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Chapter 5

LEARNING TOGETHER AND ALONE IN VIRTUAL WORLDS

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ABSTRACT

Recent technological advances mean that 3D virtual worlds, such as Second Life™, are now freely available to educators and students with or without technical backgrounds. Given the possibilities of this technological medium, what sort of learning will flourish there, and how can we as educators support our learners in the brave new world? This chapter considers the issue of facilitating cooperative learning in a virtual world and the influence of presence and peer to peer interactions in this process. It presents analysis of qualitative data gathered during a term-long Second Life™ module for University students. Based on these findings, the chapter concludes with recommended guidelines for educators considering similar projects.

INTRODUCTION

Educators have been interested in the potential of 3D graphical virtual environments for learning for at least a decade. In an early example of a 3D virtual world in which students could learn computer science concepts, Goldberg (1998) reports on a system called LearningWorks, developed at The Open University from 1994 onwards.

> LearningWorks is intended to be an entry-level learning system and strives to be fun – much like a toy – in its use of 2D and 3D graphics and its support for constructing software in a 3D virtual reality world. Since we live in a 3Dworld, we conjectured that studying in 3D virtual

> worlds would be engaging for the students and easier for them to visualise the complex interactions of system components. Think of LearningWorks as a construction playground. (Goldberg, 1998, p6)

Second Life™ has rapidly gained in popularity recently among UK educators (Kirriemuir, 2008), but the idea of learning in virtual worlds is by no means new. Over ten years on, and several cycles of technological developments later, this argument remains reasonable: a graphical virtual environment with end-user programming facilities can be a motivating way for computer science students to learn within a constructionist tradition.

PRESENCE AND LEARNING

One argument for investing in immersive virtual learning environments relates to the concept of presence from the virtual reality literature. Intuitively, 'presence' refers to a sense of 'being there' while using a virtual environment. Lombard and Ditton (1997) define presence as 'the perceptual illusion of non-mediation'. When people using a communication environment use their normal perceptual, cognitive and affective systems to respond to the environment as if the experience is not transmitted through a medium, they are said to experience presence. Presence can occur during the use of any of the human-made media, including television, telephone, cinema or virtual environment. Physical presence is the illusion that a virtual reality experience is perceptually real. The probability that users will experience presence is related to how similar the sight, sound, feel, taste and smell of the mediated experience are to those in an unmediated experience. When an environment stimulates users' senses and responds to their actions, the experience is more immersive and they are more likely to experience physical presence (Anderson & Casey, 1997).

Another aspect of presence is related to the content portrayed by the medium; social presence is included in this category. Social presence can be defined as the 'extent to which a medium is perceived as sociable, warm, sensitive, personal or intimate when it is used to interact with other people' (Lombard & Ditton, 1997). Self presence is defined as 'the users' mental models of themselves inside the virtual world'; differences in self-presence are 'due to the short term or long term effect of virtual environments on the perceptions of one's body (i.e. schema or body image), physiological states, emotional states, perceived traits, and identity' (Biocca, 1997, section 8).

These three aspects of presence can be used to identify aspects of graphical virtual environments that help to make them suitable for learning. Learners may enter a fictional world within Second Life™, and experience a degree of physical presence. While there, they may encounter and interact with a 3D representation of an object or system they are studying, such as a virtual solar system or the inner workings of a molecule. Audio sound effects and voice chat can also add to the sensation that learners are 'there' within the world they are studying. In this sense, visiting a simulation in a virtual world is a way of making unseen or difficult-to-visualise concepts visible and concrete.

In the context of computer science learning, students can examine an external representation of the objects they create and see clearly how these objects' behaviour changes as a result of reprogramming. For subjects that require the visualisation of abstract ideas, the graphical nature of Second Life™ can be more beneficial than text-based learning

environments. In other domains, the evocation of self-presence within the virtual world may be more important than physical presence. Exploring issues of identity and self through the double safety of an educational role-play and an avatar 'costume' can be helpful for personal and social development (Robertson & Oberlander, 2002).

The main focus here is on social presence within a Second Life™ learning environment. In order to support cooperative work, an environment should engender some degree of social presence so that group members feel connected to their collaborators and part of a community. The chapter is based on a case study of a Multimedia Design module at Heriot-Watt University, Scotland, in which a mixed class of fourth-year undergraduate and MSc students used Second Life™ to create an interactive multimedia portfolio. We use our experiences as educators on this module to examine the extent to which the environment lent itself to cooperative learning, and also to investigate interaction patterns that are associated with ineffective group behaviour.

