INNOVATIVE APPROACH TO TEACHING ARCHITECTURE & DESIGN WITH THE UTILIZATION OF VIRTUAL SIMULATION TOOLS

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INNOVATIVE APPROACH TO TEACHING ARCHITECTURE & DESIGN WITH THE UTILIZATION OF VIRTUAL SIMULATION TOOLS

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Abstract

Today’s society is growing, moving, pushing and pulling in so many different directions. Society has moved from the invention of electricity in the 1800’s to the invention of the iPhone, which has changed the way we use, and perceive technology today. The survival of an architectural student depends on being able to communicate multiple drawings, graphics, images, diagrams and more in the most productive method. Each phase in design requires a clear and concise conversation between the designer and the observer. Schematic Designs generate some of the most creative ideas during a projects progression. With this understood, this section of this paper will analyze the introduction of Second life to students, professionals, and clients of architecture in a virtual simulated environment. The ability to demonstrate a design solution to a professor or another student across the world will truly increase the effectiveness of collaboration, critic, and cooperation. This applied research paper will analyze the application of Second Life in architectural education, communication, and creative design solutions.

Keywords: Architecture, education, systems engineering, creative design solution, second life, usability design, information systems.

1 OVERVIEW OF RESEARCH

The objective of this research is to identify the role and importance of virtual technologies within the disciplines of architecture or design. This shall be done through researching multiple resources provided through the internet, online journals, industry experts, and articles.

The main objective of an architect is to strategically solve a problem in a collaborate environment. With the help of clients, contractors, engineers, and other consultants; the problem becomes a creative solution that resurrects through multiple conversations. The issues of today go far beyond just designing a structure, but it involves how well these key components can communicate. This research topic has been explored at Duke University's Center for Instructional Technology. A professor by the name of Annabel Wharton explores the Second Life’s (SL) abilities to influence the field of architecture. In an article entitled Exploring architecture in Second Life, Wharton states “It's impossible to understand space conventionally any longer; digital worlds and immersive spaces play too large a part in our economy and culture to ignore ’[1]. The key word in the abstraction is “understand”. The engaging aspect that SL has contributed in an educational environment has evolved from just entertainment but as a virtual open source tool to communicate. Wharton further states “It is really worth investigating digital technologies,” Wharton says, “They give you a new means of rethinking your old assumptions—a central concern of education” [1]. Furthermore the stimulus of SL allows the educational system to be challenged to re-evaluate its tactics; to re-invent its methods, and rejuvenate its tools kit in the classroom.

Also reviewed in this research is an Open Source Software (OSS) version of SL known as Open Simulator which allows for further freedom in the development of virtual platforms that have the potential to be hosted in SL. Two design research projects are reviewed in which SL was utilized. Fig. 1 provides an example view of SL architecture.

This research paper however is limited in scope. Not covered in this research paper are the programming concepts, programming tools, and full detailed systems engineering design concepts used to design both design projects.
2 WHAT IS SECOND LIFE & OPENSIM

SL is an associated free client program known as the viewer which allows the users, known as residents, to interact with other individuals through avatars. Students created avatars which were representative of their personality and how they best felt to interact with other residents. This course allowed students to develop virtual objects with limited knowledge of the Linden Scripting Language. As the Linden Scripting Language has syntax familiar with the C programming language the students were able to jump right into developing scripts. Fig. 2 is an example of the Linden Scripting Language that would be utilized to have an object display text when they are five meters near the object.

OpenSimulator is an OSS application that can be utilized to simulate virtual environments. This would allow architects and designs the freedom to develop their own virtual representation of an
environment. However an architect would need to have knowledge of the .net framework and
programming in order to develop or modify items without any support.

"Keeping with the collaborative spirit of the Open Architecture Network, this entry was created by an
open and public community of over 40 contributors from around the world representing a wide range
of disciplines and backgrounds. To facilitate this effort in design collaboration, we developed a
grassroots '3D-Wiki' technology that is built on the virtual reality platform: Second Life. With this
technology, we were able to focus a very diverse range of ideas into a naturally evolving process
ranging from comprehensive text-based research to 2D plan diagrams and on into immersive 3D
virtual models designed and built on a replica of the project site" [2].

Furthermore, this competition not only developed a health care facility, but also created an entirely
new vernacular by approaching this with SL virtual design capabilities. The introduction of a new form
of instant communication beyond words and diagrams but in a full on demonstration of ideas, creates
a platform for creative designs. The implication of SL into competitions will provide user with a clear
path to think creatively. The ideas can then over flow into a multi-faceted direct source; instead of just
using one or two types of devices to demonstrate ones ideas, such as through email, telephones,
video, or webcasting. The impact the SL has had will on grow into a more influential design world.

2.1 Systems Engineering Applicability

In the field of systems engineering the traditional Systems Development Life Cycle (SDLC), although
alternative methodologies are also taught in the classroom environment. For the purpose of our
research we focused on the earlier phases of the SDLC, from systems planning through the
specification of structured system requirements in functional form (i.e., logical system design) and
concentrated on the methods, techniques, and tools used to determine requirements and to document
their requirements in a thorough and unambiguous form [3]. Emphasis is placed on usability and
prototyping. With SL individuals had the ability to download a viewer to create an environment that
resembled the real world. In systems engineering prototyping is essential before a product or system
goes into production. In architecture the same is true and SL allows a potential buyer to sample the
end product.

