Virtual Online Worlds: Towards a Collaborative Space for Architects

Tiffany Nahinu
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Submitted towards the fulfillment of the requirements for the Doctor of Architecture Degree

School of Architecture
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We certify that we have read this Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in fulfillment as a Doctorate Project for the degree of Doctor of Architecture in the School of Architecture, University of Hawai'i at Mānoa.

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Abstract

Although research has been trickling forth in the last eight years about online collaboration and use of virtual online worlds (VOW) amongst architects and architectural students (2006-2010), little discussion is dedicated to how the use of VOWs have improved collaboration, communication and quality of design for those that have used it. Researching VOWs and their use in architecture was a difficult task since much of what needed to be found was scattered amongst the fields of education, construction engineering, computer science and even online blogs dedicated to architecture in video games. An analysis of those findings has contributed to the development of a pilot project conducted in a VOW called Blue Mars. The project was set up in order to discover how VOWs improve communication skills of its users and analyze what happens when architecture students are allowed to virtually experience their designs as avatars. This study is part of a growing body of research on the exploration of virtual online worlds in the practice of architecture both in the classroom and out in the field.

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Project Statement

According to a report issued by the U.S. Department of Education, students in online learning conditions performed better than those receiving face-to-face instruction.[1] Well, what would happen if the design studio got moved to an online environment, more specifically, to a VOW? Asking this question lead to the development and implementation of several test projects (with varying results) which overall, reveals that the use of VOWs in architecture students' design process can improve their abilities to graphically and orally communicate ideas.

In the last decade, VOWs have found their way into architectural curriculum within universities across the world (University of New South Wales, Sydney, Australia; Montana State University; Catholic University of America, School of Architecture and Planning, Washington D.C.; Royal Institute of Technology, Stockholm; Ain Shams University in Cairo, Egypt; and University of Auckland, New Zealand; just to name a few). Everything from conceptual design to fully-programmed studio projects have been realized in VOWs.

Thomas Kvan, one of the earliest testers of computer mediated collaborative designing, acknowledges that students need to be exposed to new communication technologies and that architecture schools need to provide students with the opportunity to master the skills of communication in this new

[1] U.S. Department of Education Office of Planning, Evaluation, and Policy Development Policy and Program Studies Service, *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies,* Washington, D.C., 2009.

medium in order to keep pace with our current industry.[2] Major CAD software developers (like Autodesk and Graphisoft) are implementing some of the key features that VOWs currently possess like real-time rendering, real-time object editing, VOIP and real-time 3D exploration *with* clients and consultants. Consolidating features like the ones just mentioned are what's happening today because it saves time, decreases opportunities for mis-communications and provides a better working environment for all users. Computer mediated collaborative designing (CMCD) involves the use of computers and communication technologies such as electronic mail (email for short) and faxes to communicate and share ideas.[3] It was the earliest form of how architects were able to remotely collaborate together on projects.

One idea that has been in development for at least ten years, is that knowledge is valued over physical presence. Businesses have been turning their attention on to remote collaboration and holding virtual conferences to supplement face-to-face meetings because it saves time and money. If relaying and presenting information to a team remotely is as effective as doing it face-to-face, then why travel? It also begs the question, why do we need a physical meeting space?

Another form closely related to remote collaboration is asynchronous collaboration. Asynchronous collaboration allows team members to work at different times and from different spaces. People with different schedules and

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[2] Thomas Kvan, "Pedagogy of virtual design studios," *Automation in Construction* 10 (2001):347.

[3] Gerard C. Gabriel & Mary L. Maher, "Coding and modeling communication in architectural collaborative design," *Automation in Construction* 1, (2002):199—200.

limited abilities to travel have found this to be a more efficient way of working than in the traditional face-to-face environment. What do you need for asynchronous collaboration? A computer, a webcam, a microphone and an internet connection.

Being in the atmosphere that a VOW creates, the virtual environment, pushes the imagination in new directions and allows for greater interaction between colleagues and classmates. Traditionally, students always present plans, sections and elevations that flatten their designs in to 2D images that make no sense to the client. VOWs allow us to present our ideas the way they were meant to be experienced—in three dimensions. Integrating VOWs in the design process also puts the focus back on designing for the user. This dissertation reveals how VOWs changed students' design process and presentation styles by giving them the opportunity to build things from the ground-up and design from a user-centric point of view.

Key components to developing the project included looking at the user interface design of VOWs, understanding the similarities in modeling techniques shared by the gaming industry and architectural industry, using the right hardware and software and learning about the constraints specific to working in VOWs and their respective tools. Realizing that teaching and learning is not a perfect process will make it easier for new forms of teaching design to be accepted—such as the ones covered in this dissertation.

Introduction

Architects are trained to design spaces and places so it only seems like a natural process to transfer our expertise to an online virtual environment where the landscape of the digital realm has started to take shape. There are many examples of architects who have crossed over in to virtual design such as HKS Architects, Kenji Ikemoto & Associates, Crescendo Designs, Filipo Innocenti, Calder Flower Architects, Greenfield Multiplex and CO Architects just to name a few. These architects have chosen to use VOWs and MMOWs for presentations, for taking clients and consultants on tours of their designs, for marketing and also for collaborating and communicating their ideas with. It is with this last idea of collaborating and communicating to which I have chosen to explore and focus my dissertation on.

For architectural students, sometimes communicating an idea effectively can be one of the trickiest things to do in a group project. Why is effective communication so important? Because it leads to design progression. Since communicating is a part of the collaborative process—and within a VOW or MMOW we are able to communicate in three dimensional spaces versus the traditional two dimensional means, ideas can be shared, understood, built upon, commented on and developed with greater ease. For effective communication (EC) to occur, the environment of the group needs to support a way to graphically depict ideas so that everyone can see; a way to hear all that's being said; a way to respond orally, textually and graphically to comments; and a way to revisit what has been said and seen.

The traditional face to face environment has always been considered the only setting that architects could truly accomplish anything in because of the vast amounts of data our industry needs to transfer between client, consultants and colleagues. Since the advent of high speed internet, online data storage and virtual teleconferencing architects can stream this information in real time or have it stored for future reference for all parties involved to access at their convenience. That's what today's technology offers—conveniency, so that designers, engineers, contractors and the like can focus on what matters instead of time consuming logistics.

The very essence of the internet is to connect people. Architects and architectural students will be exposed to an entirely different type of clientele thanks to the VOW market. Once the building industry and various architectural institutions realize how easy VOWs are to use and integrate, they'll adopt this technology in the future so it’s important to look at how a VOW affects the way architects collaborate today.

It is my general opinion that VOWs in architecture will improve the design process of architects and architectural students by increasing the level of quality contribution from each member when collaborating on a project. My aim here is to: (1) describe the potential usefulness of integrating VOW tools into the architectural visualization and communication process; and (2) provide documentation of this process.

Architectural students are constantly asked "how are you going to diversify yourself, how are you going to set yourself a part from the rest of the other interns and architects?" My answer will be this:

"*I can teach you how to transition your real life projects into the world of Blue Mars so that your designs can reach thousands of potential clients not only through the use of your typical website, but also through a cutting edge interactive 3D environment, and here's how . . .*" The "how" will be outlined in the later part of this document and in appendix A.

Our sense of virtual reality has come a long way since it was first introduced and popularized by science fiction novels in the late 70's from writers like William Gibson and Bruce Sterling. Much of the sci-fi phenomenon and video games of the 80's have inspired the expansion, experimentation and creation of our current technology. Twenty years ago the software and hardware we use today didn't even exist, but in the period of the last two or three decades we've moved from MS-DOS IBM desktop stations to touch screen enabled PC's. In contrast, the tools used to communicate architecture have only undergone four major evolutions; (1) circa the Stone and Bronze Age, memory and word of mouth were used; (2) from the time of the Egyptians till the time of Neo Classicism, Architects drafted on primitive versions of drafting tables, used quills and ink, charcoal and to some extent lead; (3) from Neo Classicism to the early version of High Tech, Architects used drafting tools either made by themselves or the store bought equivalents; and (4), out of the early High Tech style and into today's sustainable movement Architects have pretty much turned to the computer.

In this day and age, many architects believe that computers have improved their businesses while others feel like they are no more than a necessary evil. Kas Oosterhuis and Tomasz Jaskiewicz of ONL Architects believe that "...the common use of computers has drawn designers away from the meeting tables and stuck them into a single-player working mode. When we design, we are now confined to our screens and keyboards. We exchange information only when we *stop* designing..."[4] Oosterhuis and Jaskiewicz also believe that the bottleneck in a project's development is related to the way information is passed down.[5] Team members often have to wait for a single task to be completed before moving on. To some degree, this is true—but there are exceptions. According to my observations during the pilot project conducted, the single-player mode of working actually saved the students time and resulted in a better design.

The majority of students who have participated in projects that utilize VOWs have also found the interface easy to learn and enjoyable to work in. An example of this comes from a recently completed studio project conducted in Second Life by Professor Sergio Palleroni of Austin University's School of Architecture. From Palleroni, "You know, you teach a class, and your grad students want to keep working after the semester is over – c'mon, that just

[4] Kas Oosterhuis and Tomasz Jaskiewicz, "798 Multiplayer Design Game: A New Tool for Parametric Design," *Space Time Play* , Birkhauser Verlag AG, Basel, Switzerland, 2007, 358.

[5] Ibid, 358.

doesn’t happen very often, so we hope this will continue because this is just a marvelous team.” One of the students enrolled for that design studio was asked what it was like working in a virtual world: " . . . its just amazing—its not something anyone in the group could have imagined, so I think working in a virtual world like this shows us that the possibilities are endless."[6]

What made collaborating in the virtual online world of Second Life enjoyable? For Palleroni's students, it was being able to see and realize multiple possibilities. For the students that I worked with, it was the opportunity to experience their designs in a first-person-perspective as a virtual person. The environment, tools and asynchronous work also had a positive effect on the outcome of the project.

Technical requirements and process aside, the importance of this project is in highlighting the fact that this is a new way of designing, collaborating and communicating on a project. Real time collaboration between people who are remotely stationed across the globe or sitting 4 cubicles down from you is easily achieved by being connected by the world wide web (or at least on a local intranet), a modeling program and an account with one of the world's finest MMOWs.

I believe that architects can capitalize in the virtual online world (VOW) market by expanding their design services to include designing virtual buildings

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[6] Jon Brouchoud, ""Real life construction completed on innovative homes prototyped in Second Life," *Archvirtual: Architecture and design in virtual environments*, June 24, 2010, http://archvirtual.com/?p=2628, accessed October 20, 2010.

and spaces. Learning to design in an online environment is one small step in the many architects will be taking to revolutionize the way we design, collaborate, communicate and market ourselves in the 21st century. A collaborative virtual environment allows users to share the virtual environment and collaborate from within it.

It will be a challenge for architects to expand their services to include virtual online developing and consulting services. Like with any new tool, people need time to adjust to it. Architects are trained to design real life spaces and places and are accustomed to dealing with real world constraints. Perhaps in 10 years, the number of architects and architectural students exploring the online environment will quadruple.

Seeing how people use space virtually is an interesting way of gathering information and poses a new realm for creativity. We're at an appropriate technological age to start looking at different ways the internet's interface could change the architectural industry. My argument is that building technology, design strategies and economic conditions are *not* the only guiding forces determining new avenues for exciting business opportunities in architecture. Software drives our industry as much as the availability of resources.

Creating a virtual place for virtual business modeling is not a new concept, but I would like to challenge architects to look at what virtual worlds have to offer. We try to create a better built environment in real life, but have we succeeded? If we had, would the concepts of virtual worlds even exist? A virtual world does not restrict itself to the computer or the internet, although if one does a Google search of ‘virtual world’, it will come up with a definition that directly links it to being associated with a computer or having some kind of digital presence.

Rather than spending millions of dollars on new buildings, why not create a virtual space? Despite having a plethora of building styles and types to emulate in the VOW setting, there are certain tradeoff’s that occur. One tradeoff I will be touching upon is design considerations because believe it or not, designing a space to gather in real life is not the same as designing a gathering space in a VOW.

The developers in Blue Mars today are using the software and applications that architects are already familiar with and they don’t have any architectural background or even need it to create the world of their dreams. Blue Mars is the next generation in VOW platforms. The graphics are better, the game engine is more powerful and the platform being developed is being designed from the ground up for the future. Architects have been slowly dipping in to this online world market since the advent of Second Life© nearly 6 years and counting.[7]

There were a lot of attempts to create 3D worlds in the web, but these attempts were faced with several challenges; slow internet speeds, un-reliable internet connections and the inability to transfer large files over the internet. The gaming industry has really helped to push the standards of other industries. Doug Lowenstein, president of Entertainment Software Association (ESA) had this to say back in 2006:

[7] Second Life is a trademark of Linden Research, Inc. and has been since 1999.

"*. . .various examples of game industry technology are being used to grow other businesses, including IBM's use of Cell technology in medical image-,mapping, the military's use of games for training purposes,* ***how real estate agents use game-technology to entice buyers*** *and how games are driving uptake of mobile phones, broadband and home networking*. . . *gaming's impact is only going to grow*."[8] And it certainly has. Another potent piece of information he shared was the fact that there would be over 75 million Americans between the ages of 10 and 30 years of age, making it bigger than the baby boomer generation. This particular age group will be extremely comfortable with videogames.

This form of online communication is not just for fun and chatting, but also for business development. Architects have been designing buildings and spaces long before the internet existed and it only seems fitting that we offer our expertise and consulting services in these new virtual worlds.

In Chapter 1, the basic features of VOW platforms are introduced, described, defined and compared so that the reader understands how and why I have chosen to test my hypothesis using Blue Mars. Avatar Reality Inc., are the makers of this VOW and to my knowledge, the School of Architecture was the

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[8]"An Industry Shows Its Growing Value: ESA's Doug Lowenstein recently discussed the games industry's current trajectory -- one that attests to its rising influence," *BusinessWeek,* May 12, 2006, http://www.businessweek.com/innovate/content/may2006/id20060511_715050.htm?campaign_id=rss_innovate

first institutional body that taught a studio design course that utilized Blue Mars. There are many VOW's to choose from (hundreds in fact according to KZero[9]), but I'm selecting Blue Mars because the tools are designed to work with the tools we've already been trained to use.

In Chapter 2, several examples are brought forth as to how architects and non-architects have been using VOW's to collaborate, design and present their ideas to clients as well as to the larger public. This chapter helps to establish the precedents of architects taking on commissions for virtual online projects. A selection of real-world projects and VOW projects designed by actual architects was examined a selection of real in the VOW environment, the architects that use them and the integration of VOWs as a means to improve oral and graphic communication in remote collaborative situations. are discussed along with the leaps in technology and how it has affected the way architects design today.

Chapter 3 covers the integration of design considerations for VOWs that architects must understand before heading in to a virtual online world project. I use an example of my previous attempts as an illustration of what happens when there are no instructions and a lack of guidance.

Chapter 4 includes the results of two pilot projects conducted during 2010 at the University of Hawai'i at Mānoa School of Architecture.

Chapter 5 contains my recommendations and conclusions on how this work will benefit the larger professional architectural community and student community.

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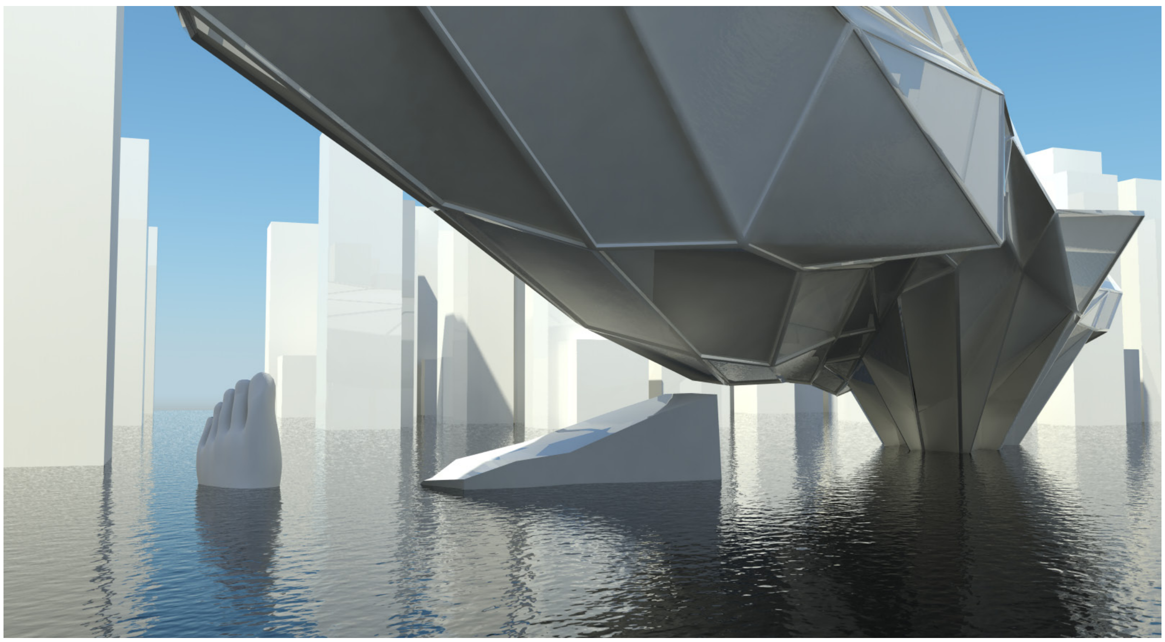
[9] Number of Virtual Worlds <http://www.kzero.co.uk/industry-forecasts.php> , accessed May 2, 2010.

1

Stepping in to Virtual Online World platforms



VOW
virtual online word

MMOW
massive multi-player online world

MMORPG
massive multi-player online role playing game

Chapter 1

Stepping in to Virtual Online World (VOW) platforms

Everything that we do in the real world carries over into the virtual and virtual worlds are microcosms for everyday life. The most obvious differences being in character and environment design (character = people; environment = built and natural). Think of a **v**irtual **o**nline **w**orld (VOW) as a master plan that has been built in a 3d program complete with urban centers, major modes of transportation and a multitude of landscapes. A VOW connects people via the internet and provides a digital “space” where its users project a digital self, also known as avatars, where they can interact with other avatars from around the globe. A few features of VOW's are as follows:

- The world allows many users to participate simultaneously;
- Interaction takes place in real-time;
- Some VOW's allow users to develop, alter and submit customized context;
- When an individual logs out, the VOW continues to exist;
- The VOW encourages the formation of in-world social groups.

Avatars are a digital projection of one’s self and can take any size, shape or form of one’s choosing. People toggle between first person perspectives and third person perspectives to gain a better understanding of their environment.

Surreal is closer to ideal in VOW space. VOW making can be thought of as temporal space making because these worlds are as permanent as the platforms they were made on. It isn't really real, but because our eyes can be tricked, and therefore our minds as well, we believe the spaces and worlds created in VOWs are real.

Figure 1 Third person perspective.

Figure 2 First person perspective. The camera is your eyes

1.1 Virtual Online World Platforms

There are literally hundreds of virtual online worlds today with many different variations on themes and features. Some companies target a specific age group, while others target real businesses by providing supplemental and total solutions for communication and networking services. The five MMOW platforms examined in this thesis have the most ideal set of features to support the testing ground of my hypothesis. Out of the five potential platforms, I have chosen to work directly with Blue Mars because of the following reasons: superior graphics; ease of transition from our architectural software to theirs; marketability; scalability; data security; professional appeal; and flexible pricing structures. The four platforms reviewed include, Kaneva, Protosphere, Second Life and Exit Reality.

When reading about how certain platforms are "scalable" and "consistent", those two terms are referring to a characteristic of the system to maintain the sole state of environment. That means any change of an avatar's state is visible for all users. This term of consistency can also be applied to other objects within the virtual online environment/world. Scalability is a characteristic that ensures effective consistency control even when many users enter the world, city or environment. The definitions of these terms are being borrowed from Kristina Lapin's article entitled "3D Immersive Virtual Collaboration."[10] So as not to confuse the reader, the terms virtual online world (VOW) and massive multiplayer online world (MMOW) will be used throughout the paper.

The biggest hurdle to overcome in Lapin's opinion is the user friendliness of the VOW platform. In order to complement face-to-face education with interaction in a virtual world, the educator needs an available platform which does not require deep technical knowledge. Second Life satisfies this core requirement, but lacks graphic quality and acceptable geometry formats.

Figures 3 and 4 compare features and technical specifications of all 5 MMOW programs mentioned earlier. It was important to compare them side by side in order to determine why Blue Mars was the ideal MMOW to test my project in. Although Second Life allows for in-world modeling, it is my assumption that (1) students will be spending more time playing around with the UI instead of focusing on the design and (2) students will not be focusing on one design at a time, but rather designing separate-individual solutions.

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[10] Kristina Lapin, *A comparison of Three Virtual World Platforms for the Purposes of Learning Support in VirtualLife*, (Vilnius, Lithuania: Virtual Life, 2008).

KEY	
YES	green
NO	red
Unsure	yellow

Comparitive chart of features

	Second Life	Blue Mars	Kaneva	Exit Reality	Protosphere
Real time rendering	YES	YES	YES	YES	YES
EASY Parametric road modeling	NA	NA	NO	NO	NO
Parametric building modeling	NA	NA	NO	NO	NO
Rule based modeling	NO	NO	NO	NO	NO
Stand alone license available to purchase	NA	NA	NA	NA	NA
Offers programming partnerships	YES	YES	Unsure	Unsure	NO
Offers professional training and modeling services	NO	NO	NO	NO	NO
Mac support (Native)	YES	NO	YES	YES	NO
Linux support	Unsure	NO	NO	NO	NO
Windows support	YES	YES	YES	YES	YES
Collaborative multi-user support	YES	YES	YES	YES	YES
Collaborative multi-user communication (Native)	YES	YES	YES	YES	YES
LOD support	NO	YES	NO	NO	NO
Use of GIS data	NO	NO	NO	NO	NO
Map-controlled city modeling (from images)	NO	NO	NO	NO	NO
Vehicular simulation	YES	YES	NO	NO	NO
Pedestrian simulation	YES	YES	NO	NO	NO
Construction simulation	YES	NO	NO	NO	NO
Real time online communication tools	YES	YES	YES	YES	YES
Ability to export 3D files directly to web pages	Unsure	Unsure	NO	NO	YES
Chat functions (Native)	YES	YES	YES	YES	YES
In game/real time modeling	YES	NO	YES	NO	NO
Chat functions/Comment fields	YES	YES	YES	YES	YES
Partnerships?	Unsure	YES	Unsure	Unsure	Unsure
Import					
SHP	NO	NO	NO	NO	NO
DXF	NO	NO	NO	NO	NO
OBJ	NO	NO	NO	NO	NO
OSM (openstreetmap)	NO	NO	NO	NO	NO
Images (.jpg, .tif)	YES	YES	NO	NO	NO
Collada	NO	YES	YES	YES	NO
3DS	NO	NO	NO	YES	NO
TIN (triangulated irregular network)	NO	NO	NO	NO	NO
FBX	NO	NO	NO	NO	NO
FLT	NO	NO	NO	NO	NO
DWG	NO	NO	NO	NO	NO
MI (Mental Images)	NA	NA	NO	NO	NO
CGF	NO	YES	NO	NO	NO
SKU (SketchUp)	NO	NO	NO	NO	NO
MAX	NO	NO	NO	NO	NO
RVT (Revit)	NO	NO	NO	NO	NO

Figure 3 MMOW platform comparison chart part 1.

