

Virtual Reality Worlds for Real Time E-Learning Environments

Harkiolakis Nicholas

Hellenic American
University
12 Kaplanon Street
Athens 10680
Greece
nharkiolakis@hau.gr

Chrysanthis Panos

Department of Computer
Science
University of Pittsburgh
Pittsburgh, PA 15260
USA
panos@cs.pitt.edu

Tsarouhas George

Hellenic American
University
12 Kaplanon Street
Athens 10680
Greece
tsarouhas@gmail.com

Abstract

The tremendous advances in Internet technologies have made possible the efficient delivery of instruction in virtual 3D environments in real time. Students and educators from distant physical locations can participate in the learning process and simulate the functions of real world classroom environments. Learners' observation, experts' knowledge, and other participants' information are continuously accumulated in the shared 3D environment while the virtual world is being updated dynamically.

This presentation/paper will demonstrate a case study about the implementation of such a system along with preliminary results and observations. The environment was built using Adobe Atmosphere and includes an arrival site at one of Athens's most frequented tourist attractions - the Lecabetous Hill - where visitors can enjoy a panoramic view of the city. The students can then transfer themselves to the university campus site and enter the virtual classroom. The web page at this stage displays the virtual classroom along with a control panel for communication purposes.

The virtual environment has proven ideal for discussions and role-playing simulations, giving a realistic perspective to those students and instructors that are not able to physically attend classes. It has also been effective as a supplement to regular classroom sessions by providing an alternative to the delivery of instruction.

1 Introduction

Training is the learning process that is tight directly to specific real life situations. As part of training practices, technology involvement is becoming a critical component in many types of organizations. The effectiveness of this practice improves the overall training [Barnett et al 2000] and in some situations (primarily the military [Karr et al 1997, Badler et al 1996, Amburn et al 1996]) it becomes an integral part of the training process. Computer technology with the introduction of virtual environments offers one of the promising solutions in the training area. In order to approach real world experiences, instructors in higher education are using a variety of traditional approaches like sharing personal experiences, presenting real world case studies, perform site visitations and inviting guest speakers among others[Frank 2000]. Supplemental to these approaches many academic institutions [Hughes et al 1997, Meyer 2002] are beginning to experiment with interactive media and explore their possibilities for adoption to traditional and online delivery of instruction. The downside and the limiting factor for a wider adoption of such practices to this day remains the high cost of the development and distribution of such products. Academic environments usually lack the resources of the magnitude required for implementing effective real time online training, therefore for the most part such endeavours are prohibited.

Present examples [Haldane et al 2001] of implementations of business environment simulations are initiated by individual institutions [Phelps et al 2003] as part of their experimentation process with different forms of technology and instructional practices. An element that is extremely difficult to simulate [Smith et al 2003] and is lacking from present applications is the social interactions that characterizes learning in real world situations. In order to give students an authentic experience that includes exploration of spatially oriented virtual business worlds, real-life human interactions and practical field-based observation skills the virtual environment has to be functioning and realistic in

both spatial and temporal sense. Businesses appreciate graduates with efficient socialization skills and particularly induction into organizational canons appropriate for each discipline or profession.

2. Role-Playing Simulations

In this paper a role modelling simulation is presented that was part of a Systems Planning and Implementation course that was offered in the Fall of 2004 as a requirement of the IT concentration of the MBA program at the Hellenic American University in Athens Greece. A primary objective of the course was the presentation of the Systems Analyst job characteristics and its operational mode and aspects of their information seeking skills. It is evident that organizational documents, publications and research papers cannot reveal all aspects of organizational life and part of a Systems Analyst job, is gathering information requirements from different members of the organization or departments under study to reveal unreported details that might prove essential for the design of an effective information system. In that respect students were taken through a simulated business environment where they would 'visit' and 'interview' employees of the fictional organization. Our purpose was to improve their perception and understanding of the initial phase of systems analysis and design and more specifically the identification of information requirements of executives and the informal means of interactions in office settings. The methodology followed was a structured observation of the environment [Kendal et al 1984] and simulated interviews of business employees.

