THEATRON Final Report

September 2009

Summary

Research questions

The Theatron 3 project, was funded by Eduserv and led by King's Visualisation Lab, and aimed to create twenty theatres from different periods in history in the immersive virtual world Second Life with accompanying pedagogical content. Additional tools were developed to support exploration of, and performance in, these theatrical spaces. To test the viability of this as a medium for education in theatre studies and English literature, five subsidiary pilot pedagogical projects were established at different HE institutions.

The objectives of the project were to evaluate the process of creation in Second Life, the process of implementing learning at the separate institutions, and to identify successful strategies for learning and teaching in immersive virtual worlds in order to provide practical guidance to the HE community. The single question underpinning all of this research was '*Are immersive virtual worlds a viable platform for research, learning and teaching?*'

Findings

The key additional element that immersive virtual worlds bring to 3d modelling is the introduction of avatars. Avatars enable these spaces to be populated, for the user to be embodied within those spaces and for copresent communication to take place between participants at a distance. To a limited extent, the ability to manipulate these avatars also enables the creation of performances within those spaces. The effect on research, learning and teaching of these avatars is:

Research:
- The ability to place oneself within those spaces provides insights into the lived experience of historical theatrical places.
- Presenting these spaces as populated enables the nature of the spaces to be conveyed more fully.
- Locating research content within the spaces enables the material to be conveyed more effectively

Learning and teaching
- Presenting at a distance within these environments is effective, since participants feel a strong sense of social presence of the presenters.
- The effectiveness of the environments is dependent on students and staff experiencing embodiment within the environment, and since not everyone experiences this, this can divide responses to the environment into strongly positive and strongly negative
- Second Life is a social environment, and the presence of other people within the environment can also be viewed as beneficial by some students and staff and be a source of anxiety and cultural and ethical barriers for others.

Performance
  The ability to move and animate avatars is limited and difficult to master. As a medium for replicating real life performances, immersive virtual worlds are impractical at present. As a

tool for exploring new forms of performance, based solely on the virtual, the medium presents many opportunities

The platform itself produced a mixed reaction from participants.

- The level of detail and aesthetic qualities of the Theatron builds was described as unfailingly appealing.
- The Second Life interface was found to require a longer time to master than could be accommodated in the time available for most of the learning and teaching sessions
- Many institutions lacked the resources to effectively run Second Life and placed bureaucratic obstacles in the way of implementation.
- The Linden Scripting Language had "peculiarities" that prevented some technical developments, but left open loopholes that could be exploited with experience
- The platform itself had technical problems with lag, prim limits, downtime and blocked registrations that made it too unreliable for mainstream activity.

Success and impact of project

The Theatron builds were achieved to the required level of detail and pedagogical content was effectively embedded within them. The slow start of the build process was rectified through effective workflow planning. This part of the project was entirely successful and met the original goals of the project.

The pedagogical pilot projects were a mixed success. Second Life proved to be insufficiently reliable to build into mainstream activities and the infrastructure of many institutions did not meet the standard required to run it effectively. These factors, combined with the demands it placed on students because of the time taken to learn to operate it, and the challenge to many of working within a virtual environment, meant that learning activities had to be reduced and moved to optional courses. Of the five subsidiary projects four engaged to an extent where the environment could be tested and good practice identified. Additional, non-funded work carried out by the larger community also contributed to the project findings, and indicated that the materials will be used outside of the direct intervention of the project.

The Theatron project has been represented at close to 30 separate conferences, workshops and events. Interim findings have been drawn upon by initiatives such as Virtual Worlds Watch and publications such as Getting Started with Second Life, as well as forming the basis of staff development sessions at various universities.

Within the institutions involved in the project, the project has been a major contributor to the development of King's Visualisation Lab's status as a developer and researcher in immersive virtual worlds. In three of the four institutions running pilot projects Theatron has contributed to an ongoing development of Second Life as an educational tool, at one (Wolverhampton) it has not had an impact, due to difficulties faced there. At YSJU, the project has had the effect of altering institutional commitment to virtual worlds, to the extent that the institution is much more open to further developments and is considering supporting further work.

A range of research studentships have also been supported through connection with the project.

Overall conclusions

1. Second Life is a suitable environment for creating accurate and complex structures and embedding related pedagogical content. Build times can be greatly reduced through effective workflow plans.

2. During the lifetime of the project, Second Life was too unreliable and presented too many barriers to institutions for full testing pedagogically. It is an appropriate medium for educational innovators, but early adopters will find that there are still too many issues for incorporating it into their practice.

3. Immersive virtual worlds as a medium present many challenges to students, particularly due to cultural attitudes and the absence of embodiment experienced by some students. The time required to invest in learning to use the environments also is a barrier to adoption. For these reasons, it may always be problematic to make the use of immersive virtual worlds mandatory for students.

4. As a medium for studying and communicating, Second Life presents many opportunities. As a performance medium it is limited when attempting to place existing, real life performance in a different medium, but has much potential when used to explore new forms of expression.

5. The introduction of Second Life at institution often reveals many weaknesses in those institutions' technical and service infrastructure. These inadequacies need to be resolved before widespread adoption of these technologies can occur.

6. Immersive virtual worlds are a relatively new technology in education, and there was little understanding of the barriers to implementation within an institution and their most appropriate application to learning when the project started. Second Life itself needed much development in terms of reliability. In the intervening two years, there have been many steps forward in understanding its application to education. The technological goals of the project were well timed in this development cycle, but in retrospect the pedagogical aims were set too early, before the capabilities and limitations of the medium were sufficiently understood. However, the lessons learned pedagogically from Theatron will be invaluable in informing future practice.

Contents

Project Activities

Aims of the project

The THEATRON project was funded by Eduserv and led by King's Visualisation Lab at King's College London. At the start of the project Theatron consisted of a set of models of 19 key theatres in the development of European theatre design. These had been developed through an EU Telematics in Education, Training, and Research Programme, beginning in 2002. Each site was represented by both a simple, real-time navigable model and a collection of pre-rendered images and animations of highly detailed models together with accompanying texts and images, linked to specific locations within the model. Theatron 3 aimed to transform this and additional content since created by King's Visualisation Lab, into an extensive, content-rich range of models within Second Life. These models, and their accompanying information, would provide highly innovative, interactive teaching and learning resources designed to take full advantage of the pedagogical potential of the environment.