PEER LEARNING FACE TO FACE

It is clear that sociability is important to learning in a face-to-face context. Johnson, Johnson and Smith (2007) describe cooperative learning in which the learners have a shared goal as 'one of the success stories of both psychology and education' (p15). They review a series of studies which measured the impact of cooperative learning compared to competitive or individualistic learning and report that cooperative learning promotes significantly higher individual achievement than competitive or individual learning. The authors' earlier studies catalogued a series of additional benefits for collaborative learners, including

> greater long-term retention of what is learned, more frequent use of higher-level reasoning (critical thinking) and meta-cognitive thought, more accurate and creative problem solving, more willingness to take on difficult tasks and persist (despite difficulties) in working toward goal accomplishment, more intrinsic motivation, transfer of learning from one situation to another, and greater time on task. (Johnson, et al., 2007, p19)

Positive social interdependence is a component of cooperative learning: learners can only achieve their goals if their co-learners also achieve their goals (Johnson, et al., 2007). This increases the likelihood that learners will promote each other's success through substitutability (willingness to stand in for each other when necessary), inducibility (willingness to be influenced and to influence other learners) and positive cathexis (the investment of mental energy in subjects outside oneself). Relating this to the concept of social presence, it seems likely that an environment that promotes warmth, sociability and sensitivity will foster positive social interdependence, particularly positive cathexis.

The success of a group working on a collaborative task is related to the types of interactions between group members. Johnson, Johnson and Smith (2007) define promotive interactions as those in which group members encourage each other to meet the goals of the group. Examples of promotive behaviour include individuals helping each other, sharing resources, communicating effectively and trusting each other. Managing conflicts constructively is also a key skill required in promotive interactions. By contrast, oppositional interaction is characterised by group members discouraging or sabotaging each other,

increasing their own productivity at the expense of other group members' productivity, and communicating in a damaging way. Instead of managing conflict constructively, groups with oppositional interaction patterns might threaten or bully each other, mistrust each other, or try to win the conflict rather than arrive at a negotiated compromise. In some cases, group members may have no interaction with each other; in such cases group members ignore the contributions of others and act independently without considering how their contribution will benefit the group.

PEER LEARNING IN VIRTUAL WORLDS

It is well understood how these processes occur in face-to-face learning, and research has also been conducted to investigate how educators can facilitate peer learning in textual virtual environments. Other research, into informal peer learning in graphical virtual environments, has opened up a fascinating range of issues. Researchers studying massively multiplayer online games (MMOGs) have identified interesting collaborative behaviours in which players spontaneously and informally self organise for peer learning. Yee (2006) conducted a factor analysis of player motivations assessed by a 40-item questionnaire administered to 3000 MMOG players. Three main components emerged: achievement, social and immersion. Within the social component, three sub-components were identified: socialising through chatting, helping people and making friends; relationship development through finding and giving support; and team work through collaboration, group activities and group achievements. Yee's results demonstrate that sociability is an important independent dimension as a motivation for gaming, and that players voluntarily enter into positively interdependent relationships with each other.

Steinkuehler (2008) describes collaborative problem solving she encountered as a regular part of game play during her ethnographic study of Lineage. She reports that groups of five or more players join forces to solve problems that cannot be tackled by a single player. Group membership can be fluid, changing from task to task, although players are also generally members of more stable higher-level organisations known as guilds. The groups are self-managed; they plan, execute and reflect on problem-solving strategies without the help of an instructor. They are composed of individuals with complementary skills, but redundancy or substitutability is built in to ensure the task can be completed if problems are encountered. Steinkuehler's extended example of cultural mechanisms for learning in MMOGs demonstrates other aspects of positive interdependence: inducibility and positive cathexis in the form of peer tutoring as a more able player scaffolds the learning of new skills in a less able player. She demonstrates that such cognitive apprenticeships are reciprocal; a learner may be an expert on one task, but a novice on another. Players take it turns to play the roles of teacher and learner. This may occur while cooperating to accomplish a common goal or task, but players may also choose to help others for social enjoyment.

Seely-Brown and Thomas (2006) provide another example of collaborative behaviour found in MMOGs and how this might lead to the development of new skills. Discussing the role of guild leader, they describe skills in fostering promotive group interactions:

> the process of becoming an effective World of Warcraft guild master amounts to a total-immersion course in leadership. A guild is a collection of players who come together to share knowledge, resources, and manpower. To run a large one, a guild master must be adept at many skills: attracting, evaluating, and recruiting new members; creating apprenticeship programs; orchestrating group strategy; and adjudicating disputes. Guilds routinely splinter over petty squabbles and other basic failures of management; the master must resolve them without losing valuable members, who can easily quit and join a rival guild. Never mind the virtual surroundings; these conditions provide real-world training a manager can apply directly in the workplace. (Seely Brown & Thomas, 2006, p2)

In order for a guild to function well, it seems likely that all members require the capacity for promotive interaction, not just the guild leader.