Familiarizing students with the structured observation approach is easy to describe but difficult to apply without actually engaging in the process. It involves the physical placement of the student in a business setting where they interactively inquire employees and observe their environment. This way they get insight into their information requirements and their style (formal or informal) of retrieving and organizing information. Such observation includes the examinations of the primary workplace of decision makers and their approach to human interaction. Eventually the results of observing the surroundings and interacting with decision makers will be compared with existing observations or conclusions achieved by previous interviews or questionnaires. A negative aspect of the whole process is the influence of the objectiveness of the participants that inevitably is part of any evaluation made by human observers

Kendal and Kendal [Kendal et al 1984] identified seven concrete elements that an analyst is required to explicitly observe.

1. Office Location
2. Desk Placement
3. Stationary Office Equipment like filing cabinets
4. Small equipment like pens, post-its palm-computers also called props.
5. Information sources in print like publications and reports
6. Office Lighting and Color
7. Clothing Worn by Decision Makers

Office accessibility and visibility tends to increase an informal flow of information and lead to a consensus oriented attitude in decision making while inaccessible offices tend to isolate and focus on the information priorities of the individual. Desk placement can indicate a welcoming participation and willingness to explore alternatives or a defensive and threatening attitude for enforcing authority. Office equipment and primarily objects that are used for recording, storing and distributing information can be a measure of the decision maker's reliance on information. Finally, dress codes and clothing can give clues of the credibility exhibited by managers in organizations.

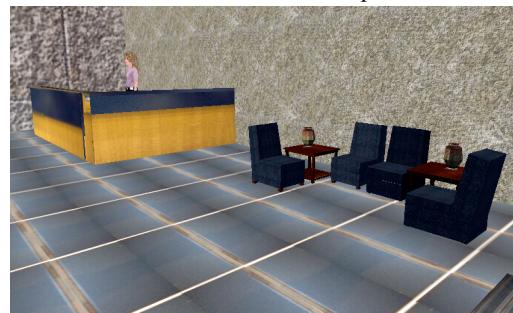
3. Virtual Reality Technology and Setting

For the purposes of our experimentation we used Adobe Atmosphere [<http://www.adobe.com/products/atmosphere/>] on typical configuration Pentium 4 PC in our university lab setting. One of the machines was assigned to be the server where students connected and joined the simulation. Long distance capability was tested successfully in a small scale (2 connections from another setting in Athens) but a wide range implementation has not been performed as of the time of this writing. The virtual exploration starts at the Lecabetous hill in Athens, Greece which is one of the most popular tourist destinations in Athens. At this stage visitors/students are represented with the default avatar form that the environment provides. If the users wish they can select a more representative/entertaining avatar from a wide range of avatar forms. From that scene the students can

“teleport” to the University location for more sightseeing or proceed to the virtual classroom. At that point the instructor might select the option to present class material through video displays, initiate chatting sessions or proceed with the observation of a business environment.

3.1 Static equipment and facilities

A fictional business setting is build around a hypothetical company that provides consulting services to the telecom industry. The setting includes [Fig. 1] a reception area [Area A], a cafeteria, four executive offices [Area B], an open office space area [Area C], a group of closed space offices [Area D] and two isolated offices [Area E]. The “analysts” enters a reception area [Pic. 1] where they get a first impression of the company’s organization culture and style. We’ve build an inviting environment that is an open, bright area with abundant light and soothing colors. Company related general information can easily be found in brochures, charts, plans, and even Internet access points. During class sessions students are expected to discuss the



Picture 1. Reception



Picture 2. Organized Executive Office



Picture 3. Disorganized Executive Office

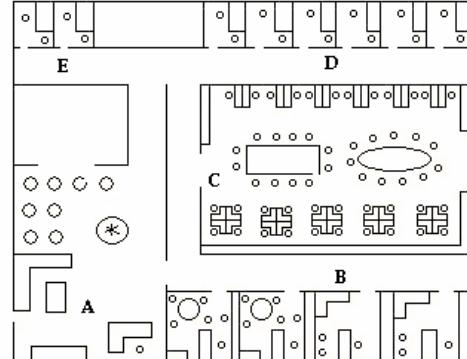


Figure 1. Floorplan

purpose and functionality of the different elements, comment on their necessity and usefulness and ponder on the hypothetical luck of such elements. Adjacent to the reception we’ve build the company’s cafeteria as a relatively open area similar in style and colors to the reception. Again the emphasis is in an ideal sort of arrangement were staff can interact and socialize effectively.

