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3D Interactive virtual environments for E-learning, teaching and technical support: Multiplayer teaching and learning games for the School of Art, Design & Architecture.

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Key words:

Collaborative, independent learning; interactive, distance-learning, learning support, proactive, resource; 3D; virtual

Abstract

This paper outlines the key stages of a University funded teaching and learning project, the main objective of the project is to build an online 3D virtual Ramsden workshop (RW) game learning environment. Using 3D modeling software and interactive 3D game programming technologies the project team have accurately modeled and simulated the Ramsden workshop (RW) building; The 3D virtual RW workshop has been accurately built to scale and is fitted with virtual furniture, virtual computers, virtual engineering machinery. These components have been developed as an initial range of interactive game based learning tools. In this project the team has also begun to simulate Health and Safety procedures, created software CAD/CAM tutorials and are developing and testing innovative learning support tools for all levels of learners.

The 3D Virtual Ramsden workshop (RW) game is part of ongoing research work that applies the use of 3D virtual software for developing appropriate interactive 3D spaces, avatars, objects and simulations for learning, teaching, training, exhibitions, experimental art and practice in virtual environments. Additionally within this project the research team also modelled a virtual Creative Arts Building and a University of Huddersfield virtual campus.

Introduction

At the 1st University of Huddersfield Teaching &Learning conference in 2006, Dr. Ertu Unver and Andrew Taylor presented their research in a paper titled 'Exploring and developing Interactive 3D Learning Environments for Art & Design Education' [1]

During the phase 1 presentation we introduced the 2006 conference workshop participants to the cultural phenomenon of online social networking, through a MS Powerpoint review using a selection of screen captured images from the increasingly popular online 2D and 2D virtual environments/worlds. We explained how the cultural explosion of global popularity in Multi-user virtual environments (MUVEs) and Massively Multi player online games (MMOGs)of social user investment is encouraging humans to learn new skills, technologies, new ways of thinking, alternative approaches to living, and altered styles of communication in time and geographical location : The 2006 Teaching and Learning paper on eprints outlines the methods we initially tested in the early stages of learning to design, build and test functionality in order to develop 3D virtual interactive learning spaces/environments shown in image 1 and 2.

Image 1   Image 2

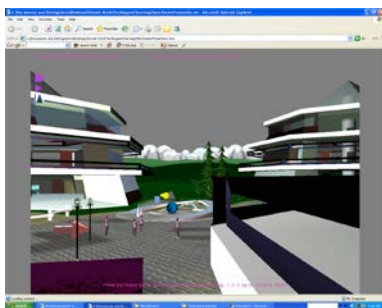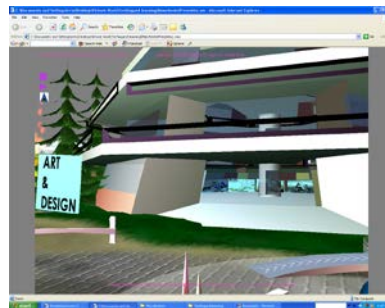Following on from this initial work; in the 2008 we made a successful research bid to the University of Huddersfield teaching and learning funding award. This

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[1]   Unver, E, Taylor, 'Exploring and developing Interactive 3D Learning Environments for Art & Design Education'; online 'Teaching and Learning matters' Spring Issue http://www.hud.ac.uk/ezine/spring/features/focus_on_e_learning.html

funding has enabled us to bring a research team together to work on different aspects of research, design, production and programming of virtual environments.

The team is made up of three undergraduate 3D, product and transport students, a postgraduate MA 3D Design student and two academics from the department of architecture and department of design. The team has worked together through the spring term and summer (July-September 2008) period to build and produce a dedicated 3D Virtual Ramsden (RW) workshop learning environment, which includes furniture, machinery and a range of interactive game based learning tools that incorporates simulated H&S procedures, CAD/CAM tutorials and other learning support for all levels of learners in the School.