2.2 Optimizing Student Participation in the Design Process

A widely held principle in the field of systems engineering is that the success of a system is directly
proportional to the extent of user participation in developing the system. The results of this are that
when an end user has a higher level of perceived meaningfulness task this would positively impact
subjects' attitude and performance. The other result is that when the user has a perception of control
and procedural justice then the user’s outcome is satisfaction and their performance increases for the
subjects as one increase the user’s mode of participation. Perception of user control with procedural
justice yields an outcome that increases the performance of a project as the user is given more
opportunity to voice their opinion. It is interesting when the users are given the choice to establish
boundaries in the decision making process there are increasing gains in user participation attitudes
and performance. When the users task meaningfulness is increased then procedural justice and
control task commitment and performance also increases. The user participation positively influenced
perceived control even though none of the users received their preference. Perceived control
influenced perceptions of procedural justice. The direct path from decision control to outcome
satisfaction reinforces the fundamental importance of perceived control. Path analysis demonstrates a
direct effect of task meaningfulness on performance. Meaningful task evoke feelings of inclusion and
increase perceptions of control [4].

3 ARCHITECTURE & DESIGN PROJECTS

In this section two design projects shall be described in detail. The first design project described shall
be a military training facility and the second shall be a modern student building. Both projects were
designed as part of graduate level coursework in computer science and systems engineering
programs where the students had limited knowledge on architecture and design principles. The
students were allowed to use script generators to develop code for objects to include purchasing some
of the materials needed from the SL Marketplace.

The utilization of SL for these graduate students provided them the ability to develop concepts with the
larger picture in mind. As many new computer science and system engineer graduate students are
new to the concept of systems thinking these projects provided them the ability to understand how design concepts are essential to the larger picture. Many of the students thought that job was only important for architecture, civil, or design students however they quickly realized the importance of understand these design concepts themselves in order to provide a full solution to the end users or customers.

3.1 Military Training Facility

This design project was to develop a military training facility that would be the virtual representation of a training facility that could be utilized in the real world. This virtual prototype was developed to test the usability of a proposed military training facility. The facility required a passcode to enter to include a presentation viewer that displayed training on national security. This design project went through the systems development process. Requirements were captured and tested during the design of this system to include a significant number of tests conducted with live participants. Fig. 3 displays the end result of the completed military training facility.

![Fig. 3. Virtual Military Training Facility.](image)

This design project proved that SL was a viable place for designing military training facilities. SL also proved to be a cost efficient tool for testing the system’s design concepts, and usability with end users to include stakeholders.

3.2 Modern Student Building

The main objective the modern student building project was to research and clearly understand the requirements of an Automated Teller Machine (ATM) system, as well as understand the application model requirements for integration with an ATM system simulation. The goal of this research design project was to discuss the planning, analyzing, designing, implementing, testing and evaluating phases of the development of a graphical user interface of an ATM machine model using the software SL; virtual world.

To accomplish this design project the researchers had to plan the path in which a developer will take to follow for production. This meant properly analyzing requirements and literature review to understand the entities within the system. The use of Object Oriented Analysis & Design (OOAD) to graphically model users, use cases and scenarios, data and flow diagrams was implemented.

The Object Oriented (OO) model was implemented into SL by constructing an environment in which the system will possibly be able to operate in. Programmed objects to function when virtual users wants to perform a task. Fig. 4 displays the system modelling done for the project.
Beginning from the initial problem definition and users’ requirements a High Level Systems Analysis (HLSA) was proposed resulting into graphically modeling the system with high level and low level systems diagrams. This allowed the developers to capture the main important entities within this project.

Once the program was analyzed and system a plan for design was implemented into Enterprise Architect (EA) using the SDLC OOAD methodology. The idea then leads to purchasing objects from the SL Market to use as prototypes within the environment of SL. Difficulties aroused while using the software SL. Difficulties such as programming objects as well as receiving objects from the market; some objects were unable to be modified and required to purchase other objects that would cooperate with the proposed system and environment.

The overall experience was interesting in learning to plan a development of a Graphical User Interface (GUI). Future work will be to present the development process of the research project as well as further enhance knowledge within SL to use an effective tool in simulation work. Fig. 5 displays the finished design project in which live participants utilized the system to capture valuable data to test the hypothesis.
4 CONCLUSIONS

One of the most important aspects about architecture and engineering is one’s ability to change the environment. SL provides this ability in a boundless form, which can be filtered into one of the most productive open source applications. While most people are still using this SL as entertainment, it can also be used effectively in architecture for education, communication, and creative design solutions that may have significant impact on the way the consumer can interact with the design earlier in the build process. By exploring the world through different virtual technologies, the architect can solve design problems but truly understand societies push towards a more effervescent future. As engineers and architects it is essential we continue to push the boundaries. W. E. Halal states that our societies will continue to move online [5] thus we need to utilize the available tools to push engineering, architecture, and design fields into the virtual world.

REFERENCES