> *Our original rationale for the Theatron project was that the limitation of the existing Theatron resources was that they were unpopulated. Whenever they were shown to anyone, the response was that something was lacking. This element was the human body; even the sense of the viewer's own body was absent. The intention was to invoke the essential aspect of the theatrical experience; the participating presence of other people.*

> *A secondary desire was to introduce voice, although it was yet to be introduced to Second Life when the project started; being able to actually communicate within the world. Of the Appian expressive elements of time, movement, visibility, sound and possibly music, Theatron 1 and 2 could only evoke some of those, and this new project had the power to evoke others.*

> *Finally, it seemed potentially that because we already had a great deal of pedagogic material and a lot of research work that if we could transpose that to a more appropriate medium it would be really good.*

> Prof Richard Beacham

Objectives of the project

The nature of the Second Life environment, and the developing role of Second Life as a pedagogical tool within the education sector, provided an opportunity to exploit these models for a range of different purposes. The process of developing these models, and the development of the learning activities designed to make use of these models, enabled a range of research questions to be asked throughout the project. These were:
• How can the models be used as a research tool?

- What are the technical issues associated with developing content in Second Life?
- What are the barriers and incentives to implementation of Second Life learning and teaching activities in an educational institution?
- How can learning and teaching activities be designed to take advantage of the potential, and reduce the difficulties, of using Second Life as a medium?

In addition, the high profile the project developed enabled the participants to take a central stage in the discussions around Second Life as an educational medium, providing an opportunity to discuss the wider implications of Second Life as an environment for learning, and contribute to the debate at conferences and various institutions.

Structure of the project

The project was made up of the following personnel and institutions:

Project directors
Professor Richard Beacham and Dr Hugh Denard, Kings Visualisation Lab, King's College London
Roles: Academic lead, overall direction, design consultation, dissemination

Project Manager
Mark Childs, Yr 1 Self-employed consultant, Yr 2 Coventry University
Role: Evaluation, dissemination, liaison with pedagogical projects, funding body, HEA Advisers, Implementation Manager,

Implementation Manager
Drew Baker, King's Visualisation Lab
Role: Building and scripting, co-ordination of developers (Beta Technologies), specifying technical requirements

HEA Advisers
Brett Lucas, HEA English Subject Centre,
Lisa Whistlecroft, PALATINE, HEA Subject Centre for Dance, Drama and Music
Role: Co-ordination of pedagogical projects, liaison with HE community,

Pedagogical activities

At the start of the project, a call was put out through the Subject Centres to Higher Education institutions throughout the UK to bid for funding to conduct learning and teaching activities using the Theatron resources. 28 expressions of interest were submitted, from these 5 sub-projects were selected.

Three projects were co-ordinated through PALATINE. These were:

Seeing space: Exploring scenographic principles in Second Life
Project lead: Paul Brownbill, University of Wolverhampton
This project was intended to allow students to experience, analyse and evaluate stage configurations that are tied to actual theatre buildings, giving them a greater opportunity to understand how the spaces work and the possibilities each space offers to the scenographer thus better informing their scenographic decisions.

Integrating film technologies into Second Life
Project lead: Joff Chafer, University of Coventry
The project explored ways of performing in chorus within the theatrical spaces, and analysed the experience of movement in unison. In addition, the project integrated live and virtual performance, for example by creating animations for avatars to react with real life performers in real time using back projection, or finding ways of using multiple projectors to explore the virtual spaces at a more human scale rather than on a computer screen.

The fools' zanni': exploring prominent characteristics of the Commedia dell'arte
Project lead: Gordon Duffy-McGhie, Middlesbrough College
This project facilitated learners' exploration of the link between theoretical knowledge and practical understanding of the Commedia dell' Arte. It utilised the unique opportunities a virtual medieval open-air stage will present, in order to allow learners, of all abilities, the opportunity to recreate the distinctive staging devices and techniques of the commedia troupes.

Two projects were co-ordinated through the English Subject Centre. These were:

Virtual Poiesis: The New Creative Pedagogy of Second Life
Project lead: Chris Wigginton, Northumbria University
This project considered and exploited Second Life as a location for the teaching of interdisciplinary work across literature, writing, performance and media. In so doing focused on the creation of new texts which, rather than mimicking or recreating historic and textual mediations of 'real life', respond to and emerge from direct engagements with the Theatron project's theatres. Accordingly, rather than rehearsing campus based and led teaching methods, the project investigated the potential of these environments as spaces for new pedagogic developments.

'Insubstantial Pageants': learning about Renaissance drama in Second Life
Project lead: Professor Gweno Williams, with Toby Gordon, York St John University
This project invited undergraduates studying Renaissance drama on English and Theatre degree programmes to experiment with the processes of staging scenes within the virtual Globe Theatre and contrast this process with that of staging performances on a real life stage. Issues such as performance, gestures, props, positioning of actors and overcoming various technical barriers were all investigated.

Additional activities
Since the theatres are publicly available, additional activity has also been conducted using the Theatron resources, but not funded through the project or tied into the overall project structure. Of these, three were of particular interest:
- Theatre Design and New Media, University of Warwick, led by Iryna Kuksa
- Introduction to Virtual Worlds, University of West of Scotland, led by Daniel Livingstone
- Staging Titus Andronicus, Bryn Mawr College, led by Katherine Rowe

Technical activities

The technical activities of the project consisted of three different aspects;
1. The builds of the theatres
2. The development of inworld tools
3. Web-based booking system

1. Theatre builds
Two islands were purchased for the Theatron project. Originally these were both for development of theatres, but after the first year of the project, one of these was dedicated to development, the other for teaching and dissemination activities. The builds were rezz-on-demand, i.e. by clicking on the image of a theatre on a billboard located in the viewing platform (a building created as an entry point for visitors to the island), that particular theatre would appear inworld. Rezz times were typically 5 to 10 minutes. The landscape of the island would also be altered to suit the theatre. This enabled all of the theatres to be available but only occupy a single island. Those marked Temporary Stages are also available as objects that can be shared and stored in inventories as well as being able to be rezzed at the Theatron Island.

