, law, business, nursing, teaching, psychology, criminology and design. An important part of that education is the ability to relate theory to practice (Barrett 2011), and developments in technology over the past years have now created opportunities to enable students to experience simulations of events and situations that are difficult, unethical or impossible to organise in the real world, before they put their skills into practice in the real world (Newland 2008). Virtual worlds are proving to be popular and effective environments at UWE for simulations of a range of experiences, such as accident investigations, risk assessments, business ethics cases, psychotherapy practice and sociological experiments. However, as the number of students undertaking these simulations increases, so the call on tutor time will significantly increase. These simulations require to be scalable, to enable their potential for study by large cohorts of students. This year we have experimented with automated non-player characters, also known as "bots," to enable students to undertake some dialogue during the simulated scenarios without the need for a number of tutors to be available to take particular roles. The bots are currently unsophisticated keyword recognition systems, but even these have proven to have some value in two of the simulations; the accident investigation and the risk assessment, where students were able to gather information from characters they could "talk" to, making more realistic the experience of exploring the environment where the simulations were taking place. This paper discusses the results of student feedback, evaluations of these simulations and prototype development for the next generation bots that we want to implement in future learning simulations based on the findings of the evaluations.

Keywords/Key Phrases: learning simulations, non-player characters, professional practice, virtual worlds.

1. The environmental health scenario

Virtual worlds are three-dimensional representations of environments, either realistic or imaginary, where users can participate in a variety of ways from game play to social interaction. Users of virtual worlds create a virtual self, an avatar, which represents them within the displayed environment. The virtual world of Second Life® is a geographically large, customisable environment. Users of Second Life® can manipulate and build their own environment using inert components or user programmed interactive scripts contained within objects.

MSc Environmental Health students at UWE undertake an accident investigation and risk assessment in realistic industrial sets in the virtual world Second Life®, as part of an underpinning theoretical module that covers risk evaluation theory. Half of the cohort witness the accident in the virtual world and then act as witnesses for the other half. Once they have been interviewed by their colleagues, the witnesses undertake a simulated risk assessment in neighbouring premises whilst the accident investigators carry on with the investigation by inspecting the premises, picking up clues from objects, taking photographs and interviewing a simple automated bot that takes the role of one of the workers involved in the accident. The risk assessors also have the opportunity to interview a bot taking the role of a worker in the company during their inspection. At the conclusion of the exercise the students are asked to complete an evaluation questionnaire and take part in a "cafe style" forum to discuss their reactions to their risk studies.

The next section of this paper is a summary of the part of the results of the evaluation undertaken in April 2011 that refers to bots and personal interactions.

2. Student feedback

Generally the students were interested in the idea of undertaking an accident investigation or risk assessment in a virtual world when they first joined the module in September 2010. None of the students had ever used a virtual world before, but most were keen to try it out. Some weren't though,

as can be seen from Figure 1 below. However, Figure 1 also shows how their views changed over the course of the exercises.

