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The development of educational

3D virtual interactive learning environments

for art, design & architecture education

1st University of Huddersfield Teaching & Learning Conference

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Abstract

Online interactive 3D virtual environments are becoming increasingly globally populated and integrated into everyday physical society. The paper discusses the development of online interactive 3D games technologies and how integration of these media can extend the 'traditional' learning and teaching experience.

In this paper the initial stages of the research project are described and the development of the technology and methods used for creating an online 3D virtual interactive learning and teaching for the School of Art & Design environment are discussed and presented.

The funded University research project is exploring the explosion in popularity of Massively Multiplayer Online games (MMOGs) and on-line interactive 3D programming tools, that when integrated are enabling new and innovative pedagogies to evolve, that will influence the future of our learning and teaching experiences.

At the University of Huddersfield 1st Teaching & Learning conference in 2006 we presented the development of the 3D virtual interactive learning environments, where virtual 3D students and staff can interact and experience University life as part of an online virtual educational community. The interactive 3D virtual learning environment can include online teaching support materials, link to 'live' lectures and provide real-time distance learning experiences for off campus students and international/franchise courses.

Background

Art & Design education operates within unique and constantly evolving space; it is orientated around collaborative project based learning and teaching. Within Art & Design studio environments the experimentation of different media, is explored through 2D and 3D physical and virtual experiences, using a combination of experimental images, narrative, animation and movement to facilitate multi layered, communication between both students and tutors individually and in groups.

A recent explosion of engagement and interest in recreational and educational gaming has led to increased research into 3D gaming technology and engagement/learning theory, focusing on the effect of

using games in practice, for training and to develop the structure of cooperation in game play situations. The serious implications of gaming are still new and unfolding, but we are not far away from seeing what virtual games in education can really teach us.

Multiplayer games provide a social and networking experience within the game itself.   In the virtual space of 3D massively multiplayer games, several, hundreds or even thousands of people as virtual characters known as avatars, can be playing and networking at the same time via Internet technologies.

3DMMOGs significantly changes the nature of the computer game as we previously knew it. You are no longer playing in a preset world, constrained and only evolving as the game developer has determined. The actions of other people and their ideas make the game unpredictable, open ended and spontaneous – just like real life.

Online Social networking

Everyday, millions of people of all ages are socializing and expanding their opportunities for meeting new people and networking across the planet, through sites like MSM, Hi5, Google – g mail, You tube, My Space, Dodgeball, Facebook and Friendster.

The use of social online messaging is now culturally, socially and globally embedded and is mainly used by teens and early 20s.   2D Image based profile & chat sites are extremely popular and extensively used outside the educational environment by College and University students.

Use of Blackboard for teaching and communication

The University of Huddersfield uses Blackboard web teaching technology which provides teaching and learning for all schools in many different ways. Blackboard is a very useful tool for non design subject areas such as Business, Law, politics where a large amount of text based information is passed to students, stored for convenience and ease of access and repetition.

Blackboard has definite limitations for art and design courses sharing a diverse range of images, materials pictures, sketches being created and shared by students and staff. Individual and group discussions are also carried out regularly using these visuals, product and art work.

On the school of Art & Design Blackboard site recent developments have been made to the aesthetics, image/content and improved interface functionality making it more user friendly. Also some flexibility has been experienced in School of Art & Design by customizing the design of web spaces dedicated to certain subject areas like Design Business.

Use of 2D and 3D online sites at the University of Huddersfield

The following web site technologies are currently available at the University:

- Three web sites are created www.huddersfielddesign.co.uk extensive student portfolio, links and tutorials and www.huddersfield3d.co.uk for 2D image gallery and 3D animations that are regularly and extensively accessed by current students, schools, colleges, and companies.
- Online 2D flash maps were developed by Library staff 3 years ago. These are regularly used by students/staff for navigation.
- 3D VR walk through has been setup and is currently at development and testing stage for finding direction on campus by the University web staff http://crete/virtualtour/aVirtTour.aspx

Research Project

The online 3D virtual interactive world has been developed by 3D and Textiles/Surface design collaborative academic team in the School of Art & Design at University of Huddersfield.