In addition to the 3D Virtual Ramsden (RW) workshop, the team have also modeled the new SADA CAB building to scale, and the HUB University reception area and located them within a simplified prototype model of the University of Huddersfield campus all of which is situated on a basic 3D Huddersfield Town layout template.

At this 2008 E-Learning T&L conference, we will present the T&L funded project work in a fully interactive 3D virtual workshop experience. Interactive participant play and collaborative team exploration of the RW virtual environments is the aim of the workshop for those in attendance. We will encourage users to interact within the RW virtual space as avatars. Participants will explore new ways of accessing and learning both theoretical and practical applications of RW; navigation of the building, rooms, location of the machinery and working safely and productively to apply when in the real world workshop. During the workshop we will invite/encourage questions, ideas, and debate between participants and will record the feelings and experiences of the participants. To guide and inform how to develop appropriate T&L resources in our on-going work on the virtual environments data will gathered from educators and students. Through analysis of this data the team can use code to programme /test the future-functioning of virtual learning spaces. A summary of the processes during the development of the

work using 3D virtual interactive software is outlined using a series of screen shots in the project development section below.

Project Objectives

The objectives of the University L&T funded research project were :

- 3D modeling of the Ramsden workshop environments (RW1-4)
- 3D Programming of interactive environments
- Simulation CAD/CAM processes and machinery
- Creation of textures, lighting, production effects
- T&L demonstration videos
- Evaluation with participant users at University E-Learning conference.

Background to the research

21st Century learners belong to the 'Generation Now' culture [2]; young people who are actively engaged in developing advanced communication skills to enable them to have a presence and a voice in a universal web based multi-dimensional society. The extensive globalization of the world's cultures, it could be argued, is evolving all cultures into spaces that are functioning from non-sequential online web inter-dependant interaction.

The majority of new learners are entering HE education skilled at interfacing multiple varieties of digital hardware devices and graphic software interfaces. Their skills are practiced to a high level through extensive mobile phone and regular use of interlinked upload/download into social networking profiles such as Facebook, Bebo, Twitter and My Space and numerous others. The latest 'must have' 3G wireless mobile computer phones, web 2.0 connected interactive multi-player 3D computer games, WII touch sensor devices, and

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2   Tresser,T; Generation Now, Young, wired and living life on the digital edge - meet the Millennials.

http://seattle.consciouschoice.com/2007/07/millennials0707.html

the latest downloadable music and movies activate and captivate brains with a moving myriad of sensory light and sound.

Art and design education functions within unique, constantly shifting and evolving spaces; courses are orientated around both independent and collaborative practice/project based learning and teaching. Traditionally, within studio practice experimentation in a range of media and tools the student is encouraged to acquire the non-sequential developing of new skills to design and produce art or product in all its varieties and forms.

From our teaching and research practice we know that SADA students are highly motivated to explore the tacit properties of the physical and pixel light qualities of digital media. Digital and physical materials/media are combined with image, scale, material, media, narrative, animations, and movement to develop multi layered communications between themselves, and the world around them.

The research team have developed an online 3D virtual interactive workshop environment specifically for art and design learning on SADA courses including product, transport, textiles, surface Design, crafts, architecture, fine art, multimedia etc.. The virtual learning environment will, in the future be used to super-enhance the staff team's guidance, parallel support working alongside independent and collaborative student learning experiences. With multi user functionality programmed into the environment this will super enhance single user operations and enable improved learner interaction and shared understanding of all aspects and levels in the real world workshops. The 3D virtual environment will provide a variety of media and game-style learning tutorials for communicating and embedding the industry processes of 3D CAD/CAM operation and other essential workshop health and safety support information

The recent acquisition by 3D Design of the laser cutter and 3D RP printing equipment has increased the user demand of students for consistent support. Students require support with editing/processing of CAD files, repeat

demonstration and up-to date monitoring and delivery of health and safety information from the academic and technician staff, provided in limited physical space to increased numbers of students who have ever more diverse course project requirements. The School of Art, Design and Architectural 3D workshop in RW14 has two 3D Stereo lithography printers, laser cutters and a wide range of other cutting, moulding, manufacturing and finishing machinery.

