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Supporting distributed team working in 3D virtual worlds: A case study in Second Life¹

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¹ Figures are placed at the end of the paper and after the references. There are placeholders for them in the main text of the paper.

Supporting distributed team working in 3D virtual worlds: A case study in Second Life

Abstract: Purpose –This paper reports on a study into how a three-dimensional (3D) virtual world (Second Life) can facilitate socialisation and team working amongst students working on a team project at a distance. This models the situation in many commercial sectors where work is increasingly being conducted across time zones and between multiple teams. Collaboration in these geographically distributed teams is virtual rather than through face-to-face interactions. We investigate how a virtual world such as Second Life compares to other collaboration tools such as instant messaging or Skype; and the challenges that students experience in becoming acquainted with and working in Second Life.

Design/methodology/approach – The paper has employed a qualitative research methodology involving data collection through group interviews, epistolary (email) interviews and semi-structured individual interviews. The data has been analysed by applying the inductive analysis technique.

Findings – The analysis is presented through answers to questions which educators may have about the effectiveness of virtual worlds in supporting collaboration in virtual teams.

Research limitations/implications –The paper highlights the pedagogical role of 3D virtual worlds in supporting communication, team working and community building. The methodology will be of interest to researchers in the area of virtual worlds as there is little guidance in the literature about how to evaluate student experiences of these environments.

Practical implications – The research reported in this paper is timely and significant in view of current business scenarios such as: the challenges of a globally distributed work-place; the need to offer training to develop employees' skills of working in distributed environments, and to meet changing market needs. Furthermore, the research will support the development of a coordinated response to the Leitch review of skills in the UK, which identified issues of resource-intensive travel, global warming and the need for businesses to be seen as 'green' for customer attraction and retention.

Originality/value – The paper discusses the role of 3D virtual worlds in supporting student team projects involving students who are geographically dispersed. The sense of visual presence and of place in a 3D world can make socialising in a virtual world, a more 'human' experience than in 2D environments such as websites, e-mail, wikis and blogs, and even phone or video-conferencing. The research reported in this paper could enhance uptake of 3D virtual worlds by organisations facing the challenges of facilitating socialisation and knowledge sharing in a distributed workforce.

Keywords: 3D learning environments, 3D learning spaces, 3D virtual worlds, collaborative working, social software, virtual team, virtual worlds

Article Type: Case study

Introduction

Three-dimensional avatar-based virtual worlds offer new opportunities for teaching and learning in immersive and creative spaces. The sense of visual presence and sense of place that a 3D world offers can make socialising in virtual worlds more similar to face-to-face situations in real life than in 2D environments such as websites, e-mails, wikis and blogs, and even phone or video-conferencing (Bronack et al., 2008a). The paper shows how a 3D virtual world such as Second Life can facilitate socialisation and team working amongst students working on a team project at a distance; how Second Life compares to other collaboration tools such as instant messaging or Skype, and the difficulties that students experience in becoming acquainted with and working in Second Life. The research involved introducing Second Life into a Computing course at The Open University, UK in which student teams, typically four to six students per team, work at a distance on a scenario that involves software requirements gathering and analysis.

We analysed students' Second Life experiences and perceptions by applying a number of techniques such as group interviews, email interviews and semi-structured individual interviews. The data from forty-four students over two presentations of the course has been analysed by applying the inductive analysis technique. We hope that the research results will encourage and enable the uptake of 3D virtual worlds in organisations that are facing the challenges of facilitating socialisation and knowledge sharing in a distributed workforce while developing a socially responsible green agenda.

The paper is structured as follows. First, we discuss the context of the team working course and how different technologies have been introduced in the course since 2005 to support team working, facilitate collaboration, and synchronous and asynchronous communication among students. We then discuss the rationale and the process of introducing Second Life onto the course in 2009. This is followed by a description of the research design and the results from the analysis of students' experiences in Second Life. We conclude the paper by deriving the implications of this research for 3D virtual world researchers, and for educators and organisations who are planning to adopt 3D virtual worlds in skills training, socialisation, and as collaborative workspaces for distributed virtual teams.

The context of the course

Software development teams are increasingly working collaboratively at a distance and across multiple time zones. This creates challenges in communication, building shared values and trust, and coordinating activities. Distance can slow group communication and consensus making (Cummings and Kiesler, 2007). In response to these trends, social software tools such as wikis, blogs, and 3D virtual worlds such as Second Life^{2,3} are being integrated into communication and collaboration processes to enhance the productivity and effectiveness of virtual teams (e.g. Farrell, 2006; Decker et al., 2007; Rufer-Bach, 2009).

² <http://www.secondlife.com/>

³ All the URLs in the footnotes were last accessed on October 1, 2010.