This new work was recently presented at the University of Huddersfield Teaching and learning conference in September 2006, and in a 'live' workshop at the Studio Culture 4: Studio Futures conference at Manchester Metropolitan University in December 2006.

The project is focused on learning integration and transformation within higher education. Students and staff can interact and experience University life as part of an on-line virtual educational community, as virtual 3D characters. The 3D interactive environment enables users to experiment within a virtual experience of design areas especially focusing on digital, theory and physical skills and techniques. The environment creates opportunities for interactive 3D on-line teaching support materials, links to 'live' lectures and provides real-time distance learning experiences for students on international/franchise courses.

Through the strategic use of virtual programming software and 3D modeling and animation software research & development of the Virtual environment we have investigated and applied methods of learning and thinking by looking at games as the intersection of play, pedagogy, and technology.

Academic and student user experiences have been tested within the 3D multi user virtual environment; the first stage of development includes; modelling of basic characters, programming movement, testing communication tools using sound and animation and creating gallery spaces.

Methodology

The methods for building and developing virtual spaces within the 3D environment for character styling and functionality of objects are as follows:

- Research and Design
- Concept layout: ideas development, illustration and story boards
- 3D modelling of environment
- 3D object modeling for simulation
- Character design and clothing
- Lighting design
- Preparation of texture and surfaces
- Sound and video capture and editing
- Programming
- Testing and evaluation with academic/student users in education.

Virtual School of Art & Design

The images below show views of the initial testing and first stage development of the virtual environment. The 3D virtual School of Art & Design area includes the product/transport studio space, design business space and a large projection screen.
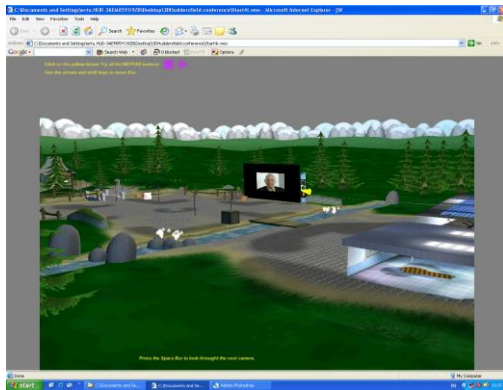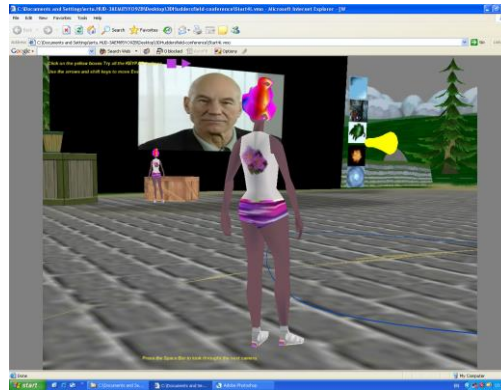
Image 1   **Image 2**

Image 1, is a camera view of the stage 1 environment.
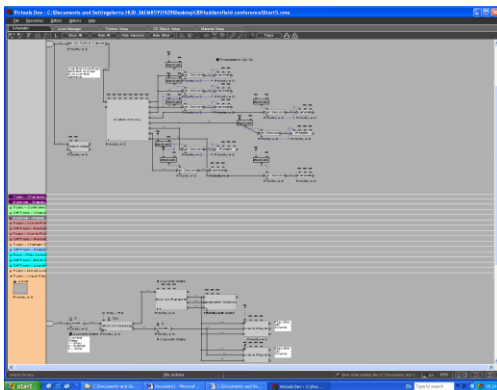Image 2, shows avatar Eva listening to Patrick Stewart talking to the School of Art & Design.
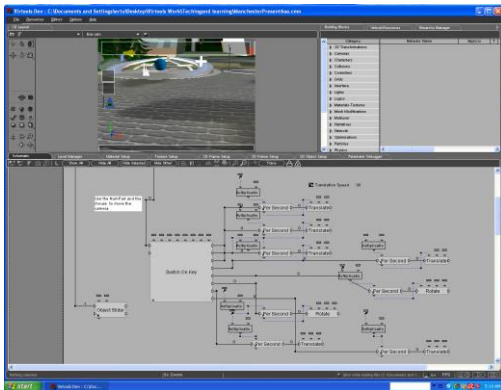