Completed
- The Odeion of Agrippa, Athens, Greece
- Bayreuth Festspielhaus, Bayreuth, Germany
- The Theatre at Epidaurus, Epidaurus, Greece
- The Globe Theatre, London, England
- Medieval Fair Booth (Temporary Stages), Europe wide
- Hellerau Festspielhaus, Hellerau, Germany

- The Odeion of Pericles, Athens, Greece
- Medieval Pageant Wagons (Temporary Stages), The Greek World
- Phylakes Stage (Temporary Stages), The Greek World
- Plen-an-Gwary (Temporary Stages), Cornwall, England
- Theatre of Pompey, Rome, Italy
- Teatro di Sabbioneta, Sabbioneta, Italy
- Saint Piran's Round, Goonhavern, Cornwall, England
- Skenographic Stages (Temporary Stages), The Roman World
- The Theatre of Dionysus, Athens, Greece

Completed pending sign off
- Drury Lane Theatre, London, England
- Drottningholm Court, Stockholm, Sweden
- Noh Theatre, Kyoto, Japan

Prepared for SL not completed
- Teatro Farnese,Farnese, Italy
- Teatro Olimpico, Vicenza, Italy
- Schaubuhne, Theater am Lehninerplatz, Berlin, Germany

Awaiting from partner
- Lisbon Opera House, Lisbon, Portugal

2. The development of inworld tools

Three tools were developed to support the activities within Theatron. These were the Director's tool, the audience Heads Up Display (HUD) and the Explorer HUD.

Explorer HUD

The Explorer HUD was created to enable users to access the Theatron information, and to do so in a geographically-specific context, i.e. depending on where the avatar is located, different content, specific to that location, is presented. The explorer HUD was completely redesigned part-way through the project. Version 1 was aimed at getting all the information from the original Theatron project into a HUD. The problem was that as it was very graphically based, the text was too small and there was a combination of different media; images of text, notecards and websites. This meant that the HUD was very cumbersome to use. The intention of the project team was that people could create their own pedagogical packages for use with the theatres, and hopefully contribute it to the project.

The original HUD was also dependent on fixed points within the world. Version 2 doesn't depend on these fixed points. There is only one fixed point inworld (the stand for the "now playing" board) and everything else is derived from that (including the build), which means that within the one build many different HUDs can be used at the same time by different users. When the HUD is attached it tracks where the avatar is, the positions of avatars are calculated from distances from the fixed point and processed on the client side, which is a lot more efficient; then, if there is content appropriate to that position, it is brought up on the user's screen. A guide to the Explorer HUD is presented in the appendices. This functionality also enables the builds to be exported to other locations more easily.

The Director's Tool

The Director's Tool allows sequencing of events by controlling actors' HUDs and objects inworld. Actors can select one of three different HUDs which does one of the following: simply provide cue for the actor to perform certain actions or speak lines of text; automate some aspects of the performance; or automate all aspects of the performance. The Director's Tool then sends out information to the actors' HUDs. The difficulty with the director's tool was automating the avatars. There is no way to translate or rotate the avatars from an external control using the Linden Scripting Language. Also the animation doesn't actually move the avatar position, if the animation involves moving forwards when the animation stops, the avatar returns to the point at which it started. Solutions have been found to these issues, however.

The audience HUD

The audience HUD also communicates with the Director's Tool. From the Tool the Director can direct the audience viewpoint to particular positions, so that the audience can be given a preferred directions from which to view the performance. The HUD also enables audience responses, such as cheering, clapping, booing, throwing an apple, etc. Audience members can select a gender which will then provide a gender-specific sound for each response.

3. Booking tool

This is a website (http://theatron.betatechnologies.info/) which allows users to register with Theatron and book Theatron Island for a particular period, select a theatre to be rezzed for the start of the session, and list the other users who will be present during the session. Anyone not listed will be blocked from the island for that time, enabling teaching sessions to be conducted in private.

Project Communication

Project communication was conducted using an online communication forum, which disseminated all emails and acted as a repository for all project documents. This was hosted at the English Subject Centre. There were some issues with this as a platform at the beginning of the project as some of the participating institutions filtered emails from the forum.

Monthly meetings were also held inworld. These were held on the third Thursday of every month at the Theatron viewing platform at 13:30 and hence were known as the Th[5] meetings (Theatron Third Thursday at Thirteen Thirty). These proved invaluable for ensuring the technical developments and the pedagogical projects were effectively kept informed of progress. The sequence of builds could be requested through these meetings and the academics involved could be informed of new technical developments and act as beta testers when required. These meetings also acted as opportunities for those members of the project who were less familiar with Second Life to gain routine experience of the environment. Meetings were conducted in a combination of text and speech, depending on the minimum capacity of participants and their preferences. The most frequent mode was for the

majority of communication to take place using text, but with occasional one-to-one dialogues to ascertain specific information, such as interim meetings. Text was felt to support an experience of presence to a greater extent than speech, with taking on the feeling of a telephone conversation, with the virtual world becoming peripheral, a finding reported in Savin-Baden et al (2009; 21).

Three face-to-face meetings were held, one at the beginning of the project at King's College London, the second at the end of the first academic year of the project in Coventry University and the third in November 2008.These were found to be immensely useful as points to share collective experience and motivate further activity, but were discontinued when the participants felt sufficiently embodied and connected within the virtual meetings for the face-to-face to offer little additional benefit.

Evaluation activities

The evaluation consisted of three main strands. The first of these was directed towards answering the questions posed as research questions by the project: i.e.
- How can the models be used as a research tool?
- What are the technical issues associated with developing content in Second Life?
- How can learning and teaching activities be designed to take advantage of the potential, and reduce the difficulties, of using Second Life as a medium?
- What are the barriers and incentives to implementation of Second Life learning and teaching activities in an educational institution?

These research questions are all practitioner-focused; i.e., the intention of the evaluation was to identify practice-based information that would contribute to the use of immersive virtual worlds by the higher education.

This strand of the evaluation was conducted through the dissemination of a questionnaire for participants to use as a tool for reflection on their experiences in developing content, liaising with their institutions and conducting learning and teaching sessions inworld. These were based largely on Steven Warburton's *Six Barriers to Innovation* work. The questionnaire is available in the appendices (appendix B1).

The second strand of the evaluation comprised the individual research questions of the pedagogical projects. Each submitted their separate questions and these were collated and shared, so that all of the projects would be able to draw upon the others' research questions. These are shown in appendix B2).

The third strand of the evaluation consisted of the work of a doctoral student working on the project (Mark Childs). This research consisted of an exploration of students' experiences of immersive virtual worlds and the factors that influence this. Two of the pedagogical projects and two of the additional activities contributed to this work and some of the findings of this research are also presented here.

Dissemination activities

The project has generated a lot of interest within the HE sector, mainly in Europe but also in North America. Many of these are presentations of research papers; however there were many opportunities for presenting work about immersive virtual worlds at many seminars and workshops during the period of the project, and efforts were made to ensure that Theatron had a presence at as many of these as possible.