Ethnographic research 'in the wild' draws our attention to behaviour that emerges naturally in an online graphical virtual environment, and this can, in turn, inform educators about appropriate ways to support such behaviour in learners. Although Second Life™ lacks in-built game rules and is therefore not a MMOG, it is sufficiently similar for these findings to be relevant.

Learning with peers, whether this learning is face to face or mediated by technology, is an important element of Computer Science and Information Systems degrees, as students learn how to function effectively as part of a software development team. Group assignments are often used to help students develop the necessary interpersonal and technical skills for group work. In the next section, we describe how assessment in the Multimedia Design module was structured to promote both individual and group learning.

Figure 5.1. A screenshot of the island used in the project.

MULTIMEDIA PORTFOLIOS IN SECOND LIFE™

Seventy final-year undergraduate and MSc computer science and information technology students studied this 10-week module in Multimedia Design. A large proportion of the undergraduates were from the UK, with others in the cohort from France, the Czech Republic and Hong Kong. The MSc students were mostly international, from China, Greece, India and a selection of Gulf states. Few of the MSc students had English as a first language. The first author was the module leader and the second author was an observer of both face-to-face and online classes. The emphasis of the course was on building within Second Life™; the learners acquired new 3D building and Linden scripting (programming) skills appropriate for computing students of this level. As in Goldberg's construction playground in LearningWorks, the Multimedia students used Second Life™ to develop new technical skills in a motivating environment in which it was possible to see interactive external representations of running programs.

Students attended one hour of lab class and one hour of tutorial each week. There was one hour of in-world teaching from a tutor available, and teaching staff also casually visited the island to help the students if and when they had time to do so. As part of the assignment, class members were instructed to keep a learning log throughout the module, and could choose to do this within the university's virtual learning environment or using free blogging software. The instructor randomly allocated students to groups of four within their cohort, so there were no mixed MSc and undergraduate groups. Each of the 17 groups was given a 2,000-acre section of the Heriot-Watt private island (see figure 5.1) to terraform as they pleased. As a result of constraints on the island as a whole, each group was able to use no more than 500 prims (basic building blocks). Each group member had terrain editing, building and scripting rights to their group land and a shared teaching space.

During a face-to-face class, the authors facilitated groups as they brainstormed themes for their section of land and decided what each group member might contribute. Themes were diverse, including a haunted house, a circus, a cocktail bar and a water park. Groups directed their own collaborative work and chose whether to meet face to face, in Second Life™ or a mixture of both. A peer-review session took place in the lab class of week 8, during which learners reviewed the work of two other students and received feedback on their own work. They were assessed on the quality of the review they wrote. Week ten included a Second Life™ 'Oscars' ceremony in which students who had been nominated by their peers demonstrated their work to the class and visitors, and the second author chose prizewinners.

The students were assessed (100% course work) via a portfolio containing a multimedia tutorial aimed at novice Second Life™ users, a learning log, peer reviews, an individual interactive exhibit and evidence of their contribution to a group (the latter worth 20% and 25% of the marks respectively for postgraduate and undergraduate students). MSc students also submitted a written essay about multimedia theory and its relationship to Second Life™. The learning logs, along with participant observation notes and follow-up interviews, are a rich source of qualitative data which can help us to understand patterns of social interaction inside and outside the virtual environment, and how this impacted on learning.

METHODOLOGY

Data was gathered and triangulated using a mixture of qualitative sources: seven lab observations, an end-of-module questionnaire (36% response rate, 50/50 undergraduates and postgraduates), five interviews with volunteers, and analysis of all students' learning logs in the cohort. Data relating to the behaviour within a group, between groups, with instructor-allocated peer reviewers, with other members of the class and with other users of Second Life™ were all considered to be relevant. Thematic analysis (Hayes, 2000) was used to identify issues relevant to the Johnson, Johnson and Smith (2007) categories of positive interactions, obstructive interactions and no interaction.

OVERVIEW

The module was successful in terms of both student engagement and learning. Most class members enjoyed learning in Second Life™, although a few expressed initial reservations in their learning logs. Some students enjoyed the opportunity for independent learning and thought this would be useful in the future. For example, one undergraduate wrote

> The main aspect I have gained from this experience has been developing a generic approach to learning. When first presented with the idea of having to learn about SL, I was apprehensive and put-off by the idea. By identifying what it was I required from SL, learning what I needed to know, and applying this learning, I have been able to create a portfolio which I am pleased with. This approach does not merely apply to learning SL. Such an approach could easily apply to the learning of any programming language, new technology or likewise. Learning and using SL, has therefore taught me a great deal about my own personal approach to learning which I can use to good effect in future tasks. Whether I actually log onto SL again is debatable!!