Image 3   **Image 4**

The images 3/4 show a section of Virtools software programming for every action in the environment code must added correctly and tested.
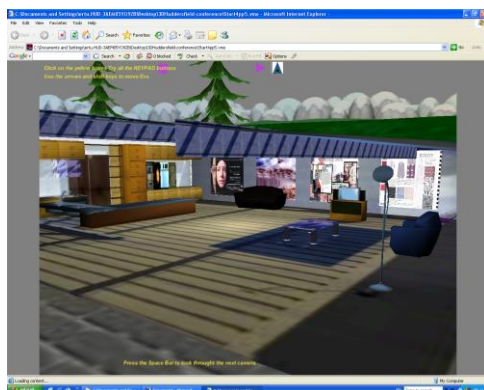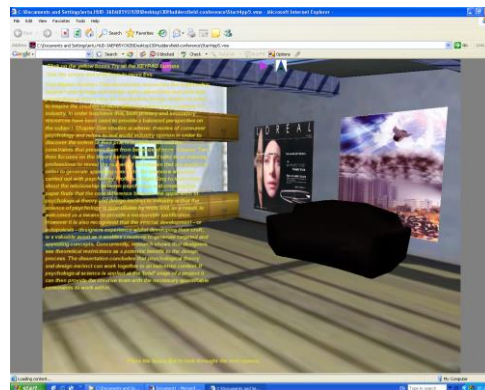

Image 5   **Image 6**

When user clicks on the space bar they can change the camera to different views. Image 2 shows the character mode as the avatar the user can use arrow keys to turn towards the screen, walk or run away using their chosen avatar.

Image 5 and 6 shows the Design Business subject area meeting room, it is a combined social/seminar space which has examples of student work on the walls.

This room could also be the location of an interactive library of blogs, previous years projects, reports, journals and dissertations. Documents can be input via scanned text and bookshelves contain links to dissertation abstracts that can be linked to a .pdf document in blackboard or on a server. A thumbnail image can be added so the student can review quickly and then open from the blackboard link if required.

These tools could potentially create new methods for accessing, reading, discussing and storing reference material for independent learning. This will improve student use and develop more interactivity between Blackboard in the future.

Presentations, videos and animations can also be viewed from the screen or TV (image 5) and viewed collectively in the virtual Design Business meeting room.

Interactive Rapid Prototyping (RP) machine student learning simulation
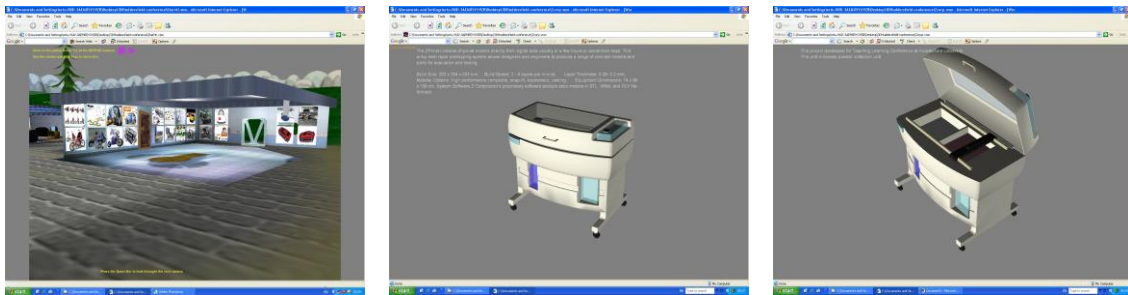
Images 7 / 8/ 9

Image 7 is the virtual product & transport design courses exhibition studio. Users can move camera using assigned keyboard commands to walk into the room and look around and move closer to the student work.

Images 8/9 show the next room through the door is the manufacture room and so far includes a 3D rapid prototyping user teaching & learning simulation. RP or Stereo Lithography is a process that prints many layers of powder or resin to build a complete physical model from a 3D CAD model.

