Agile in Wonderland: Implementing a Virtual World Workshop Activity

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Abstract

For immersive 3D environments to be useful for specialist teaching, their programming facilities must be powerful enough to enable educators to create flexible learning tools. In this paper we describe the creation of a virtual environment designed to be used to host a workshop activity based on agile software development. Following an initial assessment of some available virtual world tools, the Java-based 'Project Wonderland' was used to create a proof of concept for running the workshop. We discuss the features that were implemented and a number of significant issues encountered during the process. In the light of our experiences, we assess the utility of Project Wonderland as a tool for creating an immersive workshop activity and describe the future work that would be needed to enable a robust and useable environment to be developed.

Keywords

Virtual world, Project Wonderland, agile workshop, Java

INTRODUCTION

Advances in technology allow for the creation of novel and more interactive teaching tools. However, the ability of computer technology to transform education has consistently failed to be fully realised despite findings that a teaching approach that uses a range of technologies results in positive student learning (Doesburg 2008). More recently the potential of virtual reality as an educational medium has renewed calls for more novel teaching tools. The last decade or so has seen an increasing interest in multi user virtual environments (MUVEs), which provide immersive 3D virtual worlds. This type of computer application has its roots partly in the longer tradition of Massively Multiplayer Online Games (MMOG), such as Doom and Quake (Lewis and Jacobson 2002), and also partly in single player simulation games such as The Sims. Not all of these worlds are games, however, as in some cases there are no specific objectives or tasks set for players. Rather, they are a simulation of life and society. Within these worlds, an increasing number of educational tools have been developed.

MUVEs combine many of the characteristics of instant messaging, IP telephony and social networking web sites, but in an immersive environment where users are represented by avatars to enhance user interactivity. These avatars can walk, talk and interact with objects and other avatars, sharing a virtual environment in real time (Suzuki and Huang 2004). Because of their integral communication tools, these virtual worlds can be likened to chat rooms in that people often use them for socializing, making friends and discussion. However it is also possible to use such environments for education. One of the key motivations for this is that a MUVE overcomes the limitations of distance or other impediments to in-world learning such as working or child-rearing while studying part time. An educator is thus able interact with people who are not able to attend lessons in person. However, beyond the concept of providing a virtual classroom "game-based learning is often experience-based or exploratory, and therefore relies upon experiential, problem-based or exploratory learning approaches" (de Freitas, 2006) so the activity should have an objective or a problem to solve to keep up interest.

In general, the response of universities to the opportunities of immersive learning in MUVEs has thus far been largely exploratory and short term (Salmon and Hawkridge 2009.) A number of significant MUVE educational projects have come and gone as their project funding has terminated and, as Salmon and Hawkridge (2009) note, we cannot know at this state where we are in the overall cycle of development; are we at the beginning of a major development in learning technology, or already towards the end of its potential? One critical factor that will influence our success in using MUVEs for education is the difficulty of going beyond those things that are

relatively easy to deliver, such as virtual historical or cultural environments that avatars can freely explore. Once we move into more challenging areas of delivering complex knowledge, the difficulties of creating such tools may create significant barriers to progress (Atkins and Caukill 2009).

In order to advance understanding and appreciation of the possibilities within the tertiary sector we have taken an existing interactive workshop on agile software development into the virtual world. Currently, this workshop can only be experienced in the real world, limiting its reach to those who are able to physically attend scheduled sessions. By building the support tools for this activity into a virtual world, we hope to extend its reach to a wider population of learners. This proof of concept study aims to explore the viability of using a virtual world as a platform for delivery of this workshop in an immersive learning environment.

THE MUVE ENVIRONMENT AS AN EDUCATIONAL TOOL

Mennecke et al. (2008) argue that information systems researchers are uniquely positioned to understand how virtual worlds are used based on the need for more understanding of how new technologies fit with corporate and consumer applications. They highlight the need for more investigation into designing, building, managing, and using complex MUVEs. While the focus of their research is business and social uses there are several points that apply more widely. In particular they identify the opportunities to gain in-depth experiences from these rich interactive and creational environments that support visual experiences, animations, role playing and social communities. These features are particularly of value in an educational setting where new generations of students (digital natives) are developing online skills using different learning methods than those familiar to older generations of digital immigrants (Moltenbray 2008). These students are used to immersive computer mediated experiences both socially and in schools that are not being replicated within the higher education sector (de Freitas 2006; Lynch and Tunstall 2008). While schools are beginning to address the need for games and other online experiences in learning, universities still adhere to methods of putting traditional materials into the online environment. While they have embraced e-Learning as a support tool, universities have not yet taken the same advantage of the opportunities that new technologies such as MUVEs offer in terms of immersive learning (Lynch and Tunstall 2008).

