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Knowledge networking via social media for sustainable supply chains

Business applications for Virtual World Platforms for Training

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1.0 Introduction

Education and training is in a period of transition. According to Freedman (2008), "Today, higher education is at a historical juncture, transitioning from the industrial era to the information era, and from a national perspective to a globalized one". In addition and equally significant, the twenty-first century student is evolving. Having grown up with an assortment of technologies and ubiquitous access combined with the explosion of Web 2.0, the old paradigm of learning, is becoming no longer applicable, but the current model is one that is collaborative, autonomous and also exploratory.

In addition to 'standard' Web 2.0 tools (Blackboard Learn, Facebook, Google, etc.) the 21st Century has seen an explosion of Web 3.0 platforms. Virtual World (VW) platforms fit into this category. They are immersive, online environments where the imaginary meets the real to promote shared experiences and the exchange of ideas and information. They are online spaces, accessed through a computer graphical user interface, where all that is perceived takes place in real time (Schoonheim, *et al.* 2014).

VW can represent many varied environments, however for training and teaching purposes, they often reflect a 'known' physical environment, such as a campus, lecture theatre or library (Figure 1). These created environments are three dimensional spaces which enables the avatar to experience the environment in 'true' 3D. This means that the user can, through the medium of their avatar, 'walk around' and view any object from any direction or angle. The VW world is accessible from any computer that is connected to the web through a Web 3D browser such as Firestorm (http://www.firestormviewer.org).

A key feature of VW's is the user engagement. VW's allow non co-located participants to meet to socialise, exchange data in real time, network and attend a variety of 'virtual' functions such as lectures, seminars, tutorials and peer meetings. All of these activities happen in 'real time' and 'conversations' can be recorded for future reference. In addition, participants can explore a variety of designed and created 3D environments, which enable them to explore the subject at a deeper

level than might be afforded by current methods. These include things such as the Journey through the Testis where an avatar becomes microscopic and can take a journey through the human testis (http://virtualoutworlding.blogspot.co.uk/2014/06/2014-edu-video-second-life-testis-tour.html)

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Figure 1 Entrance to student area at virtual Brunel.

VW's have been used in academia since their inception, but also many commercial enterprises have set up their own VW grids to enable their staff to engage with the company and each other in this medium. A leader in this area is IBM who has both public and firewalled VW Grids, which they use for a range of applications including, training, conferences, peer to peer discussions and social networking. In a compressive web overview of IBM's VW activities (http://www.ibm.com/developerworks/library/ws-virtualspaces/) IBM states that: The global economic downturn provides a compelling driver for change, accelerates our transformation, and challenges some of the old ways of doing business. Our experiments in virtual spaces have already demonstrated tangible cost savings, as well as softer benefits in different areas of our business. Near-term projects include integration of virtual spaces with collaboration tools, video, and mobile technology to minimize the need for travel.

2.0 Knownet study using the Brunel University virtual world platform, virtual Brunel

In 2013, the KNOWNET project was launched under the leadership of Dr Susan Grant (PI). The Project (a Marie Curie funded IAPP under FP7) was carried out in collaboration with Royal Sun Alliance Insurers(RSA). A key objective was to develop and build a web based interactive environment – a supplier social network (SSN) to support and facilitate exchange of good ideas, insights, tacit and explicit knowledge, across a diverse group of suppliers within a multi level supply chain within the Insurance sector. For this purpose two components were designed, a social network (private) and the use of a VW environment. In addition to this, the social network and a previously created 'Holly Farm' area (see section 2.3) were used across a body of circa 200 Distance learning students on MSc programmes at the University.

As in the commercial case with RSA, the Social networking platform and VW environment were designed to encourage training, collaboration and knowledge sharing, especially tacit knowledge sharing. Knowledge transfer is affected by all of those things that encourage or inhibit inter-personal communications.

Tacit knowledge includes the cumulative storage of the corporate experiences, mental maps, insights, acumen, expertise, know-how, trade secrets, skill sets, organisational learning and organisational culture. Explicit knowledge (or leaky knowledge) deals with objective, rational, and technical knowledge, such as data, policies, procedures, software, documents, products, strategies, goals, mission, and core competencies.