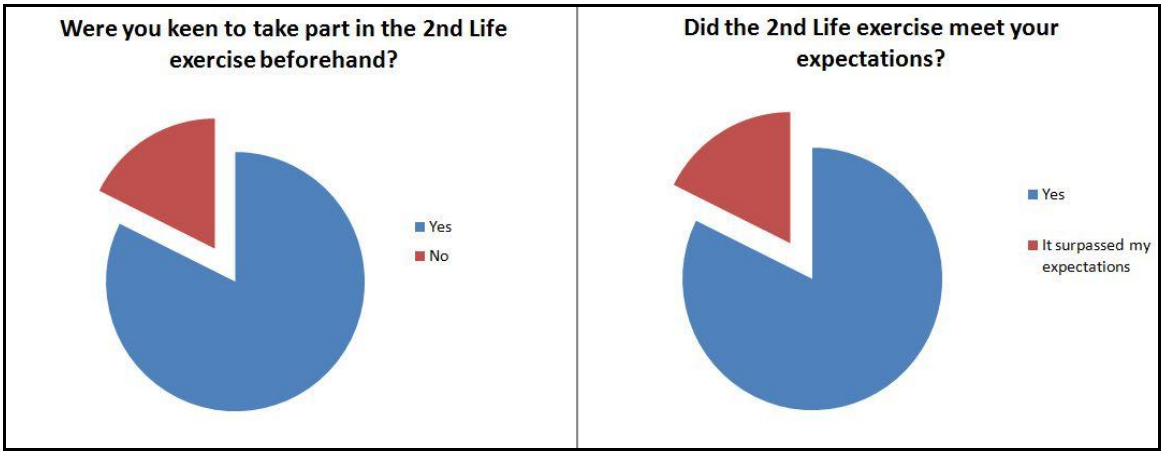

Figure 1: Changing views before and after the exercises

The change of view in the students who were trepidatious at first is summed up by the following comment: “I like that it simulated real life. I was a bit apprehensive at first because I do not particularly like 'video game' type things but I found it a very useful exercise. I like the visuals in second life and how real everything looked. I like that you could meet with friends and have a chat, as opposed to regular online chatting and it’s just you and the screen. You sort of feel like you are real people in a fake world.”

Figure 2 below shows the students’ responses to questions about the learning outcome of the exercises, and demonstrates how they felt very positive about their learning experiences overall. The following comment illustrates the reality aspect of the exercises: “It is visual and a more realistic way of learning as I felt like the actual person doing the investigation.”