The Benefits of Immersive Learning in MUVEs

Immersive learning is not a new concept in tertiary education and there has been substantial use of role playing, simulations and other learning techniques in the last two decades (Johnson and Levine 2008). However, the tendency towards an emphasis on *learning* rather than *teaching* is fueling a new move towards more adventurous innovations. Simulation and gaming are seen to be increasingly important in the university environment and some Business Schools are taking advantage of corporate online games to promote learning, although there is a lack of concentrated initiatives in other areas (Lynch and Tunstall 2008).

Immersive learning is very good at inducing learning with a high level of efficiency and effectiveness. In traditional forms of immersive learning students have not been taught to go beyond the reflexive stage so that abstraction and experimentation can take place. This is where virtual worlds can bring exceptional value as staff and students learn to use the three dimensional environment in new and exciting ways to gain high value immersive learning (Johnson and Levine 2008). Kolb's learning cycle describes how "immediate or concrete experiences provide a basis for observation, and then reflection. In higher modes of learning, these observations and reflections are refined into abstract concepts that can be applied across contexts." Applying these concepts in practice then forms the highest level of the learning cycle which translates into new experiences and supports understanding (Kolb, in Johnson and Levine, 2008, p. 166). The derivation of experiences and understanding is of immense value within virtual worlds where the consequences of these rich environments are not confined to the virtual but have real world consequences from MUVE activities (Mennecke et al. 2008).

Beyond the experiential depth of learning, other benefits arise from the social and collaborative nature found in virtual worlds, which have emerged as highly social environments. MUVEs are designed to foster social interaction and collaborative group experiences. In the education sector, the dynamics of learning and social interaction are very powerful and have been found to engage students, encourage more interaction between groups and enhance students' desire to learn and share experiences (Johnson and Levine 2008). This supports other findings where a virtual café was used to enhance socialisation in a postgraduate course and increase student engagement in the course blog (Day 2008). This is of particular interest in meeting industry demands for graduates who have highly developed teamwork skills.

The Challenges of Immersive Learning in MUVEs

The use of MUVEs in tertiary education is still in its infancy and there are many challenges that face educators who are interested in more widespread use of virtual worlds to enhance learning. In a study for the UK Joint

Information Systems Committee (JISC), de Freitas (2006) reported that there is still a lack of understanding of how immersive learning is derived from games and little empirical evidence to show how gaming environments such as MUVEs provide value within the education sector. Without recognition of the value there is little incentive to scale the high learning curve that is required to be at home in the multi-user virtual environment (Mennecke et al. 2008). However, Johnson and Levine (2008) argue that attaining such skills to develop immersive learning opportunities is an investment that pays rewards.

Once there is recognition of MUVE initiatives as having a role in education, there are several considerations to be taken into account when creating an environment that promotes further development of learning skills. There is the need for a space where concepts and terms are developed to make this type of educational development more legitimate. This is beginning to happen as educationalists and game developers move towards more collaborative initiatives, including the creation of shared vocabularies and expectations (de Freitas 2006). Such partnerships will help to develop technical knowledge where education design underpins educational game design (Lynch and Tunstall 2008). This will contribute to the design of the interface and interactions being "tightly coupled with the aims and objectives of the educational context, which stem from its philosophical roots" (p.385). Achieving a balance of what can be done and what should be done is important and arises from knowing the objectives of what is being designed (Lynch and Tunstall 2008), based on sound pedagogical principles and the need for clear learning outcomes that are relevant to the real world context of the learner (de Freitas 2006). In conjunction with the pedagogical requirements is a need for more in-depth understanding of how people's psychological needs are met in virtual worlds (Mennecke et al. 2008). In the education sector it is anticipated that different experiences will arise for individuals based on factors such as personality, attitudes toward technology, self-image, and cognitive ability.