The students performed well in the assessment, with 66% and 62% averages for the MSc and undergraduate students respectively. All students passed the module, with the exception of one who dropped out of university for personal reasons. Several class members devoted a considerable amount of time to their projects and achieved outstanding creative results.

From the point of view of the lecturer, the module was both stressful and rewarding to teach. This was the first term in which we had used Second Life™, and we encountered various time-consuming technical and administrative problems. However, it was enjoyable to see the island changing from day to day as the students worked on their projects. It was possible to see tangible indicators of the students' progress, which does not normally happen when students' files are stored privately on their own computers. Dropping in on the island to meet students casually was useful for small-scale teaching and for social interactions, which would not normally occur as both students and staff often work from home. The learning logs proved to be very valuable for understanding the students' points of view and stimulated the production of targeted lessons to address common problems. These logs demonstrated that the model of learning to program by active experimentation in Second Life™ helped to boost the confidence of some of the less able programmers in the class.

Table 5.1. A breakdown of grades for group aspect of the assignment for undergraduate and postgraduate groups

	Undergraduate group	Postgraduate group
A grade	3	3
B grade	2	3
C grade	1	3
D grade	2	0
E grade (fail)	0	0

As indicated by Table 5.1, the performance of most groups was satisfactory or better; no groups failed the aspect of the assignment on which they were evaluated according to what they produced in their group area in Second Life™. Marks were not assigned for the quality of the group process. However, three groups appeared to have particular difficulty with the group process: one in the MSc cohort and two in the undergraduate cohort. The MSc group interacted with each other negatively, to the point of deleting each other's work. One undergraduate group did not argue with each other, but individuals did ignore the efforts of other group members, resulting in an incoherent group area. This group contained one member who finds it difficult to function in a group and who the university's disability service has diagnosed as being on the Asperger's spectrum. One member of the other notably non-functioning undergraduate group received fewer marks for the group aspect of the assignment due to complaints about his lack of contribution. Various other groups within both cohorts encountered difficulties during the project, but most were able to resolve them.

SOCIAL LEARNING IN SECOND LIFE™

Positive Interaction

As described above, promotive (positive) interaction occurs when individuals encourage and facilitate each other's efforts to reach a common goal. It includes mutual help, exchange of needed resources, effective communication, mutual influence, trust and constructive management of conflict (Johnson, et al., 2007).

Exchange of needed resources was particularly important in this module, because Second Life™ only allows a certain number of prims (basic building blocks) on any given land, so each group had a limited amount of these available. Groups which evidenced the most successful and positive interaction, resulting in coherent group projects, were effective communicators who negotiated the use of resources early on and held regular meetings throughout the module in which they checked on progress. One student summarised his group work experience: 'I have been in regular contact with student N and student M and we have been exchanging ideas etc.' Mutual help and assistance were part of the process of dealing successfully with finite resources, and one student in a high-achieving group noted in his learning log: 'The code used to implement such a device was adopted from one of my group's colleagues which was originally adopted and developed by him.'

Those groups also achieved coherence, not only by deciding on a group project and effectively dividing the tasks but also by tying individual work into the overall theme. One student reflected: 'Individual portfolio (Exhibit): The idea came as a complementary work to the group's portfolio, where I thought would add a value to the overall work done by the group.'

Existence of trust was implicit in groups that communicated effectively and exchanged resources and assistance, although it was not explicitly expressed in the learning logs. However, two groups provided evidence of successful management of potential conflict. One of these had to change their group project late in the module. The group had originally meant to create a fire-themed amusement park but none of its members had mastered the working of a fire script (program). One student proudly commented in his log:

> After Monday's group meeting, we decided to build a fire amusement park in our land. That means we are going to build a small amusement park with 3 or 4 rides in it, but everything you can ride in there will be on fire!!! Sounds fun and cool, huh?(That was my idea!!!). To build a park should be easy, but to set it on fire will be diffcult.

Indeed, this group did not solve the anticipated problems, but they were able to pool their resources and decide amicably on a new theme. The same student explained that

> We got a trouble for our group work that is we can not make the 'fire' script. So, we decide to charge our park topic to 'black & white'. Student L made a script code which can switch the ground's colour between black and white every time when you touch it. And, all of us charge our object's colour to white and black to match the park topic.

Later, the same student noted that

> I changed my interactive exhibit because we have changed our park's topic. I created a Micky Mouse in the park. For this object, it is to make fun for the people who visit our park. That Mouse's colour is black and white which is matched our park's theme.

Another group was faced with adverse reactions from a neighbouring group, which forced them to re-evaluate their chosen project and to brainstorm a new decision. One group member's learning log described the process.