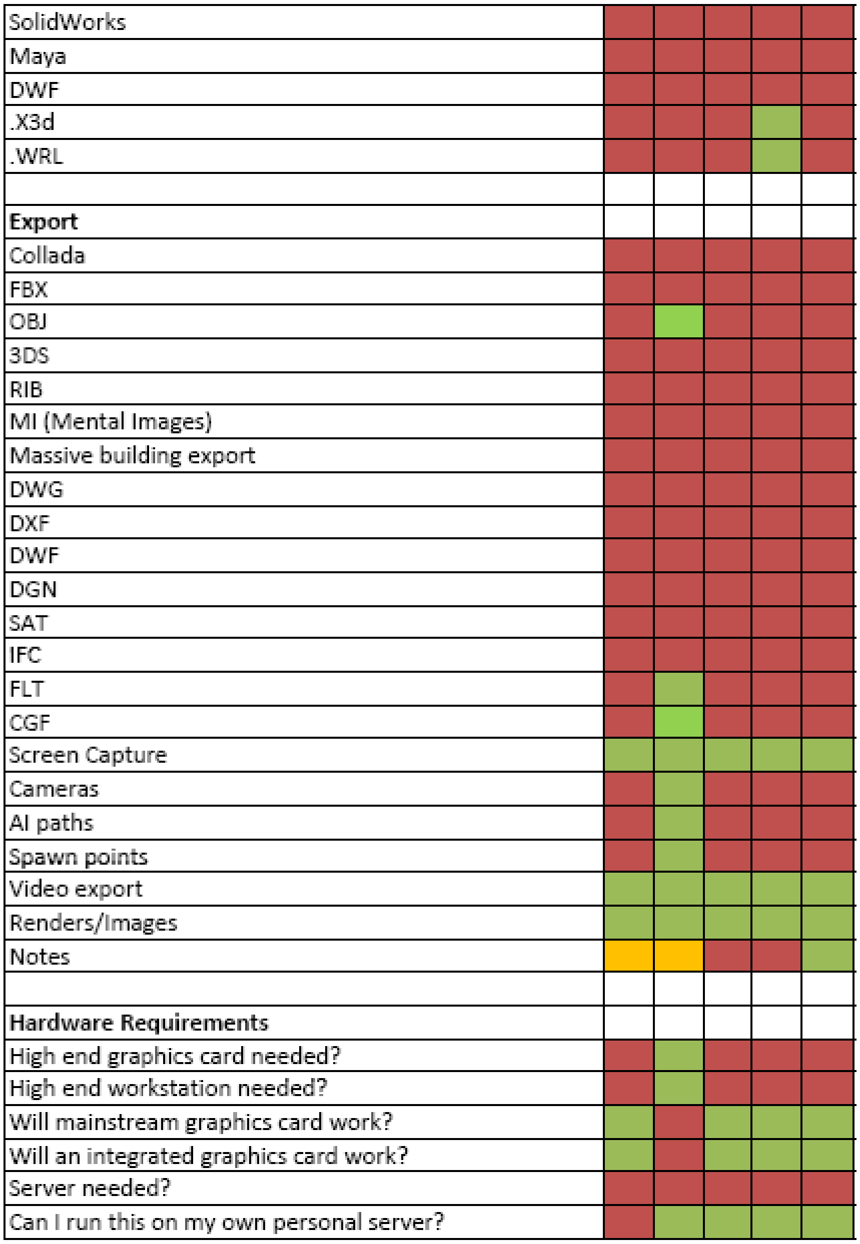

Figure 4 MMOW platform comparison chart part 2

1.1.1 VOW Features and Requirements

Architects that adopt VOW creation and its toolset will be providing their clients and the public with a new way to experience space. Juhani Pallasmaa believes that architecture has become static eye candy that deprives us from the actual experience of walking through it.[11] According to Susan Sontag, our minds are slowly being reprogrammed to look at our world as a “set of potential photographs.”[12] VOWs bestow upon us the ability to re-invent reality.

The problems of using VE and VOW tools today . . .You can’t “skim” the surface of a program like you could a few years ago. To have an outstanding design, whether it is in model form, a rendered image or a cinematic animation, students and professionals need to have a deeper understanding of how each function works within that program. In a VOW, you have to program everything to provide a user experience, which also includes sound. One implication about designing in a VOW is that it forces you to realize what you take for granted. The gaming industry is giving us something to critique all the while masking their product with “fun”. I foresee this affecting the way one designs in a VOW because it forces architects to be much more people oriented and it forces you to understand the function of every silent element in space. Articulation of spaces that allow conversation, contemplation and appreciation can be overlooked. But in VOWs and MMOWs, those kinds of spaces are absolutely necessary because there is no “real” programmatic function. There is no need for a roof because, well, there is no weather—and you don’t need stairs because you can implement teleportation devices.

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[11] Pallasmaa, Juhani. *The Eyes of the Skin* (Chichester, West Sussex, England: Jon Wiley & Sons Ltd. 2007),12-13.

[12] Susan Sontag. *On Photography* (New York, NY: Picador Press, 2001), 7.

"For typical urban planning and architecture projects, however, VR (Virtual Reality) has not found widespread use."[13] That was true in 2007 but today thanks to the rapid growth in technological advancements and the growth in people who generally "know" about VR and VOW's this statement has the potential to be falsified. Virtual Reality is the foundation upon which Virtual Online Worlds have been built upon. Virtual Online Worlds (VOWs) are explorations of infinite variations of a virtual space which are streamed over the internet.

If you were to group virtual reality development for architectural design and urban planning applications you would have two categories: one for visualization and one for rapid prototyping. With visualization, architects and planners would be only focused on 3D design and graphic output. With rapid prototyping, graphic output is not a concern. Environment immersion, creating interactive objects as well as dynamic environments are. These two categories have now been consolidated with the advent of Blue Mars. What can be created within virtual reality is no longer restricted to either category.

The earliest hurdles for adopting VR and VOW technology were numerous:

- Setting up specialized and costly hardware;
- Requiring special teams of developers and maintenance staff;

[13] George Drettakis, Maria Roussou, Alex Reche and Nicolas Tsingos, "Design and Evaluation of a Real-World Virtual Environment for Architecture and Urban Planning," Presence Vol*. 16, No. 3, June 2007, MIT Press,* 318–332©

- Finding high-level tools that will support users in their complex tasks Establishing a collaborative VR work environment among individuals of different disciplines;
- Availability of software (sometimes the programs you needed hadn't been developed yet or were currently being developed);
- Additional training for current staff, etc.

Back in 1995 during VR's earliest development, many experienced practitioners believed that working efficiently in a virtual environment (VE) meant that the program they were using had to have the following qualities:

- Ability to access or change environmental/systems/parameters;
- Create and manipulate particular objects;
- Perform analyses;
- Export changes.[14]

Those desired qualities haven't changed; in fact, the list has grown to include:

- Ability to track changes;
- Graphic display superiority;
- Ease of use;
- Ability to set constraints (locking and unlocking what can be manipulated);
- Artificial Intelligence (AI) integration;
- Advanced physics and particle programming;

[14] Sowizral, H., Angus, I. G., Bryson, S., Haas, S., Mine, M. R., & Pausch, R. (1995). Panel session on performing work within virtual environments. *22nd International Conference on Computer Graphics and Interactive Techniques,* 497–498.

- Parametric object support;
- Report generation (program logs);
- Ability to send large files over the internet to all parties involved;
- Data security;
- Cross platform compatibility;
- Large concurrent user support;
- Multi-format support;
- and Customer support.

The reason for choosing Blue Mars over Kaneva, Second Life, Exit Reality and Protosphere were because it offers all of the above and more. From an architectural student's perspective and practicing architects, it is imperative that any VR, VE or VOW have the necessary functions to allow the following:

- Collaboration amongst team members (including end-users and contractors);
- Superior graphic output;
- Import of Architectural/Construction Industry standard CAD file formats;
- Exportable changes;
- Some way to manipulate an object;
- Communication tools;
- Accurate environment design tools to depict existing and future settings;

- and Realism (lighting, shadows, vehicles, traffic simulation, crowd simulation/animation, high quality geometry and textures and vegetation).

As a side effect of integrating new software, opportunities for collaboration between computer scientists and architects are being developed. A good example of this would be the “Augmented urban planning workbench: Luminous Table” project developed by Professor Hiroshi Ishii of MIT’s Media Lab and MIT’s Architecture and Urban Planning department. The “Luminous Table” was a workbench that assimilated information from 2D drawings and 3D physical models to support the urban design process.[15]

The collision of these two fields have furthered the development of AR for the field of architecture and urban planning by providing the groundwork for future development and experimentation.

In reviewing "Design and Evaluation of a Real World Virtual Environment for Architecture and Urban Planning," every program feature requested by the architects can be easily implemented using the MMOW platform of Blue Mars. Their summary of observations had five categories; learnability and use, effectiveness-efficiency, satisfaction, VE Interface and realism. One of the most interesting observations made under realism was the effectiveness of sound and shadows during testing. Overall, 3D sound, shadows, sun coverage, vegetation,

[15] Ishii, et. al, "Augmented urban planning workbench: Overlaying drawings, physical models and digital simulation," *IEEE & ACM ISMAR* (2002):327.

crowd simulation and multiple view-points all contributed to a better understanding of the VE.[16]

What I am most interested in is the results pertaining to realism. It allowed the observers to determine when and where to use a high level of realism. When using a higher level of realism during the actual design phase, more information extraction and exchange had taken place between designers and architects. Whereas, when the VE was revealed at a City Hall meeting, the public became confused because the images conveyed a kind of "this is the final decision." It was too realistic. When sketches and hand renderings are used, the public "are more aware of the level of abstraction of the design" and are more receptive because they feel like they can contribute to the design.[17]

In their conclusion they found that engaging real users in the process of design and evaluation of real world VE's was beneficial to all parties. Involving actual end-users (architects and clientele) allowed the team of scientists to make better choices in the design of the VE interface. Introducing practicing architects to their VE tools and hardware provided the team of scientists with feedback which would have been completely unavailable if they had limited the experiments to graduate students of their respective institutes.

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[16] Drettakis, George, et. al. "Design and Evaluation of a Real World Virtual Environment for Architecture and Urban Planning," *Presence,* Vol. 16, no. 3 Paris, France: MIT Press 2007:327.

[17] Ibid,329.

Second Life

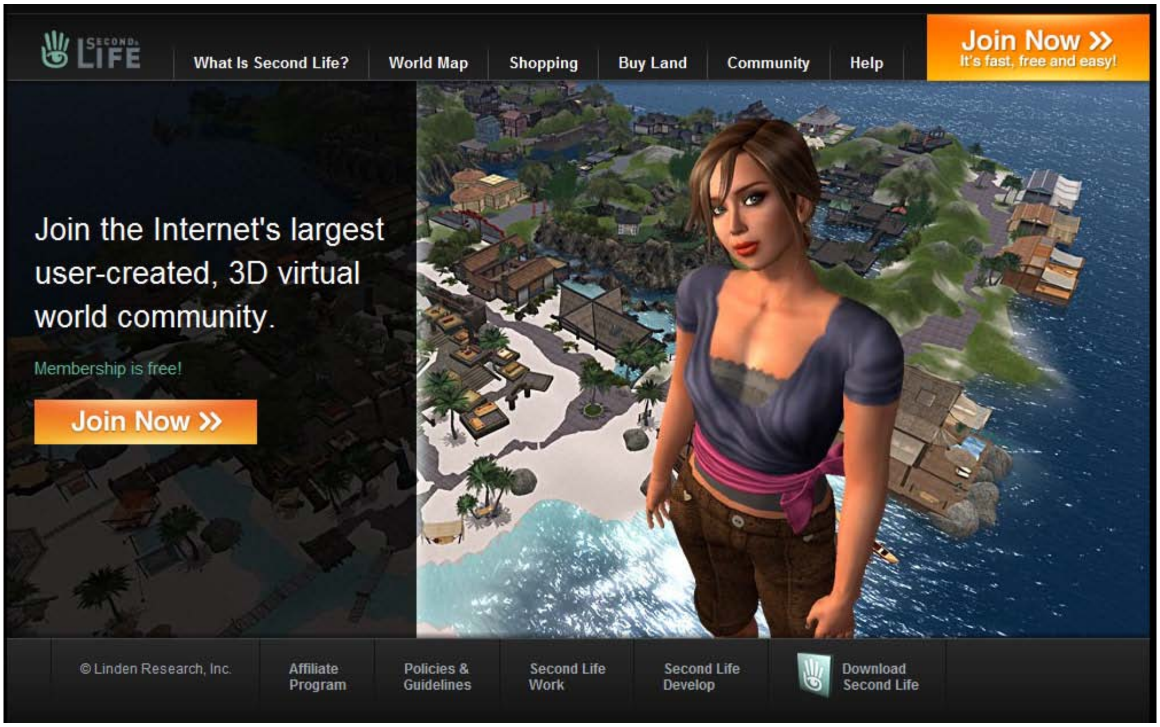

Figure 5 Second Life homepage screen shot. Image courtesy of http://secondlife.com/.

According to Second Life's homepage "Second Life® is a 3-D virtual world created by its Residents. Since opening to the public in 2003, it has grown explosively and today is inhabited by millions of residents from around the globe".[18]

[18] http://secondlife.com/whatis/world.php, accessed February 4, 2010.

Figure 6 SL game play shot. Image courtesy of http://rj3sp.blogspot.com/2007/01/zweden-krijgt-ambassade-in-second-life.html (accessed February 10, 2010).

Figure 7 SL game play shot. Image courtesy ofhttps://wikis.uit.tufts.edu/confluence/display/UITKnowledgebase/Virtual+Environments

Figure 8 SL game play shot. Image courtesy of http://www.flickr.com/photos/vieeto_voom/509522876/sizes/m/in/photostream/

The maker of this online world is a company called Linden Labs. Founded in 1999 by Phillip Rosedale with the intent of creating a new form of shared experience where people in the real world jointly inhabit an online 3D landscape with the ability to build the world around them. Their tag line is “Your World, Your Imagination.” This virtual world boasts the highest concurrent users since its launch in 1999. You also have the option of purchasing your own virtual land to build your house or business on. Residents retain intellectual property rights for their digital creations; however, due to weak encryption protocols, many content developers have reported "stolen" items. That aside, most users buy, sell and trade with other residents. Second Life even provides a Google Earth type application so that you can find the specific region you’d like to live and work in.

The “marketplace” currently supports millions of US dollars in monthly transactions. This commerce is handled with the in-world unit of trade, the Linden™ dollar. These Linden dollars can be converted to US dollars in world at online Linden dollar exchanges.

Like the real world, you also have the ability to get a job. Second Life is a massive multiplayer online role playing game, MMORPG for short. In all role playing games (RPG’s), you take on the role of a fictional character. Statistics show that worldwide revenues for MMORPGs exceeded half a billion dollars in 2005[19], and Western revenues exceeded US$1 billion in 2006.[20]

Back to job seeking; it’s the same in the online world as it is in the virtual. You obtain a set of skills; however, the twist in this acquisition lies in networking with other people instead of spending months or years learning how to perform a specific task(s). They have classified the jobs into Skilled, Unskilled, Freelancers and Entrepreneur types which break down even further. Under the “unskilled” category you have modelers, dancers, bouncers and shop attendants (store clerks). Skilled laborers are the animators, architects/builders*, texture artists, fashion designers, scriptors, event hosts, DJ’s and even stand up comedians. Freelancers and entrepreneurs include land barons and Linden Dollar brokers

[19] Parks Associates, "Online Gaming Revenues to Triple by 2009." http://www.parksassociates.com/press/press_releases/2005/gaming-1.html (accessed March 2009).

[20] Harding-Rolls, Piers . *Western World MMOG Market: 2006 Review and Forecasts to 2011.*(UK, London: Screen Digest, 2007).

who mostly act like the bankers, real estate agents and developers in the real world.

Since 2007, the number of people joining the MMOW known as Second Life is increasing 15% per month.[21] It was estimated that there were over 7 million registered users in this MMOW in 2007.[22] Linden Labs provides daily metrics of concurrent users (amount of people logged in), amount of acres auctioned, land for sale, land sales, resident transactions by amount, in-world business projects and monthly customer spending distributions free of charge.[23] In 2010, the average number of active users is well over a million. Of those users there are approximately 149 registered architectural groups with over 4,100 people claiming the title "architect" in Second Life.

With the announcement made on May 3, 2010 that Second Life would be supporting mesh imports as well as keeping up its in-world modeling tools, this may draw much more support from the Architectural, Engineering and Construction (AEC) Industry. Looking at figures 3 and 4, its clear that Blue Mars and Second Life provide the most comprehensive features that appeal to this industry.

[21] Bray, David A, Konsynski, Benn R. "Virtual Worlds: Multi-Disciplinary Research Opportunities," *Database for Advances in Information Systems,* November 1, 2007, http://www.allbusiness.com/technology/software-services-applications-virtual-reality/8889076-1.html (accessed May 2, 2010).
[22] Ibid.
[23] http://secondlife.com/whatis/world.php, accessed February 4, 2010.

Blue Mars

Figure 9 Blue Mars game play shot. http://www.avatar-reality.com/newsroom/gallery.html

Blue Mars is a program developed by Avatar Reality Inc., a new development entity dedicated to the advancement of online community building. Henk Rogers, owner of Blue Planet Software, is the main body sponsoring the massive multiplayer online virtual world (MMOVW for short) game. His initial concept was to create a terra-formed tropical version of Hawaii on Mars. Not only are they boasting a terrestrial environment to navigate, but they are also opening the potential to underwater environments. The company was founded in 2006 and has plans to do a major public press release in June 2009. This is a new program that began promoting itself as soon as it was formed. The game differs from Second Life by being an MMOVW instead of an MMORPG and has redefined the graphic quality for this budding market. MMORPG's are described as games that must be finished because they have specific goals to be met once game play has started and will usually have single shared universes. MMVW's are described as an expanding set of independently operated cities that feature unique themes, activities, attractions and personal spaces; they are known to have multiple universes but a single log in entry point.

Avatar Reality wants to create a system that doesn't hold back your creativity when creating the content for Blue Mars. The company will not be creating the content for this platform but has been partnering up with other companies that specialize in building 3D models which Jim Sink, Chief Executive Officer (CEO) referred to as "components." Avatar Reality was approached by the Dean of the School of Architecture at UH Mānoa to do a presentation on this platform. One of the hopes that the Dean had was to introduce the possibility of integrating the Blue Mars gaming environment into the school's curriculum. Since then, there have been two classes dedicated to the exploring the tools used to create a Blue Mars City.

The editors supplied by Blue Mars free of charge are meant to help developers design their cities. Without these tools, there would be no way to provide digital 3D content to Blue Mars. The current set of editors are separated into the following categories

Refer to appendix A to review findings on the work flows I have been able to establish between architectural software and the Blue Mars Editors.

Figure 10 Blue Mars gameplay shot 2. Image courtesy of http://www.virtualspaceentertainment.com/

In terms of computing requirements, a year from now Avatar Reality will format the game to be more graphic processor unit (GPU) intensive. Since the graphics engine was not written by them, but by CryTek. One part of the puzzle in developing the infrastructure was to figure out if they were going to build from scratch or license Cry Engine (made by CryTek). The engine allows for high quality graphics output to occur at faster frame rates. Depending on the type of game you want to design, if you want the whole menu of high graphics, believable physics and interactions, there are only a few options. Massing the environment of your “dream world” can be done by using programs like 3d studio max or Maya indefinitely. In other words, you can build outside the tools provided and then import your models into the interface. I will be exploring this particular method and presenting the results later in this paper.

Another asset of Blue Mars is being able to allow large numbers of people to access the world you've created. In Second Life, there is a 50 person limit. Blue Mars is hoping to have a 10,000 person limit which will allow 10,000 separate users to access your world simultaneously. If you need more than 10,000 frames they will replicate the server for you. That amount of traffic will imply that the environment is being used for online concerts or networking events.

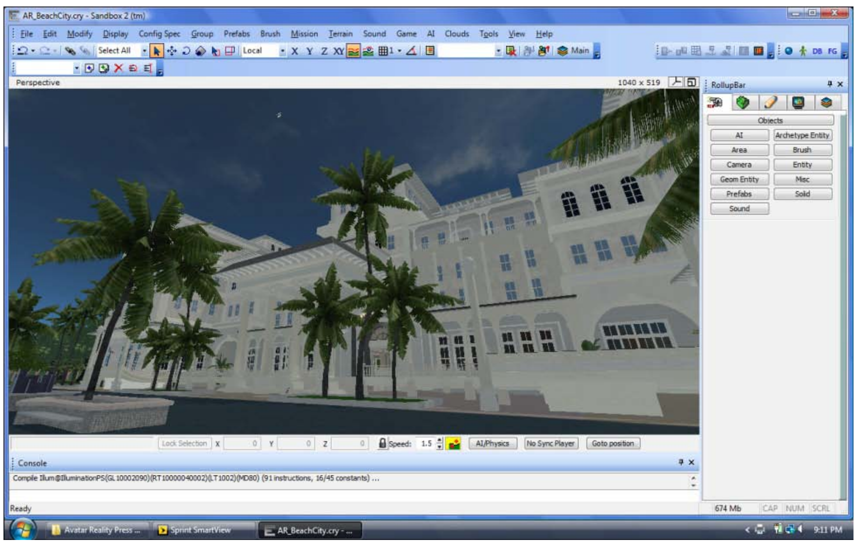

Figure 11 Blue Mars editing window.

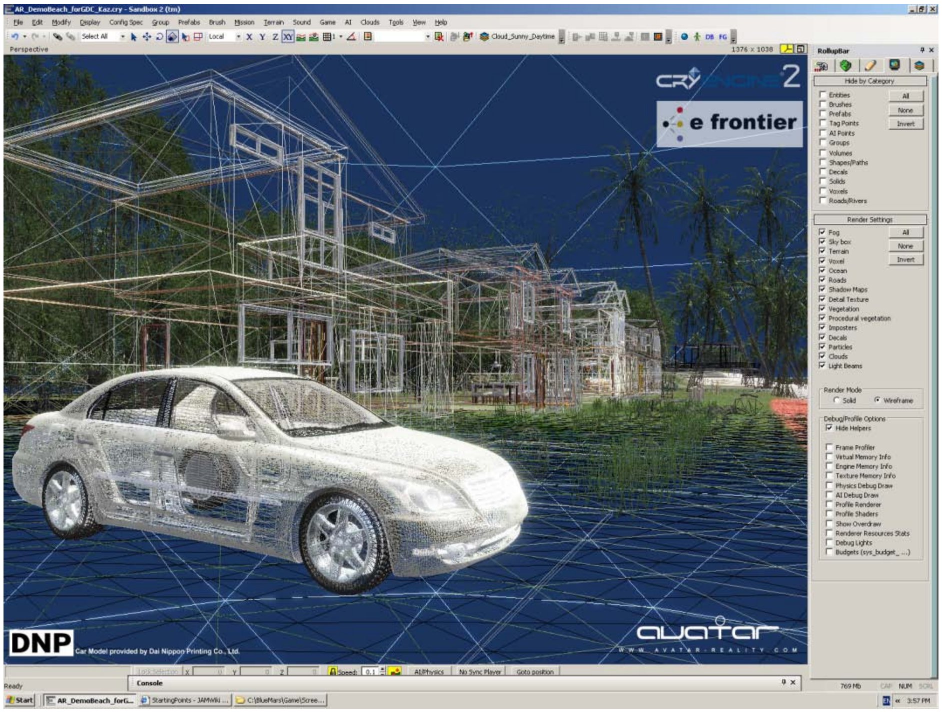

Figure 12 Early version of main editor.