A further challenge to more widespread use of MUVEs in education will be technical constraints. Roche and Lester (in Mennecke et al. 2008) raise several issues regarding technical constraints and the need for huge network capacity to ensure a positive experience in real time. This is also recognised in the JISC report where de Freitas highlights problems of a technical nature in terms of access to appropriate equipment and bandwidth (2006). Questions that remain unanswered in this area include the costs of design, programming, hosting and ongoing maintenance. Implementing a virtual world learning environment is time intensive and can be costly. In this study we have used available resources in a proof of concept that will go some small way to answering the call for more immersive learning in an environment that is becoming familiar to a new generation of students.

AN ANALYTICAL FRAMEWORK FOR THE USE OF MUVES IN EDUCATION

To address some of the many issues and challenges that affect the use of MUVEs for educational purposes we have developed an analytical framework, which supports understanding of the requirements and forces that impact on the design of an educational delivery within a virtual world (Figure 1). As previously acknowledged the simplicity of the model is not intended to replicate Jäkälä and Pekkola's (2007) 'N-dimensional space' of all the themes to enable a full understanding of virtual worlds (Parsons et al. 2008). However, the framework does provide guidance on the concerns that affect educators in their development of learning environments within a virtual world.

This study builds on previous research into the use of a virtual world (Second Life) as a learning environment for external students (Parsons et al. 2008). This earlier study focused on the upper level of the framework where we replicated a traditional teaching environment and used basic resources to support learning such as documents and multimedia. The low investment in the initial study was reflected in limited returns in terms of student engagement. We found from observation and student feedback that the focus of learning at this higher level was indeed mostly extrinsic (i.e. learning about things outside of the Second Life environment of the study) and that there were limitations in the value proposition.

However, the framework did prove valuable in terms of understanding the opportunities and returns from the Second Life learning environment that we created. In this study we are extending the learning initiative to a simulation environment using interactive resources. With a higher level of investment we believe that the focus of the students' learning will be more immersive, resulting in a mix of extrinsic and intrinsic study (i.e. using elements of the virtual environment to learn about the world outside). This will reflect a higher unique value in that the learning environment will add features that will enhance learning and that would be difficult to deliver by other means.

The focus of this particular research project is to explore the viability of porting a workshop activity on agile software development techniques into a MUVE (Project Wonderland), thereby creating an experiential simulation environment using interactive resources.
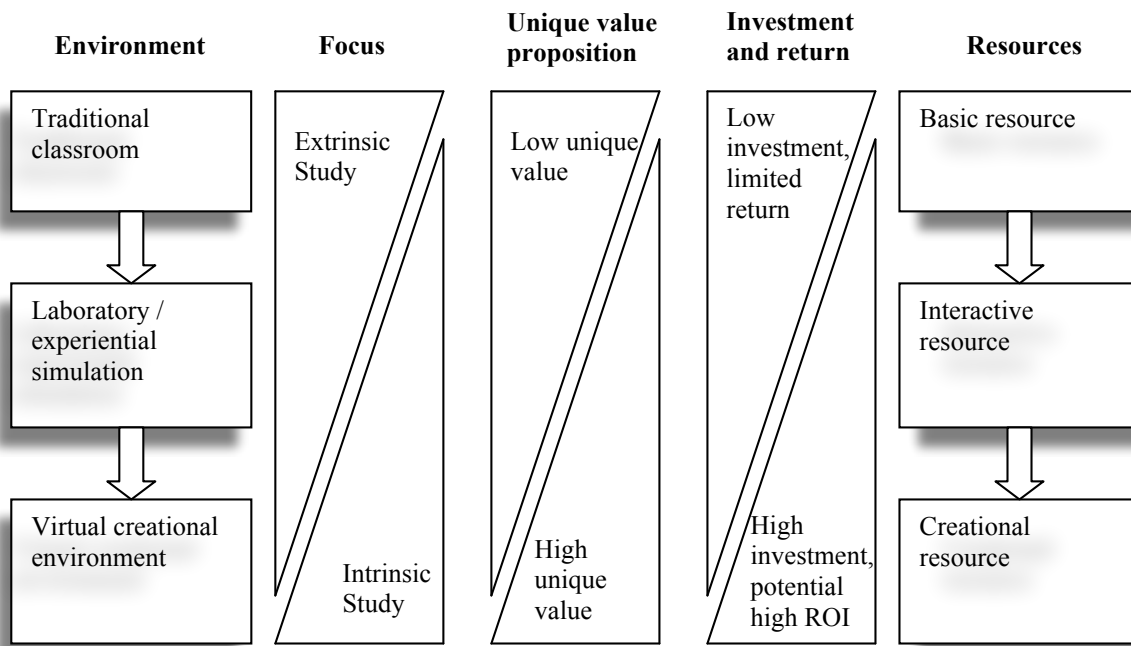
Environment	Focus	Unique value proposition	Investment and return	Resources
Traditional classroom	Extrinsic Study	Low unique value	Low investment, limited return	Basic resource
Laboratory / experiential simulation				Interactive resource
Virtual creational environment	Intrinsic Study	High unique value	High investment, potential high ROI	Creational resource