High levels of face-to-face contact and a process of socialization are usually required to establish and reinforce a relationship of trust and confidence between agents who are transferring knowledge.
Furthermore, the richness of face-to-face contact can help counterbalance the communications difficulties arising from differences in culture and language. The use of technologically mediated communications such as the SNS and the VW environment were not designed to replace face-to-face contact, but to support the transfer of both tacit and explicit knowledge when individuals were working at a distance.

VW's are environments where "thousands of individuals can interact simultaneously within the same simulated three-dimensional space" and engage in collaborative knowledge sharing and learning activities. The use of avatars in the

3-D environment provides richness, realism, and heightened levels of co presence/social presence. (Majewski 2011).

Collaboration. VW's, like other virtual environments, have been found to (a) enhance iterative or interactive collaboration, (b) provide shared outcomes, and (c) support the altruistic behavior of individuals (Jarmon, Traphagan, Mayrath, & Trivedi, 2009; Thomas & Brown, 2009). In addition, VWs have been found to create more personal connections (Melcrum Publishing, 2008), provide unprecedented levels of interactivity (Kohler et al., 2009), and improve collaboration, communication, and cooperation (Fetscherin & Letttemann, 2008).

Knowledge migration. There is evidence that creativity in the VW can lead to innovation and that this innovation can be transferred to the real world or can be leveraged in the VW (Hemp, 2006; Kohler et al., 2001 VWs provide a promising learning environment that resembles the real world (Dede, Ketelhut, Nelson, Clarke, & Bowman, 2004). For example, IBM uses VWs to train new employees to absorb the company's culture, values, decision-making structure, and technical skills. "IBM employees can immerse themselves in a digital realm where learning, collaborating, and play are all part of the work environment" (Pollitt, 2007, p. 14).

2.1 Creating the VW for the RSA participants

To engage members of the RSA in this study, a VW environment was specifically designed and created by Dr Olinkha Gustafson-Pearce on the Brunel University virtual world platform, virtual Brunel. Prior to the creation of this area, Dr Gustafson-Pearce monitored the RSA Knownet social network platform for typical comments and areas of interest of the participants. It was found that a lot of the discussions were weather or geological related, with some contributors even giving 'live' Met Office updates in times of poor weather conditions. Therefore it was determined that the created area should have the ability to stream real time data from a geological or meteorological source. The United States Geological Survey (USGS) Earthquake feed was chosen, since it is highly stable and the stream can be used to show data in real time. An area was created with a sphere, which used the streamed data to show earthquakes on the surface of the Earth, Figure 2.