Sandbox 2 is the asset building software/editor used to create the current Blue Mars environment, but Avatar Reality understands that they need to be flexible so they're constantly improving translators. For example, their pre-loaded golf game is only 600 lines of code and its interface is on Adobe Flash. When creating the user interface, they aren't trying to "reinvent the wheel." By offering the ability for people to edit and create content using the tools they know, it makes the game more desirable to use.

A sample city called Beach City is loosely based on Honolulu. When users come to the site, there are cities to greet you, but it's not a contiguous thing. It's more like a browser. You load each environment which has its own distinctive data set. When creating a new environment it's important to know how much you want to store and otherwise allow access to your world. If you control the city, you control the rules.

Boundaries

In a virtual world, location is an illusion. If you want to see one city closer, it can be easily faked; however, you won't be able to track what happens. The cities are true separate servers. There aren't any physical links because the jumps are jumps between worlds, there isn't a physical path built in to connect one city to the next. Transportation is must be accomplished by either teleporting or using a vehicle. Space is limited by server and memory capacities, which is comparable to humans being limited to the planet earth for developing life.

Artificial Intelligence (AI) researchers are developing chat boxes for Blue Mars. Chat boxes are bots, programmed to exist as "other people", or artificial people. They are easy to program, give rules, responsibilities and tasks to. Chat boxes can learn from each other. Avatars can respond. It was recommended that users lock down their bots to prevent them from learning things outside their region. This aspect of game functionality is a key component in providing students with the experience of creating a building and seeing it used. Even though there may be little or no traffic online, these bots can still be programmed to interact with the environment.

Avatar Reality hopes that creative professionals with their own personal library of ideas will upload them on to Blue Mars, have them look absolutely beautiful and get feedback. An important thing to remember is that Blue Mars is a registered developers program.

Audience

There are 100's of competitors, going after 18 year olds and older. Blue Mars will make their product graphically exceptional. One way for them to get this target group interested is to advertise their product in higher educational institutions or Universities. Avatar Reality wants to raise the bar to brush away the rudimentary experimentation which is why they are targeting a more mature and skilled crowd.

One other valuable aspect of this game lies in running training simulations because it allows you to script an event for disasters to happen. People have to react to the world.

Expectations from AR for the UH Mānoa School of Architecture if they were to partner up would be to have the content that students create inspire potential customers, digital entrepreneurs, corporations and other educators. When Jim Sink stopped by the UH School of Architecture he gave a presentation in front of some students about the game and expressed wanting to see how far students can take the program with their designs. "If amazing worlds are designed, then I think it creates a great marketing tool for Avatar Reality because we can say *hey, that's in Blue Mars*, our site . . ."[24]

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[24] Jim Sink, Guest Lecture, February 3, 2009.

Kaneva

Figure 13 Kaneva screenshot taken while program was installing.

Kaneva is a 3D virtual online world that is mainly used by teenagers and pre-teens. This MMOW was created by CEO Christopher Klaus in 2006. "Kaneva is the first to integrate social networking, shared media, and collaborative online communities into a modern-day, immersive 3D world for the masses."[25] Although this platform has a well established user base, communication tools and model upload capability, it doesn't market itself for professional use. Despite its shortcomings in graphic quality, Kaneva allows any registered user to upload a COLLADA file. COLLADA stands for Collaborative Design Activity and carries a unique .dae (digital asset exchange) file extension.[26] COLLADA files are an

[25] http://blog.kaneva.com/?page_id=2 (accessed April 21, 2010).

[26] "COLLADA." *Wikipedia: The free encyclopedia.* http://en.wikipedia.org/wiki/Collada accessed March 9, 2010.

interchange file format for interactive 3D applications. COLLADA was intended originally as an intermediate format for transporting data from one digital content creation tool to another. Applications that support this usage are Maya, 3ds Max, Poser, LightWave 3D, Cinema 4D, SoftimageXSI, Sketchup, CityEngine, CityScape, Blender and the Unreal Engine, just to name a few. The benefit of using Kaneva is that you don't need to use another program to translate your .dae into another acceptable format, unlike Blue Mars where you need to use the Item Editor to create .cgf files. As long as you use one of the modeling applications listed above, export your model into a .dae file, you can upload the file directly to Kaneva without having to go through a quality assurance check. It's also free. However, you can only upload items to the default apartment that the program sets you up with after registering an account on Kaneva. Although this is a nice feature to have, the rest of the program is not well suited as a testing ground for measuring the effectiveness of design collaboration.

Protosphere

Figure 14 Proton Media screen shot. Image courtesy of http://www.hypergridbusiness.com/2010/04/gartner-names-protonmedia-cool-vendor/

ProtonMedia is the developer of ProtoSphere, a virtual environment used in life sciences that boasts the most advanced 3-D virtual environment for collaborative decision making. According to their website, "Since 2006, ProtonMedia has been helping businesses overcome the limits of traditional online collaboration tools with engaging environments that improve the productivity and organizational effectiveness of globally distributed teams."[27] Protosphere is a platform that people use to hold virtual meetings and classes. The most prominent feature of this VOW is its document transferring and presentation tools. However, this VOW is not well suited for architectural 3D design collaboration despite being able to accept 3D geometry files. The environments are just not immersive enough because of the lack of real world ambiance.

[27] "The Company." *Protonmedia: Virtual Collaboration for the High-Performance Workplace.* http://www.protonmedia.com/ accessed March 9, 2010.

Exit Reality

Figure 15 Exit Reality user interface screen shot. Image courtesy of http://fileforum.betanews.com/detail/ExitReality/1222229458/1

Exit Reality is unique in the sense that on top of supporting a VOW, users can generate a 3D web page that provides users with a free residence which is customizable that links you to other 3D web pages. Its users can also upload items they've created under the .dae format, as well as .wrl and .x3d formats. Any program that exports to these three formats can be used to generate 3d content. Unlike Second Life, Kaneva and Blue Mars, Exit Reality does not allow users to create virtual landscapes or cities. At most, a user can upload clothes and furniture. Exit Reality, for these shortcomings, is not a suitable program for testing my hypothesis.

The following quantitative data identifies the economic, social and psychological benefits of gaming.

The cost of developing a competitive commercial MMORPG title often exceeds $10 million. These projects require multiple disciplines within game design and development such as 3D modeling, 2D art, animation, user interfaces, client/server engineering, database architecture, and network infrastructure. Many MMORPGs feature living economies. Virtual items and currency have to be gained through play and have definite value for players.[28] Such a can be analyzed using data logged by the game and has value in economic research; more significantly, these "virtual" economies can have an impact on the economies of the real world.

So what does this have to do with architecture? First of all, knowing your client (or target group of potential investors) means you understand where they're coming from financially, what they're personal tastes are and how they plan on using the resources they already have, will or can obtain. Although the application of this collected data from "virtual" economies is currently only benefiting the MMORPG industry, it has already begun to merge with current applications in the world of architecture.

Designing in the online gaming world has its advantages; no gravity and no architectural review board. If architects wanted to take advantage of this

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[28] Radu Privantu. "Tips on Developing an MMO Economy, Part I". February 17, 2007, http://www.devmaster.net/articles/mmo-economy/part1.php (accessed March 19, 2009).

budding market, now would be the time to do so. Through the months of September and December in 2008, since the bail-out of major investment bankers, architectural offices have been forced to restructure their work force. Moving into designing online worlds would be one such way to diversify.

1.2 Some Design Considerations

Developing an architectural practice in a VOW can either be a short term or long term investment in time and money. An architect or a student of architecture needs to develop an understanding for the fundamental principles of game level design and its respective tools. Working with VOW or MMO tools have many advantages and disadvantages. However, architects must first download, install and participate in a VOW to understand how this technology can change their collaborative design process.

Level designers work on building an environment for games. They are tasked with compiling elements of vegetation, street networks, buildings, landscaping and artificial weather. Level designers are a lot like urban designers and urban planners. The design team usually consists of a lead designer and several video game level designers, much like the regular organization and hierarchy of an architectural or urban planning office. This team is responsible for the ambiance and feel of the game.[29] They have to understand and design the world for the particular game or level much in the same way an urban designer or an architect needs to understand the existing site and its surrounding context.

[29] "Game Level Design," *A Digital Dreamer* http://www.adigitaldreamer.com/articles/video-game-level-design.htm, accessed November 29, 2010.

Research is done on the kinds of buildings they want to include which includes whether or not it has to be historically accurate or if it needs to be culturally specific. Architects and urban planners pull reference material from all sorts of places and sources, level designers have to do the same thing. They also have to develop an extensive library of textures, vegetation, street furniture, regular furniture and other game building objects (also known as assets).

Game level design is also a lot like creating movie sets. In my previous research about cinematic architecture I circled around this one conclusion without ever really landing on it, but films create freedom for your own associations and memories by what they don't show; which can infer that the more you show, the less the rest has to be imagined and the less you have to imagine, the easier you are to control. You can imagine what isn't real because reality is fixed and very difficult to change. In the world of cinema and video games, the level designer chooses what reality is for you and what experiences you will have, and what memories you will make by interacting with the artificially intelligent and pre-programmed world.

Stephan Doesinger, author of *Space Between People*: *How the virtual changes physical architecture* comes to an overall conclusion that interactive spaces leading to more creativity is a "myth."[30] But even if interactive spaces don't inspire creativity, they *do* push the level of design in the real world to emulate a kind of "interaction" with seemingly static elements. With that said, how does architecture play a role in virtual online worlds? In my opinion

[30] Stephan Doesinger. *Space Between People* (Munich: Prestel Verlag, 2008),13.

architecture is no longer a silent-static element, it is interactive and it doesn't have to be a replica of our real environment. In the instance that architecture relinquishes itself from function, it becomes art.

People want places to go, things to see and basically inhabit. MMOW's are creating new worlds which need places to go, things to see and basically inhabit.

What Blue Mars does is position itself as an MMOW like Second Life but with a steeper learning curve because the tools to create items are more complex. In today's economy, this is a problem, but in the future it's not. Avatar Reality Inc. is building an MMOW platform for the future. It was stated by Doesinger that our world is becoming like one massive videogame.[31] If that's true, then designing virtual architecture should be second nature for architects.

Figure 16 Geographic map and street view photos of New Ordos. Images compiled from multiple sources. (Left) http://commons.wikimedia.org/wiki/File:China_Inner_Mongolia_Ordos.svg; (Center and Right) screen captures in a video uploaded to Youtube taken November 10 ,2009, http://www.youtube.com/watch?v=0h7V3Twb-Qk.

In real life, there are supposedly no such limitations to growth and density concerning cities and suburbia. But there are consequences when you don't plan your cities right. Case in point, China, post 2008 Olympics. There's a city

[31] Ibid, 22.

outside the borders of China in the vicinity of Mongolia called Ordos. It was founded in 2001 and has a higher GDP than Beijing, making it one of the richest cities in China. It has over 1.5 million inhabitants but much of its modern architecture remains empty leaving one with the impression that it's a ghost town.[32] Here in lies the problem for the city of Ordos (which means "palaces" in Mongolian), it's like Las Vegas. There's an old side and a new side. Unlike Vegas, the local government in Ordos has not found a way to convince people to migrate their businesses into the newer side of the city. There are tons of buildings with commercial space to rent, but no one is moving because it's too expensive. The Ordos government is not creating an incentive for their citizens to invest their time and money in, thus creating an un successful city. This example proves the fact that without people you can't have a business.

Figure 17 Geographic map and aerial photos of the South China Mall. Images compiled from multiple sources.(Left) Slightly manipulated to indicate general location http://maps.google.com/maps?um=1&hl=en&client=firefox-a&rls=org.mozilla:en-US:official&biw=1645&bih=793&q=South+China+Mall+map&ie=UTF-8&sa=N&tab=il;(Center) http://special.lifeofguangzhou.com/2008/node_801/node_805/2008/08/28/121990769049801.shtml .

[32] http://gizmodo.com/5444592/the-ghost-city-of-ordos?autoplay=true Accessed January 9, 2010.

Another example of poor planning in China is the South China Mall in Dongguan which was completed in 2005.[33] To this date, that mall is still completely empty and is the world's largest "ghost mall." There are about 1,500 rentable spaces – mostly food chains – and they are spread out over 7 million square feet. These oversized projects were not well planned. One of the points I had hoped to make about MMOW's and VOW's was that they could serve as microcosms of what not to do in real life. But instead, I have found real world examples that illustrate this point perfectly.

For this particular section I am interested in the types of interior and urban spaces designed for computer games because they can serve as a starting point for architects to begin understanding the different spatial qualities of both realities. In order to design for VOWs and MMOW an architect must understand how the game and level design functions together in order to support the story line of the game itself. Or if the game is without a storyline, then the level design must immerse the player into the aspect of communication and networking.

A room or streetscape within an MMOW or VOW may not function like a space in real life even though it has been modeled after it. On the other hand, when a game designer researches the built environment for ideas, they are more interested in determining how the game element creates space and works itself into the game play. Essentially, how a player might use the space or the elements in it.

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[33] "Episode: Utopia, Part 3: The World's Largest Shopping Mall," *PBS,* August 18, 2009 http://video.pbs.org/video/1218530801/program/1154485580# , (accessed December 22, 2009).

Unlike a standalone game title, an MMOW or VOW doesn't need a storyline. The plot doesn't have to exist, but in order to keep people interested and immersed, there needs to be some kind of interactive element involved.

For social networking games that cross over the virtual barrier and require real world spaces, an architectural response is always needed. An example of this is a game called *Breakout for 2* developed by Florian Müller and Stefan Agamanolis. The game objective is to kick a ball against a local physical wall. On each wall is a projection of the remote player enabling the participants to interact with each other through a life sized video conference. Both players kick the ball against the wall in order to obliterate the other's blocks. First one to break all blocks wins. All one needs to play this game is a ball, a computer with webcam, and a sturdy wall. Although the game is meant to bring people together, it's the creators belief that breakout for two will provide people with a direct personal experience, facilitating a sense of shared space and supporting social connectedness between the remote players. When you give people something to do in a room, they can forget about the space and its spatial qualities because they are involved with the task at hand. This is one example of how architecture becomes muted. Architecture can take a side seat, it can become part of the game as an object or it can become an experience enhancer.

Storytelling

With the help of the internet, the story telling space has become a social space where the actions of other players can influence the setting. For example, the game *Counterstrike*, released in 1999. If we consider the maps of *Counterstrike* as architectural artifacts, they would be the equivalent to ghost towns. A map is a user-created level that has been massively distributed for others to play and download over the internet. The most valuable aspect of *Counterstrike* in the context of this paper is the ability to share these maps with thousands of other players. If the map is well designed, it draws people in to play it and no longer becomes a ghost town. Alex de Jong, author of *Counterstrike-Lock and Load!* concludes that architecture must be able to give access to environments that are real and virtual simultaneously. To do so, it will require architecture to create a new theory – one that combines architecture's physical space and medial aspects.[34] Medial aspects might refer to architecture's threshold spaces, the spaces in between buildings or the circulatory spaces.

Difference of space in computer games

Aside from the storyline and goal, the computer game environments are about spatial negotiation and representation. Thinking about those two key words, I ask myself "how does this virtual environment draw me in for a totally immersed experience?"

Architects need to understand this first: to understand all the cultures and sub-genres of VOWs, MMOWs I would stress that an architect will need to join an MMOW or VOW like Second Life, OpenSim, or Blue Mars.

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[34] Alex de Jong. "Counterstrike: Lock and Load!", *Space, Time, Play* (2007): 42.

Henry Lefebvre believes that all space is produced and socially constructed by a society's "spatial practice".[35] Computer games, including VOW's and MMOWs are allegories of space: they pretend to portray space in ever more realistic ways but rely on their deviation from reality in order to make the illusion playable.

Game designers don't simply tell stories they design worlds and sculpt spaces. MMOWs and VOWs are turning over that power to create to the average Joe. It's important to note that when telling an environmental story (whether it be in real life or a virtual one) to never let a contradictory element in to the scene because it could break the rhythm and shatter the sense of immersion. By combining the tools of creation with the means to network and communicate on a global scale, MMOWs are (as a side effect) allowing millions of people to walk through millions of worlds and memories. Not only walk through, but also participate, contribute, shape and reshape those worlds as they see fit.

Kevin Lynch authored *The Image of the City* in 1960 and he presented a comparison of urban design to game level design. The urban planner is actually more relaxed than the game level designer. Urban planners should not predetermine the uses and meanings of the spaces they create because it makes it more difficult for fresh spaces to be created. So instead of predetermination, he would rather design an urban space with poetic and

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[35] Espen Aarseth, "Allegories of Space," in *Space, Time and Play,* (Basel, Switzerland :Birkhauser Verlag AG, 2007), 44.

symbolic potential.[36] Understanding how game level designers treat the cityscape could benefit urban designers and planners because game level designers design for fun and interaction. Architects and urban planners design from a functional point of view**.**

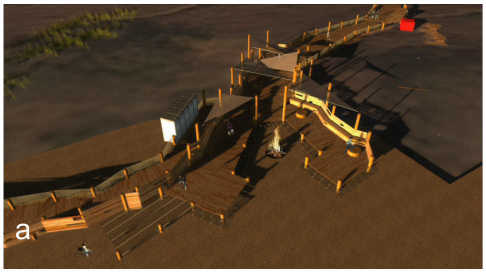
Question the need for physical space

What would happen if your company didn't need office space? If you could work from home? Thereby eliminating the need to commute. Why would we need office spaces? Typical office spaces for that matter. Specialized facilities for server storage, medical research, chemical research, treatment centers, care homes, restaurants, those would still be needed. If we have phone contracts like T-mobiles "pay as you go", why can't there be spaces like that too? The digital conference room (one that resides in an online environment) offers that opportunity. As more and more office buildings begin to lose tenants, this could potentially affect the way an architect designs his or her buildings. Architecture serves as permanent shelter from the elements. It satisfies some core human need. Art tries to reconcile expressions we cannot describe in any other communicative form.

[36] Lynch, Kevin. *The Image of the City* (Cambridge, MA: MIT Press, 1960), 116.

2

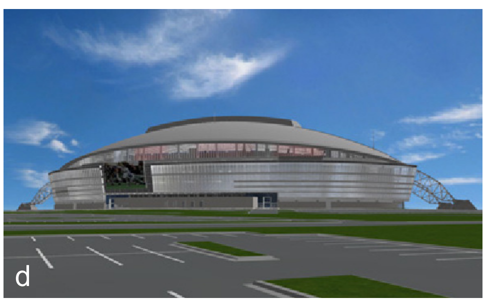
Architects and VOW projects


a

a. ARCHVIRTUAL
b. UH ISLAND
c. CO ARCHITECTS
d. HKS ARCHITECTS
e. KENJI IKEMOTO
f. CALDER FLOWER ARCHITECTS
g. FILLIPO INNOCENTI


b


c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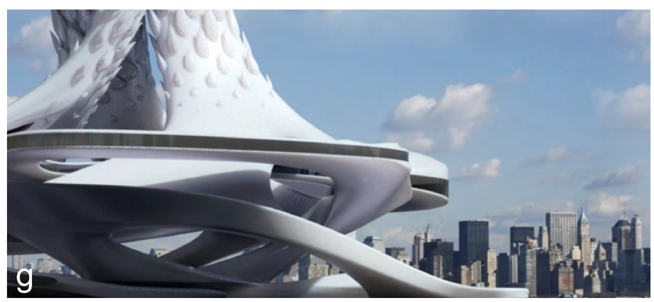
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Chapter 2

Architects and Virtual Online World Projects

Millions of Us isn't an architectural firm but they create virtual cities for large brand name companies like General Motors, Warner Bros., Intel and 20th Century Fox, to name a few.[37] Another leading company in the business of creating virtual content is *Electric Sheep Company*, which has executed projects for AOL, Starwood Hotels and NBC.[38] Jon Brouchard of *Crescendo Design* specializes in new homes, remodels, additions and virtual design visualization utilizing OpenSim. He and hundreds of other architects have tested the waters in Second Life at designing in virtual online worlds for both real and virtual projects. These virtual design services are not inexpensive—the average cost of a project in Second Life for a major company runs in the low six-figure range in US dollars according to David Bray, writer for Database for Advances in Information Systems.[39]

Some of these virtual design services are being used to assist in real-world projects. For example, in 2007, Electric Sheep Company worked on replicating Starwood Hotel's newest hotel which was scheduled to be completed in 2008. Starwood Hotels became the first company in history to open a new

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[37] <http://millionsofus.com/> (accessed April 30, 2010).

[38] < http://www.electricsheepcompany.com/> (accessed April 30, 2010).

[39] David A. Bray and Benn R Konsynski, "Virtual Worlds: Multi-Disciplinary Research Opportunities," *All Business*, November 1, 2007, http://www.allbusiness.com/technology/software-services-applications-virtual-reality/8889076-1.html (accessed May 1, 2010).

hotel brand inside of a virtual world. Approximately 3 years later, the hotel was donated to TakingITGlobal, an international organization that is led by youth from over 200 countries whose aim is to inspire young people around the world to get involved with improving their local and global communities.[40]

The examples discussed thus far indicate that real life architectural firms are using Second Life to enhance their real-world business. Autodesk is well aware of the potential usefulness of VOW's and even has an island in Second Life. Autodesk University is the company's branch that reaches out to the education community in the AEC, film and animation industry. They hired John Brouchard of Crescendo Design to demonstrate how he uses his virtual land in Second Life to build virtual models of his design concepts and redesigns the virtual site so that it is similar to the actual site. By conducting meetings in virtual real time where both the architect and client meet in the form of their respective avatars at the virtual site, both are able to tour the design together. In addition to enhancing its real-world architectural practice, Crescendo Design is starting to compete with digital design firms like Electric Sheep Company and Millions of Us to help companies build virtual architecture in Second Life. [41] Jon Brouchard also runs a blog called "The Arch Network: Architecture and design in Virtual Worlds" which has been going strong for several years. It is on his site that I was able to count at least 10 real world projects that, are or were, under construction between 2006 to current. Some of which will be discussed in this thesis paper to

[40] Aloft in Second Life. < http://www.virtualaloft.com/> (accessed April 29, 2010).

[41] Khemlani, Lachmi. "Exploring Second Life and its Potential in Real Life," *AECbytes* (2007), http://www.aecbytes.com/buildingthefuture/2007/SecondLife.html. (accessed April 26, 2010).

support the precedence of architects in VOW's and their continued interest in using them to expand their business, share their work with a global audience, gain valuable feedback from consultants and clients before the building process starts and utilize the innovations in technology to propel their business forward in to the future.

According to Lachmi Khemlani, founder and editor or AECbytes, for Second Life to really appeal to the Architectural, Engineering and Construction (AEC)industry it will need to allow the imports of cad geometry.[42] The AEC industry relies heavily on the ability for their files to be compatible between programs which is why Autodesk is the industry's number one software solution of choice. In May of 2010 Second Life confirmed rumors of their platform being able to accept mesh imports. The simple ability to import native mesh files without having to re-create a model from scratch using Second Life's Prim system is what many virtual world architects have been waiting for. Virtual worlds are currently being used for reviews, presentations and for collaborations. By opening up a platform to accept mesh files, these virtual online world companies are opening their doors to the entire AEC industry which means more presence, more jobs, more opportunities for the AEC industry to find better solutions to work together, communicate, share information and collaborate on projects large and small.

[42] Ibid.

The lack of file compatibility is the only thing that stands in the way of architects really moving forward in to Virtual Online World and virtual item creations.