In order to prepare students for these changes in software engineering practice, there is a need to use technology in software engineering education to simulate authentic structures and work practices. Use of collaborative and discourse tools will provide students with the experience of communicating and negotiating with diverse stakeholders with different views and backgrounds, and also enable the development of transferable skills for working with community tools in the computing industry (Minocha et al., 2008). Furthermore, team working is a skill which continues to be in demand by employers (see, for example the report published by e-Skills UK, the Sector Skills Agency for ICT and Computing, Ratcliffe, 2009). This requirement has long been recognised by professional computing institutions such as the British Computer Society and the Association of Computing Machinery. Finally, the subject benchmark statement for Computing in the UK states that students should have “the ability to work as a member of a development team, recognising the different roles within a team and different ways of organising teams” (QAA 2007).

In response to these requirements for software engineering practice, a course called ‘Team working in distributed environments’ (course code: M253⁴) was launched in 2005. M253 is a six-month long, undergraduate second level part-time distance-education course in the Computing curriculum at the OU. The course is presented twice per year and has 150-250 students on each presentation. While studying the course, student teams of typically four to six students per team, work at a distance on a software requirements gathering and analysis scenario. Example scenarios include: requirements analysis and design of prototype websites for a holiday lettings agency, a gardening club, or a travel agents offering specialist tailor-made holidays. Each student team is assigned a tutor, who has the role of a team mentor (not a manager); moderates discussions in the forum if required; monitors progress; resolves any student problems, and assesses the assignments and provides feedback on them. Further information on the design of the course can be found in Oldfield and Morse (2005, 2007).

Technologies on the course

When the course was first launched in 2005, each student team was assigned an online discussion forum for asynchronous communication and for sharing documents. It was suggested that teams could chose other synchronous or asynchronous technologies for team communication. Students have been using online conferencing tools such as FlashMeeting⁵ and Skype⁶ and instant messaging tools (e.g. Yahoo Messenger⁷). In 2007, each team was given a wiki as a collaborative working space for team-related materials such as meeting agendas and notes, decisions, list of tasks, and so on. In 2008, the course team decided to introduce a 3D virtual world to a volunteer set of M253 students and tutors to support synchronous communications and team working. The course team felt synchronous avatar-based communication and

⁴ <http://www3.open.ac.uk/study/undergraduate/course/m253.htm>

⁵ <http://flashmeeting.open.ac.uk/home.html>

⁶ <http://www.skype.com/>

⁷ <http://uk.messenger.yahoo.com/>

real-time collaboration in a 3D virtual world would help student teams in the following ways:

- enhance socialisation within teams;
- support team building and facilitate team meetings better than other synchronous technologies which the students have access to, such as Skype and instant messaging.

Perceived lack of socialisation in 2D environments

The decision to introduce the 3D virtual world Second Life onto M253 was based on our research into other courses at the OU. Over the last few years, we have introduced a number of technologies onto our courses to enable our students to communicate with their tutor and other students, and to collaborate online with other students on course activities. For example, we have introduced blogs on courses for students to keep diaries of their thoughts and reflections, or wikis to support team projects where students can collaboratively write documents, or forums to encourage dialogue between students who may never meet one another or their tutor in person. Our empirical research on the pedagogical role and effectiveness of wikis (Minocha and Thomas 2007) and blogs (Kerawalla et al. 2008; Minocha and Roberts 2008) in distance education has shown that inadequate socialisation at the start of the collaborative activity was a key obstacle to conducting group projects or activities at a distance. Our research has shown that students were hesitant to review critically or comment on each other's contributions, or they had difficulty in scheduling tasks in a collaborative activity, or to negotiate time schedules. The students reported that they did not know one another well enough to be able to act as critical reviewers or commentators at a distance.

Socialisation encompasses the social act of coming together for a common purpose, for example, when students familiarise themselves with one other and learn the norms, roles, rules and codes of conduct of the team. This initial phase of familiarisation is achieved by interacting with one another and sharing ideas and information. As a result of this shared experience, participants are able to gain an awareness of one another, relate to one another (Wegerif 1998) and establish a connection. Socialisation activities could involve students sharing their personal interests such as photography, travelling, etc. in their first few blog posts or discussing their reasons for taking up the course in the discussion forum, and so on. Although blogs, wikis and forums can support socialisation, their asynchronous nature can affect students' perceptions of social presence and the effectiveness of collaboration.

A 3D virtual world such as Second Life that supports synchronous interactions via avatars with voice, text and gestures may facilitate socialisation, an antecedent for effective online collaboration (Minocha and Roberts, 2008). The sense of presence and sense of place that a 3D virtual world gives makes learning, and indeed socialising a more 'human' experience than many other 2D technology-enabled learning environments.