> So we had to back off and do further review and evaluation to the portfolio and decide what things we should keep and which to take out. It was not an easy task as it may sound like, since it really meant sacrificing some of the things we put an efforts on. The negotiation is still on going for further decisions. Here might not be a technical lesson to learn, but it represent a real life case where you are most likely to face when working on real life projects, and you have to give up things in order to proceed and make the task a complete success after all.

This group did, indeed, complete its portfolio successfully.

The group that accomplished greatest coherence, while simultaneously achieving top individual project marks, was efficient and successful in all of the above aspects. As a group project, they decided not to replicate items from the analogue world, but to delve into the full potential of a virtual world with all its creative possibilities and to build floating giant cocktail

jugs, with a Lizard Lounge cocktail bar inside, a giant interactive guitar that animated avatars (individual project), dragonflies that avatars could ride (individual project) and a platform that transported avatars between the different levels. The group members also ensured that individual projects would fit in the overall group project, as one of the members explained in his learning log:

> My task was to develop a Saxophone, which should function like a rocket loader that fires avatar to see the island from a far point in the sky. Further enhancement was made to the script in order to make function the way we want, combining it with a sound effect to make it looks really interesting. The overall result was accepted by the group's members and hope it finds the acceptance from the judges as well.

There is evidence of mutual help and shared resources throughout this group's work. Student G reflected:

> It was an remarkable effort what everyone did, as we agreed to split all the work among the four of us to have something we can proudly present during the Oscar event that will take place the following Monday.

Last but not least, this group communicated effectively throughout the module, they met face to face during lab time and also fully online. Due to geographical restrictions (one student lived far away from campus), the group also met in a combination of face to face and online, with two group members sitting in the lab and the third in world, which enabled them to check on their built project items from all 3D angles in Second Life™, thus turning a potential disadvantage into a clear advantage. Student G reflected in his learning log summary: 'The group worked as single entity during the weekend, through meetings conducted in the Second Life™ environment to do the required changes and add all missing bits and pieces.'

Obstructive Interaction

There were some sources of obstructive interactions both within groups and between groups. In addition to problems which student often encounter in group work, such as communication problems or uneven contributions from group members, some resource conflicts emerged which were specific to Second Life™.

Problems Managing Resources – between Groups

These problems were often related to the fact that all the students were working within the finite resources of the university's Second Life™ island which has a limit on the number of prims which can be used. Each group was allocated an area of land, and a maximum number of prims with which they could build. The plots of land for each group had boundaries with neighbouring groups; negotiation between neighbours was sometimes necessary in order to put an idea into practice. For example, one ambitious project that would have required access to plots of land all through the island to create a monorail tourist ride encountered problems:

> We quite liked the idea of mono-rail and therefore we approached (a) few people. They liked, so we thought we'll give it a shot. So I went ahead and talked to our next door neighbours ... and after a polite question, I got a one word answer. NO!. So I tried to ask why and I was sent to appropriate places. Rage that I encountered was similar to when the real life struggle with neighbours ... It is similar situation like having bad neighbours in real life ... it's a pity...Anyways, there went our mono-rail idea (reverted back to the game house).

Problems of this sort were occasionally visually obvious in the form of two-dimensional mountains, facades or walls constructed to block the view of neighbouring land. The reaction to one of these walls was:

> So, our neighbours obviously were not only rude, they obviously needed total privacy and sealed off their parcel. Not only that, they build a giant wall all round it .. a bit like the Berlin wall .. :) So ... it's sad, we thought our neighbours will be our friends ... and instead of that they isolated us ...

There were also points of tension when, due to technical errors, all students could build on one group's land, as an interview with a student reveals:

> One of the, one of the other groups, he liked to build on our area, so, yeah, before, at one point, you know, we didn't have the administrative ability to remove the objects to return them to him, So, we're, uh, yeah, the equivalent of yelling in SL at him, to try and get him to remove the items. He believed that because the whole island was HW *[owned by the University]*, that he should be able to build wherever he wanted.

Another student decided to take direct action to remove the work of students who were not in his group:

> The land suddenly full with prims which I think created by someone from other group. I just delete all the unnecessary prims which I think not belong to my group. Well, supposed they shouldn't blame me at any cause their prims is missing because they are not supposed to create it in my group area. It messing the place actually.

Problems Managing Resources – Within Groups

The constraint on the number of prims also caused problems within groups. An undergraduate student, when asked about the challenges of the group work in an interview, answered: 'Uhm, really the portioning out of prims, and deciding who did what, uhm, and actually getting people to follow through on what they'd been told they're meant to do.'