University of Hawaii at Mānoa UH Island

Figure 18 UH Island.

UH island was the brain child of Peter Leong, Sam Joseph, Diane Nahl, and Jonathan Wong. University of Hawai‘i at Mānoa (UHM) had purchased the island (at an educational discount of $150/mo. + setup fees) with a grant they received in April 2008 and privately contracted a firm in the UK to three dimensionally build the main buildings on the island. In July 2009 there was a coming out party to celebrate its public opening. Virtual E was the design group who built the initial buildings. Three different companies bid for the job, per to the requirements of the University of Hawaii’s contracting guidelines.

UH Island was built in Second Life and is one of many VOW institutions. Many educational institutions have a customized presence in Second Life that allows them to collaborate, offer instruction, and explore the vast possibilities of three-dimensional spaces.[43] It’s a first for the University of Hawaii and was

[43] http://www.hawaii.edu/secondlife/ (accessed February 18, 2010).

created to help students and faculty train for a future in which distance and online learning, multimedia conferencing, professional networking and even recruiting will happen.

Speaking with Sam Joseph about the learning tools and how to create them gave me a better idea on the major differences between Blue Mars and Second Life. For example, students and faculty are able to create their own presentation tools in-world, where as in Blue Mars, much of the work needs to be done externally and then imported. The most necessary learning tools for students and faculty are "…presentation tools and anything that allows people to do their jobs and complete assignments," said Joseph. The background needed in order to create these tools requires one to know the C languages. Linden Labs, creators of Second Life, use a scripting language called LSL, short for Linden Scripting Language. According to Joseph "...it wasn't necessary to hire anyone to create the tools for us. Students and faculty have either a BA in CS or an MA in CS. With that degree, it basically means they've learned the basic computer languages like Java, all the C languages (C#, C++, C), Lisp, Prologue, Ruby, PHP, etc. The Linden Scripting Language (LSL) follows those basic language algorithms and so it enables students and faculty to write their own tools in Second Life."[44] If architects wanted to integrate dynamic objects, they would either have to hire someone or learn how to script. Speaking from firsthand experience, learning how to script on one's own time is a challenge even with the availability of online resources and bookstores. However, the effort

[44] Interview with Sam Joseph, February 17, 2010.

made to learn scripting has been beneficial. Stepping outside of the realm of architecture exposes one to new ways of thinking about architectural collaborations between different disciplines.

Sony Home

Figure 19 Sony Home's main building. Image courtesy of http://images.businessweek.com/ss/09/01/0123_playstation/1.htm

Architect Kenji Ikemoto of Jota Architects, Tokyo, Japan utilized a combination of Vectorworks and photoshop to design the Sony Home welcome area for the PS3. It was an intense 6 weeks of designing for Ikemoto which was publicly released on December 11, 2009.[45] Ikemoto was contacted by Sony to design the Home area with realistic architectural elements. The design included a split-level plaza surrounded by four buildings. It all sits on an island, and in the background, beyond a body of water, is a city located at the foot of a mountain

[45] Kenji Hall, "Architect Designs Sony's Virtual World," *Business Week,* January 23, 2009, http://www.businessweek.com/globalbiz/content/jan2009/gb20090123_837565.htm (accessed January 24, 2010).

Figure 20 Sony Home Cafe. Image courtesy of http://images.businessweek.com/ss/09/01/0123_playstation/1.htm

range. In the real world, Home Square would cover 5,000 square meters (54,000 square feet). "Everything in Home can actually be built if you spent the money," Ikemoto said.

The online 3D world is part social network, part multiplayer online game, and it's a free download through Sony's PlayStation Network for more than 17 million PS3 owners. For now, Home isn't much more than chic apartments, a mall, a bowling alley, an arcade, a movie theater, and a cafe. So it's no surprise that most of the reviews have been either mixed or critical. "For many of us, Home simply isn't anything we want," writes one user of Sony Home.

Typically, architects have to think about cost, availability of materials, and local building codes, and can spend up to two-thirds of a project in on-site meetings with the builders and other contractors. With Home, none of those things mattered. It was as if a developer had written Ikemoto a blank check and freed him from the usual limitations. Ikemoto was stumped. "Without those considerations, it's harder than you might think," he said.

Sony's team in Tokyo was also in unfamiliar territory. Many of the team's members had experience creating games and were accustomed to giving orders to programmers and designers. "We had to do the opposite this time," said Home producer Yoshikatsu Kanemaru. Ikemoto met with programmers who would then transfer his design concepts into the game. Ikemoto's involvement with this project is evidence that practicing architects are also taking on VOW commissions.

Palomar West Medical Campus, San Diego, California

Costing over $810 million to build and design, the Palomar West Medical Campus is a new state-of-the art medical center due to open in San Diego, California in 2011.[46] In February 2008, it had its virtual grand opening three years early on the Internet-based VOW of Second Life. The most convincing ideas of utilizing a VOW to test and design architectural concepts can be found in this example. CO Architects was the lead architectural firm responsible for this design and also implemented it in Second Life.

Figure 21 Second Life screenshot of Palomar Hospital. Image courtesy of http://archsl.wordpress.com/tag/second-life/

In Second Life, avatars can tour the facilities and see some of the amenities of the $810 million, real-life publicly financed hospital, which will serve California's largest public health district, covering 850 miles in San Diego. The facility was designed "from the ground up to be integrated with leading-edge technology, including medical

[46] *News*@Cisco, http://newsroom.cisco.com/dlls/2008/prod_022508d.html (accessed April 15, 2010).

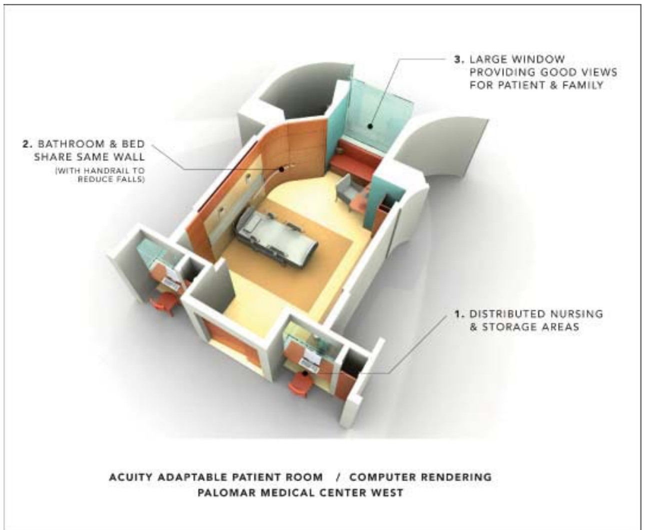


Figure 22 Poster image for room layout. Image courtesy of http://www.worldarchitecturenews.com/index.php?fuseaction=wanappln.showprojectbigimages&img=3&pro_id=13972 (accessed April 10, 2010).

technology, as well as being eco-friendly," said Orlando Portale, Palomar Pomerado's chief innovation officer. The Second Life presence "gives our patients and the health care community a chance to demo these innovations in the virtual world years before the physical facility opens."

"Virtual visitors to Palomar West can also help Palomar Pomerado test out some of its concepts for how leading-edge technology could be used at the new facility or how futuristic concepts might provide opportunities for the health care industry at large, said Portale. . .We want to have our constituents in our district, the taxpayers and others, to provide feedback on this multimillion-dollar facility," said Portale, who has spent 20 years in the health care IT sector and joined Palomar Pomerado last May, after serving as general manager for global health care at Sun Microsystems."

Via Second Life, visitors to Palomar West can test some technology that's likely to be deployed in the real-life hospital. For instance, avatar patients taking the virtual tour can also test out RFID-enabled bracelets that can not only track patients but could automatically guide them to the appropriate areas of the facility, based on what kind of health services they're scheduled to have. For

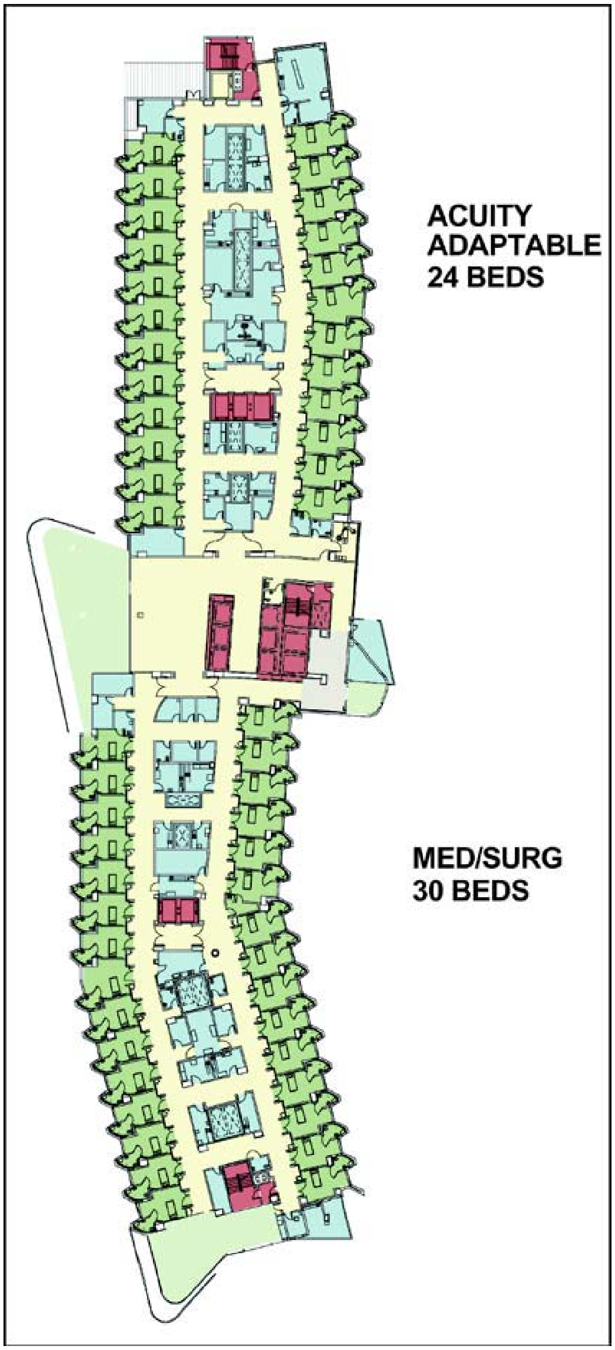


Figure 23 Floor Plan. Image courtesy of http://www.healthcaredesignmagazine.com/ME2/dirmod.asp?sid=&nm=&type=Publishing&mod=Publications%3A%3AArticle&mid=8F3A7027421841978F18BE895F87F791&tier=4&id=17B10459919F4E40831FCBE0B7FF394F

instance, a virtual patient slated for day surgery could automatically have the hospital elevator land on the correct floor based on the information programmed in the RFID bracelet.

"In some cases, we're demoing technology that's ready for today but has low adoption in health care -- RFID is one those technologies," said Portale. "We wanted to demonstrate to the hospital industry how these technologies could be deployed." The real Palomar West might end up using a next generation of RFID once the facility is open, he said.

"Some of the concepts we're exploring aren't being done anywhere and may not be viable," he said. For instance, a virtual tour to a mock patient room may demo how a patient could have a full-body imaging scan test performed while the patient is inside the room. But today, in real life, hospital patients need to be moved out of their rooms and brought into special testing rooms for such imaging, he said. "We want to provide a vision for where technology could go," said Portale.

Cisco, which provides network technology and services to Palomar Pomerado's other real-life health facilities and medical centers in California, assisted Palomar Pomerado in developing the Second Life tour, Portale said. Looking ahead, Palomar Pomerado plans to host in the Second Life version of Palomar West industry events and meetings with health care leaders, policy makers, and others on a variety of topics, said Portale. Those meetings could focus on health care issues, as well as the design, architecture, and technology used in the real-life Palomar West.[47]

[47] Karen McGee, "Hospital Takes Its Grand Opening To Second Life." *Information Week* Februaruy 25, 2008, <http://www.informationweek.com/news/internet/ebusiness/showArticle.jhtml?articleID=206801783> (accessed March 17, 2010).

Trestles

Figure 24 Trestles Area Map. Image courtesy of http://www.openarchitecturenetwork.org/competitions/trestles

The power of designing in an online collaborative effort utilizing a VOW called OpenSim is captured in this Open Architecture Network (OAN) sponsored competition. The ARCH Network team is lead by John Brouchard, owner of www.archvirtual.com and a practicing architect in Madison, Wisconsin. The project description entails providing safe access to Trestles, one of North America's most celebrated spots to surf in California. Currently, over 100,000 people each year follow informal trails through wetlands and over active train tracks to gain access to the surf breaks at Trestles. These impromptu manmade paths present a safety hazard with passing trains and threaten the fragile ecosystem of Trestles.

Figure 25 Trestles Site Plan. Image courtesy of http://www.openarchitecturenetwork.org/node/6417/resources

In response, a coalition of concerned groups organized by the volunteer non-profit organization Architecture for Humanity, are launching "Safe Trestles," an open-to-all, two-stage design competition to create a safe pathway to serve surfers, the local coastal community and day visitors to San Onofre State Beach. This coalition was looking for cohesive designs that eliminate the danger of crossing active train tracks, help to restore wetlands that have been damaged by the present path, preserve and improve vistas, and offer education about the history of the site and the beach marsh environment. The new path should ensure continued access to the resources by all members of our community and adhere to Americans with Disabilities Act (ADA) standards.

While placing no limitations on the originality or imaginativeness of design ideas, OAN are looking for tangible low-impact solutions that can actually be built at a future date. Ideally, the winning entry will be sensitive to the remote and undisturbed nature of the area—providing safe access without compromising the pristine environment and views of this rare example of natural Southern California coast.

Some of the people working in this collaborative effort did not have a background in architecture, but did have experience with the tools of OpenSim. In the words of one of the participants,

> "...the future submission will be the end result of a group of individuals collaborating using open tools and open methods. With the exception of a visit to the site, the entire design process was conducted over the Internet. The group has been open to anyone who believes in developing the collaborative process. If the design from this collaborative effort is chosen for the second round of competition, new members will be welcome to join the team because it is our goal to simply produce the best possible design."[48]

Much of what this participant has said runs parallel to the underlying goal for this D.Arch project. Although participants and project type differ greatly, the idea of collaborating together on a design from remote locations utilizing the

[48] http://studiowikitecture.ning.com/profiles/blogs/final-powercharrette-help?xg_source=activity. (accessed April 8, 2010).

Internet is at the core of both experiments. The tools and functionality of a VOW platform are important to projects of this nature. The mix of casual users and professionals like Brouchoud take the experiment of collaborative design in an entirely new direction because of the integration of non-architects or persons with an architectural background. In terms of organization, the project lead has to be an architect or someone with an architectural background for several reasons.

- The project requires an architectural installation
- The project requires an architect's specialized knowledge concerning ADA accessibility, parking and bathroom requirements
- Graphic presentation requirements are specific

The Trestles project accomplished what my hypothesis is currently set up to test in Blue Mars; that is successfully collaborating on a project where the designers are solely gaining feedback in an online environment.

New Cowboy Stadium

Figure 26 Cowboy Stadium in progress construction photos. Image courtesy of http://www.tidbitsaday.com/tag/nfl

A more recent project developed is one accomplished by the architectural firm HKS scheduled to be completed in 2009. John Gaudiosi wrote the article and conducted the interview with principals and architects at HKS who worked on accomplishing the project for the new Dallas Cowboy's football stadium. HKS is also busy designing the Indianapolis Colts' $500 million stadium, and the Liverpool, England Soccer Stadium, which is still in the planning process.

Gaudiosi writes:

"As Epic has improved on its Unreal technology, HKS has continued to build its own custom tools that allows its in-house team to translate the 3D models of its building projects seamlessly into the UE3 world, getting the textures and lighting right. Carmichael said that over the next 18 to 24 months, as the company integrates the new Autodesk REVIT technology

> across all of its projects (this software translates 3D models into 2D drawings), UE3 will be used for real-time visualization for every building. Over the next few months, 10 HKS employees will be using UE3 technology. Carmichael said the goal is to have all 200 design presenters using UE3 for pitch meetings within two years. HKS is currently working with NVIDIA and Intel to bring PC Express 2 into the fold, which will give Carmichael and his team system memory as well as video memory to bring these complex buildings to life."

From Bryan Trubey:

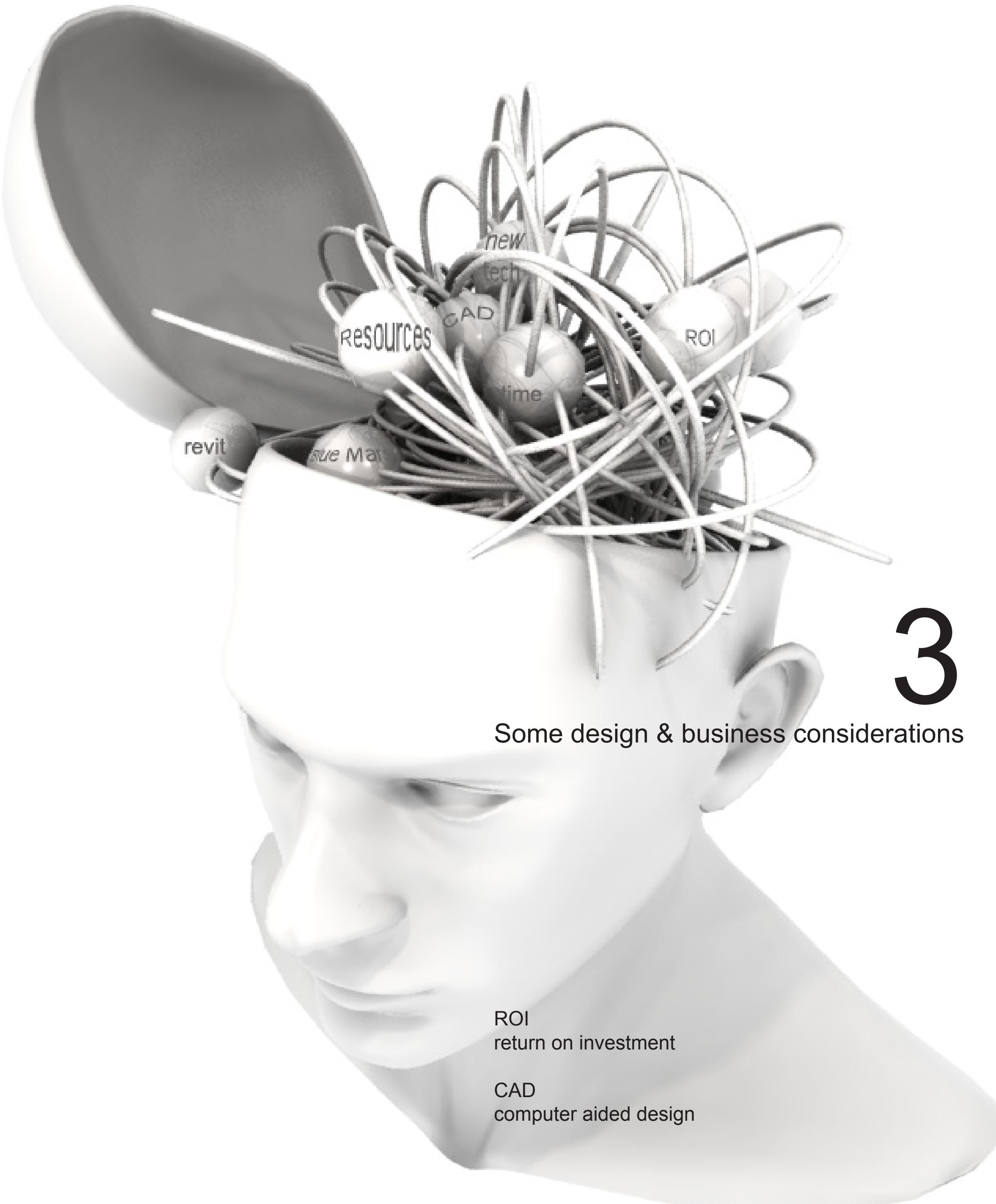
> "There's not much comparison between what we're doing with Unreal now to how we used to show clients' projects before," said Bryan Trubey, Principal and Senior Vice President, HKS. "It's like comparing a Model T to a space shuttle. We can show so much more in a really comprehensive way so the client can understand what they're getting, and the message the space is trying to give to anyone who has the fortune to be in it later when they're built. There's just no way to do that as effectively as with Unreal technology."[49]

[49] Gaudiosi, John. "Unreal Engine 3 Brings Architecture to Life," January 2008, http://www.unrealtechnology.com/case-studies.php?ref=cowboys-stadium

Figure 27 Work in Progress shot of FC Dallas Soccer Stadium in Unreal Engine. Image courtesy of http://www.archengine.org/

HKS began using the game engine "Quake" around late 1997 but switched to the "Unreal" gaming engine developed by Epic in 1998 and has been building their designs using the 3D engine for 11 years (and counting). HKS had the resources to develop such a futuristic vision of services which cost them millions to develop. Foster + Partners is another architectural firm that utilizes 3d game engine technology to visualize their projects. Sadly, I learned that due to the economic downturn in 2009, much of the staff that developed this technology was let go.[50]

[50] Bill Hethcock,"Area architects deal with job cuts," *Dallas Business Journal*, November 1, 2009 http://www.bizjournals.com/dallas/stories/2009/11/02/story5.html, accessed November 26, 2010.



3
Some design & business considerations

ROI
return on investment

CAD
computer aided design

Chapter 3
Integration of Design Considerations & Working with Blue Mars

3.1 Human Resources

Hiring a recent graduate or a student intern usually means "I can pay you about $9.00/hour for fixing drawings for me." This is a tactic that I know a lot of firms use on student interns. Although a student intern is at the bottom of the corporate ladder, they have valuable skills which are under-utilized or not used at all for the first couple of months. But this is expected because they need to be re-trained for the office environment.

It also forces the appropriate use of architectural interns. Why bother learning 3D software programs if the only function is to produce a static image or pre-rendered animation for your client? Programs that allow 3D spatial data to be converted to two-dimensional data is absolutely wonderful, but it doesn't engage the client.

3.1.2 Physical Resources

How does architecture help virtual architecture and vice-versa? For starters, digital information as we all know today is stored on a hard drive. A server contains many hard drives and can share the contents of those hard drives with anyone who has access to the server. Where are servers stored? Easy answer; in specially designed buildings that require greater levels of consideration concerning HVAC, telecommunications, mechanical, structural, electrical and security needs than your typical mid-rise office. Internet service providers (ISP) are just one type of industry that demands these kinds of buildings.

A server farm could easily cost hundreds of millions of dollars. In May of 2009, it was announced that Apple Inc. would be spending close to $1 billion dollars over the course of 9 years to design and build their own server farm in North Carolina.[51] An architectural firm can charge up to 20% of the construction cost as a fee. Breaking down a billion dollars over the course of 9 years, that's roughly $111,111,111.00/year, and then divide that another 12 times to see the monthly intake which equates to $9,259,259. Taking 20% of that would generate over $1.8 million a month as income for the architectural firm. As the demand for communications and online storage grows, the architecture, engineering and construction (AEC) industry will need to respond accordingly.

[51] Michael Hickins, "Apple Building a $1 billion Server Farm For What?," *Bnet.com,* May 27, 2009 http://industry.bnet.com/technology/10001895/apple-building-1b-server-farm-for-what/ (accessed January 20, 2010).