Three-dimensional virtual worlds

Three-dimensional virtual worlds, also called synthetic worlds, are multimedia, simulated environments, often managed over the Web that are persistent, and which users can 'inhabit' and interact via their graphical self-representations known as 'avatars' (Meadows, 2008). A 3D virtual world with multi-user capabilities such as Second Life provides users, through their avatars, with the facility to engage in embodied verbal communication via text and voice, as well as embodied non-verbal communication in the form of gestures and facial expressions. An avatar-based 3D virtual world is distinct from 2D environments in that the user's avatar and the avatar's appearance are additional dimensions to the user's online identity. In a 3D virtual world, the avatar can navigate (fly, walk, sit), encounter other avatars, and communicate with them through gestures, voice, text, and instant messaging. These communication and interaction mechanisms in 3D virtual worlds create a sense of 'being together' in a 'place' with other avatars (Bronack, et al., 2008b). Since Second Life is a non-game-based programmable environment, the learning spaces within Second Life can be designed and adapted to suit the learning context and activity. The ease of adapting the virtual designs is cost effective compared to changing the design of learning spaces in real life⁸.

Figure 1 shows a group of international educators who regularly meet in Second Life to share good practice in technology-enabled teaching and learning.

Figure 1: A meeting in progress in Second Life

In the next section, we describe the process of training M253 students to use Second Life. We will then present the research methodology for eliciting students' experiences in Second Life. Finally, based on our empirically grounded data, we will draw conclusions about the effectiveness of Second Life in supporting team working at a distance.

Introducing Second Life onto the course

The course team was interested in evaluating the effectiveness of Second Life on M253 before using it on the course more widely. Our methodology is as follows. Volunteer students are recruited for the Second Life trial at the start of every presentation. Typically, 18-24 students are recruited in each presentation, i.e. 3-4 teams. The researchers provided Second Life training to four M253 tutors when Second Life was first introduced onto the course. The volunteer students are allocated to these tutors because some training and induction is required before users can feel comfortable interacting with Second Life.

Developing students' Second Life skills

Based on our experience since 2008, we have identified two key areas of training and skills development in Second Life: (a) using the Second Life software; and (b) communication and group-working skills.

⁸ DELVE project (Design of Learning Spaces in 3D Virtual Environments, <http://tinyurl.com/3g937f>; <http://oro.open.ac.uk/20072/>; <http://oro.open.ac.uk/21267/>)

The Second Life website⁹ has resources that explain how to download the software and create an account, including the steps necessary to create an avatar. The website also has a quick start guide which introduces new users to the Second Life user interface, how to change an avatar's appearance, how to walk and fly, and how to communicate within Second Life using instant messaging, text chat and voice. We send the URLs of these resources, along with our own user guide, to the students so that they can install the software, become familiar with the interface and can learn about avatar-based interactions. We have found that taking students through the Second Life user interface features again when they come into Second Life for the first session is helpful. Before the first session, we (the research team and the tutor(s), who act as trainers or facilitators) enquire of the students their avatar names and send them details of the meeting venue. We then 'friend' the 'avatars': this enables us to know when the students come into Second Life and we can teleport them to the meeting location if the students find it difficult to reach it themselves.

During the first session, we run a tutorial on our university's island (called Open Life¹⁰) where we introduce Second Life user interface features to the students and give them an opportunity to ask questions. In this session we also ask the students to 'friend' one another as a way to learn this Second Life feature and also as a means of getting to know one another. We provide the students with a guide to the etiquette and norms of interaction and collaboration within Second Life.

Figure 2(a) show the meeting point in Open Life where we ask students to report for the tutorial. Figure 2(b) shows a tutorial in progress using a slide presenter within Second Life.

Figure 2(a): Meeting point in Open Life

Figure 2(b): An induction tutorial in progress

In Second Life there are many interesting educational islands¹¹. We take students on tours to some of these islands, which helps introduce students to the potential of 3D virtual worlds in education and through these tours, the students learn to navigate (fly, walk, teleport) and communicate (group chat in text and voice) in Second Life. The tours also facilitate socialisation. In our first couple of sessions we give students note cards (similar to brief documents) with landmarks of meeting locations in deep|think¹² (our department's island in Second Life, Rapanotti, et al., 2010) and take them on a tour of deep|think. These locations are a mix of formal (chairs and tables) and informal (bean bags on the floor or in a tree house or underground) locations so as to give some variety to the students.

⁹ <http://www.secondlife.com/>

¹⁰ <http://slurl.com/secondlife/Open%20University/97/45/25> (Location of Open University's teaching island in Second Life; SLURL: Second Life URL)

¹¹ <http://secondlife.iste.wikispaces.net/SLTours>

¹² <http://slurl.com/secondlife/Deep%20Think%20West/44/220/23> (Location of deep|think island in Second Life)

Figure 3 shows one of the meeting locations in deep|think, which are pods in the sky. The design of the pods is such that the communications in one pod can't be heard in another pod. So two breakout discussions are in progress in Figure 3.