Figure 1: An analytical framework for learning environments within virtual worlds

THE VIRTUAL AGILE WORKSHOP

The agile software workshop activity has been used in a face to face context on many occasions, and is freely available on the web (Parsons and Cranshaw 2007). In this workshop, groups of participants work in teams to design a human powered vehicle by drawing individual features, based on user stories, on overhead transparencies. Since one of the most useful features of a MUVE is that the participants can be remote, the objective of this research was to see if this workshop could be delivered within a virtual world environment so that it could be run for groups of participants who were not co-located. The minimum requirements of this activity were that:

• User stories should be available to the participants.

The system has to have some way of providing a specific set of stories to an individual user based on a selection made dynamically by the person in the role of stakeholder.

• The participants should be able to draw features of user stories.

In the original workshop, participants in the role of developers draw individual features (taken from user stories) on separate overhead transparencies. Some way of enabling participants to draw features is required.

• Participants need to be able to combine their features together at the end of an iteration

The system needs to provide some way of combining individual feature pictures into a single picture. At the end of an iteration in the live workshop, the feature transparencies are laid on top of each other to make the overall vehicle. The system needs to provide some other mechanism so that the separate drawings can be merged together to provide an overall set of features.

COMPARING VIRTUAL WORLDS

In the initial stages of our research, we evaluated three immersive virtual world environments to see which of these would be the most appropriate platform to use in order to support the virtual agile workshop. The three environments that we examined were Second Life, Active Worlds and Project Wonderland. A brief overview of these three tools follows.

Second Life defines itself as "a free online virtual world imagined and created by its Residents" (Linden Lab 2009.) Started in 1999 and opened to the public in 2003, it has grown exponentially over recent years to have 7 million users. In Second Life you can rent land and buy virtual artefacts by using Linden dollars which can be purchased using US dollars or traded for on LindeX (Second Life's dollar exchange). On your land, you are allowed to create objects, buildings, gardens, pools, etc. If you do not wish to create your own building, you can

rent building space. If you wish to create your own movements for your avatar, modify objects, or create games, you can use the Linden Scripting Language (LSL), an open-source C/Java type coding language.

Active Worlds was created by Active Worlds Corporation. Active Worlds' goal was to create a 3D web browser. They wanted to take everything that would be put on a website and put it in a more creative and interactive 3D environment. Like Second Life, Active Worlds is a 3D virtual world controlled by its "citizens" or users. Each user controls their avatar and can alter the world using the Active Worlds browser. Chat features include a regional chat box, as well as a talk feature in which you can verbally communicate with others. Active Worlds was created using the RenderWare scripting language (RWX) and can be edited and altered by a user using RWX as well.

Project Wonderland is a free, cross-platform and open source Java project , developed by Sun Microsystems, for creating virtual worlds with sophisticated communication tools and the ability to share applications and documents. Unlike other virtual worlds, Project Wonderland is primarily intended as a business communication tool where staff members in-world can interact in virtual meetings and share information using tools such as whiteboards and PDF documents. The default world in the Project Wonderland installation is a virtual workspace called MPK20 (Yankelovitch 2009). The potential key advantage that Project Wonderland has over Second life and Active worlds as it is an extensible open source Java application, rather than a commercial venture with its own scripting language. This means that there are many programming resources available and Project Wonderland can be used on a local network within a firewall of an organization, without the cost of renting virtual space and material on a third party server.