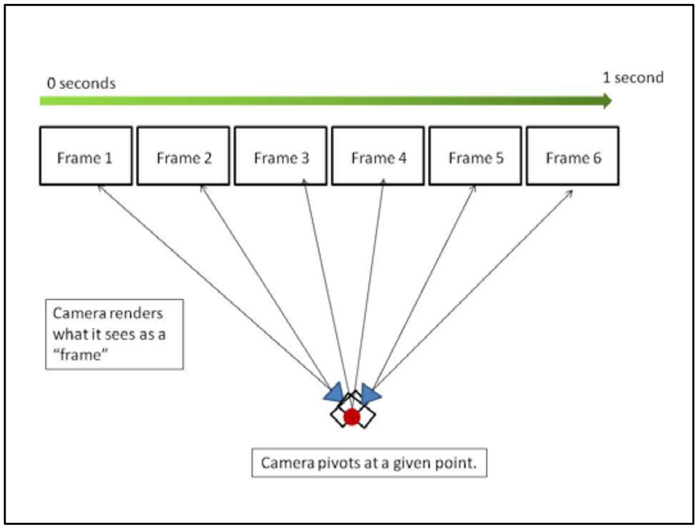


Figure 28 Frames per second (FPS) explained. FPS shown as an example is six.

In the immediate context of what is needed to participate in an MMOW, the hardware resources vary. For simple MMOW's, any standard or high performance laptop will do. For something like Blue Mars on the other hand, a computer with a high end graphics card is needed to run the advanced graphics generated by the CryEngine2. In general, a gaming engine has a few advantages over the typical animation or 2D rendering. Architectural renderings are 2D static images that capture the general look and feel of a space or elevation but can take several hours to render. Cameras within the 3D model application are restricted to capturing only one image at a time unless a camera path is added to produce an animation. 3D game engines, on the other hand, have the capability to represent a virtual environment in real-time and allow its user to navigate the virtual environment as if in the real world. It's like an interactive animation without a fixed end time.

The other benefit of using a 3D game engine lies in rendering time. 3D game engines are graphics processor unit (GPU) intensive. A high end GPU running a 3D gaming engine application can render over 100 frames per second

(FPS). Without the additional use of special plug-ins and software, Autodesk's VIZ, 3D Studio Max or even Maya are only capable of rendering one frame at a time by comparison.

When in a video game, the camera view most likely to be reflected is the first person perspective—where your eyes are the camera. While standing in one point, you can actively turn, look and move in any direction. Whatever's being captured by the camera in that turning motion is constantly being rendered by the gaming engine. Everything in your field of view is broken down in to "frames" by the camera and GPU within the scene, as shown in figure 27. The term "scene" is also interchangeably used with environment. The environment will usually consist of static or interactive objects like vegetation, buildings or other characters. Each frame has a new perspective and new elements in it which the GPU is constantly updating. Instead of rendering one image at a time, a gaming engine can render multiple images per second.

The start-up cost for software purchase will run close to $17,500 (US); licensing for the CryEngine 2 is comparable to that offered by their competitors at Epic Game Developers. AutoCAD and 3D Studio MAX would cost roughly $7500 total, if purchased together.

Being able to interact within the virtual environment and decreased rendering time are the most valued aspect of using a 3D game engine over the traditional static renderings done by computer modeling software and their respective renderers.

3.1.3 Ways to record feedback

If online design collaboration amongst architects and architectural students is to take place in a MMOW, then one must also look at how the public views this information. An architect must be present to explain his or her work in real life, sometimes even defend it. In the virtual world, architects are able to discuss the design concept with many different people from varying backgrounds, keep a chat log of what was discussed and leave behind note cards, messages and even program artificially intelligent bots who continuously disseminate information to visitors about the design. Means for recording such data are critical tools during the design process because it allows one to go back in time and review what was said and who had said it. This can all be done within either one or two different applications.

3.2 Early trial

Bill Brooks, one of three principals at Ferraro Choi & Associates (FCA) and his esteemed colleagues had put forth an effort in 2009 to catalogue everything in their office-- the amount of energy star appliances they have to the amount of daylight each room receives—in hopes of getting their office LEED certified for commercial interiors. While on practicum, we met every other Thursday to discuss our findings and report our progress. In early April I had made a suggestion that the office be “digitized”. The project would not only provide me with a small case study to explore Blue Mars with but it could also be used as a marketing tool for FCA. The 3d model being built of their office is meant to be placed on their homepage as an example of how they've embraced sustainability. Ideally, as a user navigates their way through the office's virtual environment they'll be able to identify the manufacturers, materials and energy consumption of each component within the office. One could argue that this could be done statically with a simple office photo of each area with call out bubbles that pop up to describe each component, but it doesn't immerse the user into their world as completely as walking through the virtual office.

FCA's virtual office can be a place for current and future potential clients to congregate. Architectural offices around the world have embraced the internet and have posted their projects, firm bios, contact information and other useful information as a way to promote their firm. Having an interactive virtual office on your homepage really sets you apart from the rest of the architectural firms out there.

3.2.1 Procedures

Figure 29 FCA office lobby rendering - 45 minutes to render

Permission from Ferraro Choi & Associates was granted to re-build their office in a 3d environment so that I could test Blue Mars's compatibility with other programs. Unfortunately, the necessary documentation and technical support were unavailable at the time so the project was never completed. However, a few test renderings were done to mimic the graphic quality of the CryEngine 2, along with a more detailed description for each phase of my procedures are contained in appendix J. I began building the model on March 27, 2009 and continued to work on it till May 13, 2009. Listed below is my work summary for hours spent at each phase which resulted in an 11MB file size. The model has over 200,000 faces and on average took about 45 minutes to render a single frame at 100% size on my laptop. Spec-wise, my laptop has an Intel 2.6 GHz Core 2 Duo CPU, 3GB of RAM, it runs 32-bit Windows Vista and has an NVIDIA 8400M GT graphics card.

Building & cleaning up drawings = 12 hours

Material . . . . = 8 hours

Lighting . . . .= +60 hours

Texture rendering . . . .= 16 hours

Total . . . .= +96 hours

Phases of Procedure

Figure 30 Testing procedures of first trial run**.**

Although this trial run had been a failure, another attempt was planned for the summer of 2009. A design studio was to be offered through the School of Architecture in which the students were going to be introduced to Blue Mars. While there, I hoped to retest using the procedures provided by the instructor on how to move between programs.

3.3 Education to business

From a student's perspective, learning how to utilize the technology that allows you to design in a 3D game engine platform will automatically set you apart from the students that don't. All students need to understand design (composition, function, aesthetics, etc) and how their designs will translate into a physical building (construction documentation, working drawings, etc). I don't disagree with that learning process, but as it turns out, a student will most often start off as a draftsperson under the supervision of another architect with more experience and then work his or her way up the corporate ladder -- that's just the traditional model which has never changed. Today, a basic understanding of any 3D modeling program, drafting program and even the LEED system are what firms are looking for in a student intern. However, I have also come to realize that architectural firms look for:

- Independent thinkers = those who can anticipate;
- Workers that don't require a lot of guidance;
- People that can manage their time;
- People that understand how buildings come together;
- Project managers;
- and people with a good sense of design.

In January of 2008 there was a conference held in Monaco under the title of IMAGINA: "The European 3D Community Event." This was a gathering of literally 100's of businesses involved in the using and making of 3D technologies. IMAGINA offers a venue where, once a year, professionals can meet to find out more about the latest state-of-the-art technological innovations available to serve design in architecture and other design oriented industries. Specialists, experts and trend-spotters were on hand to share their views on the current situation, presenting their opinions on a wide spectrum of relevant situations. These will encompass the application of 3D technology within their own structures, their own relationship with 3D technology and the manner in which it is used in architecture on a daily basis. Each speaker presentation is followed by a debate or a question-and-answer session. This year it was held again in Monaco and the next conference is being scheduled to be held there on February 3-5, 2010. One of the special events was a presentation entitled "An analysis of the Interactive Virtual Model." According to the presentation overview, key questions such as

- To which needs is the interactive virtual model responding?
- How vast is its scale of action?
- How is the interactive virtual model combining itself with today's decision and communication plans?
- Which resources are needed to guarantee its success?
- What kind of difficulties does the interactive virtual model encounter during its mission?[52]

Despite being held in Europe, this conference is international and also offers awards for the best use of 3D technologies in architecture, film, industrial design and gaming (to name a few). Students are also encouraged to attend.

By having the skill set of creating interactive environments, it opens up the doors of communication between project managers, project architects, construction administrators, principals and even clients. UCLA, Sci-Arch, Virginia Tech, University of Southern Mississippi and University of Sydney, Australia are among several colleges that offer courses teaching the integration of 3D game engines into architectural visualization. However, these courses are not requirements of their architectural programs.

Instead of relying on static images, architectural firms are relying on the models and interface that the student intern has created. This kind of

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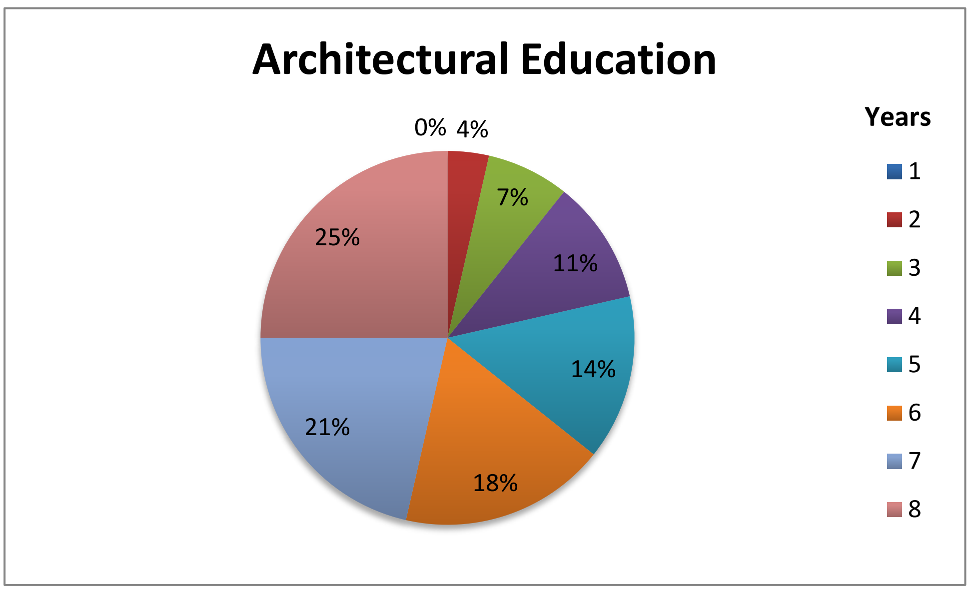
[52] "An analysis of the Interactive Virtual Model." *Imagina 2008,* http://www.imagina.mc/2008/content/Home/homeUK.php (accessed March 10, 2008).

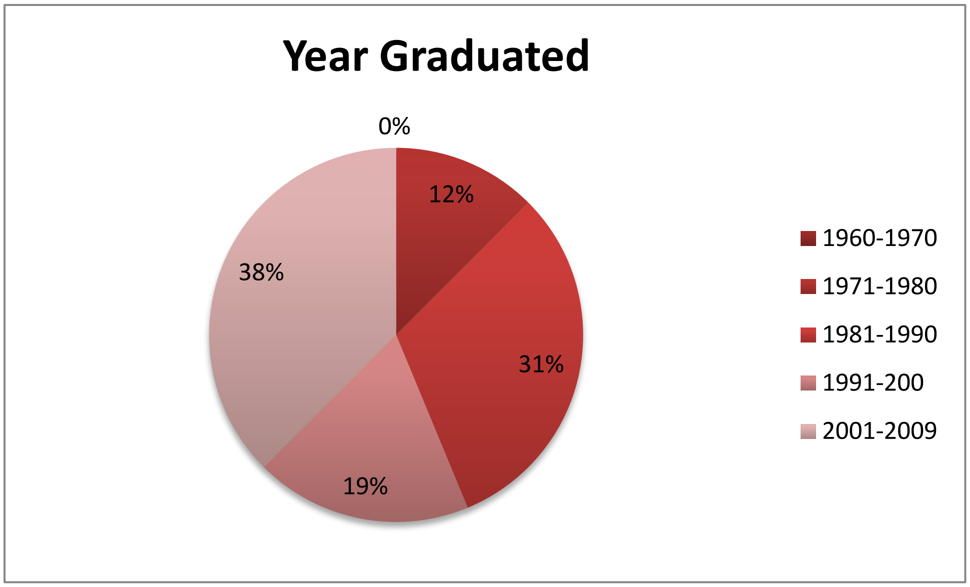
participation and communication has the power to break down traditional barriers that have separated the internal hierarchies of the architect's office. A Principal may or may not be interested in the typical work of the intern, but when building their designs with an interactive interface, it piques curiosities.

In the 15th week of my practicum experience at FCA, I conducted a survey containing questions that were technologically oriented. All employees with architectural training were recipients of this survey – 16 in total. These were the results:

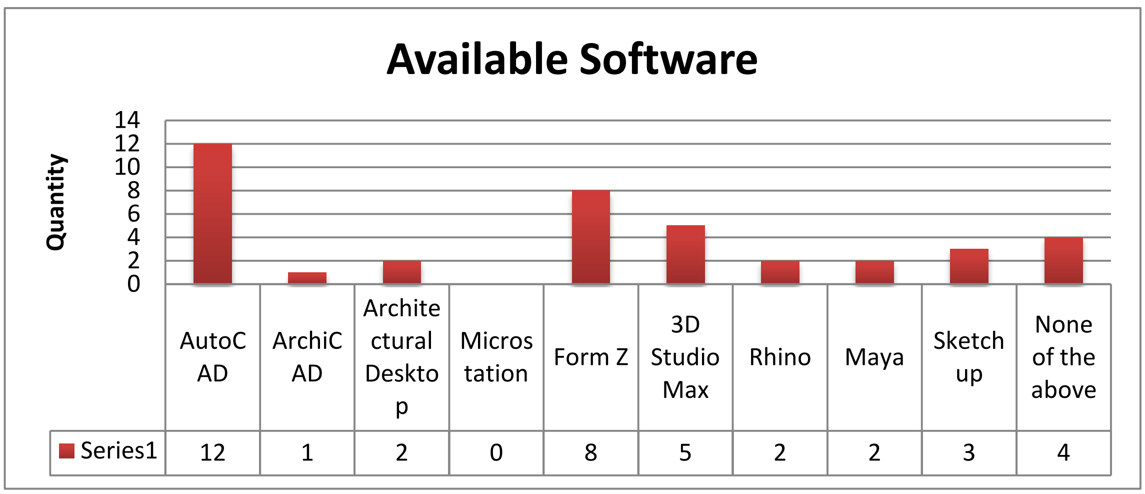


Q1. How many years of architectural education have you received?

This pie chart shows the amount of architectural education FCA's employees have received. What it doesn't represent is their years of experience each employee has accumulated at the office of Ferraro Choi & Associates.

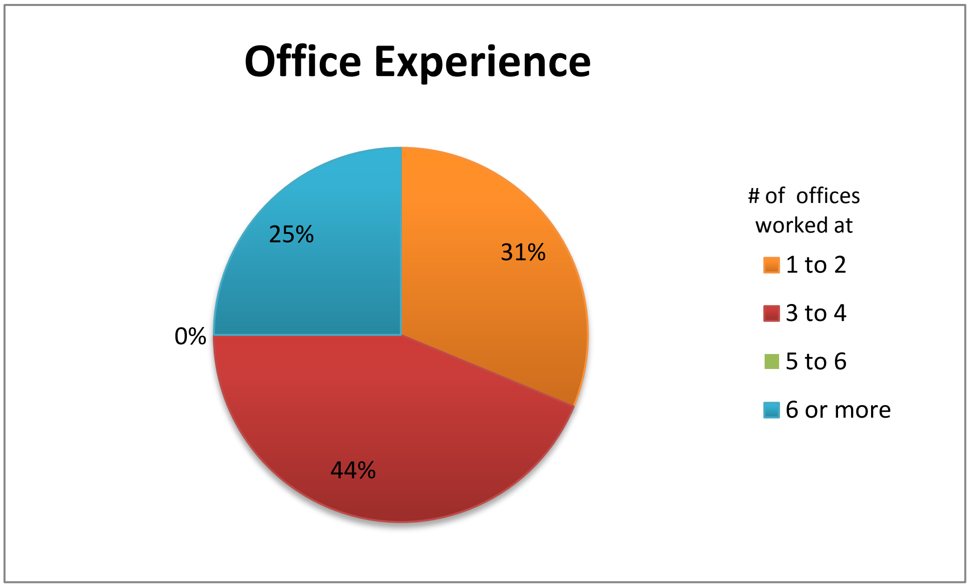


Q2. Circle the time frame that best describes your graduation date:

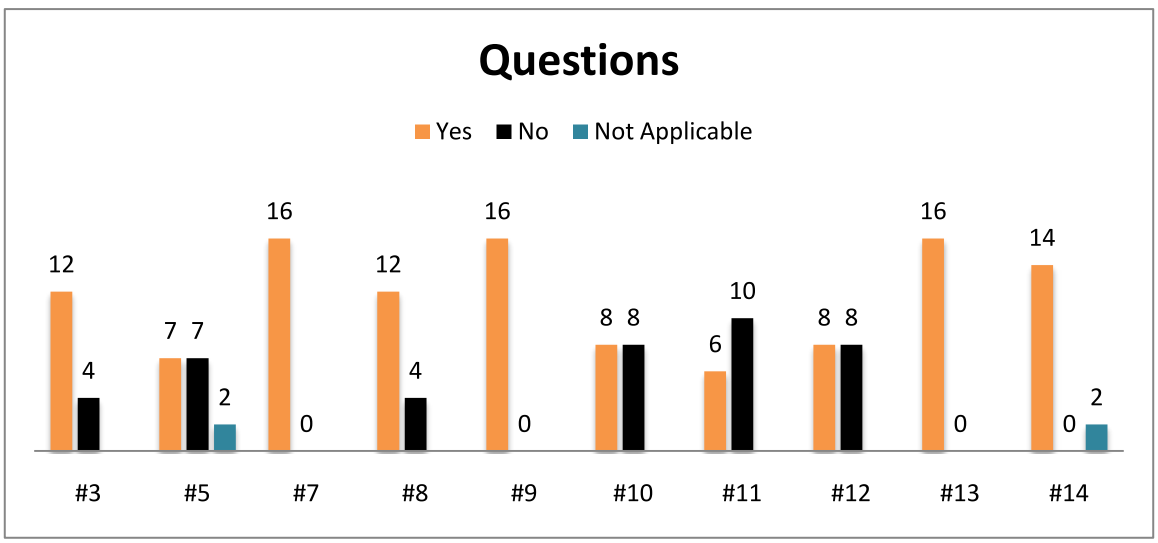


Q4. Which of the following programs were available at your institution? (Highlight all that apply)

Both charts on this page are the results of a paired question that allowed me to understand the integration of software usage during their years of architectural education. The number series at the bottom are misleading, although 16 people were surveyed, they were allowed to indicate all programs that were available at their institution.



Q6. How many architectural offices have you worked for thus far?



3. Were there any computer aided design courses available? (If <u>no</u>, please move on to question 6)
5. Were you encouraged to produce presentation graphics utilizing computer software?
7. Have the architectural offices you worked for embraced technology and computer aided design?
8. Have you been able to apply the computer skills you learned in school towards designing and producing documents in architectural offices?

9. Would you agree that creating presentation graphics consumes a great deal of time? (Presentation graphics = rendering, 3d model making, etc.)

10. In your opinion, would it be **useful** to have an in-house employee dedicated to producing presentation graphics so that your time could be better spent on solving design issues?
11. In your opinion, would it be **economical** to have an in-house employee dedicated to producing presentation graphics so that your time could be better spent on solving design issues?
12. Are you familiar with online world making games (The Sims & Secondlife)?
13. Do you think that clients and end-users would benefit from virtually touring the designs you've created before they've been built?

14. Do you feel that the interactive aspects of these games could be used to guide clients through a design and help them better understand the quality of that space?

Questions 3 and 8 were important because they provided a glimpse of the transition of software usage between school and profession, while questions 10, 11, 13 and 14 zoomed in to the apparent opinion of the use of virtual walkthroughs.

The people interviewed provided a dynamic range of results because of their diversified experience in the architectural profession. It was important for me to establish this so that I could begin to understand the level of difficulty an office would have in accepting a potential employee or separate company who has the knowledge of providing the service of building interactive virtual environments. FCA's office agrees 100% that the end-users would benefit from virtually touring a final design before it's been built but is skeptical of the economical benefit involved.

Proving those benefits are very difficult. I also feel the same skepticism, and think that the only real benefit of virtual walkthroughs will yield a kind of end-user satisfaction. Another problematic issue lies in the design process itself. Architectural firms aren't taught how to organize individuals with the ability to create 3d models. The main focus of a project team is to deliver a sound design that can be built. Having an individual begin modeling during the final stages of the design stage may actually become problematic. The sooner the modeler understands the design intent, the better the outcome.

From the client's point of view, their level of expectations for graphic representations will also be higher. Although the benefits of having an interactive walkthrough are numerous, the architect must be extra careful to not misrepresent his or her designs. For example, I had the privilege of working with the project manager and project architect on developing day lighting analyses for a new IT building being planned for the UH Mānoa Campus. The design called for horizontal external shading devices. It was a difficult task to coordinate design changes because they occurred so frequently. Not only was I required to build a digital 3D model, but I was also expected to manage it across two software programs. My personal slip up happened at one of the in-house update meetings, there was a single horizontal fin missing at each floor level. I didn't realize that the design had been changed the day before and when the animation was played at the meeting, people noticed. This event illustrates one of the current problems utilizing digital 3D models; thankfully this problem was caught before any presentation to the client was made. Misrepresentation can have expensive and reputation damaging consequences if not monitored correctly.

Even then, projects that would use an interactive virtual walkthrough are hard to come-by. But there are examples of the service of providing walkthroughs utilizing a 3d game engine. In fact, there are precedents as early as 1998 according to a report done by two Virginia Tech students who wrote a document entitled "Virtual Office Walkthrough Using a 3D Game Engine."[53] They provided several examples of successful projects that utilized 3D game engines to create highly realistic virtual walk throughs. For their report they were testing the interoperability of a game engine called Unreal with a model they had built outside of that program (AutoCAD) and accomplished what I was unable to do with CryTek's CryEngine2.

Table 1
List of projects compiled by Virginia Tech students.

Year	VE Project	GDK	Developer	Description
1998	Virtual Florida Everglades National Park	Unreal	Victor DeLeon	A project to educate the public and also promote ecological awareness.
1998	Notre Dame Cathedral of France	Unreal	Digital Studio	Funded by UNESCO. Demo can be downloaded at http://www.vrndproject.com
1999	Long Island Technology Center	Unreal	Perillith Industrielle for Rudin Management	
1999	Heartland Business Center	Unreal	Perillith Industrielle	An office complex in New York.
1999	Hypo Vereins Bank	Unreal	Perillith Industrielle	Virtual bank in Germany.

[53] Mohd Shiratuddin, Fairuz & Walid Thabet. "Virtual Office Walkthrough Using a 3D Game Engine." Paper published online through *Department of Building Construction at Virginia Polytechnic Institute and State University*, (2002):15.