Figure 3: Meeting pods in deep|think

After these induction sessions, the student's tutor continues to provide support on interacting in Second Life, if required, to the students when they start meeting in Second Life for the teamwork. The tutor does not participate in their team meetings (as per the course design) but informs the students that he or she will be available in Second Life during the meeting times so that the students can send him or her a message if they need help.

Research methodology

Our overall research goal is to investigate the pedagogical effectiveness of a 3D virtual world in supporting working in a distributed team. In order to do this we introduced Second Life on a trial basis into a course that has been running since 2005. Our motivation for running this trial is founded on the perceived lack of socialisation in 2D environments, based on our empirical research on blogs and wikis. This led us to formulate Research question 1.

Research question 1: Does a 3D virtual world such as Second Life facilitate socialisation and team working amongst students working on a team project at a distance?

The trial of Second Life was run within an existing course, therefore we could not have set up control (student) groups for different technologies to compare the effectiveness of the technologies and student satisfaction: that is, where one student group uses one set of technologies (say, Skype) and another group uses Second Life, and so on. Setting up such control groups raises the possibility of disadvantaging some students which would not have been acceptable to us (as researchers and educators) nor to the course's external examiner. However, our students, as part of their OU studies or at their workplaces use a number of other collaboration and communication technologies - Skype and instant messaging being two popular tools. In our informal discussions with students, we noted that they often compared their Second Life experiences to tools that they were already familiar with, which led us to formulate Research question 2.

Research question 2: How does Second Life compare to other collaboration tools such as instant messaging or Skype?

Finally, we were interested to find out the obstacles (if any) that students face in their interactions with Second Life so that we could improve our induction and training procedures. This led to Research question 3.

Research question 3: What are the difficulties that students experience in becoming acquainted with and working in Second Life?

The analysis in this paper is presented in the form of answers to the three research questions listed above. Through empirically grounded data, this paper will highlight the factors that affect the student experience when conducting a team project in Second Life. It is hoped that the factors identified and the vignettes from the data will provide useful guidance and triggers for

ideas to educators who are planning to set up learning activities and spaces in Second Life.

At the start of the course, we send the research information sheet and a consent form to students by email. The information sheet has the following details: the research team contact details, the motivation for the research, how the research will be carried out and time it will involve, who has access to the data collected, and how the data will be stored and handled. In the consent form, we explain that participants are agreeing to be audio and video recorded, how their anonymity will be maintained, and explain that they have the right to withdraw at any point during the study without any impact on the course or their assessment. We also encourage students to contact us if they have any questions prior to giving their consent to participating in the research. The ethical guidelines of the British Educational Research Association (BERA)¹³ are followed in the preparation of the research materials. These research materials, including the interview protocols, are submitted to the Open University's Ethics Committee¹⁴, who review and approve the project materials and the research design. We have discussed the ethical aspects of conducting research in 3D virtual worlds in Minocha et al., 2010.

The empirical investigations, guided by the research questions, involved conducting email interviews, group-interviews and semi-structured interviews with individual students in Second Life. The various stages of data collection, analysis and synthesis are described below along with the rationale for our choice of techniques:

Stage 1. Conducting in-world group-interviews

The in-world (within Second Life) unstructured group interviews are conducted with each team that is participating in the Second Life trial. The tutor and one member of the research team meet the students within the first month of the course starting. We chose to conduct group interviews with the students to help establish the rapport between the researcher(s) and the students. Further, the group interviews help to elicit early, collective feedback from the students about their experiences of the Second Life software, how we (the tutor and research team) can support them better and the extent to which Second Life is supporting their teamwork. Each of these group interviews lasts for 10-15 minutes and gives an opportunity for the students to share their concerns and seek any help they need. Figure 4 shows a group interview in progress.

Figure 4: Group interview with the students

Stage 2. Interviews by email

In this stage, we send a question by email to each of the students (see Table 1) and ask them to respond within a fortnight. Our aim is to make our research investigations as unobtrusive as possible and give flexibility to the students to respond in their own time - hence, our motivation for conducting email

¹³ <http://www.bera.ac.uk/files/2008/09/ethica1.pdf>

¹⁴ <http://www.open.ac.uk/research/ethics/index.shtml>

interviews. The style of the question sent by email is based on the descriptive phenomenology approach of Langdridge (2007), which intends to allow participants to talk about their experience as much or as little as they want, guided by open-ended questions.

Table 1: Question sent by email

We would be grateful if you could describe, in a couple of paragraphs, your experiences with Second Life on M253.

Please describe your thoughts and feelings in as much detail as possible: (a) the problems you have experienced; (b) the benefits to your study and to the project on M253; (c) what changes you would make to the Second Life environment to support you better in your course work, and (d) any other aspects of your experiences in Second Life that you think are relevant to M253.

Please do not omit any details, even if you think they are insignificant or irrelevant because they may be very useful for us. Please provide as much concrete description as you can about your experiences.