Following some initial experimentation, we decided to use Project Wonderland for this project for a number of reasons. Among these were that it is open source, so free to use, and that many existing Java resources can be leveraged. However the most important reason was that a the time of the project, the whiteboard and PDF viewer tools available in Project Wonderland appeared to provide more flexibility and potential for this project than similar tools in the other virtual worlds we investigated.

USING PROJECT WONDERLAND

Wonderland is a client application for creating virtual worlds based on the Darkstar server (Project Darkstar 2009.) Darkstar is a Java game server application that monitors and maintains all objects in the virtual world and controls how they interact together. Each user runs the Java Project Wonderland client application that connects to the server. Wonderland uses technology from a number of Java Projects. The interface is based on the Looking Glass 3D project, and 3D models and textures are currently handled by Java 3D. ISO Standard X3D models can be imported into Wonderland and converted for Wonderland using a utility called J3Dfly. Wonderland is deployed with a default 3D world that can be modified. Alternatively, you can create custom rooms with Wonderland's World Builder, a web application that can be run on any server that supports the current version of Java Enterprise Edition.

Two educational projects that have previously used the Wonderland toolkit are MiRTLE (Mixed Reality Teaching and Learning Environment) (University of Essex 2008) and Darkstar University (Sun Microsystems 2007). MiRTLE (a project of the University of Essex) provides a virtual classroom environment. A remote lecturer is recorded with a web cam and this is beamed to the students. Students can ask the lecturer questions as if they were attending a real-world lesson. Darkstar University is a business venture to provide a virtual learning environment to universities and colleges from countries including the U.S., U.K., China, Canada and Australia.

Implementing the workshop environment

To implement the workshop environment, as many as possible of the existing tools were reused or modified. A room from the MPK20 default world was used as the virtual project room, and the built-in PDF viewer and whiteboard tools were adapted for the purposes of the workshop.

In order to address the requirements of making user stories available to participants, Wonderland's PDF viewer was used. A PDF viewer can be added to any space in the wonderland environment, and can dynamically read its content from a web server (not the Darkstar server but a separate web server). Its size, position, orientation etc. is configured in an XML file. Because at each stage of the workshop a participant will work through a set of user stories, these are grouped together into a single PDF file. The various PDF files that make up the workshop's overall collection of stories are deployed as a web archive onto a web server. Figure 2 shows the overall architecture that supports PDF viewing. The XML file includes the URL of the web application containing the PDF files on the web server, and other aspects of configuration such as whether the PDF pages should be shown as a slide show or controlled by the user. A separate XML file is used for each instance of the PDF Viewer, so

each can include a separate URL pointing to a particular downloadable PDF document. The document
information is read at startup by the Wonderland client and loaded into the viewer.
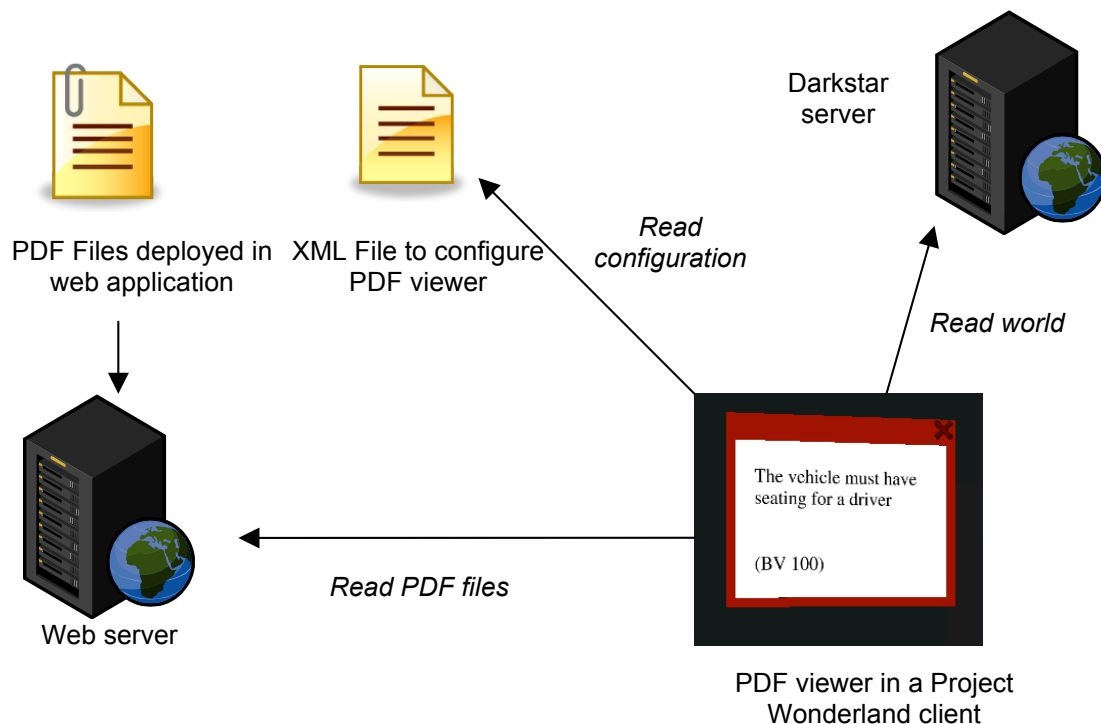