2000	Virtual Graz of Austria	Unreal	Bongfish	Gaz is the second largest city in Austria. Funded by UNESCO
2000	Virtual International Space Station (VISS)	Unreal	NASA Langley Research Center Spacecraft & Sensors Branch	
2000	Cambridge University and Microsoft Science and Technology site in West Cambridge	Quake 2	Martin Centre for Architectural and Urban Studies	Part of a project on using electronic communication between building's architects and their end-users
2000	CAVE Quake 3	Quake 3	Visualization and Virtual Environments Group, NCSA	A CAVE system based on the Quake 3 Arena engine.
20001	CAVE UT	Unreal Tournament	Department of Otolarynology, University of Pittsburgh	A CAVE system based on the Unreal Tournament engine.

Today, for medium and smaller sized firms, similar technologies are within reach and thankfully don't cost as much to develop or implement. Through the research I've done, I'd say it's taken a little over a decade for this kind of interoperability and interactivity in programs to ground itself in the architectural profession. Statistically, larger firms and firms that do exceptionally well financially have been able to support special departments for research and development into other sectors of the architectural profession; i.e., software, materials, modules, etc. What's leveling the playing field in terms of offering services today is the speed of technology and those that have learned how to use it properly.

Looking at the client-architect relationship, architects are sharing their work with the immediate client based audience; with a project larger in scale, it's intended to meet that same audience, but be shared publicly. Massive urban development projects and large community centers are two such examples. Large and small scaled projects built within the 3d environment are meant to take the place of physical models which are extremely time consuming to build and will never provide a first person experience like the one being discussed in this paper

If you think about it, universities and select Schools of Architecture are really the ones churning out the people who utilize today's technology. The chart below is a comparison of interns with the basic skill set described earlier. One intern knows how to build a model using a 3d game engine technologies and the other doesn't. Intern A works on one project at a time while Intern B works on multiple projects simultaneously.

Table 2
Intern Comparison

Intern A	Intern B
Understands the nuts, bolts and details of the project	Knows the project history for multiple projects
Understands problems	Understands problems
Knows project history	Understands formal, spatial and aesthetic qualities
Interacts with consultants	Interacts with project architect and principal architect in charge

They are both assets to have and as their skills develop, they'll both evolve into two very different architects. One that is design oriented and one that is project management oriented. However, in regards to architectural schools in the US, if the skills we're learning aren't the ones being demanded, then the student is the one that takes a loss. Learning a program that they won't use in their future career is a waste of time and money. But, the inevitable truth here is that they are both needed in an architectural firm; for today and tomorrow.

In 10 years, doing virtual commerce in a 3D interactive environment will be as common as buying groceries from a supermarket. For architects, a website is essential because it's your digital portfolio. You can't expect potential clients to visit every building you've designed (unless they're filthy rich). Thanks to internet ready phones, netbooks and the like, it's impeccably easy to show someone what you've designed.

Virtual online worlds indirectly force random people (with varying backgrounds) to interact with each other more so than in everyday life, which is how Jon Brouchard of archvirtual.com was able to meet so many people interested in collaborating on the Trestles project.

3.4 Program Comparison and Integration methods

This portion will be presenting an overview of the major tools that Architects use to communicate their ideas. There will be information on currently available tools but I would also like to introduce a few other strategies that have not been explored yet at the School of Architecture on the UH Mānoa campus; mainly virtual online world making and its affiliated software. Most of these tools have a greater chance of showing up within the educational system specifically at the collegiate level because it's a place where new technology can be tested and shared.

Computer Aided Drafting

Computer Aided Drafting (CAD) has dominated the architectural industry for at least 29 years, a drip in the bucket when compared to the thousands of years Architects had been drawing everything by hand. So why has it taken us so long between each evolution to upgrade our own tools of the trade? One could simply answer, well, because it had worked for hundreds of years! That answer, however simple, is simply not good enough.

Each era had its restrictions and advancement problems, but for now I should like to focus on the period of 1982 to 2009 in this short brief. The first computerized program to become widely used and accepted as an industry standard was Autodesk's *AutoCAD,* initially released in 1982. Not every office was offering *AutoCAD* drawing services; it was considered a "specialty" because it wasn't a program that every firm used or knew how to use. However, as soon as Architects and most involved in the building industry understood the benefits of digitizing their drawings, they slowly made the transition.

About five years later, Graphisoft, another software company often viewed as Autodesk's rival in the CAD industry, made its first release of *ArchiCAD*. This new program offered the same 2D drawing capabilities as *AutoCAD* but differentiated itself by being the first program to do building information modeling (BIM). Being able to build a 3D model whose components could be understood and tracked through the course of its design was what made this program so appealing. Autodesk was not going to sit quietly while its competitor began pushing their limits of technology and later developed *Revit* to compete with

Graphisoft's *ArchiCAD*. It was again, a mere five years later that *Revit* was purchased and then re-released under Autodesk.

Today, the benefits of architects switching to AutoCAD in the early 80's pales in comparison to the benefits obtained by switching to BIM capable software. BIM offers:

1. Improved visualization,
2. Improved productivity due to easy retrieval of information,
3. Increased coordination of construction documents,
4. Embedding and linking of vital information such as vendors for specific materials, location of details and quantities required for estimation and tendering
5. Increased speed of delivery,
6. and Reduced costs.

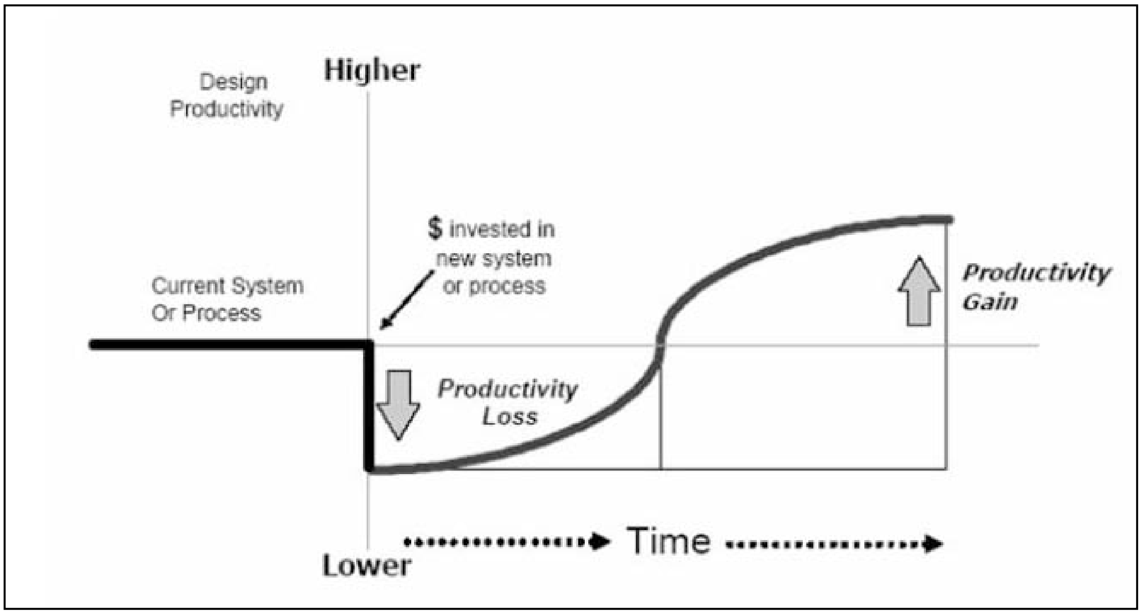


Figure 31 From Autodesk Systems white paper BIM's Return on Investment, showing how design productivity fluctuates after introducing a new software into the work flow.

In August 2004 the US National Institute of Standards and Technology (NIST) issued a report entitled "Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry" (NIST GCR 04-867 (PDF), which came to the conclusion that, as a conservative estimate, $15.8 billion is lost annually by the U.S. capital facilities industry resulting from inadequate interoperability due to "the highly fragmented nature of the industry, the industry's continued paper based business practices, a lack of standardization and inconsistent technology adoption among stakeholders".[54] What may or may not be included in this cost estimate is the time it takes to train employees to effectively use such BIM software. In discussion with Joe Ferraro, one of four major principals at Ferraro Choi & Associates, the topic of licensing agreements came up: "Not only is it time

[54] "Building Information Modeling," *Wikipedia, the free encyclopedia*. November 6, 2008, <http://en.wikipedia.org/wiki/Building_Informaion_Modeling> (accessed February 16, 2009)

consuming to train employees, it becomes an additional expense to renew the licensing agreement each time there’s an upgrade.”

On the academic level, BIM allows students to understand how buildings come together. Through years of academic training students are supposed to envision and communicate spatial experiences. Architectural drawings of plans, elevations, sections, 3D models and physical models are used to convey an idea. We verbally and visually have to take our clients through static representations of our visions for their buildings. With the advent of 3D virtual online worlds, we can now walk with them in real time through the designs we've made for them. Clients don't need to understand the construction process or look at otherwise confusing 2D plans and sections, instead, they can experience what it will be like to walk from room to room through a first person perspective (FPP). Just about any massive multiplayer online virtual world can allow this to happen, but not all of them can support large amounts of data without lag, produce real time photorealistic images or provide capitalistic opportunities.

The impact on firms just beginning to adopt new softwares like Revit can be visually represented in this return on investment graph. The input variables used were derived from a survey issued by Autodesk in 2003 to over 100 users. Autodesk was able to generate this graph by using a standard Earnings/Cost equation. They used the compiled data from the survey as the variables for the equation. A healthy return on investment as determined by the equation is 60%.

One of the Principals that Autodesk followed up with was Donald Powers of Donald Powers Architects, and to quote him he reports that “With about 20 projects completed in Revit, the firm has seen productivity gains of 30 percent in design and documentation, and a 50 percent drop in requests for information during construction[55]." Autodesk also made an estimate that it would take an average sized office 3 months to train and adjust to the new program. In Donald's case, it only took his firm 14 days. As you can see in figure 30, when Revit was first introduced to a firm with no prior experience, productivity took a dive. As time went on, the same firm was able to stabilize and then rise to a higher level of productivity. This graph is a good model of how firms react to new software- showing a before and after in terms of productivity losses and gains.

Investing time and money in learning a new software is what the industry calls an IT investment. Architects taking advantage of an MMOW like Blue Mars can either be a short term or a long term investment. By providing students with the opportunity to learn and use new software's while in school they won't need to be retrained once they've entered the workforce. This means productivity doesn't get drastically affected. Student interns and the recent graduate can make smoother transitions in to the office's working dynamic.

Time can sometimes be our which is why it’s important to keep up with software trends. Tools are being offered to save time and ultimately money over the lifespan of our industries. I’d like to suggest that technology also enables us to free ourselves from the constraints of a large workforce. Firms can downsize

[55] Donald Powers in an interview with *Autodesk* about ROI, 2007, http://static.ziftsolutions.com/files/8a7c9fef2693aa1e0126d282571c02c7 (accessed May 3, 2010).

and still function like a huge office of 600 people by adapting to programs that are made for smaller task forces. Who can afford to operate like a large conglomerate anymore when the economy is down?

It's often said that we are only as strong as our weakest link; therefore it begs the question, what is the weakest link in architecture? There are as many answers as there are firms, maybe double that amount. A major problem concerning adapting to new technology is using it effectively. As fast as software companies are churning out new programs, there needs to be a supporting network to foster transitions from platform to platform and version to version. The architect is left up to his or her own device to make his or her own transitions in the world of software and hardware. The workflows being offered in this document are meant for architects and architectural students to follow.

It has also been said that our generation can "do more" because we have all this new technology, and usually that phrase is taken in a positive light. However, doing more doesn't necessarily mean doing more good; it can also translate into doing more harm or even be turned into an insult by asking, *doing more of "what?"* Which leads me in to several questions I intend to propose in this paper. With all of this wonderful technology at our fingertips, what exactly is the architectural industry doing to apply it in practice? How will architectural firms change, if at all, in response to this technological age? What good or harm, can or will Architects do with today's technology? Will the evolution of technology force the field of architecture to diversify its already complex list of services even further? These are the questions I hope to address in this document.

Productivity and software enhancements are crucial to firms these days; those that have adopted a mindset to keep up with the trends will be reaping the benefits of their proactive approach to technology. The survival for architectural firms depends on their ability to adapt to the changing needs of their clients as well as the global economy.

Up until 2007, most of these technologies were just an idea. But now, they're right at our door step. VOW's and MMOW's offered us a way to communicate and collaborate in a 3D environment in real time with a fair amount of detail. I feel that if I didn't include some kind of analysis on the emergent software today, I would actually be lowering the credibility of my document. So today I'm presenting 5 programs which I predict will rapidly change the architectural industry by 2012.

3.5 Autodesk Project Newport + City Engine + City Scape + Urban Circus + Reality Server

These programs are inspired by game engines, supporting real time rendering over the internet, are powerful presentation tools, are made to work with industry standard file formats, running on game engine technology -or- are being paired with it and intended to be used during design process. These aren't MMOW programs, but are tools to be used in the creation of VOW's or independent projects meant for physical actualization. When combined, they achieve what Blue Mars is already accomplishing as an individual software solution. These programs are not the best solutions for small projects (in terms of budget and scale) because the software requires additional training and extensive hardware with yearly maintenance fees. Figure 32 and 33 lists a side-by-side comparison of all the programs I reviewed.

City Engine and City Scape are programs that people can buy licenses at $17,000 and $4,500 respectively. Both function as generative city modeling tools, which means there is a set of predefined geometries that can be generated in hundreds of different combinations to fit within the parameters and boundaries of urban layouts that you either import or create yourself with their street generation tools. Urban Circus is a company that provides the service of creating generative city models. Project Newport is Autodesk's attempt at integrating game engine technology in their CAD programs. Reality Server provides the service of server side rendering. Revit, aforementioned earlier is a Building Information Modeling program that architects use for drawing production and other documentation.

All of these programs are powerful tools individually but when combined, they offer the same kinds of features that Blue Mars already has built in to its interface.

KEY	
YES	
NO	
Unsure	

Comparitive chart of features

	City Engine	City Scape	Urban Circus	Project Newport	Reality Server	Revit
Real time rendering	YES	YES	YES	YES	YES	NO
EASY Parametric road modeling	YES	YES	NO	NA	NA	NA
Parametric building modeling	YES	YES	NO	YES	YES	YES
Rule based modeling	YES	NO	NO	YES	NO	YES
Stand alone license available to purchase	YES	YES	NO	Unsure	YES	YES
Offers programming partnerships	YES	YES	NO	YES	YES	YES
Offers professional training and modeling services	YES	YES	YES	YES	YES	YES
Mac support (Native)	YES	NO	Unsure	NO	NO	NO
Linux support	YES	NO	Unsure	NO	YES	NO
Windows support	YES	YES	YES	YES	YES	YES
Collaborative multi-user support	Unsure	YES	NO	NA	NA	NA
Collaborative multi-user communication (Native)	Unsure	Unsure	NO	Unsure	YES	NO
LOD support	YES	YES	YES	NA	NA	NA
Use of GIS data	YES	YES	YES	NA	NA	YES
Map-controlled city modeling (from images)	YES	YES	NA	NA	NA	NA
Vehicular simulation	YES	YES	YES	YES	NO	NO
Pedestrian simulation	YES	YES	YES	YES	NO	NO
Construction simulation	Unsure	Unsure	YES	YES	NO	YES
Real time online communication tools	NO	NO	NO	NO	YES	NO
Ability to export 3D files directly to web pages	NO	NO	NO	NO	YES	NO
Chat functions (Native)	NO	NO	NO	Unsure	YES	NO
In game/real time modeling	NO	NO	YES	NO	YES	NO
Chat functions/Comment fields	NO	NO	YES	NO	YES	NO
Partnerships?	YES	Unsure	YES	Unsure	YES	NO
Import						
SHP	YES	YES	Unsure	NO	NO	NO
DXF	YES	NO	YES	YES	Unsure	YES
OBJ	YES	NO	YES	YES	YES	NO
OSM (openstreetmap)	YES	Unsure	YES	YES	YES	YES
Images (.jpg, .tif)	YES	YES	YES	Unsure	YES	NO
Collada	YES	YES	YES	YES	YES	NO
3DS	YES	NO	YES	Unsure	YES	NO
TIN (triangulated irregular network)	Unsure	YES	YES	YES	Unsure	YES
FBX	YES	YES	YES	Unsure	Unsure	NO
FLT	Unsure	YES	Unsure	YES	Unsure	NO
DWG	NO	Unsure	YES	Unsure	NO	YES
MI (Mental Images)	YES	NO	Unsure	YES	YES	Unsure
CGF	Unsure	Unsure	YES	Unsure	Unsure	NO
SKU (SketchUp)	NO	NO	YES	NO	YES	YES
MAX	NO	NO	YES	NO	YES	NO
RVT (Revit)	NO	NO	YES	YES	NO	YES
ArchiCAD	NO	NO	YES	NO	NO	NO
12D, MX, Dynamite	NO	NO	YES	NO	NO	NO

Figure 32 Comparitive chart of software features

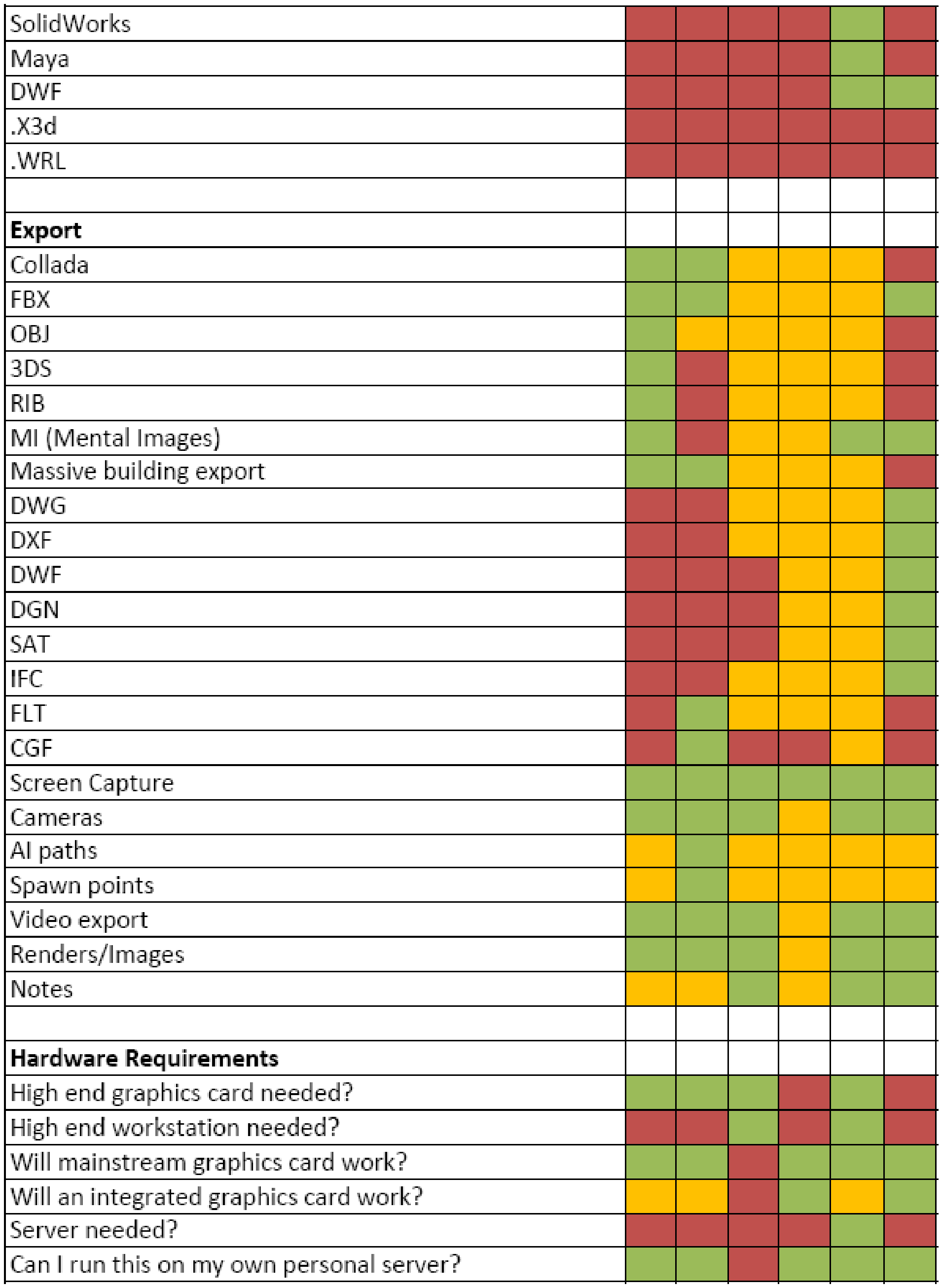


Figure 33 Comparative chart of software features continued

pilot.project.1

pilot.project.2

4

Collaborative design projects

Pilot Project 2 YouTube Links:

Group Presentation A part 1
http://www.youtube.com/watch?v=Wnk6XbIIK6o

Group Presentation A part 2
http://www.youtube.com/watch?v=XJ22ZhILeTc

GroupB Presentation
http://www.youtube.com/watch?v=Uoga-IFL2Xw

Group B feedback
http://www.youtube.com/watch?v=eNoCUDbC18M

Sneak Peek
http://www.youtube.com/watch?v=NFNcRjiw6IU

Chapter 4

Collaborative Design Projects in Blue Mars

Learning from 2009 Summer Studio + 2009 Fall Elective Course

Thanks to the architectural summer studio and fall elective course held in 2009 at UH Mānoa School of Architecture I was able to: 1) import several projects made in 3ds Max to the City Editor provided by Avatar Reality; and 2) generate documentation for students that outlined specific work flows of moving models to the Blue Mars editors. A running journal was kept throughout the entire summer session to chronicle the many obstacles and "a-ha" moments that occurred during the class (see appendix B). The main purpose for auditing the summer studio was to help me determine how to help other architectural students and architects utilize the powerful tools distributed by Avatar Reality. The fall elective course allowed me to distribute the documentation developed during the summer to the students attending the elective. Both courses were run by the same instructor.

The summer project required students to replicate a well known Korean garden situated in South Korea as an environment that would play host to the students' designs. The project program was inspired by the 2009 Gwangju Biennale scheduled to be held in September in Seoul, South Korea of that same year. The studio ran Tuesday through Friday from 1:30 to 4:30pm (Hawaii Standard Time).

The fall elective course required students to take an old studio project and rebuild it in the City Editor in hopes that they would refine their old designs. The class was held once a week for about 1.5 hours.

After the summer studio was held, it was clear that without the help of clear documentation with recommended solutions to common and recurring errors, students would be unable to make any progress. The mixed skill level of program knowledge of each student as well as existing hardware/software conflicts added another level of difficulty to the class and hindered students' ability to learn. The solution for this was to develop documentation and then disperse it.

Based on the documentation developed (see appendix A), an assumption that the students in the fall elective would have progressed further than their predecessors was made. The assumption was wrong. The next missing element was tutelage—without help, the documentation is rendered useless and there would be no progress in design development. Other factors that inhibited students progress included few meeting times, high expectation levels and low levels of assistance. Although students were given hands on demos, there was no follow up time for troubleshooting problems. The documentation developed over the summer covered the basic steps of importing and exporting but didn't cover environment detailing.

The result of observing the strengths and pitfalls of both classes allowed the development of a more structured system to be formed for the use of teaching a class of architecture students on how to use Blue Mars. The system being proposed includes written documentation for support when face to face troubleshooting is unavailable and several introductory sessions that go over the aforementioned documentation so students know how to use it. With this system in place, students being introduced to Blue Mars and its editors will be able to progress in the areas of discussion, design and collaborative teamwork. This framework was absolutely critical to establish before taking on the two pilot projects.