The follow up discussions and any clarifications after the initial response from the student also take place by email. This process of interviewing participants over a period of time is also referred to as epistolary interviews in the literature (e.g. Debenham, 2007), although an epistolary interview is a generic term for asynchronous one-to-one interviews that could be mediated by online technologies other than email, such as via discussion forums.

Stage 3. Conducting in-world semi-structured interviews with individual students

Once the course has ended, we conduct an hour-long interview with each of the students within Second Life. These individual interviews enable students to reflect on their personal experiences and perceptions of Second Life. The questions focus on student's experiences with Second Life: how it contributed to their team meetings; how it compares to other collaboration and synchronous communication technologies that the students may have used at work or on other courses; their choice of spaces within Second Life for meetings, and any recommendations they might have for the course team and researchers to consider for enhancing the student experience in Second Life.

Stage 4. Data analysis and synthesis

The Second Life initiative on M253 is ongoing. In this paper we report on the analysis and synthesis of the data collected over the last two presentations of the course: May 2009 - October 2009 and November 2009 - April 2010 involving 24 and 20 students, respectively. An inductive analysis (after Braun and Clarke, 2006; Thomas, 2006) of the data was undertaken by the research team to identify the themes, subthemes, and any causal or other relationships between the themes, using the research questions to guide the data analysis.

The inductive approach is not as strong as some other approaches in the area of theory or model development (e.g. grounded theory, discourse analysis),

but it provide a simple analytical and efficient way of analysing qualitative data for deriving findings linked to focused evaluation questions (Thomas, 2006).

The inductive analysis involved two team members independently reading the different interview accounts multiple times. Although the analyses and interpretations of the raw data were influenced by the evaluation objectives and the research questions, the findings have arisen directly from the analysis of the raw data, and not from a priori expectations or models. The research questions provide a focus or domain of relevance for conducting the analysis, not a set of expectations about specific findings.

The primary mode of analysis adopted by the individual researchers (coders) was the development of categories from the raw data for the key themes during the coding process. After an independent data analysis by the coders, the team focused on looking across the data to find recurring themes and sub-themes. The themes, along with a representative set of comments from students, are now presented. Note that in the data-extracts, Second Life is often abbreviated to SL.

Collaboration in Second Life

In this section, we present the themes related primarily to Research question 1. However, some of the themes also pertain to Research question 2 because students sometimes compared Second Life to other communication and collaboration technologies that they use in their work or other contexts when describing their Second Life experiences.

Avatar-based interaction: The avatar, being controlled by the user, is a portrayal of the user or an alternative self (de Freitas, 2006). This online identity helps to support a rich sense of psychological immersion in the performance of the tasks, as well as facilitating communication, collaboration and relationship building (de Freitas, 2008).

I began to see that having an avatar did lend itself to promoting the feeling of real people at a meeting; even to the point of directional sound (the person on your right sounds like they are on your right).

Sense of presence: The students explained that the Second Life environment provides a sense of 'being there' but also a sense of 'being there together' or co-presence with other geographically dispersed fellow students (Schroeder, 2002).

We primarily used SL as a space where we could meet and have some real-time interaction. It was a novel way to do it and the sense that avatars were real people responding to commands from their users definitely gave a sense of reality

Also the ability to see who is talking is excellent, particularly when you don't know the people you [are] talking to.

Sense of place: The sense of presence or co-presence in a 3D virtual world is a consequence of being in a place or the 'sense of place', and is greater than in text-based alternatives such as instant messaging or discussion forums.

...benefited towards the project of M253 by allowing the team to communicate effectively like they would be in the same room.

...unlike a conference call, here [in Second Life] we feel that we are sitting in the same space; we are together

Anonymity with regard to real-life appearances: Avatar-based interactions can give a sense of anonymity, of hiding real-life characteristics such as physical appearance, physical disabilities, or ethnicity, which was preferred by students.

It felt almost like I had met my team members but maybe better, because I could not apply any judgement based on age, appearance, ethnicity etc.

We were never sure of the others age, appearance etc. and went purely on the merits of their contribution

I think it is better than video conferencing because people can be self conscious of what people think of their appearance and it stops the need to dress for a meeting, whilst getting a graphical representation of people and a place helps engender familiarity and reassurance

Fun and engagement: Students felt a sense of fun and engagement in an avatar-based 3D environment.

We could do fun things together and joke about our appearances/avatars/actions so it was more informal and friendly.

...takes the edge off the fact that we are studying. Kind of like studying in the field on a sunny day...

Team bonding: Students explained that the immersive experience in Second Life enabled them to bond better as a team compared to using instant messaging tools.

I think an IM [instant messaging] tool would not have allowed the same sense [of] immersion as SL. I think that this helped us bond as [a] team much better, as it helped us see more of a person's personality. Ed [an avatar name] for example was always playing with the toys, firing bubbles or playing with cards etc. He [Ed] frequently changed costume. Flavio and I got some new clothes at the very start and then didn't change much

I think it [Second Life] was preferable to instant messaging as it was more personal and could be fun at times. I think SL helped getting to know my fellow students and tutor.