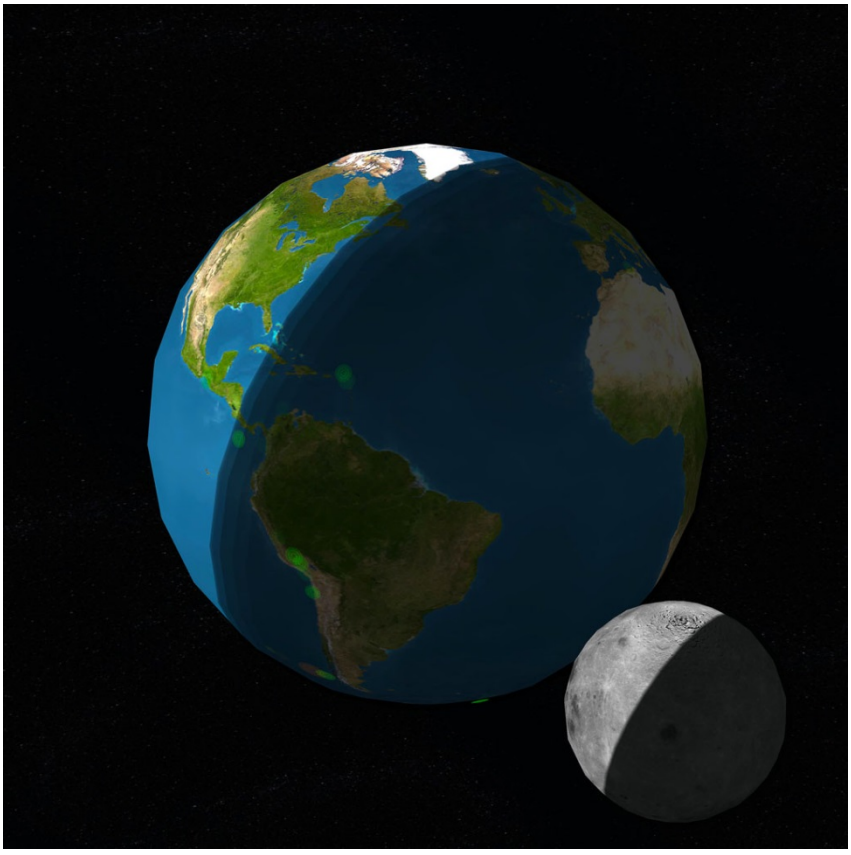

Figure 2. Earthglobe

Earthquakes are shown as coloured circles, red for earthquakes over 7 on the Richter scale, green for quakes between 4-7 and yellow for 2.5-4. When the earthquake first occurs the colours are bright, as time passes the colour slowly fades (using opacity) over a three day period. The depth of the earthquake is shown by the circles spiralling outwards – the deeper the quake the slower the spiralling. So for example an earthquake of 7.2 at a depth of 10km would show as a fast spiralling, red circle on the surface of the globe. All data was shown in near 'real time' with the software updating every 10 minutes. In addition the night/day zone also updated in real time, so that participants could understand lighting conditions that would be 'on the ground' at the current time. This would be relevant to any emergency responders, however it would also allow the RSA participants to understand how live data could be streamed into the VW. Additional areas were also created. These include an exhibition which showed various aspects related to earthquakes including a 'what to do in an earthquake' with an interactive Q&A panel that tested participants knowledge about how to stay safe in the event of an

earthquake. There was also a 'discussion' area with seating where participants could sit and chat. See Figure 3.

Figure 3. Knownet Social Area

2.2. RSA Participants

An IM was sent out on the RSA Yammer platform to ask for participants for a VW platform pilot study. A number of people responded, which resulted in 10 people, who were the initial group of volunteers for the first VW pilot study. Parameters for the study included: How easy/hard did the participants find using the VW, did the platform enable knowledge exchange and how immersive did the participants find the experience. In addition the authors were interested in any suggestions or ideas that the participants might have for the use of the VW platform in the context of knowledge exchange in complex supply chains.

2.3 Engagement

Researchers have found the level of engagement to be higher in VW environments than in other virtual environments because of the ease of communication in VWs (Howarth, 2008) and the choice of method for self-expression (Kohler et al., 2009; Owens, Davis, Murphy, Khazanchi, & Zigurs, 2009).

In the pilot that was conducted, the researchers found participants (through the medium of the avatar) reacted in a manner that suggested 'presence'. This was shown by individuals apologising if their avatar 'bumped' into another avatar and generally behaving as if the avatar was 'them'. Statements such as "I will follow you …" and "over here" also indicated immersion in the created environment. Interest in the displays was high, with many questions about what they were viewing. They were keen to understand the various forms of the displays and, in further discussions in the 'breakout' areas, they had extensive conversations about how a platform of this kind could be used in for the RSA. A number of the participants were 'home workers' and felt that a created VW environment would enhance their workplace activities and reduce the feeling of isolation that they sometimes feel. This aspect will be taken further in future developments of project. In addition to the focussed discussions which related to knowledge exchange specific to the RSA, it was also found that participants engaged in 'water cooler' conversations. These included exchanges about the weather and their individual locations etc.