Introduction

To better understand how collaborative design in a virtual online world (VOW) can improve design and communication amongst architects, we need to look at the existing method of collaboration which is traditionally done face to face (F2F). Two pilot projects were conducted in 2010 in order to gather the information needed to support the hypothesis and to test the efficacy of a teaching strategy being developed.

Information pertaining to architectural education will inform those unfamiliar with the requirements, expectations and skill sets a student of architecture must acquire before beginning a career in architecture.

Schools

In the forties, a man by the name of Joesph Hudnut compiled a list of essential subjects an architect needed to be proficient in; by his calculations it would take 22 years to learn everything on that list.[56] Time has proven that as the years roll by, architects assume more and more responsibilities. Architects

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[56] "Architectural Education." Association of Collegiate Schools of Architecture http://www.acsa-arch.org/adaview.aspx?pageid=126, (accessed January 2010).

understand how to adjust to increasing complexities both in and out of the field and office. Finding a way to coordinate clients, consultants, staff and other resources has been eased by the rapid advancement in computer software and hardware.

The competitiveness of the earliest schools of architecture resulted in the development of separate and autonomous schools or colleges of architecture; departments and programs within graduate schools; schools of art or design; schools oriented toward engineering, technology, or sociology; schools of urban planning and design; and, more recently, schools of architecture with programs for environmental design, landscape architecture, historic preservation, interior design, digital fabrication and rapid proto typing.[57] Currently, there are 154 NAAB accredited schools in the United States that offer professional degrees in architecture.[58] The vast demands of society and the profession, and the corresponding range of programs dealing with these issues, provide the entering student with an excellent opportunity for finding the program best suited to his/her talents and interests.[59]

Like the Universities and professors of other similarly constructed experimental projects, I have also had to set up several ways for students to collaborate. Although smaller in scale, my project adds to the limited existing body of knowledge surrounding the use of Virtual Online Worlds in architecture

[57] Ibid.

[58] "NAAB Accredited Architecture Programs in the United States," *National Architectural Accrediting Board*, 2010, http://www.naab.org/architecture_programs/ (accessed November 11, 2010).

[59] "Architectural Education." Association of Collegiate Schools of Architecture http://www.acsa-arch.org/adaview.aspx?pageid=126, (accessed January 2010).

studios. One of the earliest examples of remote collaboration involved sending and receiving messages via fax, e-mail and an early form of ftp file sharing. Five universities participated in this 'virtual design studio' in which students and faculty from MIT, Harvard, University of Hong Kong, University of Washington and University of British Columbia worked on designing a virtual village set in a traditional Chinese walled village called Kat Hing Wai.[60] The term Virtual Design Studio (VDS) was first coined by William Mitchell, a faculty member teaching at MIT in 1993.[61]

According to Wojtowicz, the cross collaboration between those five universities lead to the discovery of the following: 1) VDS collaboration varied with time and was not space dependent; 2) one-on-one e-mail contact was seminal and should be encouraged in the future; 3) more time was needed for design teams to mature and develop; 4) scanned hand sketches sent over the net were an excellent way to exchange initial ideas; 5) size of data storage and speed of access to that database were among the main problems—use CD ROM, video disc to ; 6) large collaborative projects create serious burdens for staff and faculty in terms of support and information management—hire a TA to solve this issue; and 7) the role of the design critic in the virtual environment also takes on a new twist by becoming an active editor and tutor.[62] The distance between participants is shorter, the project is smaller and the time given to

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[60] Davis van Bakergem, "Kat Hing Wai and the Electronic Red Line," in *Virtual Design Studio*, (Hong Kong: Hong Kong Press, 1995), 31.
[61]I Jerzy Wojtowicz, *Virtual Design Studio*, (Hong Kong: Hong Kong Press, 1995), 9.
[62] Jerzy Wojtowicz, James N. Davidson and Takehiko Nagakura, "Digital Pinup Board — The Story of the Virtual Village Project," *Virtual Design Studio*, (Hong Kong: Hong Kong Press, 1995),20.

complete it is a little more than a lot, however, the experiences and discoveries are remarkably similar to the ones those pioneering in the field of virtual environments have already made.

Looking back at this early case study done in 1993, and comparing it to what has been done today, almost 18 years later, the entire world now has access to an online agora of their choosing for remotely collaborating on any type of project. Of the seven recommendations proposed by Wojtowicz , points 3, 5, 6 and 7 are in my opinion the most critical to understand and implement on academic virtual collaboration projects.

The Design Studio

Architects first learn to design collaboratively while in the architecture design studio. The typical design studio has several defining characteristics: studio work is organized into projects of varying length - typically three to four weeks per project or when at the advanced level, a semester long project may be issued; the studio project will be complex and open-ended (which means there is no correct solution); the faculty assigning the project will set an expectation for the student to do an overall conceptual design, provide drawings or models, and at the end of the project - be able to defend it at a final presentation; students' designs will undergo multiple and rapid iterations; critique is frequent and occurs in both formal and informal ways (from faculty and peers); multiple topics are discussed during critiques and often occur simultaneously or successively - discussion topics may also be off-subject; students are required to study precedents both in and out of the studio to gain a better understanding of the context their projects are in; studio professors provide feedback in order to aid students process and design progression; and students use a variety of design media over the course of the project which can significantly support and improve students' insight and designs.[63] It should also be noted that the design process means nothing if it doesn't result in a design or an end product. It is necessary to analyze both process and product to determine the efficacy of utilizing VOW's in the practice of architecture—academically and professionally.

Figure 33 and 34 illustrates how first and second year architectural students enrolled in a design studio work. They are all given the same project but come up with very different solutions in the end. The first two years are devoted to allowing students to explore their own ideas so that they can develop their individual design skills. Figure 33 depicts the way students work when in an environment that they don't feel safe in. Figure 34 depicts the way students work after trust has been established amongst their classmates. Students are more sociable, eager to share their ideas and more open to constructive criticism from their peers.

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[63] Kuhn, Sara. "Learning from the Architecture Studio: Implications for Project-Based Pedagogy." *International Journal of Engaging Education* 17, no. 4 and 5 (2001): 349-352.

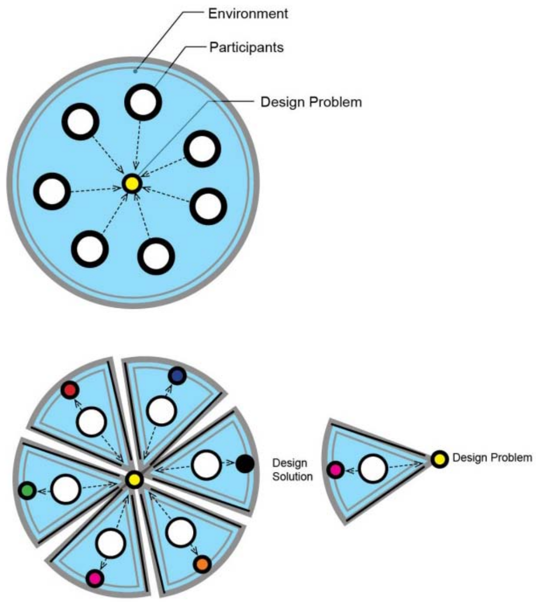

Figure 34 Not a trusted working environment.

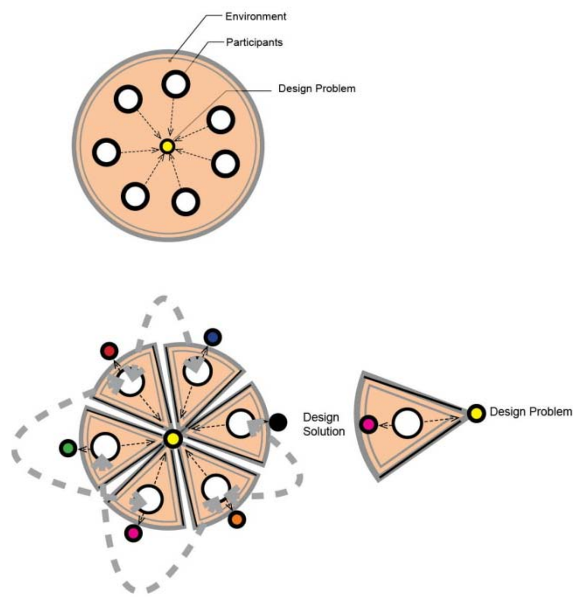

Figure 35 Trusted working environment.

Pilot Project Purpose

Pilot project 1 was conducted to prep and introduce a group of students to the proposed teaching material, suggested instruction methodology, measure the effectiveness of the teaching material, and test students' adaptability to working in a virtual online world (VOW).

Pilot project 2 was conducted to compare the collaborative design process and quality of design of two groups of students—one that was restricted to communicating and collaborating in a VOW and one that utilized the traditional face-to-face method of design collaboration. Student participants from the first pilot project returned to be the VOW study group (Group A), while two new student participants agreed to become the second study group (Group B).

Purpose for VOW Constraints

Constraints are imposed to replicate an extreme case of remote collaboration where the physical working environment can never be shared. The constraint allows for exploring one of the most interesting facets of remote collaboration; the idea that people can work together without having to be in a face to face environment. Requiring students to work with the prescribed communication and object creation tools also draws out more issues that need to be addressed so that appropriate responses can be implemented to improve the experience of working in a virtual environment.

4.1 Evaluation Methodology

The evaluation methodology for analyzing the instructional material of Blue Mars, draws from the structured framework proposed by Gabbard, Hix, and Swan (1999) for the design and evaluation of user activity in virtual environments (VEs). This evaluation methodology was used by George Drettakis, Maria Roussou, Alex Reche and Nicolas Tsingos during the creation of a custom VE tool for an Urban Planning firm whose project was to design some new public spaces for a tramway in the city of Nice, France.[64] Drettakis and associates were interested in studying and understanding the workflow of designing a novel VE tool that combines realism and interactivity while applying it to a real world project. The Architects and decision makers of this project were interested in using the interactive VE as an aid in decision making and brainstorming, as well

[64] Drettakis, George, et. al, *Design and Evaluation of a Real-World Virtual Environment for Architecture and Urban Planning*, vol. 16, no. 3 (Paris, France: MIT Press, 2007), 324.

as for a presentation tool.[65] Gabbard, Hix and Swan's evaluation methodology has been modified to suit the needs of this experiment.

In summation, their principle methodology includes the combination of a user needs analysis, user task scenario and usability evaluation. Figure 35 illustrates the procedure of refining the evaluation methodology.

A **user needs analysis** requires one to interview both users and end-users to determine a set of features and tools to implement in the proposed program.

A **user task scenario** is the “testing ground” or “project” for which the program can be used.

A **usability evaluation** comes at the end of the task scenario to determine the program's pitfalls, strengths and whether or not the tools need to be tweaked for improvement.

[65] Ibid, 321.

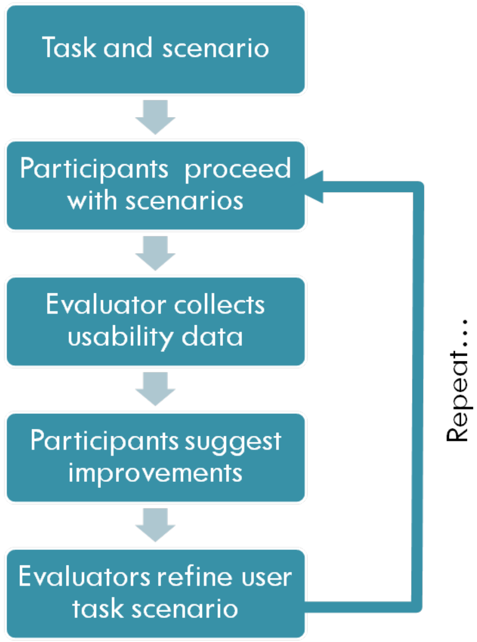

Figure 36 Evaluation methodology of work flow.

The user task scenario for pilot project 1 involved student participants to design collaboratively utilizing Blue Mars. The usability evaluation came in the form of a survey handed out after the completion of the first project (see appendix E for surveys). Only a user task scenario and usability evaluation was implemented since the results of a user needs analysis is negated by the fact that an existing MMOW like Blue Mars was used. The overall user interface and basic functions are preset and cannot be altered, however, the opportunity to create scripted entities does exist, but the creation of such is outside of my existing expertise. The specific tasks of students and project details can be found in appendix D.

The environment in which the user task scenario was tested in was within an academic setting, which is one of two ideal settings. The other ideal setting would be at the professional level getting actual architects of an architectural firm to collaboratively design using Blue Mars.

The goal of the first pilot project is to specifically evaluate the effectiveness of Blue Mars as a tool for design collaboration amongst architectural students in hopes that what is learned can be applied at the professional level.

4.1.1 Evaluation Instruments

Instruments used to evaluate will include direct observation, a post experiment questionnaire, and a post experiment group interview sessions. Meeting sessions within Blue Mars will be recorded by a program called FRAPS and then later edited using Windows Live Movie Maker. The questionnaire will be developed to identify the pros and cons of using Blue Mars as a tool for design collaboration, the user's perception of the effectiveness as a design tool, and their level of satisfaction during the collaborative practice. Some of the questions involve yes or no answers but the majority of the questions will require students to answer and rate their experience on a 1-5 likert scale or equivalent (see appendix E for survey).

Surveys and feedback from students will be incorporated in to the final recommendations about the ways in which practicing architects and those in pursuit of an architectural degree can go about using the virtual online world of Blue Mars as a design collaboration tool.

4.1.2 Participants

Participants for both pilot projects are students who hold graduate level status. Due to the highly experimental nature of the program, these students are the ideal candidates to be tested because of their; (1) ability to adapt to new software; and (2), their promising conceptual design skills.

Participants working with Blue Mars were expected to know how to use 3dstudio Max and Photoshop.

4.2 Pilot Project 1

Figure 37 Pilot project 1 location outlined in red. Both maps scaled according to scale graph. Images exported from Google Earth 2010.

The first pilot project was conducted to measure the effectiveness of the teaching material and instruction methodology as well as test students' adaptability to working in a VOW. Student participants were given laptops to use which were pre-loaded with all the necessary software needed to work on this project. The laptops ran a Windows based operating system (OS) since the gaming engine, as described in an earlier chapter, was not designed to work on any other OS. See appendix D for full laptop specifications and list of preloaded software used.

4.2.1 Project Brief

Student participants were given a project to complete in approximately seven weeks which required them to design a series of five fishing piers along the southern most inlet of Taquile Island,Lake Titicaca, Peru (see figure 36). The fishing piers would be used by both local fishermen and visiting tourists throughout the year. To ensure fish populations are maintained at a sustainable level, only one fishing pier would be allowed to remain active at a time by the local inhabitants.

A heavy emphasis was placed on developing a unifying set of architectural elements and architectural vocabulary for this project. Such elements did not have to respond to the site or local culture. Emphasis was placed on developing a style that could be repeated and re-configured, thus, eliminating the painstaking process of designing five unique piers across the bay. Participants were not allowed any face-to-face contact during the design phase of the project. Their primary means of communication were restricted to Blue Mars, Skype and TeamViewer.

Students were scheduled to meet twice a week for 7 weeks. The following is a general break down of the *proposed* agenda for each week:

- Week 1 = Introduction
- Week 2 = Going over software
- Week 3 = Going over software/Desgin
- Week 4 = Design
- Week 5 = Design
- Week 6 = Design
- Week 7 = Final Design and Presentation

This was the *actual* schedule:

Students met face-to-face in a small lecture room at the University of Hawaiʻi at Mānoa School of Architecture for week 1 and week 3 for 2.5 hours twice a week.

- Week 1 – Intro to project and software (face-to-face)
- Week 2 – Design and upload
    - Tuesday: Students/client walked around site
    - Thursday: First upload
- Week 3 – Trouble shooting
- Week 4 – Design and upload
- Week 5 – Design and upload
- Week 6 – Skipped 1 design & upload session
- Week 7 – Design and upload
- Week 8 – Final upload and presentation

4.2.2 Schedule

On the first day, students were given a handout with the project description, a brief introduction to virtual online worlds, introduced to Blue Mars and created accounts for both Skype and Blue Mars. It was decided that the first week would be dedicated to getting the students familiar with virtual online worlds and with the Blue Mars work flows. Prior to going in to the project, students were briefed on the project for 15 minutes and then required to sign a subject consent form which clears the way for the analysis and results to be published in the future while preserving their anonymity.

On the second week, students did a site visit in Blue Mars utilizing the procedures learned in week 1. On the second meeting session of that week, students uploaded their first designs. Students still had not discussed their actual design concept because they were still in the process of learning how to use the Blue Mars editors. After the second week had gone by, it was apparent that the students needed another face to face session to troubleshoot.

The third week was dedicated to going over how to fix the errors they encountered while working with the editors. Since I attended all meetings and lead most of the tutorials, there was no need to video record any of the meeting sessions. The rooms we used had a whiteboard, a projector and display set up so that the instructional material could be easily viewed and expanded upon. The whiteboard was used on the third week to illustrate one of the principles of modeling for a computer game. Students had to learn the fundamental principle of physicalizing an object for a virtual environment because without this type of specialized geometry they would be walking through walls and falling through floors.

The instructional material and work flow procedures were developed in almost a year in advance to implementing it in this pilot project. Please view appendix A for instructional documentation.

From the fourth week on, the remaining three sessions were dedicated to designing. On the eighth week, students gave a final presentation to a three person jury that included two architecture faculty and the Dean from the School of Architecture.

4.2.3 Data and development of coding scheme

The time allotted for each session was 2.5 hours. Some days we went over time and some days we ended early. Participants missed a session in the sixth week due to an overload of homework and additional projects from other classes. Figure 37 provides a detailed look at how the participants were accountable for their time.

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Week 7		Week 8	
Day	T 5-25	R 5-27	T 6-1	R 6-3	T 6-8	R 6-10	T 6-15	R 6-17	T 6-22	R 6-24	T 6-29	R 7-1	T 7-6	R 7-8	T 7-15	
Hours	2.5	2.5	1.5	1.5	2.5	2.75	1.5	1.5	2.5	2.5	2.0	X	1.75	1.0	2.0	
StudentA presentation	Intro		X	12 min	Troubleshoot		10 min	15 min	13 min	5 min	5 min		20 min	10 min	20 min	
StudentB presentation			X	17 min			15 min	10 min	16 min	10 min	5 min		15 min	8 min	20 min	
Client feedback			40 min	16 min			14 min	15 min	15 min	X	X		35 min	X	10 min	
Post discussion			30 min	48 min			50 min	55 min	77 min	34 min	75 min		10 min	40 min	25 min	
Upload	X	X	X	O	X	X	O	O	O	O	O	X	O	O	O	

Figure 38 Pilot project 1 combined schedule, attendance and discussion time.

Based on figure 37, students uploaded their designs a total of 9 times. On the eighth week, all 5 piers were present. Students had spent 7 sessions developing their ideas and the overall look associated with their concept. Figure 38 indicates the amount of uploads and whether it was successful or not.

Question	Student A	Student B
Was the material file created?	Yes – 9/9	Yes- 9/9
How many textures were missing?	None – 9/9	1 texture missing on week 7
Were any faces fractured on the model?	Yes - 1/9	Yes - 1/9
Was the model visible?	Yes - 9/9	Yes – 7/9
Was the model at the right scale?	Yes – 9/9	Yes - 7/9
Were there proxy issues?	Yes - 7/9	Yes – 6/9
How long did it take you to complete the converting process successfully?	Average = 12.3 hrs past deadline	Average = 16.7 hrs past deadline
Was the model uploaded on time?	Yes – 3/9	Yes – 0/9

Figure 39 Successful upload metric

Categorization of information pertaining to discussion topic and progression of work occurred after the project had been totally completed. Discussion time and the successful upload metric had been a running record from start to finish. After the project had been completed, a careful review of all the recordings had been made to categorize the major discussion topics at each session. The following categories and keys are indicated in the table below. Instead of considering every little utterance or recurring speech overlap, it was more important to identify the topic of discussion, whether or not it related to the project and whether or not it progressed the design forward.

Table 3
Code key for discussion topics.

Topic Code	Code	Description
Structural system	STS	Discussion of wood, concrete, steel or modular system properties.
Scale + dimensions	SC	Size of building members.
Proportion	PRP	Size of spatial volume and adjacencies.
Program	PRG	When participant has questions about required spaces.
Site	SIT	When participant makes a reference to existing vegetation or proposal of new landscaping, pathways, sun & wind direction, etc.
Location	LOC	When participant proposes different placement of design.
Building material	MTR	When participant discusses interior and exterior finishes (colors and material type).
Form	F	When participant makes a suggestion to manipulate exterior envelope.
Concept	CPT	When participant discusses inspiration and uses "it should look like..."
Clarification of idea	CLA	When participant provides a detailed explanation.
Rejection of idea	REJ	When participant says "no" or "it doesn't make sense to do that".
Acceptance of idea	ACC	When participant says "yeah, that sounds cool/good".
Revisiting an idea	REV	When participant starts a statement with "remember the..."
Off subject idea	RAN	When participant makes a reference to pop culture or family life. Something not related to the project at all.
Responsibility	RES	When participants delegate tasks to one another.
Schedule	SCH	When participants check their calendars
Response to feedback	FDB	When participants reference guest critic.
Instruction	INS	When participant instructs the other participant on how to fix, draw, or where to place things
Technical issues	TEC	When participant makes an inquiry about the software being used and any procedure associated with it.
Review of information	ROI	When participant was introduced to project.

Table 4
Pertains to sessions online. Participants may have uploaded a total of 9 times, but they had 10 virtual meeting sessions**.**

Session	Topic	Lead to design progression	How
Session 1	ROI +RAN +SCH + TEC + SIT + LOC+SC	No	
Session 2	SIT + LOC + F+ CPT +TEC+SC +REJ	No	
Session 3	All but RES + ROI + SCH	No	
Session 4	All but RES + ROI + SCH	Yes	New concepts proposed which led to development of new forms and choices of materials.
Session 5	STS+MTR+F+CLA+ FDB+RAN	Yes	Concept became unified.
Session 6	F+MTR+STS+CLA REJ+ACC+TEC	Yes	Uniform architectural vocabulary started formulating.
Session 7	REV+STS+MTR+TEC+SCH+RES+ INS +F	Yes	Design iterations began adopting uniform materials.
Session 8	F+SIT+PRP+SC+CLA+REV+TEC+LOC	Yes	Designs for other locations appeared for the first time.
Session 9	RES+F+SC+PRP	Yes	All designs were tweaked based on feedback of previous session.
Session 10	All but SCH + INS	No	Final Presentation

Table 5
Ranking Amount of times each discussion topic surfaced during meeting sessions

Frequency of discussion topics for sessions									
9	8	7	6	5	4	3	2	1	0
F	TEC	SC	STS SIT LOC MTR CLA	PRP CPT REJ REV RAN	ACC FDB	PRG RES SCH INS	ROI	None	

The tables above provide a general summary for the results of what effective communication can lead to on a project requiring collaborative design. **Effective communication** leads to design progression. In order for effective communication to occur, the environment in which all parties involved must have the following elements: a way to graphically depict ideas so that all can see; a way to hear all that's being said; a way to respond orally, textually and graphically to comments; and a way to revisit what has been said and seen.