For office observations we have designed an executive area [Area B] with four executive offices that represent different styles in terms of the information seeking and organization style of the executive. The first office [Pic. 2] is an easily accessible space with a well organized arrangement of visitor chairs next to the executive’s desk, a small conference table and usable computer equipment, indicating a preference to informal message exchange and subordinate and peer interaction. Visitors are positioned next to the executive’s office as an indication of encouraging participation and equal exchanges. The second office [Pic. 3] is a replica of the first with a more chaotic appearance. Furniture are not orderly aligned, documents are all over the place mixed with irrelevant personal artefacts and electronic equipment misplaced and unused. The setting makes human interaction very difficult and emphasizes task-oriented message exchange. The third office [Pic. 4] is similar to the first but the visitor chairs are cornered between the executives desk and the wall indicating executive’s tendency to put themselves into the strongest possible position. Finally the fourth office [Pic. 5] is a combination of the main characteristics of the second and third office presenting another alternative executive style.



Picture 4. Well Organized - Authority Attitude

job function is a measure of the need for external and internal information. An example is a sports magazine and a printout of a vacation offer from the web in one of the desks that has nothing to do with the executive's job, indicating a rather unprofessional and uninterested decision maker. Offices can optionally have the door open or closed as an indication of the executive's open door management style.



Picture 5. Disorganized - Authority Attitude



Picture 6. Open Space Area

Information storage equipment like filling cabinets are scattered in some of the offices as an indication to the decision maker's personal information storage preferences. Similarly some of the offices have a lot of technology indicators like PCs, calculators, and Palm computers that suggest the decision maker's tendency to access information from his office instead of moving out to access information. The documents scattered in the various offices include newspapers, trade journals, industry white papers, company and competitor reports, policy documents, and web site printouts.

The relevancy of these documents to the executives

Staff offices are distributed into two areas [Area C and D in Fig. 1] with different characteristics. The first staff area [Pic. 5] is a wide open space with most of the offices in cubicles organized in clusters around the room. In the center there is a workbench and a conference table near the back wall where a white board is hanged. Video and projector equipment are also available. This office arrangement encourages informal sharing and team collaboration. The second staff area includes a cluster of individual closed offices distributed in line to emphasize a sequential flow of information and the bottlenecks that might create by messages being held at one location. Additionally there are a couple of isolated closed offices [Area E in Fig 1] to generate discussion concerning the effect that isolation might have in the way individuals tend to view the organization and their tendency to drift away from other staff regarding objectives. Another element of the environment that can generate discussion is the lighting and colors of the different areas. Warm, incandescent lighting can indicate a tendency for informal face to face communications while a brightly lit environment can indicate a more formal interaction style where official document exchange is preferred.

3.2 Role playing avatars

Avatars are the human forms we use to represent the human entities of the business environment. In our situation we used avatars dressed similarly to the employees and executives we observe in today's businesses. Avatar movements and mannerism was controlled by faculty and students. For the most part instructors would play the role of the executive and staff of the virtual business while students would take the role of the Systems Analyst. Occasionally the instructor would role model the analyst's job while an assistant would play the role of a business employee. On special occasions specialist and professionals from the industry would join the environment and play one of roles.

A welcoming and accommodating receptionist extending her hand and reaching out to the visitors indicate an open company mentality that encourages interaction and welcomes participation. Cold and formal personnel will indicate an authoritarian mentality with a strict enforcement of rules of social contact in the workplace. These characteristics can also be applied to the executives in the different

offices. Clothing in the workplace is another element that can help students get insight into the management style and credibility exhibited by authority figures and personnel. Conservative clothing like suits for male executives and skirted suits for females tend to represent a preference for formal interactions and project authority. Casual dressing on the other hand (if not an exception) tends to indicate willingness for participative decision making and a tolerance to differentiation. Modelling all these aspects in our environment can be done by simply changing avatar appearance.

4 Conclusions

Experimenting with virtual reality technology in a classroom setting gives faculty the ability to demonstrate concepts that can only be observed in real life situations. The implementation of technology at this stage was seen by the students as an exciting add-on to the delivery of course material. After completing the process of developing the environment and implementing it in an actual course, we had a better picture of the implications that this kind of technology might present in similar settings.