Current teaching practice includes many different academic staff delivering technical output details into lectures on different modules and linked projects. All user guide, tutorials and manuals information are made available to support the learner and can be accessed from the university network and anywhere via links to the Blackboard VLE Blackboard and other school/course related link. Materials can also be accessed from www.huddersfield3D.co.uk,yahoo groups, and directly in studio /workshop demonstrations on large screen, accompanied by photocopied handouts often provided in b/& W, (rarely in colour), are text heavy which offers limited interest for learning development and interaction. Regular technician demonstrations support project delivery where students are shown how to make and safe usage of 3D Printing, laser cutting and other production machines workshop.

Project development

This section shows views of the different stages of development of the 3D Virtual Ramsden (RW) workshop and briefly describes the developing stages of the project using images.

The 3D virtual School of Art & Design area includes the product/transport RW & studio spaces, Creative Arts Building and University of Huddersfield campus.
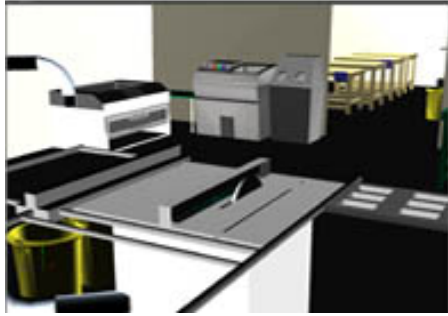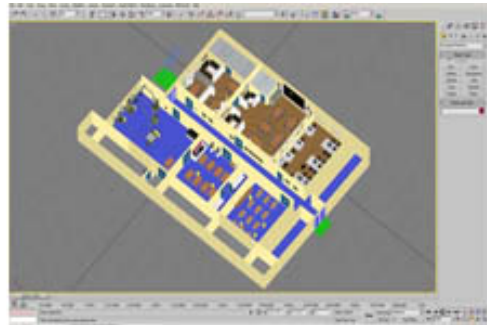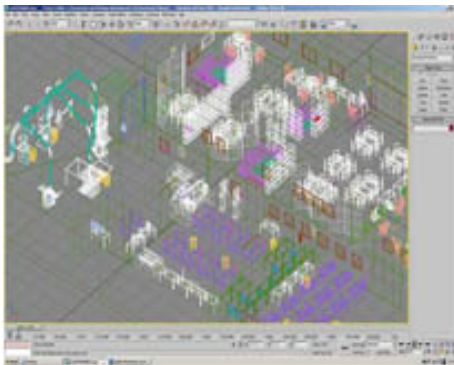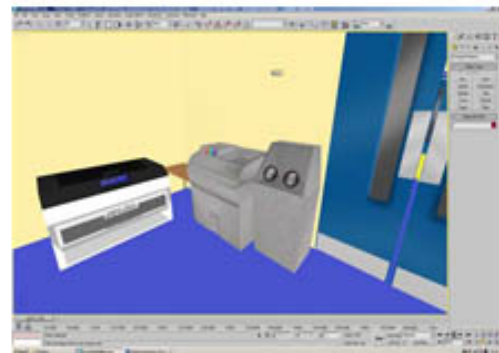
image 3

image 4

image 5

image 6

image 7

image 8

image 9

image 10

Benefits of Interactive 3D multi-user environments

The following benefits are available when developing your own 3D interactive world:

- Adaptations, customisation and to the environment can easily be added via the internal development team.
- Advertising, marketing and promotion of The University of Huddersfield are easier to control and make available to selected external parties.
- Interviews, open days, and inductions are possible in virtual 3D School/Campus environment
- Installation CD or a server download providing 3D School of ADA galleries/exhibitions such as end of year shows where large high quality files can easily be delivered.
- Collaborative Projects with franchise institutions can be conducted more effectively from within the dedicated virtual environment.
- All users can find their campus location on campus or next lectures in the environment similar to MSM, dodgeball and google maps
- Virtual environment can be restricted and open only to registered University staff/students
- Global privacy and security is ensured in this system.