Figure 2: Configuring a PDF viewer in Project Wonderland

Once the file is loaded into the viewer, the user is able to control the viewer to switch between different pages
and read the user stories allocated to them (Figure 3). Ideally, we would want to dynamically control the
contents of the PDF Viewer for each stage of the workshop. With the current implementation, with the files read
statically at start-up, we could only work thorough a single iteration of stories per viewer, requiring separate
viewers for each iteration.

Figure 3: Reading a user story from a PDF viewer

The most important component in the system is the whiteboard. For this, the whiteboard that is supplied by default in Wonderland was modified to enable multiple whiteboards to display data from a shared file on the server. Like the PDF viewer, the coordinates and location of the whiteboard can be configured in XML. However the actual functionality of the whiteboard was updated in the Java source, with additional control buttons being added to enable a user to (a) update the shared file with their own feature drawing and (b) to reload the shared file up to their own whiteboard. The image being used for painting on the board is a shared PNG bitmap file. Figure 4 shows how individual participants draw different features on separate whiteboards.
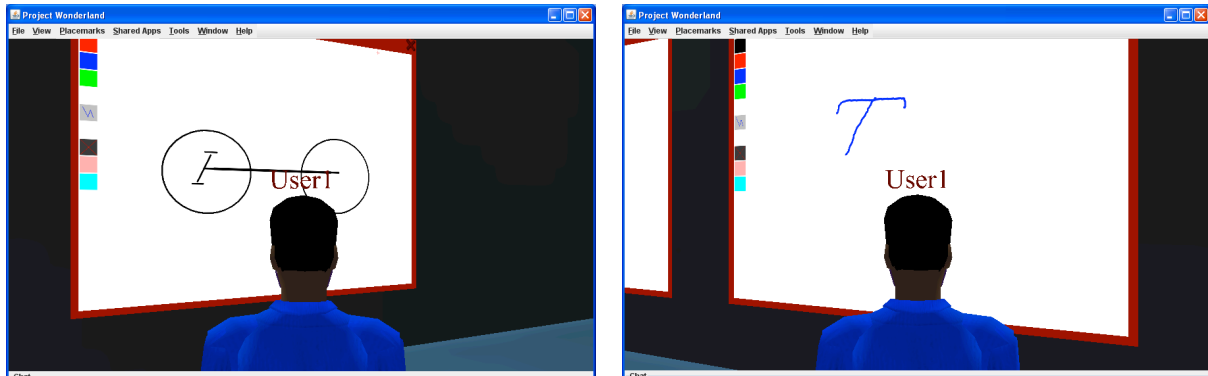
Figure 4: Drawing on the whiteboards