The limit on the number of prims sometimes caused group members to delete the work of their peers, as documented by this learning log entry:

> Unfortunately, the lights were deleted, as another group member has created lights that were invisible, but when touched, a light would stream down from them, with the appearance of running water. I was unhappy that this had happened; I was trying to contribute to the group portfolio, only to have my items returned to me, however in hindsight this was simply a communication error and did not feel so bad.

Here, although the group relations were strained by initial lack of communication, the group did manage to patch things up. A longer-term problem emerged in one of the MSc groups, which, due to other students leaving the degree programme, had only two members. This is indicated in the log entries of one of the pair (Student Y). The other student did not mention any group related-issues in his learning log.

> 11 February - The problem remains... it doesnt let me build anymore.. I have deleted any unwanted and unuseful artistic objects that were in the area (especially of my teamate that keeps playing with prims that cant be useful in our building) and in this way it allowed me build some walls for my house..

A few days later, Student Y made the decision to delete her team-mate's work: '14 February. Problem solved! I just deleted all the prims of my teammate. Continue the building of the house.' In the lab session the week after these entries, observation notes indicate that the students in this group were having serious problems communicating, that Student Y did not seem happy and that she seemed to have a firm plan for what she wanted to do. She worked on another aspect of her portfolio for a couple of weeks, but the group appeared to decide to change the theme of their area to a haunted house and to begin again. Close to the deadline, Student Y wrote:

> 14 March - So, so far I have done only the doors, the graves and the windows, everything else has been done already from my partner... He is quick.. What can I do? I will try do some more stuff if I could find some available prims (parcel is full!).

This entry indicates a lack of communication between the members about which tasks were allocated to whom, and a lack of willingness to negotiate. It is worth noting, however, that the problems in this group were not solely caused by lack of shared resources. Student Y wrote in one of her early entries:

> 6 February - Today I just introduced to my partner what we are going to do for our group project.. He wasnt completly fricked out... He rather reacted calmly and he didint chase me around, wanted to kill me. Our group project will be about a 'Playground'.

This suggests that she did not consult the other group member, but imposed her ideas on him. These ideas may not have been to his taste; a prominent feature of the playground was a 'My Little Pony' castle that had some nostalgia value for the female student, but may not have been so appealing to the male.

Uneven Contributions to Group

There were negative interactions within a number of groups, as one might expect with randomly allocated group members. Some undergraduate groups had problems with uneven contributions from members. Students felt that others were not pulling their weight, a perennial problem, as expressed in this log entry. 'We designated areas for the three members of our group (nobody had seen Student G and we decided to push ahead ourselves as we could not depend on him).' Later in the project, the same student's log indicated that the missing group member had still not participated.

> Speaking of very little to show, I am worried about how little has changed in the garden and with the building of our area. The fourth member has still not made an effort to contact us. I will resist the urge to finish anything I have not been assigned as it is over a week until the deadline.

In the last entry of his learning log, another student reflected on this aspect of his project:

> The group work has not been as good as I expected. I think we did not coordinate very well. Every one has been really busy and we only managed to meet all of us once. Despite our other coursework and stuffs, I think everyone could do better work. Particularly, two of our group mates did not care much about the land. Student Z and I mainly worried about the land.

A log entry from another student illustrates a case in which a student reflected on his own behaviour in the group, found it lacking and decided to contribute more.

> This week I have given myself a real shock, by realizing that I have not been contributing effectively to the group portfolio. Because I missed the first two weeks, I had to spend time catching up and by the time I was starting to build objects, many other people had already done so and were fine tuning items and attempting scripting.

Difficulties Managing Roles

Another source of conflict within groups was related to difficulties in managing the roles of students within the group. Two students found themselves unwilling group leaders, and commented in their learning logs that other group members relied on their creativity too much. An undergraduate wrote

> 3 March - I bumped into W in SL earlier and he assured me he will finish off the roof tonight. I asked him if he was planning on doing any more work before we submit and he replied with the mantra he has been slavoring all term. "I can do whatever you want me to do / You tell me what to do, and i'll do it.. I wish he would use some initiative. I'm not his parent or minder.

Our observation notes relating to one of the MSc groups in the lab show that one group had particular difficulties in communicating and sharing ideas in a face-to-face setting; however as they eventually submitted a high-quality area it seems they must have decided on a creative idea at some later point, possibly online, with the leadership of one of the group members. She wrote in her learning log that she felt group work was ‘really tough’ and continued to complain that ‘All the member agreed with all the suggestion that I made. Seems that I'm the one who make all the think. I’m just hoping of some ideas from them as this is a team work.’

No Interaction

There were fewer references to no interaction between group members in the data than there were to the other categories. This does not necessarily mean that behaviour in this category was less prevalent; merely that it was less documented.