Mark Childs and Iryna Kuksa, EDULEARN09 International Conference on Education and New Learning Technologies, Barcelona (Spain), 6th to 8th of July, 2009

Mark Childs. "I just don't get it!" Structuring Learning in Immersive Virtual Worlds, Ninth International DIVERSE Conference, Aberystwyth University, June 24th to 26th, 2009

Mark Childs 16th June opening session to Northampton University's staff awayday on serious games

Mark Childs 2nd June presentation at Regional Support Centre Yorkshire and Humberside elearning conference

Gordon Duffy-McGhie and Lisa Whistlecroft, Learning in Virtual Worlds Conference, 21 Apr 2009 University of Sunderland,

Joff Chafer. Performing Presence: From the live to the simulated conference at the University of Exeter, March 2009

Mark Childs. Podcast recorded as part of virtualworldwatch Start the Week http://virtualworldwatch.net/resources/start-the-week-with-virtual-world-watch/ March 19th 2009

Mark Childs. Regional Support Centre West Midlands presentation, Wolverhampton, March 2009

Gweno Williams, January 2009 Co-presentation at YSJU Learning and Teaching Conference

Joff Chafer and Mark Childs Rosencrantz and Guildenstern are Derezzed, ReLIVE 08 conference, 20th and 21st November, 2008, Open University,

Joff Chafer, Virtual Worlds 08, Stirling University, 29 October 2008

Brett Lucas and Lisa Whistlecroft, Virtual Worlds 08, Stirling University, 29 October 2008

Mark Childs, workshop at Learning in Immersive Worlds conference, Coventry, October 23rd, 2008

Mark Childs. Regional Support Centre West Midlands presentation – Coventry University, September 2008

Mark Childs. Article published in *Networks* Issue 11, 15 – 17 "Theatron 3: Real Theatres in a Virtual World", Anglia Ruskin University

Joff Chafer and Mark Childs, presentation at Virtual Worlds Forum meeting, Keele University, 24th July, 2008

Gweno Williams, Introduced Theatron Project at Second Life session at University of Greenwich Learning and Teaching Conference , 4 June 2008

Gweno Williams, Introduced Theatron Project at Second Life session led by University of Portsmouth at National Teaching Fellows Conference at London School of Economics, 6-7 May 2008

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Mark Childs. Paper presented at Networked Learning Conference, Halkidiki, Greece, May 2008.

Gweno Williams, April 2008 Presentation on project at YSJU E-Learning Conference

Mark Childs. Session on Theatron at Massive Multi Learning 08 conference, Anglia Ruskin University, 18th March

Hugh Denard "The London Charter" Open Digital Cultural Heritage Systems Conference, Rome, Feb. 2008.

Hugh Denard "Digital Humanities Island" Colloquium on Shared Virtual Environments, University of Pisa, Feb. 2008.

Hugh Denard "Parallel universes, shared worlds: visualisation in the arts and humanities" Long Room Hub, TCD, Feb. 2008.

Hugh Denard "Arts and Humanities Visualisation" Research Seminar, Goldsmiths, University of London, Feb. 2008.

Gweno Williams, Introduced Theatron Project to Yorkshire and Humber Regional Learning Forum Second Life Symposium led by Leeds Metropolitan University, At University of York 31 October 2007. (Symposium videoed by University of York)

Hugh Denard Interactive virtual posters, about Eduserv, THEATRON 3 and Pilot Projects, exhibited on Theatron Island at Digital Resources in the Humanities, Dartington and ALT-C Conference, Nottingham, Sept. 2007

Hugh Denard "THEATRON 3" JISC CETIS-Eduserv Event, London Knowledge Lab, Sept. 2007

Planned dissemination activities

Mark Childs
Presentation with Katherine Rowe at MLA's 125th annual convention , Philadelphia, December 2009

Gordon Duffy-McGhie
Submission of abstract to University of Teesside Learning & Teaching Conference – Autumn Term 2009
Submission of articles to 'Total Theatre Journal'

Gweno WIlliams
Contribute to Helen Day's *Work-based Learning Report* for English Subject Centre
November 2009 Co-presentation on Pedagogy at *Attending to Early Modern Women Conference*, University of Maryland

Published papers

Childs, M. and Kuksa, I. (2009) "Why are we in the floor?" Learning about theatre design in Second Life™, Proceedings of the Edulearn 09 International Conference on Education and New Learning Technologies, Barcelona, Spain, 6th to 8th July 2009, 1134 – 1145

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Chafer, J. and Childs, M. (2008) The impact of the characteristics of a virtual environment on performance: concepts, constraints and complications, Proceedings of the ReLIVE 08 conference, 20th and 21st November, 2008, Open University , 94 - 105

Childs, M. (2008) Using a Mediated Environments Reference Model to evaluate learners' experiences of Second Life, in Hodgson, V., Jones, C., Kargidis, T., McConnell, D., Retalis, S., Stamatis, D. and Zenios, M. (eds) *Proceedings of the Sixth International Conference on Networked Learning*, 5th & 6th May, 2008, Halkidiki, Greece., 38 – 45

Project Findings

Second Life as a Research Tool

Second Life proved to be a useful research tool in the following aspects:
The first of these was through the process of creating the spaces with the development team, scrutinising them and having the kind of paradata discussions that occur when collaboratively creating in a shared world. For example; in the production of Drury Lane there was a lot of comparison of various images, finding discrepancies and wanting to go back to the primary and secondary sources to try and reconcile those discrepancies.

Secondly, there is the effect of importing the understanding of the three dimensional medium back into the studies of 2 dimensional books and still images. This can inform one's research outside of the virtual world as a consequence, This is of particular help for students, many of whom have difficulty in interpreting a graphical design, map, elevations and plans.

Second Life has also formed a useful testing ground for ideas about the intangible but essential element of what people saw in those historical theatres; how they imagined, how they constituted and reconstituted their experiences in theatres. This is a particular research interest for the King's team, not least because the ancients also talked about these ideas. Using the Second Life models, it is possible to create sightlines and mise en scene; situations in which visual knowledge is unfolded and presented incrementally as the avatar moves through a space, and so can be perceived and understood incrementally; a process that the heads-up displays are designed to replicate. Roman paintings and buildings were very deliberately co-ordinated and stage managed so that the viewer would see individual elements at a particular time and arrangement. In Theatron 3 these things can be explored more sensually, viscerally and immediately.