Some of the advantages are:

- Different management and organization styles could easily be modelled
- The simulation could freeze at any time and discussion on the different elements and aspects could be initiated
- The environment can be easily modify so as to present alternative settings
- Student could practice information gathering skills like interviewing and structured observation of the environment
- Easy to have real life experts joining and participating from their physical location
- The cost of the technology required is low
- Ideal for describing static environments meaning that its realistic enough for students to immerse in the environment.
- User friendly due to most students familiarization with 3D games and entertainment sites
- Intriguing and entertaining especial when a lot of visitors join in and start interacting at the different settings.
- Supports chatting

In the disadvantages at this time we can include:

- Technology limitations for delivering a real time solution to great numbers of students. At present the technology we've used limits the number of concurrent visitors to up to ten.
- Developing the environment can be time consuming and requires some level of familiarity with the software.
- Avatar movement is still cartoon like and lacks the full range of physical and emotional characteristics of humans thus making difficult to simulate body language.
- Can not simulate realistically employee interactions and dynamics.
- Executive responses to real time information like responding to a phone call (making a note, return the phone call or accessing the computer calendar) can not be effectively simulated.
- Does not support speech
- Older students not familiar with technology find it difficult to accept and immerse in the environment
- Can become visually distracting due to the game-like appearance

For the purpose of a systems planning and implementation course, the virtual reality setting we developed and used offered a realistic environment for demonstrating and practicing information gathering techniques used in the systems analysis and design process and as applied in the information technology area. It gave us realistic role playing capabilities that allowed real time experts to participate from any location.

5 Recommendations for Further Research

Our future goals include the development of a complete project analysis and design process simulation where the students will follow the systems analysis and design process every step of the way. For that

process a hypothetical project will be implemented in our virtual business setting and the students will play the real time roles interactively.

Although we focused our presentation to a very specialized role playing situation the environment can be used for a wide variety of situations like collaborative teaching of foreign languages. One of our future goals is to experiment with Greek or English language teaching. The advantage of such an approach is the real time instruction in a simulated real world environment that offers realistic exploration of objects and scenes.

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References

Amburn, P., & Marshak, W. P. 1996. Design and evaluation of an air-to-air combat debriefing system using a head-mounted display. *In Proceedings of the IEEE 1996 Virtual Reality Annual International Symposium*, (pp. 131-138). Los Alamitos, CA: IEEE Computer Society Pres

Badler, N. I., Clarke, J. R., Hollick, M. J., Kokkevis, E., Metaxas, D. N., Bindiganavale, R., Webber, B. L., Chi, D. M., Foster, N., Ogunyemi, O., & Kaye, J. 1996. MediSim: simulated medical corpsmen and casualties for medical forces planning and training. *In Proceedings of the National Forum: Military Telemedicine On-Line Today Research, Practice, and Opportunities*, (pp. 21-28). Los Alamitos, CA: IEEE Computer Society Press.

Barnett, B., Helbing, K., Hancock, G., Heininger, R., Perrin, B., 2000. The Boeing Company. An evaluation of the training effectiveness of virtual environments, *Interservice/Industry Training Systems and Education Conference*.

Frank G., Helms R., Voor D., 2000. Determining the right mix of live, virtual, and constructive training. *Proceeding of the 21st Interservice/Industry Training Systems and Education Conference*

Haldane A., Heijst G. van, Shalgi N., Hoog R., John T. de, 2001. Is knowledge management just a game? The knowledge management interactive training system. *Knowledge Management*, ?, 14-17

Hughes, C. E., & Moshell, J. M. 1997. Shared virtual worlds for education: the ExploreNet experiment. *Multimedia Systems*, 5(2), 145-154.

Karr, C. R., Reece, D., & Franceschini, R. 1997. Synthetic soldiers [military training simulators]. *IEEE Spectrum*, 34(3), 39-45.

Kendall, K.E., Kendall, J.E., 1984. STROBE: A structured approach to the observation of the decision making environment. *Information and Management*, Vol .7, No. 1, pp. 1-11

Meyer, K. A. 2002. Quality in distance education: focus on on-line learning. *San Francisco, Ca: Jossey-Bass*

Phelps M., Andrew, Bierre J. Kevin, Parks M. David, 2003. Course design & learning enhancement: MUPPETS: multi-user programming pedagogy for enhancing traditional study, *Proceedings of the 4th conference on Information technology Curriculum*

Smith A. David, Kay Alan, Raab Andreas, Reed P. David 2003. Croquet – A Collaboration System Architecture. *C5: Conference on Creating, Connecting and Collaborating through Computing*