I thought SL did provide an interesting setting for our synchronous meeting with some team bonding built around the visual aspects; the scenery and each others' appearance

Facility of a transcript: At the end of the meeting, the students were able to write their decisions in the text chat. This can be logged and saved as a text file within Second Life.

The best piece of functionality was chat logging, which saved us a lot of time preparing our [meeting] minutes as the transcript was available...a real time saver.

Teams would also have liked to save the audio discussions so that students who couldn't attend a meeting could catch up by listening to the recording. It is, in fact, possible to record audio discussions within Second Life either by using an external audio recorder or using the Audacity¹⁵ software. We have now informed students of the mechanisms to record audio.

Sense of commitment: The students felt that the face-to-face style encounter in Second Life and the synchronicity of interaction gave them a sense of accountability.

Without the holding of regular meetings with synchronous meetings, I do not believe we would complete the course. From the very beginning, our SL meetings have been an anchor around which our individual efforts are centred. Asynchronous communication works well but they fail to transfer any sense of urgency or more importantly any sense of responsibility to the team. Synchronous communication gives you the feeling that you

¹⁵ <http://audacity.sourceforge.net/>

are actually facing the team. Along with this is the feeling that you may be called to answer for your actions, or lack of them. I found that team members would often prevaricate and procrastinate during the week but on Sunday, they would steam into tasks ready for our Monday meetings.

It allows us (as a team) to connect in a way that we couldn't using a forum or wiki. Using the Voice Chat it allows us to make decisions much quicker compared to making decisions over a forum or wiki (i.e. waiting for replies). Using SL decisions can be made in real time assuming all team members are present at the meeting.

Socialisation: In addition to participating in regular meetings in Second Life related to the team project, students have the opportunity to participate in events and activities organised on the Open University's islands in Second Life (e.g. seminar series, quiz, parties, Christmas pantomime).

...more socialisation as you can attend other events in SL – so not just restricted to conversations over Skype

It has been educational for me outside of the M253 meetings as it enables me to talk [within Second Life] to other students doing different courses as well as other tutors. I have learnt so much extra information from other students and tutors that is has been a valuable experience for me which I would never have got from anywhere else.

Learning spaces: In the DELVE project (Design of Learning Spaces in 3D Virtual Environments¹⁶), we have investigated the relationship between the designs of learning activities and the designs of learning spaces in Second Life. One of our findings was that for distance education students, photo-realistic or artistically realistic representations of their institutions may help to engender a sense of ownership and belonging to the institution (Reeves and Minocha, 2010; Minocha and Reeves, 2010). This outcome from the DELVE project was re-affirmed by M253 students who preferred using the learning spaces in our university's islands even though we had suggested quieter places on other islands.

Figure 5 shows a selection of meeting locations on the Open University's islands¹⁷.

Figure 5(a) An informal meeting area in Open Life

Figure 5(b) A pub in the Open University's social island called OUtopia

Figure 5 (c) A large boardroom style room in the training area of Open Life

Finally, students mentioned some issues related to meeting spaces: concerns about privacy, interruptions from visitors and possible distractions (e.g. sounds of water flowing or the sound of the wind):

...somewhere a bit more quiet, i.e. no coconuts falling, wood creaking, or water running; listening to coconuts falling down every few minutes is annoying

I like the scenery better [an outside space] than a plain room [an indoor space] but without interruptions

Obstacles in Second Life

In this section, we present the themes predominately related to Research question 3. Some of the discussion also pertains to Research question 2

¹⁶ DELVE project: <http://tinyurl.com/3g937f>

¹⁷ The Open University islands in Second Life, http://www.open.ac.uk/virtualworlds/p3_3.shtml

when students compare Second Life with other technologies such as video-conferencing, web-conferencing (Elluminate) and instant messaging.

Technological obstacles within Second Life: Students found that sometimes there was a lag while using Second Life or the software crashed. These problems could also be caused by an unstable or poor network connection at the student's end.

I found SL to be rather buggy. This most often manifested itself as [a] terrible lag which I found could be cured by logging off and then back on.

Some students mentioned the problem of not having a broadband connection in their own homes. Since project meetings are normally scheduled in the evenings, these students had to either stay in the office or go to someone else's house.

...at my flat I connect via GPRS through my phone...no way Second Life can handle it so I had to stay at my parents until after meeting

Running Second Life also requires a high-specification graphics card and a minimum of 4 gigabytes of random access memory (RAM):

Is processor hungry – demands too much from the system

Efficiency: Due to graphics demand, can be slow to perform basic tasks quickly

In summary, some difficulties in using Second Life are that the application is resource hungry and not all PCs or laptops have the graphics card required. That said, we can see that this problem will diminish once older computers have become obsolete.