One of the control buttons on the modified whiteboard enables the current drawing to be added to the shared image file. A second button allows the user to see the current contents of the shared file. Figure 5 shows how the whiteboards can be updated to show the various features together. The whiteboard on the left has been updated to show the merged features from the two whiteboards. This feature merging can be done using any number of whiteboards.
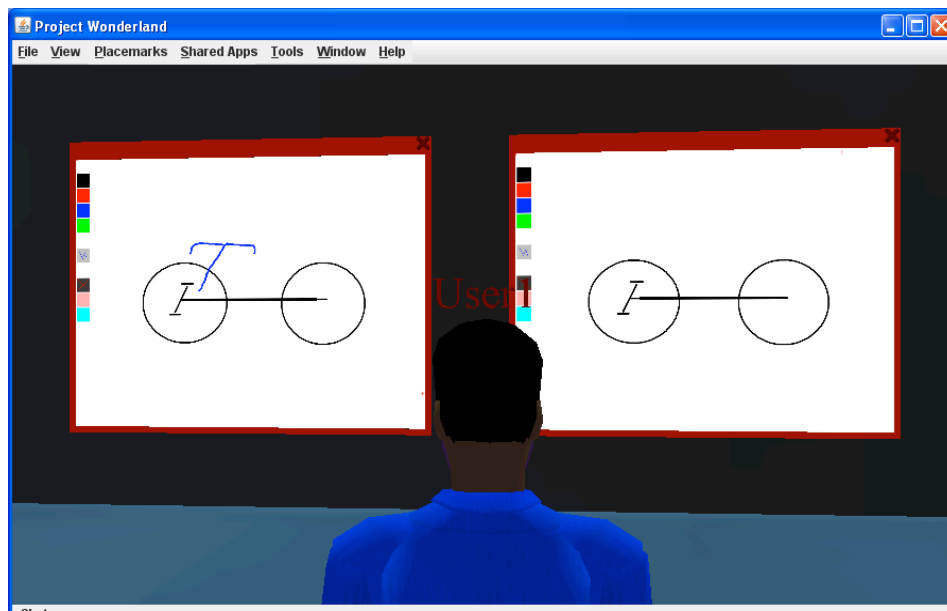

Figure 5: Combining features from different whiteboards

One issue that has emerged with the whiteboard tool is that it lacks the physical flexibility of overhead transparencies. In the live workshop, when the transparencies are laid on top of each other, they can be repositioned so that features match in the correct places. At the moment this is not possible with the whiteboard tool so it is difficult to integrate the features in their correct positions on the screen. There is also a lack of control over who can update the shared file and at what point in the workshop. These issues will need to be addressed before the systems can be properly tested with users. However one key advantage that we have in

using Project Wonderland is that we have complete control over the Java code that we use, so we are not confined by the current whiteboard functionality, which we may entirely replace if this proves necessary.

CONCLUSION

In this proof of concept study we have created a virtual agile workshop in Project Wonderland, in order to explore the educational challenges and opportunities offered by this immersive environment. We have used an analytical framework to support understanding of the forces that impact on the design of learning delivery in a virtual world, although analysis of student feedback is awaiting further testing of the experiment.

Our experiments so far have shown us that working with Project Wonderland is a difficult task, as the project is much less developed than, for example, Second Life. However we have also been able to modify and apply program components within this environment in ways that would not have been possible in other systems. We have been able to provide the very basic features necessary to implement the agile workshop in this virtual environment. There is still a long way to go until the system will be suitable for user evaluation. We need to develop a mechanism for the dynamic selection of user stories, rather than the fixed set of stories currently available in the PDF viewers. We also need to provide more control over the whiteboards so that the shared image file cannot be arbitrarily overwritten as it can be currently. There are many usability improvements that are also required before the workshop could realistically be tested with a user group. However, from our experience so far, we do believe that these improvements are technically feasible within the Wonderland environment.

We believe that Project Wonderland provides some key advantages to educational users over currently more popular alternatives such as Second Life. It is free to use and can be locally hosted, it provides the flexibility to develop code using a fully featured programming language rather than a proprietary scripting language, and does not have the potential distractions for learners of public virtual spaces. There are some potential issues however. Support for the continuing development of Project Wonderland is dependent on Sun Microsystems, which has since been acquired by Oracle Corporation, the current implementation is relatively crude when compared with Second Life, and it is difficult to get the system up and running, when compared to simply using an existing third party infrastructure. Despite these issues, we feel that this platform is worthy of further investigation as a learning environment, and has strong potential.

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