The objective for developing the simulation is that students can pre- learn to use the actual machine in the virtual workshop, they can see how it works, learn the limitations, advantages and simulate a model making process in advance of the lecture or if they missed the introductory lecture or had difficulties with learning they can revisit and use in their own time.

Slide 7/8 shows the RP simulation. Users can zoom in zoom out and rotate the RP machine using keyboard keys. The RP shows the production of a 3D model layer by layer as an exact of the real RP machine. Instructions are also shown on the screen in text format.

Image 1 and image 10: We also have three large screens in the outside area where anyone's presentations could be shown, students can upload their work and comment help each other online, ask each other questions or test exhibit their work for sense of space and audience feedback.
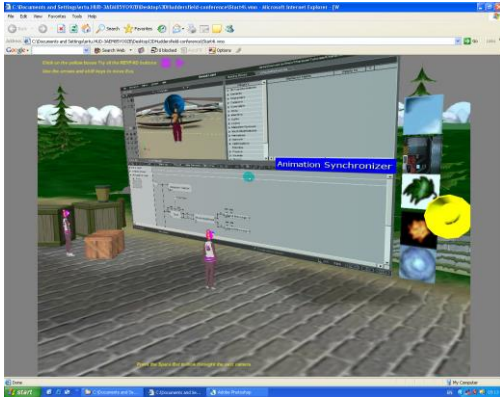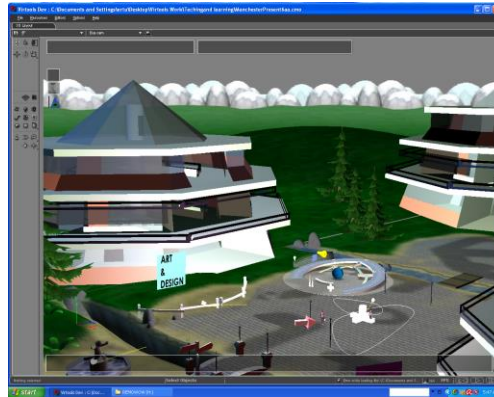
Image 10

Image 11

Image 10 shows Eva Avatar watching a Virtools software learning tutorial on one of the large screens. The buttons on the right activate different animations or movies. Also, we have added a 3D speaker so when the movie is watched it speaks with 3D sound. The speakers can also be rotated to direct the sound towards or follow the avatars position as it moves.

Image 11 shows the new buildings we have recently developed for the next stage of the project to test built spaces. Buildings are modeled in Maya software. Materials and textures are applied then, transferred to Virtools for lighting, shaders, texture settings/materials and images showing galleries of student work.

Benefits of Interactive 3D multiplayer environments

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

- Adaptations and customization to the environment can easily be added via internal development team.
- Advertising, marketing and promotion of The University of Huddersfield are easier to control and make available to selected parties.
- Interviews, open days, and inductions are possible in virtual school environment
- Installation CD or a server download providing 3D School of A&D galleries/exhibitions such as end of year shows where large high quality files can easily be delivered.
- Collaborative Projects with franchise institutions can carried out more effectively in the virtual environment.
- All users can find their location on campus in the environment like in MSM.
- Environment can be open to registered University staff/students
- Global privacy is ensured in our system

Benefits preprogrammed multi user environments PMU/MMOGs

Using preprogrammed multi user environments (PMU) such as Second life might offer some potential benefit, but in the long term we believe there will be problems using open virtual spaces as shown below:

- Generally these PMUs have their own target groups where profit is priority rather than teaching experience.
- All the developed material in the 3D worlds is generally pre defined and quite basic.
- General security is a concern.
- Distractions and random behavior can be problematic for L&T.
- Unwanted Advertising will soon be very widespread problem in PMUs

However, the general advantages are that PMUs are actually pre-defined and relatively quick to build up and setup characters and the environment using available primitive libraries. This ease of setup and wide user population is encouraging commercial activities to be established.

Conclusion

We believe 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 this is including us.

Work in progress of the developmental stages of the 3D School of A&D environment at:

http://www.huddersfield3d.co.uk/Interactive3DWeb.htm