Benefits pre-programmed multi user environments PMU/MUVEs/MMOGs

Using pre-programmed multi user environments (PMU) such as Second life.com,HiPiHi.com (China), Lively.com (by Google), there.com, homebetatrial.com (for the PS3 community) can offer some excellent immediate experiences and benefits, but in the long term we believe there could be problems using open to the public virtual spaces as shown below:

- Generally these PMUs have their own target groups where brand loyalty and profit is priority rather than teaching and learning experience.
- All the developed material in the 3D worlds is generally pre-defined and currently quite basic.
- Difficult to integrate and mediate academic assessment and module information
- General security is a concern.
- Distractions and random behavior can be problematic for specific L&T.
- Unwanted advertising could soon be very widespread problem in PMUs

However, the general advantages are that PMUs are actually pre-defined and anyone with basic 3D/user skills level are encouraged to join or build, a short learning curve to learn setup of characters and interaction in the environment using available primitive libraries. Security settings are increasingly more available, moderate ease of setup and a global user population is encouraging academic institutions and commercial business activities to be a presence in a 3D virtual World.

Conclusions

From our initial developments we have found that this project has the potential to be used to extend and enhance the 'traditional' physical learning and teaching experience for everyone students, and staff at all levels within the University. We also predict students and staff will become much more engaged and adventurous through using educational game environments and simulations as they are interpreting, analyzing, discovering, evaluating, acting, and problem solving in a space where anything is possible.

Multi player game environments are developed for the general use of social activities. The users have to play according to certain defined world parameters. Current PMU/Multi player online games such as Second Life are very easy and can be used for socializing but offer limited interactivity. Using and sharing programming script these limitations are being overcome. Programming of educational specific content needs to be developed according to educational or schools specific needs and requirements. For example creating a staff meeting room where different staff meets and discuss issues without meeting physically and recording these conversations for the people who can not attend might be beneficial.

Use of environmental sounds, real voice for chatting, number of people in a room or world interaction, server bandwidth, user internet speed, use of image quality and number of polygons of the 3D models, character details, interaction between objects and characters using physics where real world conditions can be simulated are all issues for any virtual world developers to solve and overcome.

Future work

Stage 1completed and presented during workshop each team had 1 user /avatar that was controlled by the keyboard and mouse, the other avatars were pre-programmed, and there was no voice or text chat setup as yet. In next stage we are creating different types characters, these can be customized through a menu, and we are in the process of testing the multi user access issue where several users can be together.

RW, CAB and other university buildings have been developed that are exactly to scale which provides a familiar arrangement for users in the Virtual environment to navigate around and to ensure that users are able to locate themselves and easily find tutors, meeting rooms and workshops. This set layout can be infinitely extended or change further by users if required.

Research also indicates that communication needs to be easy to experience and design specific. Results from previous research workshops have suggested that predefined buildings are limited and restrictive; this suggests that users of virtual worlds need to have freedom to choose the content or their own environments.

We believe the potential of the infinite space in virtual space shouldn't be limited by the developers and must create opportunities that aren't possible in physical world. In further development of the environment users will be able to create their own space using different programmed objects and basic primitives can be altered or properties changed.

Further research into direct user generated content and with the support of colleagues and students we will attempt to develop and simulate teaching principles in game environments. Creating creative virtual spaces and Training tools where students and staff can go to learn principles of design, making, theory, health and safety and communication that offer interactive learning to test or experience different levels of learning or subject material, through interaction, reading, listening, uploading and communication.