As a medium for *presenting* scholarly activity, Theatron 3 has also been extremely helpful. At a presentation called *The Pompey Project* (http://www.pompey.cch.kcl.ac.uk/) conducted by Prof Beacham at a symposium at the University of Georgia in Athens while Dr Denard remained in London, the presentation ended with a visit to the Theatre of Pompey in Second Life. The audience were impressed by the representation of two entities there, communicating with voice, appropriately dressed, able to move around and able to demonstrate the spatial qualities of the theatre. This was far more effective at conveying the size of the theatre and its impact on the experience of that space than talking about it, for example seeing an avatar standing on the stage, moving about and looking at it from the back row of the gallery. Also the audience were impressed by the way in which the project had enabled explanatory materials (posters, animation videos and other media) to be embedded into the space.

Theatron 3 has also addressed the challenge of communicating material as much as possible using a spatial metaphor. In Theatron 1 and 2 the content was portrayed using two separate panels on the screen (text on one side and the theatrical space on the other). In Theatron 3 the spatial metaphor remains pre-eminent and the material is accessed through the space rather than presenting it as an adjunct or something separate from it. This integrates these elements within the sensory environment of the theatre, which is essential to understanding many of the aspects of theatre since they exist in a spatial, audio, visual or movement related to their surroundings. For example, within Second Life a lazzi (comical gesture) in commedia dell'arte can be performed on stage and one can

see how it would appear standing next to the stage and looking up. Theatron aims to do that as far as it can.

> *Scholars have almost universally been significantly impressed by what they saw. The first reaction of many scholars is to nitpick small elements of the design, and not look at the overall model. Once they get over that (and it helps if they are of a theatre-historical or theatrical orientation - so that they understand the questions and issues) there has been a lot of positive feedback from talking it through. Showing it to significant scholars, the view is that Theatron 3 will completely revolutionise the way these materials are taught.*

> Richard Beacham

Content development

The process of developing content in Second Life revealed many issues with Second Life as a platform and required learning new techniques. The following information is supplied by Drew Baker (Implementation Manager).

Build offline

One thing learned is don't build inworld, build offline, plan everything out, make sure all the resources are ready and tweak inworld as necessary. At least 80% of the work can be done offline before you start inworld. You can do all of the modelling, with the exception of sculpted prims, offline. Build discrete units offline then connect them inworld. Build once, build well, re-use many. There is also an offline back-up which you can go to, for instance if pieces go missing or are nudged out of alignment.

Rezz-on-demand

The problems with the rezz-on-demand tool are to do with the amount of processing power required. This is especially true when builds have sculpties within them, because they have a high order command to resolve, and so will cause the scripts to stall. This means occasionally ending up with parts of buildings that haven't rezzed where they should have. Because this happens more often when there are lots of avatars present, the booking system was created to enable the theatres to be rezzed 15 minutes before anyone gets there. In theory then, there shouldn't be anything else going on in the sim, leaving more processing capacity for rezz-on-demand. The complexity of builds also creates problems. The project pushes the limits of the platform. Rezz-on-demand tools that are claimed to work fine do so because they're rezzing 1200 prims, the builds in the project have 12000 prims.

Sculpties

Other issues are that the measurements don't always translate effectively, a sculptie created to be 1m x 1m x 1m will not actually be cubic when imported. When creating seating from sculpted prims, avatars would be walking above the seats, since the boundary of the sculptie is still set to be a cube. This is resolved by the sculpties for the seats being set to phantom, and having a physical prim underneath and aligned so the avatars walk on the seats.

Automatic terrain generator

The automatic terrain generator won't work unless the owner of the device is inworld, which is why there is a bot permanently in Theatron; the bot is the owner of the terrain generator. Megaprims can't be used for the terrain because if people have their draw distance set too low then it won't be rendered on their screens.

Issues with Second Life as a platform for developing content

- Second life uses co-ordinates in a non-standard way. Other packages have 0,0,0 in the middle and numbers go negative or positive. SL has 0,0,0, in the SW corner and only positive co-ordinates.
- Sometimes when importing, objects become inverted. However there is a new piece of functionality which enables the object to be flipped back.
- The biggest problem is the overscaling of the avatars when working in real world measurements. Even if the avatar is scaled down, because of the boundary box around the avatar there are still issues with moving through doors etc., particularly with theatres like the Globe where there are low and narrow passages, which the avatar cannot get through.
- There is no way to get text inworld easily (there are no prims of the alphabet) .
- There is no facility for including html inworld

Using motion capture (mocap)

There were two different sources of mocap on the project, one was mechanical (Gypsy suits), which are variable in usability, the other was optical (Vicon). Some of the data from the Gypsy suits are usable some aren't, depending on the person in the suit and what they are attempting. For example, with Noh theatre a lot of the movements involve slipping feet, which the software is designed to take out. Walking upstairs is also difficult for Gypsy suits to capture. However Gypsy records in BVH format, working on a skeletal structure starting with x,y,z positions of the hips and calculating the positions of limbs from rotations of joints from those starting positions. Optical systems such as Vicon produce a set of dots which have to be joined up, so require a lot more work to convert.

Using Linden Scripting Language (LSL)

It took about three months to acquire sufficient experience to learn to exploit the loopholes in LSL. LSL is not too dissimilar to javascript or java. Using mono scripting language, most of the code can be translated directly into Linden Scripting Language. The scripting language does most things but sometimes getting things to work requires thinking outside of the box. An example of this is the static rotations. There was a requirement to have statuary on some of the builds, but making those objects would require more prims than were remaining without overrunning the permitted number on the sim. To work around this, the intention was to use a texture for a prim, track the users and change the texture, so that the correct side was always facing the user. If the texture was inworld

then because it is a multi-user platform this wouldn't work, since everyone would see the same side irrespective of which side of the statue they were standing. The solution was to use the media streamer, which is unique to each viewer. By applying the media stream to the texture that is used in the particle system (particle systems always face the user) it is possible to reproduce the effect of walking around things. By calculating which angle avatars are viewing the texture from (since the sector the avatar is in is know and what direction that is from the object) a number can be determined, the media stream is then instructed to play the frame associated with that number. The effect is stop-animation as the avatar walks around the statue. The latest release of QuickTime, however, no longer supports alpha channels, so transparencies no longer appear around the texture, so the statue appears set against a white square. It is hoped that future versions of Quicktime will address this issue.

Problem-solving in Second Life
The problem solving process for creating within Second Life is a combination of traditional software engineering problem-solving and understanding the peculiarities of Second Life. The traditional software engineering approach is to look at what can be moved onto the client side and reduce the burden on the sim, e.g cutting down on listen channels or using negative number channels rather than positive number ones, or high numbered positive channels rather than lower numbered ones (there are +- 2^{32} listen channels available in Second Life).