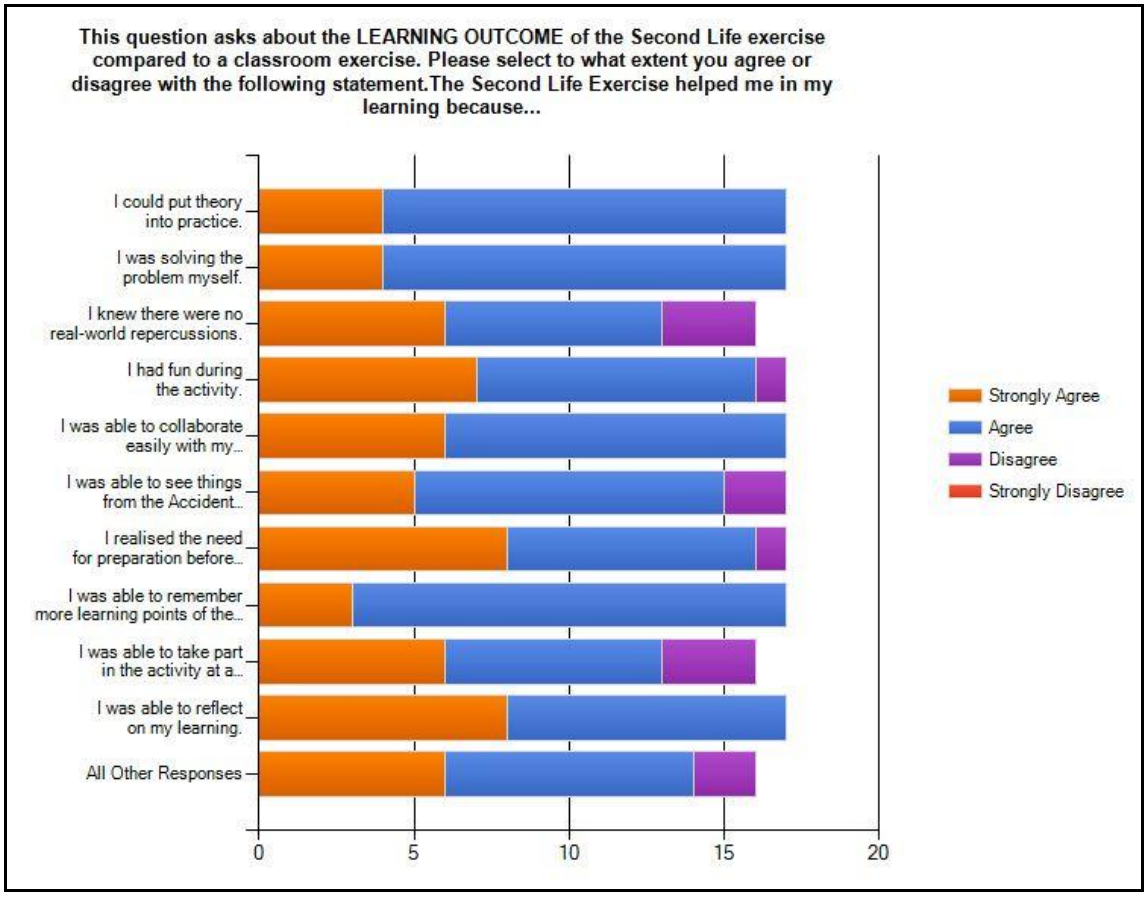

Figure 2: Students' views of their learning outcomes

Their comments regarding the activity of interviewing the automated bot do demonstrate that it was a part of the exercise that they enjoyed, but the restrictions of a simple keyword-matching bot are also apparent:

- "It has been fun using second life and I like the level of interaction you can have with the people and objects around you. This was helpful for the investigation."
- "It is a new and novel way of learning, something I'm very open to than the normal read, read, read and regurgitate."
- "It was interactive, something different, was fun and interesting. Better than role play."
- "Talking to the bot was the weakest point. It lacked the sophistication (obviously) of the manager interview and therefore was the least realistic. But it certainly fulfilled a purpose."
- "It could sometimes be difficult to see or interact/find things. The bots were not able to interact in a cohesive way."
- "Interviewing the bot I found limited. I would have thought about how to phrase my questions but the limited scope of the understanding of the bot meant that I knew the most effective way was to simply state the key words - the experience lost realism at this point. More interactions such as reporting to a receptionist and signing a visitor's book when meeting the manager may have helped produce a more realistic feel."
- "I felt restricted by the limited keywords with Buddy Norton (the bot) gave. Also I would have preferred talking as compared to typing in the interview."

These comments demonstrate the need for a more sophisticated approach to the design of bots. Advanced bots could take a more active part in the kinds of interactive scenarios that we have described above. The next section of this paper describes our current development work on advanced bots.

3. Designing advanced bots and interfaces

The need to design professional practice simulation learning activities that are sustainable from a teaching resource perspective has led us to investigate further the development of more complex automated characters. These characters can be designed to have certain specific knowledge and to be able to query online services to access information. They can also be developed to display certain personality traits. This advanced automation helps to maintain a degree of realism of the learning simulations (simulating social interaction) while adding flexibility to the experience (learners' interaction can take place at any time, any date) and helping to control the workload on teaching staff (Schalkoff 2011). The use of advanced automated characters will make it possible to design learning simulations for large cohorts of students. It also affords new learning support opportunities; students could attempt to interview the automated character several times over a period of time to perfect their technique to obtain information; students could interview the automated character via a variety of devices or online domains; and their interaction could be automatically translated to a foreign language of their choice.

We have now developed a working "proof of concept" complex bot. The development process started with a scoping phase to identify requirements and map possible technical solutions against those requirements. Artificial Intelligence Markup Language (AIML) was chosen as the main vehicle to develop the conversational elements of the system that would allow for the automation of conversations between the bot and the students (Dybala 2010). AIML as a structured computing language allows for the processing of natural language interaction. It also makes it possible to programme bot responses to be varied (they can be linguistic responses, hyperlinks, web page extracts and information feeds from web services) and also for the randomisation of the response given by the bot to a particular question. Different products already developed by third party providers were identified as being able to support different sections of the functional architecture: Discourse (Daden Limited), Sitepal (Oddcast Inc), Translate API (Google Inc), Yeast Templates (University of La Rioja) and Virtual Keyboard Interface (GreyWyvern Inc).

The current working prototype is an integration of all the above technologies. We have developed a number of scripts that control how those technologies interact with each other. We have also developed a number of interfaces for students to interact with the bots, so that conversations with the bots can be held in the virtual world Second Life, but also via a web-enabled mobile device as shown in Figure 3 below or via a web browser on a computer.