According to the observations of the instructors, and judging by the areas that were created on the island, there were some groups in which in-group collaboration was minimal beyond the initial idea. For example, one group decided on a haunted-house theme but appeared not to coordinate their efforts after that point, resulting in an incoherent group exhibit in which users lost their way. One member of this group did not contribute to the haunted house at all, but chose to make a series of electric chairs on a spare section of land outside the group land. This student had previously been diagnosed as being on the Asperger's spectrum, so may have had particular difficulty with group work.

There is a single entry in the learning logs that indicates students ignoring the efforts of others, referring to an occasion on which the peer reviewers did not return feedback forms to the student they evaluated. There is also the interesting case of a student who did not appear to value the efforts of his group members in the sense that, while he contributed to his group area to some extent, he did not build his individual work on the group space. Instead, he built it on spare land on the main teaching space. He did not wish to contribute his individual work to the good of the group, although he did contribute in other ways. He explicitly told the lecturer that he had had previous bad experiences of working in a group and did not want his work to be let down by group members on this project.

The learning logs also provide some evidence that students acted independently without regular interchanges with their group members. One student wrote, 'We divided the tasks among each other so that everyone can work on the park at their own convenience.' Another wrote:

> We had decided to make a park there at the beginning of the project so I divided our land into 3 parts at first. The middle part is mine. I did the middle part completely + all retaining walls and the decoration on this wall for my group mates (the right, middle and left retaining walls and their decoration). If you right click on them you will find my name on them.

In both of these cases, the group explicitly decided to split up their project so that each member had responsibility for an area or task but there was a lack of subsequent interaction, re-negotiation or review.

DISCUSSION

The interaction patterns of the groups that took part in this module vary from excellent examples of promotive interaction to dispiriting examples of obstructive interaction. Most groups managed to function coherently enough to pass the group work component of the portfolio, even if they did encounter difficulties on the way. It is not possible to identify conclusively which of the problems encountered within the virtual world project would have happened with the same group of students in a traditional group project. Problems such as poor communication, lack of conflict management and uneven contribution to the group do occur in other settings but the virtual world setting may have exacerbated them.

The groups had a number of communication channels open to them: face-to-face meetings, meetings in Second Life™, mixed face-to-face and virtual meetings, instant messaging in Second Life™, instant messaging in other applications, email or telephone. There is also the implicit communication channel of building or editing something that is on

group land. Data from the log files suggests that some groups may have suffered from not explicitly agreeing which channel of communication should be used under which circumstances, and which would be suitable for certain types of task. For example, while face-to-face meetings may be particularly effective for brainstorming, in some cases meetings at which detailed decisions are taken may be more effective in a typed medium in which decisions can be recorded easily. Meetings to evaluate work in progress might usefully be held in world to enable the work to be viewed from all angles. A habit that seemed to lead to difficulties was falling back on implicit communication by editing the group area without explaining this in another channel. Understandably, students become upset and distrustful when their collaborators interfere with their work without discussing it first.

Conflict management was observed to occur most effectively in synchronous communication channels, mostly face to face. Conflicts went on for longer if they were conducted in the implicit channel of working on the shared space without verbal discussion. Some students engaged in escalating 'wars' in which they added and deleted work, and they found this very demoralising. However, groups who encountered this problem and then met face to face about it managed to repair the damage by talking through misunderstandings. These escalating wars were often exacerbated by lack of resources in the virtual world, and the fact that overuse of a resource by one student led to problems for their peers. It is possible to imagine an analogous situation in an art class where a finite supply of clay is available for model making. One difference is that the amount of clay is clearly visible from the outset and so students can judge what proportion of the clay they can fairly use. In the Second Life™ project, it was not initially clear to us that the prim counts would be such a contentious issue and so we did not give students a guide to how many prims they should use. We would correct this oversight in the future. Another difference is that it is less likely that adult learners would destroy clay models created by their peers in a physical setting because such behaviour is clearly socially unacceptable to anyone who has attended kindergarten. In our opinion, an explanation for learners being willing to do this in the virtual world is the lessened positive cathexis (mental investment in objects outside oneself) experienced in the virtual world. If, instead of seeing a flesh-and-blood colleague one sees only an avatar, one might be less inclined to invest in their productivity or care about their feelings.

Uneven contributions from group members were problematic in some cases. In the virtual world, the progress of a shared project is visually obvious and it is easily possible to tell exactly what each member has contributed. Group artefacts are also available at all times, so group members can regularly monitor progress. This contrasts with a more traditional, paper-based, group-report writing exercise in which group members would have to explicitly agree to meet to share their work. It suggests that uneven contributions can be identified earlier in world (even if corrective action is not taken) than in face-to-face work. Other forms of online assignment have similar features to in-world assignments – in a group assignment to edit a wiki collaboratively, it is obvious from the edit trail how much each user has contributed. Although conflicts could arise from wiki-editing wars analogous to prim-deleting wars in world, the author of changes to a wiki is recorded. Second Life supports anonymous deletions, which can have a negative impact on trust within a group. One student, whose work was accidently deleted, became paranoid and spent some time complaining to staff that the other students were jealous of his work and were destroying it on purpose. He did not appear to trust anyone in the class from that point forward.