Learning to interact with Second Life: Students felt that it took them a while to get used to the Second Life interface in spite of our initial induction and training.

SL has a steep learning curve and steps could be taken to speed students progress up that slope.

...resource requirements, also initially having to learn to interact with the environment too much to learn for a user who just wants to participate in meetings

Some people trying Second Life with no experience or the hardware for using this kind of program and trying to help people get them sorted puts the group behind.

Use of voice in Second Life: Some students who don't have a headset or are unable to use voice in Second Life do not enjoy the meetings as much as they would if they were using voice. Without voice communication, Second Life becomes an Instant Messaging platform and the multimodal capability of Second Life is not exploited. However, some students were reluctant to use voice because of their 'foreign' accent.

Because if you have an accent for example, people can think something else about you or don't understand you

There were also regular occasions where students joined the conference, but did not have any sound. This happened to 3 out of the 4 members of a team. Generally this was resolved by a reboot, but this typically delayed the meeting by 5-10 minutes and caused dissatisfaction among other team members.

Distractions and interruptions in meetings: Although we had suggested meeting locations where we felt students would not be interrupted, students were distracted by noises and interrupted by visitors.

Uninvited "guests" crashing in: [we] need invite only meeting rooms; drink and dancing distractions during meeting: code of conduct to keep disco out of the workplace?

Lack of expressions and gestures: There is a very limited set of emotional cues, facial expressions and gestures in Second Life which can make it a rather impersonal experience for some students. It is possible that students may not have been utilising even the limited set of features in Second Life. We didn't focus on these features in our training, since we didn't realise their significance at that time.

Zombie avatars mostly sat there looking straight ahead and bored, not reflecting anything of the person behind them or giving clues to their feelings, I found it quite distant and detached during meetings

One student compared their experiences in Second Life to video-conferencing and said that not being able to see the real person behind the avatar can be disconcerting:

I occasionally use web based video conferencing through my job, and I find this considerably more engaging. As you can actually see the other participant's faces you can gauge reactions, see emotions and avoid the nagging feeling that someone at the other end has wandered off (either physically or mentally.)

Availability of collaboration tools within Second Life: During a meeting in Second Life, students would have preferred to share documents, as is common in web-conferencing tools such as Elluminate¹⁸:

While this worked well with discussions not requiring reference to materials, it soon became apparent that when the group wanted to discuss documentation, SL became a bit of a hindrance; each of us having to refer to materials outside of SL, such as websites, word documents and so on. This becomes frustrating as you do not have the abilities to reference as you would in real life; bringing up a document on a projected screen, pointing to a particular part of a complex diagram.

At work I use software such as virtual classrooms, internet meeting sites and so on. These are specifically designed around meeting the user requirements for meetings, discussions and learning. They offer functionality such as full-duplex sound, whiteboards, the ability to share documents and so on. Unfortunately, because of this SL comes a poor second to these applications.

This left the product feeling gimmicky, and not especially "business-like".

The students felt that other online collaboration environments that allow the participants to share and view shared documents at the same time are less resource-intensive than Second Life.

Also it hasn't got any collaboration tools such as screen sharing or whiteboarding which would be more useful than being able to see avatars of each other and the made up world around. I have used other tools such as MS Live messenger, Skype and IBM Lotus Sametime. These have all provided the same functionality (that we have used) as Second Life. Sametime has also allowed online meetings with the features that I said earlier which have aided greatly. Also these use a lot less resource meaning I can use them anywhere.

Hesitation in transferring Second Life use and skills to the workplace: The students commented that they would find it hard to convince their employers of the potential of the Second Life environment to support business processes:

...but if I think of it in a professional environment then trying to sell it to my managers would be difficult

¹⁸ <http://www.illuminate.com/>

...agree if I were working on this at my work they would conclude I was playing a game instead of doing my course.

Implications

The research described in this paper has implications for a number of stakeholders: educators and policy makers in institutions who are planning to adopt 3D virtual worlds in their curriculum, researchers working on 3D virtual worlds, and organisations who are facing the challenges of facilitating socialisation and knowledge sharing in a distributed workforce.

Implications for educators and institutions

- The research provides insights into the pedagogical effectiveness of 3D virtual worlds in team projects, benefits to students, and obstacles they may face, and issues that must be considered in a virtual world initiative. For example, it takes considerable time in student induction, designing learning activities, and monitoring and supporting student's initial journeys in a 3D virtual world so educators' workload is important. Most of the academic effort is still voluntary (Kirriemuir 2009; Kirriemuir 2010) so this raises the issues of sustainability of 3D virtual world initiatives. The technological requirements (memory, graphics card, and so on) limit the scalability of the initiatives and institutions face the dilemma of adopting and recommending tools in the public domain (e.g. Second Life) over which they have no control.
- The research reported in this paper can also help initiatives aimed at supporting the development of research skills in geographically dispersed research students, specifically, interviewing skills, communications skills, networking, and team-working skills.