Figure 3: Smartphone browser interface of the advanced bot prototype

The communication architecture that runs the bot prototype is quite complex, particularly for the full browser interface. We have aimed at designing an interface that appears clear and intuitive (Ju & Leifer 2008) as shown in Figure 4 below, where all features have been automated apart from the students' language choices.

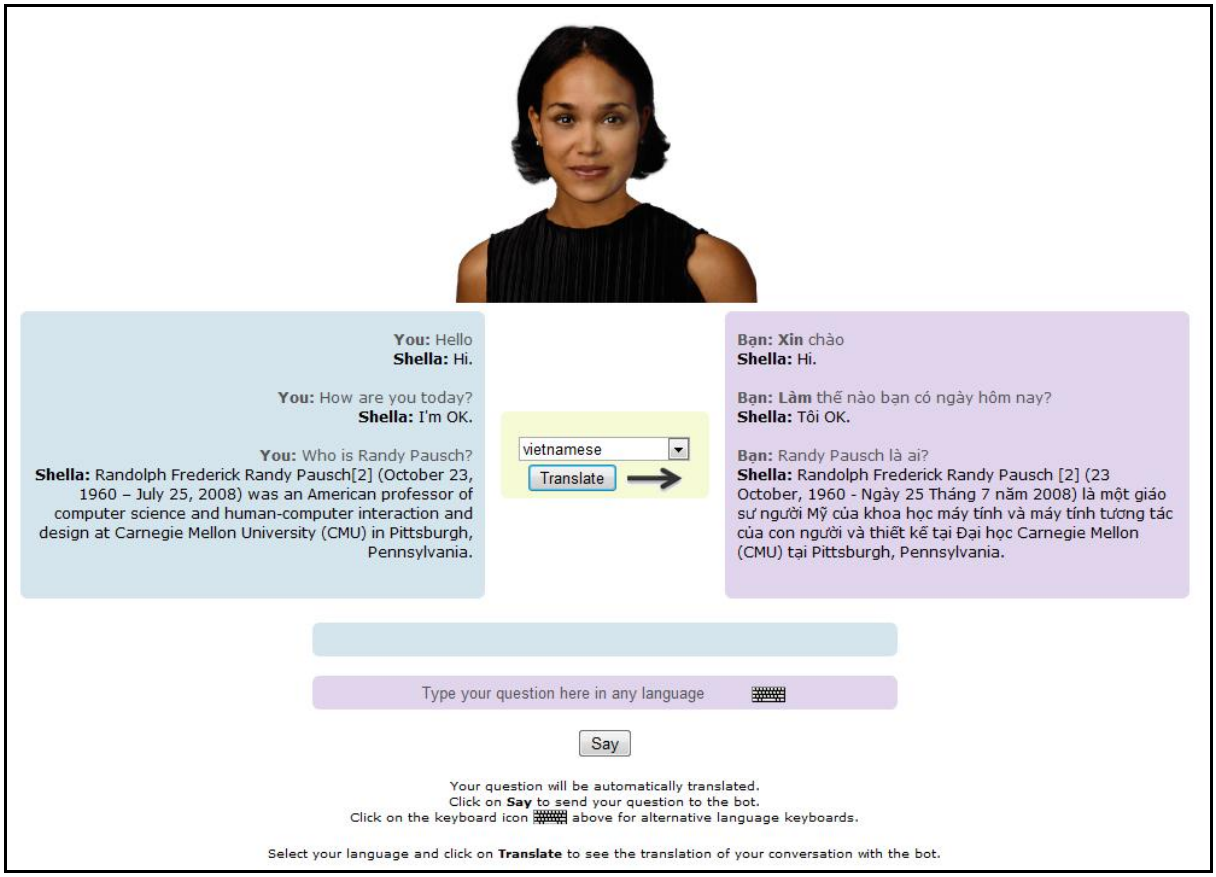

Figure 4: Full browser interface of the advanced bot prototype

4. Further work

The success of the prototype development allows us to move to the next phase of development that will focus on the sophistication of the conversational abilities of the bot, capturing and processing of questions that the bot is unable to answer, linking the information bank that drives the conversation to relevant external services and feeds, and developing distinct instances of the bots to suit particular characters in the learning simulations.

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