Resolving issues due to the peculiarities of Second Life required thinking outside of the box. For example, Second Life doesn't appear to allow you to store data, but data can be stored in the object name and description field in the object metadata. The process requires getting to know Second Life well enough that loopholes can be exploited to provide additional functionality.

The restrictiveness of modelling in prims is easy to adapt to, since this is a restrictiveness that exists in VRML modelling of prims, so the workarounds are well understood, e.g. laying down a wall then using another prim to do a shader on it, which means that the right effect can be produced using only 2 or 3 prims.

Barriers to implementation of Second Life

The pedagogical projects met a range of barriers to implementing Second Life within their institutions, both technical and bureaucratic. Some of these are problems caused by Second Life itself. A fuller account of the barriers experienced at the separate institutions is related in the section on Pedagogical Projects.

Technical barriers caused by Second Life
Second Life as a platform presented problems to educators due to:
- Log-ins being occasionally disabled
- Upgrades to the Second Life client software required frequently

- High degrees of lag at periods of high usage
- Limits on numbers of participants in any region
- Registrations from any one IP address being capped (solutions to this are presented below)

Technical barriers caused by institutions
Participants in the project also encountered problems caused by their own institutions. Some of these issues were caused inadvertently through not anticipating the requirement of educators to use a graphics-intensive package such as Second Life. Other barriers appear to be deliberately put in place, due to institutions not acknowledging their responsibility to provide educators with the technological support they require.
Examples of inadvertent barriers created by institutions included:
- Having poor IT resources within the institution, causing Second Life to either run slowly or crash frequently
- Not having a level of service provision that enabled the downloading and installation of updates when required

Deliberate technical barriers imposed by institutions included
- Blocking Second Life completely
- Allowing Second Life but blocking voice

Institutions also imposed bureaucratic barriers, through a lack of awareness of Second Life as a learning technology and therefore
- Not permitting, or not prioritising, the timetabling of IT suites, particularly for a subject discipline perceived as non-IT based
- Not permitting support from IT services for a platform perceived as non-mainstream

Cultural barriers
The projects also encountered problems in implementing Second Life due to cultural reservations. These were:
- An antipathy towards experimentation in educational provision, due to the consumer-led model becoming more prevalent in HE. This results in both students perceiving that they have a right to determine the nature of their educational experience (and therefore demanding more traditional forms of education) and institutions fears of conducting experiments that may lead to student dissatisfaction.
- The perception, inspired by news stories, of some students and staff that virtual worlds are disreputable environments.
- The superficial resemblance of virtual worlds to online games, which leads some to perceive that they are not legitimate forms for education.
- Concerns over the ethics of exposing students to an untested and problematic technological platform.

Usability of Second Life
Difficulties were encountered by participants in using Second Life.

- Familiarising oneself with the environment typically took one session to acquire. The environment also has many distractions which also adds to the time between initially going online with Second Life and the learner being ready to begin focusing on subject content.
- There were limitations in the ability to move one's avatar with sufficient dexterity, particularly for performance work. Nuanced movements, individualisation of movement and simple operations such as placing a cup, or exchanging swords, is not easily accomplished in Second Life. This made its functionality as a performance medium limited.

Effect of these barriers
The overall effects of these barriers were:
- To reduce the numbers of participants willing to take part in the activities
- To move from making the activities core mandatory sessions to making them extra-curricular optional sessions
- To decrease the number of activities – the rationale being that to expose students to fewer sessions would mean that the impact on their time of failures of the technology or in pedagogical design would be lessened.

Solutions to technical barriers

The following is taken from guidance notes to lecturers posted on the Theatron wiki.

Barriers caused by low specification systems
By configuring the clients to optimise the running of Second Life on them, the performance can be improved. An optimised configuration file can be written for the client and deployed.

Alternative viewers may run more effectively than Second Life, for example the 'Cool SL' viewer delivers far better framerate on lower spec hardware.

Barrier caused by limitation on registrations
Linden Labs sets a limit of the number of registrations that can be made from a single IP address. Planning to start off introductory sessions with students registering themselves may run into this limit.

Solutions are:

- submit a RegAPI request to Linden Labs to allow you to generate a system to use a registration API to register users yourself. More information is available at http://Second Lifegrid.net/technology-programs/virtual-world-api/reg
- Submit a request (or "ticket") to Linden Labs to "whitelist" the IP address and thereby remove the cap. The university network administrator may be able to provide them with the IP address of the university network.
- University systems use a range of IP addresses that are assigned randomly. Logging in on separate days may enable the number of registrations needed to be completed.

- Ask students to register separately from their homes. This has the advantage that the initial step (that of choosing a name for their avatar) can be done without eating into contact time, better used for taking students through the initial orientation within the environment.
- For initial introductions to the environment, a set of insitutional log-ins can be used. If there are insufficient numbers of these, students can work in pairs, often a less intimidating way for the more unconfident students to be introduced to a technology.
- Another solution is to register accounts from a variety of locations involving friends' and families' help. They also limit the amount registered to a single email address. If registering students, different email addresses need to be used.

Resolving error messages displayed by Second Life
The following is the advice prepared for users based on noting error messages when trying to run Second Life and having found methods to resolve these errors.

Error displayed - completely blank screen.
Reason - the PC has crashed because it is not up to the required specification. You need a new PC.
Solution - buy a new PC. Our observations are that PCs more than about three years old are unlikely to be able to run SL. But then, if your PC is that old you should probably be getting a new one anyway.

Error displayed - pop-up message that the PC is not up to required specs.
Reason - what it says. SL can run, just about, but the experience will be a frustrating one, with long render times and occasional freezing.
Solution - Buy a new PC. If every PC in the IT suite has this error, then start looking for other venues to run your sessions.

Error displayed - there is a problem with the clock settings.
Reason - probably the clock is fine. The problem is that there is a mismatch between the clock settings in your SL installation and the clock settings on your PC, probably because of the way that SL was installed. For example this error occurs if the SL installation has been copied across from one machine to another when being reimaged.
Solution - reinstall SL by downloading directly from Second Life.com .

Error displayed - unable to connect to service.
Reason - this could be because the Linden Labs servers are down, or logins have been disabled. The most likely reason is that although you may have an internet connection, you still have insufficient bandwidth to run SL since the basic wifi connection available in institutions is insufficient to run SL.
Soution - You will need to connect to a VPN network, or plug in a cable to a network port. Or go home and use your computer at home. Most people will find that their domestic set-ups are higher bandwidth and more reliable than their institution's.