It is difficult to estimate the extent to which the students experienced social presence. In-world observations of the high functioning MSc group suggest that this group experienced enough social presence to enjoy working there together. This group had successfully worked together face to face in the past. It is possible that social presence will be increased if group members have previously met and the learners can associate faces with avatars. Synchronous meetings could play a part in increasing social presence in virtual worlds. Synchronous discussion between avatars is more likely to generate the impression of a warm, sociable, sensitive and intimate medium than asynchronous implicit communication through artefacts created in the group land. This is an interesting issue because a potential advantage of working in a virtual world is its constant availability. Learners have the flexibility to work in the virtual world from any location and at a time that fits their own timetable. However, these affordances offered by the learning environment might suggest a behaviour pattern that is not conducive to good learning. Following individual preferences is likely to be detrimental to group interaction and so a compromise should be reached whereby groups set aside time to meet.

It is interesting to observe that, while the students were motivated by the creative nature of the assignment and wrote about how they enjoyed the module in general, the same high levels of commitment to social interaction and team work documented by MMOG researchers did not appear to develop. One obvious explanation for this lies in the motivations of the users: MMOG players are intrinsically motivated, whereas learners on a university course are motivated in part by extrinsic factors such as grades. In addition, there is likely to be a selection bias among MMOG players – those who do not enjoy online collaboration are less likely to participate in guilds and to play in a social style. University learners do not have the luxury of opting out of group work if they dislike it. Another consideration is the design of the collaborative task. MMOG game designers are extremely good at designing tasks for which successful completion requires the co-operation of many players in different roles. The task the students performed in the multimedia module was not optimally designed for online cooperation. As a consequence of the mark weightings, it was possible to pass the module without taking part in the group aspect of the assignment. The assignment contained components such as an essay and learning log that could be completed independently, and so students may have chosen to divert effort into these tasks at the expense of group work. This is consistent with the learning objectives of the module, which included the development of individual skills. However, for a module that was focused entirely on group work, it might be possible to develop tasks similar in structure to those found in MMOGs in order to encourage learners to develop complementary skill sets and to practise coordinating their behaviour in a way which promotes the success of the group as a whole.

CONCLUSION

Guidelines for Educators

Based on insights from studying group interaction patterns in our Second Life™ building assignment, we offer some suggestions for other educators who may wish to run similar projects in virtual worlds. As our students were final year or MSc students, we assumed that

they had some of the requisite skills for group work face to face, and so we did not explicitly teach group-working skills. In hindsight, some instruction on effective methods of collaboration in this medium would have been useful. Certainly, this would be necessary for younger students who might find the additional burden of working together digitally too difficult. In-world collaboration may also be particularly difficult for students who come from different educational cultures or whose English language skills are weak.

1. Encourage students to meet face to face as well as in world. Face-to-face contact will be especially important for initial planning and brainstorming. Class time could be set aside to facilitate this.
2. Once the project is planned, encourage students to meet in world regularly: synchronous communication while examining the artefacts under discussion will help to avoid misunderstandings. Discourage students from relying only on implicit communication through the creation of artefacts.
3. If the students are contributing individual parts to a shared artefact, particularly if this involves scripting, require them to follow standard software engineering practice and develop a shared written specification that describes exactly how their parts will interact. This will enable them to work independently but towards a common goal.
4. Ensure students are aware of potential resource conflicts from the start. Suggest ways of dealing with these, including negotiations in and between groups.
5. If group members cannot meet regularly, suggest that they keep blogs and that they read and comment on these in order to keep track of project progress. Blogging minutes of meetings could also prove useful.
6. Have a strategy in place for managing conflict between neighbouring groups. For example, each group could nominate a representative to discuss building plans, negotiate agreements and address disagreements. This should happen early in the project, before groups starts work.
7. Share information. As an early exercise, groups could be asked to view and comment on the plans of other groups. Produce a map showing which groups are working where, together with contact details for group representatives.
8. Encourage each group to develop a group charter at the start of the project. This should include rules about deleting the work of others, use of group resources, and behaving civilly to each other, as well as a schedule for meetings.

We hope that other educators will find these guidelines helpful in facilitating promotive interactions between group members in virtual world projects.

Please note that the quotes from learning logs are given verbatim, and that many of the students were non-native English users.

Comment [JR1]: Should this be a footnote?

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