Implications for researchers

- Our research design consisted of a set of techniques employing both asynchronous and synchronous technologies for eliciting students' experiences at different phases of the course. There is limited guidance in the literature on conducting empirical research in 3D virtual worlds. We hope that our example will help guide other researchers.
- There is a need to investigate and develop scenarios that combine 2D communication and collaboration technologies with 3D virtual worlds. We have not discussed this aspect in detail in this paper but we have observed that M253 students are using Doodle¹⁹ for scheduling meetings, their forum for planning the agenda, the wiki for recording the agenda and minutes of the meeting, a spreadsheet in Google Docs²⁰ to record 'agreements and issues', and using Google Apps²¹ to set up a project website.

Implications for businesses

Business is becoming more global and enterprises are now distributed and

¹⁹ <http://www.doodle.com/>

²⁰ <http://www.google.com/a/help/intl/en/edu/collaboration.html>

²¹ <http://www.google.com/a/help/intl/en/edu/index.html>

fast-paced. Such globally distributed team-environments face several communication and collaboration challenges. Some of the key issues are: first, there is a need for employees in organisations to continuously develop new skills and competencies to succeed in environments that are increasingly distributed and uncertain (Rosen et al., 2007); second, the challenges of building shared values and trust with colleagues from different countries and cultural backgrounds (Greenberg et al., 2007); third, limitations to asynchronous communication and collaboration technologies such as e-mail, wikis, blogs, and discussion forums, and fourth the need for synchronous technologies for networking and collaboration in virtual networks and teams (Minocha et al., 2008).

Conclusions

The avatar-based interactions help students to develop feelings of presence and co-presence in 3D virtual worlds (Gerhard et al., 2004). The students explained that the sense of presence and meeting in the same place within Second Life helped the team to gel, with the added advantage that their real life identities (appearance, ethnic background, etc.) were hidden. With regard to teamwork, Second Life gives a face-to-face style interaction so students felt that their decision-making was faster and easier when using Second Life than in asynchronous technologies (e.g. a discussion forum) or in audio-conferencing systems such as Skype.

The initial induction and training can appear onerous or time consuming to some students because they feel that they have to spend two to three hours just getting started on using the technology. Furthermore, it takes time to gain a feeling of engagement, a sense of presence and mutual awareness in Second Life. Therefore, it is only towards the end of the course that students get a 'good' feel for the technology and begin to realise how Second Life has supported their tasks on the course. As Second Life or other 3D virtual worlds are integrated into other courses within an institution, or when students start attending other social events and institutional activities within Second Life, then this initial set up time will not be required. Consequently, it will seem natural for students beginning this course, or any other course utilising Second Life, to use Second Life for meetings.

Students felt a sense of fun, engagement and commitment to other team members because they perceived a Second Life meeting to be similar to a face-to-face meeting. Some students in the last two presentations of the course (data on which has been reported in this paper), have formed their own self-help study groups and continue to meet with one another on a regular basis in Second Life after the end of M253. This is an illustration of the role that Second Life can play in community building and specifically in distance or part-time education institutions where students may have limited opportunities to meet face-to-face.

Although our empirical investigations have been carried out in Second Life, it is hoped that the results will be applicable to other avatar-based and configurable virtual worlds. The research reported in this paper could enhance uptake of virtual worlds by organisations facing the challenges of facilitating

socialisation, employee engagement, team building and knowledge sharing in a distributed workforce (for one such recent initiative, please see nteams²²).

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²² <http://www.nteam.com/> and a YouTube video at <http://www.youtube.com/watch?v=qLvL2bRG4M0>

²³ <http://www.jisc.ac.uk>

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Figures

Figure 1: A meeting in progress in Second Life

[Picture courtesy of the ISTE islands and the ISTE SL Tour group with Esme Qunhua and Janita Collins (Second Life names)]

Figure 2(a): Meeting point in Open Life
 [Picture courtesy of the Open Life island, The Open University, UK]

Figure 2(b): An induction tutorial in progress
 [Picture courtesy of the Five points island, Georgia State University, US]

Figure 3: Meeting pods in deep|think

[Picture courtesy of the deep|think islands, Department of Computing, The Open University, UK]

Figure 4: Group interview with the students
[Picture courtesy of the University of Worcester island, UK]

Figure 5(a) An informal meeting area in Open Life
[Picture courtesy of the Open Life island, The Open University, UK]

Figure 5(b) A pub in the Open University's social island called OUtopia
[Picture courtesy of the OUtopia island, The Open University, UK]

Figure 5 (c) A large boardroom style room in the training area of Open Life
[Picture courtesy of the Open Life island, The Open University, UK]