Incentives for using Second Life

Although participants in the pilots recorded many difficulties in using Second Life, there were many educational benefits experienced too. These were:

Remote delivery of learning and teaching sessions
An example of a session using remote delivery was Joff Chafer giving a performance and talk with another online actor in the Theatron Globe theatre. This was for a group of High School students at The Kincaid School in Houston and was delivered remotely from Coventry by Joff, and in Michigan by MadameThespian Underhill, via a classroom projector. The technician at the school used his avatar to be in the space but Joff used a system whereby his avatar could sit on a seat and Joff could control his camera via a camera HUD, made by Prospero Frobozz, so that it was in sync. They performed a scene from Twelfth Night , with set, costume, sound effects and animations and then did a walk around of the space and gave a slideshow presentation of other Second Life performances and spaces using a slideshow presenter made by Angrybeth Shortbread.

This worked for a number of reasons, though a lot of it had to do with the novelty aspect of the whole event. Firstly this was part of a course looking at Shakespeare, traditionally quite a dry subject area , so having the live visual element was a plus, then the novelty of hearing and being able to talk to real life actors in different parts of world, plus the fact that none of them had encountered Second Life before. A potential problem, although quite easily overcome, was that the age group of the students was under 18 and consequently the students could not have access to the Theatron spaces and there could possibly be inappropriate language etc from other avatars if the performance/talk took place in an open space. Because they were using the Theatron space it was relatively easy to have the Island closed down so that only the three avatars involved could be present and by using slides a bigger picture of the potential of Second Life was able to be given, without the need to teleport live.

Providing the opportunity for students to research and explore
At Middlesbrough College, students, working in small groups, began to explore and analyse a specific element with the aim of replicating that element's contribution to the performance within Second Life. Several learners are currently managing research activities into this area as part of a level three 20 credit module "Major Research Project". The topic and scope of these projects are currently under negotiation but cover aspects of 'performer identify'; 'gender portrayal' and 'performer globalization'. As students learnt about aspects of performance they were set the task of 'transferring' this *new knowledge* into performance opportunities within SL. The main obstacle students encountered was a conceptual one. It became increasingly difficult for them to express performance intentions within SL in the same language as that used in the *real* world. Early frustrations were inevitable as students tried to 'replicate' real world processes within the SL context. The guiding principles of each attempted performance were so different that many weeks were spent answering the question: '*Why would we want to perform in SL anyway?'* In order to answer this question the students began to explore SL and its influences on education, entertainment, social networking, gaming and many other contemporary issues.

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As a visually exciting and accurate medium to represent theatrical spaces

At York St John University, it was found that the highly detailed environment of the Second Life Globe Theatre was unfailingly appealing to project participants, staff and students. They enjoyed the aesthetic elements and proportions of the theatre and actively wanted to inhabit and work in the environment. Comments were that its ability to enable learners to explore and experience environments really plays on the strengths of the technology and keeps the overall principle simple and straight forward. The buildings constructed as part of Theatron are highly detailed and convey sufficiently the form of the theatres that they can substitute to some extent for seeing the actual theatres, according to some participants. The additional pedagogic potential of virtual theatre environments seems to be the provision for students of equality of access and opportunity, cutting out the time, practical and cost constraints of live theatre activities such as practical drama sessions, theatre visits or master-classes with theatre practitioners.

Students' experiences of virtual worlds

The study

As part of a PhD study conducted by Mark Childs at the Warwick Institute of Education feedback was gathered from students of four of the activities using the Theatron spaces. These were:

• The Fools' Zanni at Middlesbrough College
• Theatre Design and New Media at the University of Warwick
• Introduction to Virtual Worlds at the University of West of Scotland
• Insubstantial Pageants at York St John University

Students were asked a set of four questions regarding whether they valued the experience as a positive educational one, and were also asked a set of four questions about their experience of presence inworld. Those that rated the experience as a positive one (3 or 4 out of 4) were placed in the high rating category, 0- 2 in the low rating category. Those that recorded some levels of presence (2 to 4 out of 4) were placed in the experiencing presence category, those that recorded 0 or 1 were labelled as not experiencing presence.

Feedback was also gathered through interviewing students, holding focus groups and through transcripts and recording of their inworld behaviour. Students were also encouraged to comment on their experiences.

The results

	High presence (2-4)	Low presence (0-1)
High rating (3-4)	25	2
Low rating (0-2)	0	6

Table 1 – correlating presence and experience of learning.

The data in table 1 show a strong correlation between the two categories, i.e. the students that experience presence will rate the learning experience as high and those that don't will rate it as low. Some students don't fall into this pattern, still appreciating the learning even though they do not experience presence. The p value of this variance was calculated (i.e. the possibility that the correlation occurs by chance) and was found to be 5×10^{-12} i.e. a very high probability that this is a real correlation.

The figures for the proportion of students who do not experience presence is approximately one in four, which matches the research of Heeter in which she found that "About one fourth of the population is so strongly situated in the real world and their real body that they have a difficult time becoming involved in a virtual world." (1995; 200).

Engaging the positive students
In the Warwick case study, students were asked to view two Theatron theatres and two theatres located elsewhere in Second Life and respond to a series of questions (Childs and Kuksa, 2009; 1136). The observations of the activity and the students' ability to respond to the questions indicated that not only is presence essential for a positive learning experience, but that learning activities need to be sequenced in order to take account of the stages by which students develop greater levels of presence in an environment. These are outlined as:

1. *Preparatory stage* The initial steps required to get students to the place where the learning is to take place.

2. *Technology as foreground* This is a stage where the students are focused on learning the skills to engage with the environment itself and are not concerned with the curriculum content. After this stage students are ready to discuss their experiences of the environment.

3. *Acclimatising stage* In most software applications, acquiring the skills to operate the software is sufficient preparation for learning subject-related material. In using immersive virtual worlds, however, there is an additional level of experience required, whereby the skills acquired are embedded to the point at which they are unobtrusive and the student can feel immersed in the world. There is also the distracting nature of the environment, to which the student needs to become inured to some extent. A useful task to set students at this stage is shopping. This requires many of these basic skills to accomplish, exposes the student to the larger world of Second Life and also enables the process of personalisation of the avatar, which aids identification with the avatar and hence greater degrees of presence.

4. *Technology as background* Once the technical skills have been acquired then students can engage with a range of learning activities that take these skills for granted, and where students will not be distracted by the features and functionality of the environment.