Figure 4. Participant discussing Earthglobe

2.3 MSc participants :

The MSc in Engineering management (http://www.brunel.ac.uk/courses/postgraduate/engineering-management-msc) aims to have a strong practical focus, and solving problems based on real-life scenarios, forms a crucial part of the course. Engineering Masters Distance Learning students spend a great deal of their time in work, which can be based anywhere in the world, so it can be hard for the students to meet face-to-face with each other and with their tutors. The advantage of virtual world technology is that the course module content can feel more real. Students get a sense of being there together, and can engage in group work/simulations in real time. Therefore for the 200 students working on the DL mode, Dr Gustafson Pearce designed a virtual world learning, teaching and case study environment named ‘Holly Farm’.

Figure 5. Holly Farm – Library

Included in this environment was a seminar space, breakout areas, library (with interactive online materials), a 'learning space' with interactive, video and other information on the module contents and a 1/5 scale model area of the case study area of the farm and factory. Previous students who have used this environment have reported extremely positive engagement with the platform. The Brunel virtual world has also overall, also garnered a great deal of interest and support from both students and staff.

Figure 6. The Holly Farm model area showing video and static data

3.0 Conclusion

Overall it was felt that both pilot studies were successful. The use of the VW for both sets of participants was found to be easy to engage with and provided a medium to explore data and exchange knowledge, concepts and ideas that was not possible through other platforms (emails, Yammer, WebX, etc.) For the commercial partners, further work will include exploring the potential suggested by the participants to establish an environment specifically for home workers.

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References

Dede, C., Ketelhut, D., Nelson, B., Clarke, J., & Bowman, C. (2004, June 22-26). *Designbased*
research strategies for studying situated learning in a multi-user virtual environment
(pp. 158-165). Paper presented at the 6th International Conference on Learning Sciences,
Santa Monica, CA.

Freedman, G. (2008) Unlocking the global education imperative: Core challenges & critical responses. Accessed 20th January, 2015: http://www.blackboard.com/CMSPages/GetFile.aspx?guid=6032f8df-b6ba-4510-81d2-3198459529dc

Fetscherin, M., & Lattemann, C. (2008). User acceptance of virtual worlds. *Journal of Electronic*
Commerce Research, 9, 231-242.

Grzegorz Majewski, Abel Usoro and Imran Khan(2011) VINE: The journal of information and
knowledge management systems, Vol. 41 No. 1, pp. 41-62

IBM Developer Works. Virtual Spaces: Enabling Immersive Collaborative Enterprise. Accessed 20th January, 2015: http://www.ibm.com/developerworks/library/ws-virtualspaces/

Jarmon, L., Traphagan, T., Mayrath, M., & Trivedi, A. (2009). Virtual world teaching, experiential
learning, and assessment: An interdisciplinary communication course in Second Life. *Computer & Education, 53*, 169-182.

Journey Through the Testis. Accessed 20th January, 2015: http://virtualoutworlding.blogspot.co.uk/2014/06/2014-edu-video-second-life-testis-tour.html

Hemp, P. (2006). Avatar-based marketing. *Harvard Business Review, 84*(6), 48-57.

Kohler, T., Matzler, K., & Füller, J. (2009). Avatar-based innovation: Using virtual worlds for

real-world innovation. *Technovation, 29*, 395-407.

Melcrum Publishing. (2008). What do virtual worlds mean for business? *Knowledge Management Review, 11*(3), 30-33.

Pollitt, D. (2007). Learn-while-you-play program gets IBM recruits up to speed. *Human Resource Management International Digest, 15*(4), 14-15

Richter magnitude scale. Accessed 20th January, 2015: http://en.wikipedia.org/wiki/Richter_magnitude_scale

Schoonheim, M., Heyden, R., Wiecha, J.M. (2014) Use of a virtual world computer environment for international distance education: lessons from a pilot project using Second Life. BioMed Central Ltd. Accessed 20th January, 2015: http://www.biomedcentral.com/1472-6920/14/36/

The United States Geological Survey. Accessed 20th January, 2015: http://earthquake.usgs.gov/earthquakes/feed/v1.0/

Thomas, D., & Brown, J. S. (2009). Why virtual worlds can matter. *International Journal of Learning and Media, 1*(1), 37-49.