5. *Approprioception* In order for a student to feels comfortable with interacting with others, they must first be able to easily move their avatar, manoeuvre without colliding with objects and other users and manipulate objects easily. This is a combination of the idea of *appropriating* a technology, i.e. "making it one's own" and *proprioception*, a feel for the movement and position of the user's extended body in the virtual space.

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6. *Embodiment* The next stage is that arrived at when the learners have spent sufficient time inworld that they feel embodied within the space. This level is required for sensory impression of the space to make an emotional impact on the participant, as opposed to observing them detachedly, what one Middlesbrough student described as the *"atmosphere of the place"*.

7. *Acculturation* The final level requires a level of participation in the society of the virtual world in order to understand the social constructions that exist there, and the context for the activities and designs that may be observed within that environment.

These are only suggested stages, and students may well move in a different sequence through these, or miss some completely. However, the above stages have been observed with students, stages one through four being passed through within a few hours, stages five and six taking considerably longer (of the order of 10 to 15 hours) and no students having attained the final stage. These are expanded on in Appendix C.

Understanding the negative students

The focus group conducted at Warwick, the interviews at Middlesbrough and the feedback gathered from YSJU reveal a range of different responses from the students who did not perceive Second Life to be a valuable learning experience. Common themes were observed in the responses the students made, and these were categorised to form a typology of student responses.

From the Warwick case study it appears that the students who were not engaged expressed their reasons for one of the following:

The first set of these statements are located around the idea of normative values concerning what is the proper way of living; that virtual experiences and virtual identities are inauthentic, and that people should all focus on experiences that are located in the visceral world. Some of the statements express the anxieties identified by Thackray, Good and Howland (2008; 326) about boundary crossing.

The York St. John University accounts revealed some further reasons for students not engaging in the virtual world environments. Two of the students were unusual in that they refer consistently to the immersive virtual world as a game and is therefore inappropriate for an educational context. Their reasons for doing so are not clear, since although resembling a computer game through its use of computer-generated graphics, Second Life has only one of the defining characteristics of a game, given by Caillois in Man, Play and Games (1961; 9 – 10) i.e. the element of make-believe.

Students also expressed disapproval of some of the behaviour inworld, for example, public nudity and being in the vicinity of risqué discussions.

There was, however, a second set of statements from the Warwick group which were located around an absence of presence, which they attributed to the poor design of the environment. In amongst these statements is one observation of the individual nature of this experience i.e. "someone like me has a disconnect from that kind of environment". These statements echo the

account of one of the students in the Middlesbrough case study. This student acknowledged that the environments could be effective, just not for someone like him.

> *I thought it was good the 3d and stuff and virtual, I liked it. It was cool but, I don't know how to explain it because ... it just wasn't my thing. I just like acting and performing and doing that sort of stuff and being that character it just didn't interest me at all.*

These students drew a rigid distinction between physical action and action on a screen, interacting in a virtual world has no interest because they are only ever "present" at their desk, or in their bedroom. The life on the screen is therefore a flat and unengaging experience.

Of these four positions, the first three are ideological and may be possible to counter through debate before the learning activities. A standard psychological response (Richard Gilbert, personal communication) is to allow students to voice concerns, and through initial dialogue express many of their anxieties which the teacher can then assuage, or at least provide an argument against. However, the final one appears to be more experiential; despite the willingness to engage the students cannot. These students may fall into the category of users Heeter identified who cannot experience embodiment.

Conclusions

Second Life is an environment suitable for creating accurate and complex structures and embedding related pedagogical content. Build times can be greatly reduced through effective workflow plans.

During the lifetime of the project, Second Life was too unreliable and presented too many barriers to institutions for full pedagogical testing. It *is* an appropriate medium for educational innovators, but early adopters will find that there are still too many issues for incorporating it into their practice.

Immersive virtual worlds as a medium present many challenges to students, particularly due to cultural attitudes and the absence of embodiment experienced by some students. The time required to invest in learning to use the environments also is a barrier to adoption. For these reasons, it may always be problematic to make the use of immersive virtual worlds mandatory for students. However, there are strategies that can make the introduction of learning within immersive virtual worlds far more effective. A repertoire of learning activities that can help establish presence and an understanding of the level of presence that is required for a particular learning activity are essential tools for an educator working in this field.

As a medium for studying and communicating, Second Life presents many opportunities. As a performance medium it is limited when attempting to relocate pre-existing, real life performance to a different medium, but has much potential when used to explore new forms of expression (cf p.37, the Middlesbrough case study; p.50 the YSJU case study).

The introduction of Second Life at an institution often reveals many weaknesses in those institutions' technical and service infrastructure. These inadequacies need to be resolved before widespread adoption of these technologies can occur.

Immersive virtual worlds are a relatively new technology in education, and there was little understanding of the barriers to implementation within an institution and their most appropriate application to learning when the project started. Second Life itself needed much development in terms of reliability. In the intervening two years, there have been many steps forward in understanding its application to education. The technological goals of the project were well timed in this development cycle, but in retrospect the pedagogical aims were set too early, before the capabilities and limitations of the medium were sufficiently understood. However, the lessons learned pedagogically from Theatron will be invaluable in informing future practice.

Future developments and supported research

Gigs and performances in Second Life have been incorporated into the curriculum at Middlebrough College. This institution's use of SL as a platform for students' work is now an embedded part of practice.

Research studentships have been supported by the Theatron project, and these are still ongoing. These include Mark Childs, PhD, Learners' experiences of mediated environments, Warwick Institute of Education

A new project building on the Theatron project is Theatrebase, Daden Ltd, Coventry University, King's Visualisation Lab, Birmingham Royal Ballet and Birmingham Hippodrome. The Theatrebase project is designing the stage and backstage area of the Birmingham Hippodrome to help theatre managers with the process of moving and placing scenery within theatres. Longer term it is planned to create templates of many theatres so that scenery can be tested at several venues. Theatron has been valuable in enabling the theatre community to visualise the potential of the project and understand the nature of virtual worlds.

Several more projects are planned by King's Visualisation Lab following on from Theatron 3.

> *We think virtual worlds are here to stay and are getting ready to set up residence within them. We have a number of projects in progress and in prospect, primarily in Roman buildings and housing. We are adding Noh theatre and have Noh performers in collaboration with Japanese colleagues. We are excited and also grateful that the project gave us the chance to hit the ground running and to very quickly take a lot of materials which had the potential to be incorporated into a project like this and it's given us a real head start. It's put us somewhere towards the front of the pack and that's a very good place to be.*

> Richard Beacham

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