4.2.4 Concept Design

Both participants proposed two design concepts on the fourth week of the pilot project. Scheme 1 of Student A involved creating a foundation system that sustains marine life and scheme 2 involved following the vernacular architecture of the island. Scheme 1 of Student B introduced the use of high tech building materials like steel, glass & composites. Scheme 2 was based upon a modular system that utilizes a combination of imported materials and indigenous materials. Their final concept combined Student A's scheme 1 and Student B's scheme 2, which was to develop a modular foundation system that sustains marine life.

Participants decided to develop a proto type at location 3 (indicated on fig. 41 as "L3") based on their concept. After completing the basic proto type, Student A decided to work on location 1 and location 4 while Student B worked on location 2 and location 5. Unfortunately, Student B was not able to complete the design for location 2 so for the final presentation, the design for location 3 was copied over.

Student A Design Progression

Description

Session 1 — Concept scheme 1 - Foundation system to sustain marine life.

Session 2

Session 3 — Concept scheme 2 - Shelter to follow vernacular architecture of Taquile Island.

Session 4

Session 5

Session 6

Session 7 — Combined concept scheme - Modular structural system that sustains marine life.

Session 8

Session 9 (Final)

Figure 40 Design progression of Student A during pilot project 1

Student B Design Progression

Description

Session 1

Concept scheme 1 applied - introduce the use of high tech building materials like steel, concrete, glass, composites, etc.

Session 2

Session 3

Session 4

Concept scheme 2 applied - Introduce a modular system that utilizes a combination of imported materials and indigenous materials.

Session 5

Combined concept scheme - Modular structural system that sustains marine life.

Session 6

Session 7

Session 8

Session 9 (Final)

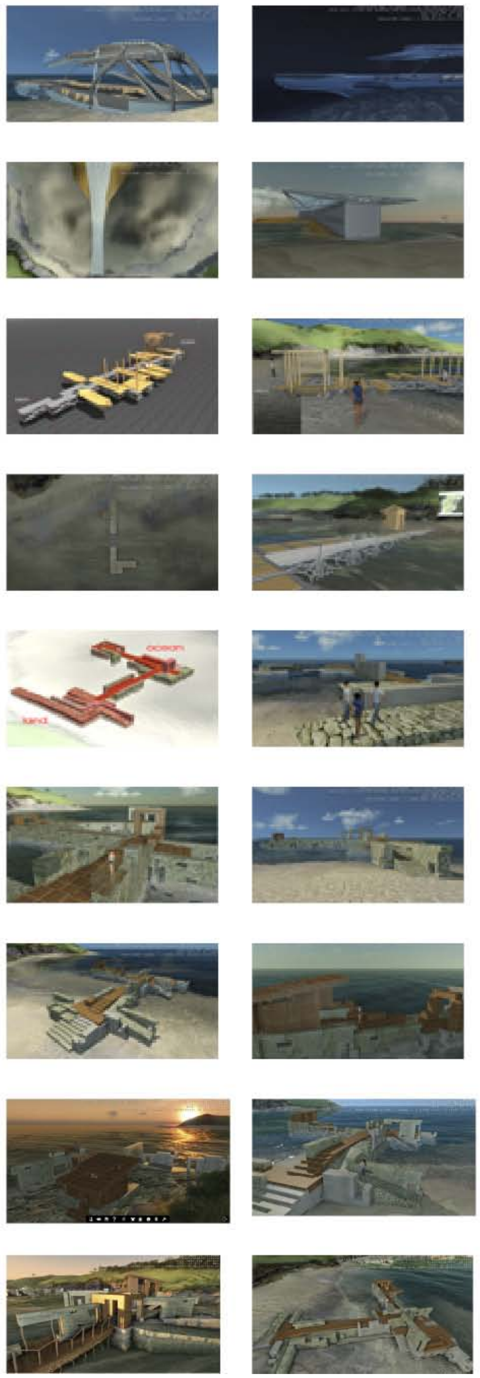

Figure 41 Design progression of Student B for pilot project 1

4.2.5 Summary and observations

As expected, progress was slow in developing their designs because participants had to develop their own work flow, learn a new program and overcome all the technical difficulties associated with it.

Conducting pilot project 1 allowed me to gain valuable feedback from students, who for the first time, had stepped in to the world of MMOW's. After gaining firsthand experience with working in Blue Mars, students provided concrete evidence (in the form of said feedback) that advanced MMOW's like Blue Mars can positively change the way architects design.

Both students agreed that Blue Mars is a very effective tool for user interaction.

> *"Audiences are getting closer to experiencing the spaces we design by being there virtually and walking through it with us."*
>
> -Student A

From the student's perspective, Blue Mars allowed them to understand their site and design on a totally different level. Although they were not able to visit the remote island, the virtual replica made them feel like they were really there. As a result, their designs were influenced by the existing site conditions, culture and available resources (material, labor, and transportation). Students enjoyed working with the Blue Mars tools, holding their design reviews in Blue

Mars and the overall experience of utilizing a gaming engine for designing, collaborating and making presentations.

Participants requested additional functions like real-time mark up tools, an in-world message board to share sketches and vehicles for use while in Blue Mars. The guest jurors at the final presentation had requested a digital laser pointer and a way to locate themselves within the greater context of the site.

4.3 Pilot Project 2

The students from pilot project 1 agreed to return for pilot project 2. This eliminated the need to re-train a new set of students on how to use Blue Mars and its editors. The same laptops were issued to these students.

Figure 42 Pilot project 2 location on google earth map

4.3.1 Project Brief

Pilot Project 2 involved two groups of students, one working as the VOW model (Group A) and the other as the F2F model (Group B). Both groups were given the same program requirements and project description. The project revisits the same island of Taquile in Peru, but at a different location and a different project scale. Students were to design a covered lakeside shelter that provides warmth for a group of 8-10 people, a fire pit/stove, restrooms, a boat dock for two and a pier stretching 20'-0" minimum from the shoreline.

Efficacy was based on the following:

- Student's ability to reach a higher level of design refinement
- Student's ability to effectively present their idea
- Student's ability to affect/alter/manipulate the immediate site

Primary Investigator responsibilities:

- Teach basic modeling and texturing techniques using 3ds Max 2010
- Attend all meetings and observe all discussion,
- Hand out project descriptions,
- Answer questions pertaining to software and project goals,
- Distribute/Collect questionnaires and feedback,
- Upload designs to Blue Mars for students.

While one group is actually working in the virtual environment there will be another group addressing the same problem, designing face to face (F2F). The traditional method of designing (F2F) is the typical form of collaboration for architectural students. Having both participant groups working on the same design problem allowed me to compare the following:

- Design results
- Development of ideas
- Tool effectiveness
- Collaboration
- Communication (Oral)
- Communication (Visual)

Group A

4.3.2 Variables

To reduce the number of variables that could cause undesired results, the following constraints were applied:

Table 6
Variables

Constraint	*Reason*	*Potential outcome affected*
Student participants must hold graduate level status	Architecture students would have the same level of design experience	One student would be the more dominant designer
Meeting time restricted to 2.5 hours per session	Duration of meeting ensures that student participants have enough time to discuss their ideas	Amount of discussion, idea sharing, collaboration and design progression will be low in quantity and possible quality
Student participant to attend all 6 sessions	Attendance needs to be monitored to ensure both groups have met at least 6 times	Progress of design
Student participants belonging to Group A must utilize recommended software	Blue Mars Editors only accept .CGF and .MTL files for actual model geometries and material files	Ability to upload a model

After conducting a usability evaluation of the testing methods and project set up from pilot project 1, it was clear that several items needed to be adjusted. For communication tools, Group A students used Skype instead of the built in VOIP tool of Blue Mars, Logitech Headsets to supplement bad computer hardware and students were required to upload their files to an ftp site that the School of Architecture IT department set up.

4.3.3 Schedule

Table 7
Group A and Group B project schedule

Group A
Week 1: **Monday** Discuss ideas and have some concept images to share **Friday** Upload models based on idea Week 2: **Monday** Upload models based on new ideas Discussion **Friday** Experiment with materials Discussion Week 3: **Monday** Finalize materials and form **Friday** Present

Prior to the first meeting online for group A, participants were worked with to develop a schedule with the PI so to be conducive to everyone (shown above). Based on pilot project 1, the time between uploads was increased to allow for development of model and to not interfere with their other studies. Students were also emailed and given hardcopies of the project description, briefed on the project for 15 minutes and then signed a subject consent form which clears the way for the analysis and results to be published in the future while preserving their anonymity.

4.3.4 Data and development of coding scheme

Table 8
VOW discussion topic code

Topic Code	Code	Description
Structural system	STS	Discussion of wood, concrete, steel or modular system properties.
Scale + dimensions	SC	Size of building members.
Proportion	PRP	Size of spatial volume and adjacencies.
Program	PRG	When participant has questions about required spaces.
Site	SIT	When participant makes a reference to existing vegetation or proposal of new landscaping, pathways, sun & wind direction, etc.
Location	LOC	When participant proposes different placement of design.
Building material	MTR	When participant discusses interior and exterior finishes (colors and material type).
Form	F	When participant makes a suggestion to manipulate exterior envelope.
Concept	CPT	When participant discusses inspiration and uses "it should look like..."
Clarification of idea	CLA	When participant provides a detailed explanation.
Rejection of idea	REJ	When participant says "no" or "it doesn't make sense to do that".
Acceptance of idea	ACC	When participant says "yeah, that sounds cool/good".
Revisiting an idea	REV	When participant starts a statement with "remember the..."
Off subject idea	RAN	When participant makes a reference to pop culture or family life. Something not related to the project at all.
Responsibility	RES	When participants delegate tasks to one another.
Schedule	SCH	When participants talk about when things are due
Response to feedback	FDB	When participants reference guest critic.
Instruction	INS	When participant instructs the other participant on how to fix, draw, or where to place things
Technical issues	TEC	When participant makes an inquiry about the software being used and any procedure associated with it.

Table 9
Group A progression summary

Session	Topic	Previous session lead to design progression	How
Session 1	SIT+CPT+REV +LOC +F+PRG+MTR+ TEC+ACC	Yes	First iteration was presented depicting formal gesture of response to site coupled with concept
Session 2	STS+SC+PRP+ SIT +F+CLA+REJ+ REV+TEC+ACC	Yes	Second iteration showed structural detail and new roof treatment, however, room placement remained the same.
Session 3	INS+RES+REV +MTR+F CLA+TEC+PRG	Yes, but limited	New materials were proposed that altered the perception of the space. Strange light house added.
Session 4	INS+RES+CLA +RAN+REJ +STS+SC+TEC	No	Students experimented with interior finishes and openings.
Session 5	INS+RES+TEC	No	
Session 6	SIT+REV+CPT +F+PRP RAN+FDB+REJ	Yes, but limited	Final design was cleaned up, but there were still unresolved issues.

Table 10 Group A
Tally for amount of times each discussion topic surfaced during meeting sessions.

Frequency of discussion topics for sessions					
5	4	3	2	1	0
	TEC REJ F	INS RES REV CLA SIT	ACC RAN CPT MTR STS SC PRP PRG	LOC FDB	ROI SCH

	Week 1		Week 2		Week 3		Week 4	
Day	M 9-20	F 9-24	M 9-27	F 10-1	M 10-4	F 10-8	M 10-11	F 10-15
Hours	.66	1.5		1.33	2.25	.5		.75
A	12min	15min		20min	37.5min	15min		3min
B	17min	15min		20min	37.5min	15min		20min
Client feedback								15min
Post discussion								10min
Technical difficulty	10min	60min		40min	60min			
Upload	X	O	X	O	O	O	X	O

Figure 43 Group A schedule

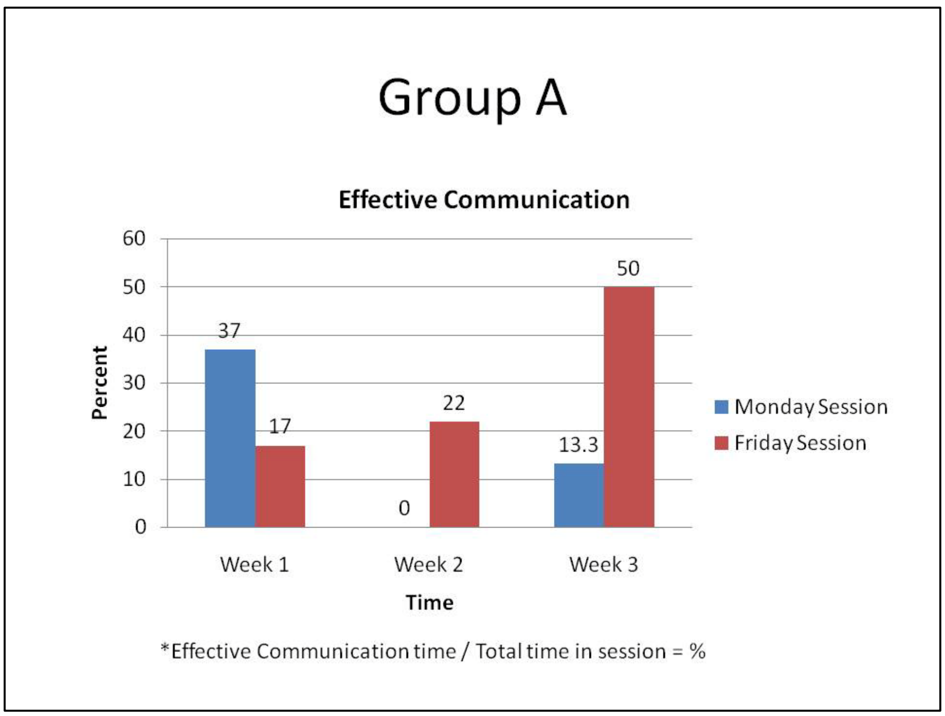

Figure 44 Effective communication chart for Group A

4.3.5 Technical set backs

At Session 1

Minimal technical difficulty was experienced at the start of the conversation. To fix the problem, we re-started the call. Since we are using a new beta version of Skype, the interface took a few minutes to get used to. Both students had files to share but couldn't find the group function for "share file". We spent 10 minutes navigating the new menu system.

At Session 2

The introduction of a new system and work flow has yielded technical issues that hadn't been previously experienced. Today we spent an hour figuring out missing materials, missing buildings and missing environments which had not been anticipated. We were able to resolve the missing material issue on their building by changing the texture directory. The missing environment textures was a result of an accidental UHARCH_Lokoia3.cry file creation. The .bat (batch) file was calling the ..._Lokoia3.cry level instead of ..._Lokoia2.cry file. Deleting it allowed us to fix the environment issue and the missing building issue.

At Session 4

We still had a minor technical setback with some syncing issues. Student A uploaded the new UHARCH_Lokoia2 folder to the ftp site which worked in the City Editor but not when trying to log in with the batch file (main program icon). Accessing the level through City Editor and then hitting "Export to Engine" fixes this issue. The file was then saved and re-uploaded to the ftp site.

4.3.6 Concept Design

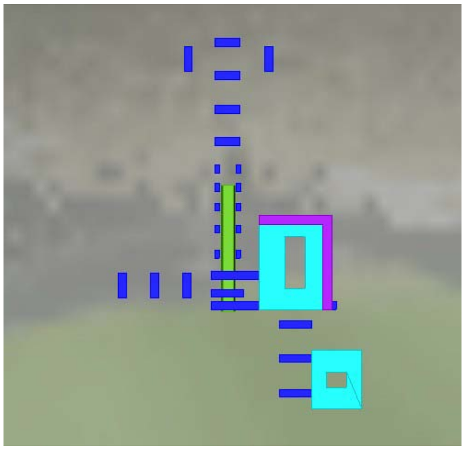

Figure 45 Student B's concept in plan view

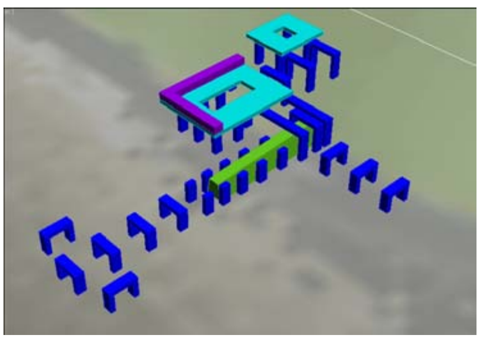

Figure 46 Axonometric of concept massing

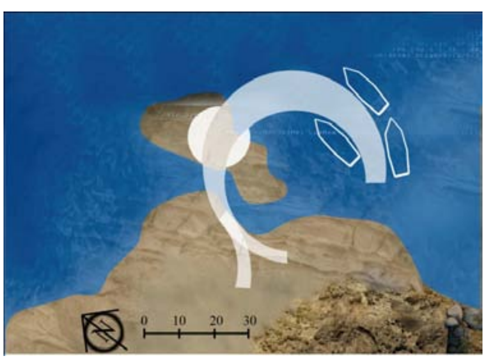

Figure 47 Site plan from Student A.

For the first session we began the discussion by going over the images sent by both students. Student A sent two images; the first, was a 3D aerial and the second was a complete overall plan view, both depicting his initial ideas and concept for the design. Student B sent three images; the first, a site plan with north arrow and scale bar, the second image had an overlay of water coverage and the last image depicted the north arrow, scale bar and initial concept.

Student A's concept and diagram expressed his understanding of the site and its relationship to the entire island. His plan was to tie the small sandbar together with the island by way of the design itself. The lakeside shelter and pier would act as the element that binds together both entities. Although no formal volumetry had been made in his diagram, he thought about taking advantage of the lake shore's natural curvature to inform potential building layout and circulation. The placement of his shelter was more on the outskirts of the shoreline, which, he felt would heighten the shelter's visibility.

Student B's concept model expressed his desire to form a connection with the existing boundary wall and the new shelter. In his plan view diagram, one can see a very linear development of both circulation and form being generated from the wall. Student B had more ideas geared towards incorporating local materials and using a similar texture palette and design approach from the previous pilot project. His diagram depicted gently proportioned volumes and a more privately placed shelter. In his 3D aerial image, there were several forms that connected the shelter to the existing boundary wall.

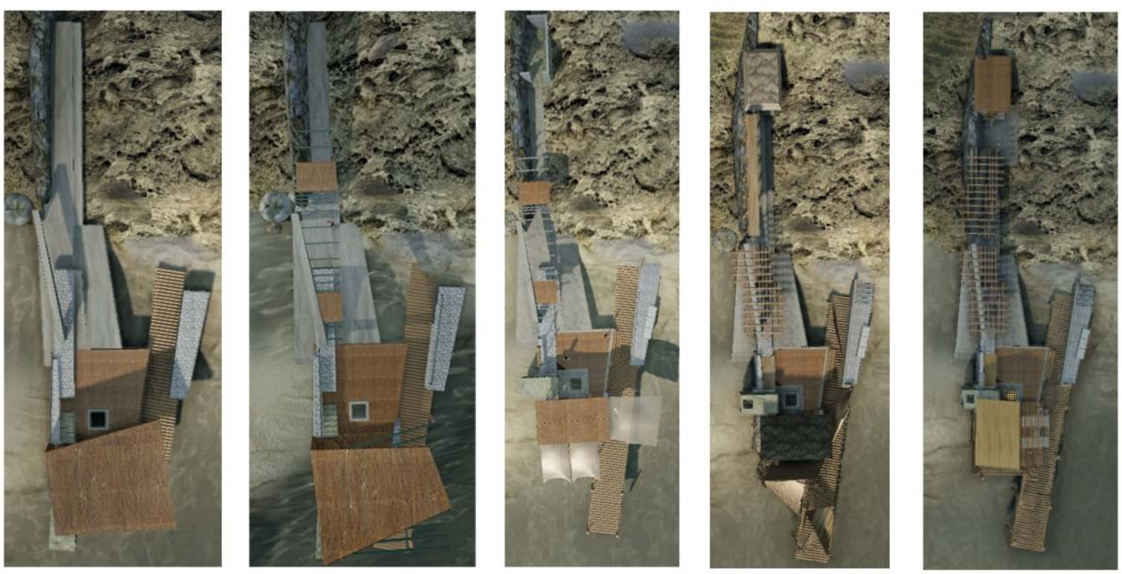

Figure 48 Design progression in plan view


Figure 49 Final design

Figure 50 Final design from main approach

Figure 51 South east view of final design

4.3.7 Observations

Session 1

As we discussed both design concepts, we traveled together to and from both site locations to gain a better understanding of how each student came to their initial conceptual conclusion. Student A's concept revolved around the idea that the architecture would distanced itself from the shore but made an attempt to establish a connection between two seemingly separated land forms. Student B's concept had the design forge a link with the existing boundary line which then expands itself in all four cardinal compass directions. They asked themselves what is the potential of the site? and how will it help us to determine function?

After sharing their ideas and giving each other feedback, they began to plan their own deliverables for the next meeting and how each of them would work. Having decided on a location, Student B will start a layout and then pass it on to Student A to tweak. File passing is how they have chosen to work.

Their previous experience in the pilot project is influencing their work flow on this project. The students are using the tactics developed earlier to work around the limitations of Blue Mars which in effect are allowing them to progress faster and further. I believe this is a positive effect because they understand the limitations of this virtual online world.

Session 2

Student A accessed our ftp site to upload their models and also created two new folders to keep track of their revisions. Student B created an initial design in 3dsmax 2011 based on their first meeting and then passed the file to Student A to tweak and adjust. In this kind of one directional work flow Student B would have to wait while Student A would've been able to see the results first. Even though Student B had to wait to see the results today, it didn't deter him from assuming the role of tour guide.

Student B began the discussion and walked us through the building layout. Since they had shared their initial concepts and ideas in the previous meeting they were able to present a consolidated concept and formal layout. Student B made structural inquiries and Student A made building element inquiries.

Having the building situated in its surrounding context allowed them to experience their joint creation. They saw it from multiple views, angles, heights, perspectives and in lighting conditions. They also began to discuss the scale and proportion of their building elements. Student A had an issue with the large open concrete frame that Student B had created. The frame was very large and "a lot of material" to be used for something that would only be used "to hang tools and fish". Among other issues, they hadn't come to a conclusion as to where to place the restroom as evidence of it not being there. Instead, they included a place to shower which was a little problematic. The spatial volume was cantilevered over at least 10 feet of water, had a stone veneer and was occupying one of the most prime locations within the overall layout of the shelter. It was a very beautiful gesture, but the function didn't suit the location.

Student B expressed his desire to enhance the detail and realness of the appearance of building materials and texture.

Session 3

Discussion points were as follows:

1. Roof
2. Restroom location
3. Massing and Framing
4. Pier extensions

Student B was unable to contribute to the design work this week because of other projects. Student A did all the design work for this session. Student A's intentions this week were to bring in structural details to their model. Student A also made an attempt to find a different purpose for the large open concrete frame that Student B had designed. The changes today were subtle and so both of them decided to do more designing over the weekend.

Student B spent 15 minutes modeling design revisions based on their conversation and sent 3 screen shots of his work via Skype.

A question about their concept lead to a discussion that compared their studio process to this new one. Student B expressed that they hadn't focused on developing a concept because:

> "it would have taken too much of our time... Since we needed to work faster, we decided to ask ourselves "what can we do for the site? because Blue Mars lets us explore the environment... instead of spending time on developing a concept statement, site plans, concept sketches, we can spend our time on exploring the site... this Blue Mars process lets us jump right in to designing for the site... In the traditional design process, we model and draw things in plan, we don't really care about the smaller details, in fact we totally skip it, and if it doesn't work, we don't pay any attention to it... but when we're in Blue Mars we look at every moment, every detail and part and it forces us to take another glance at what we've

designed because we're there. We can also laugh at the mistakes we've made instead of feeling all stressed out..."[66]

Student A also pointed out: "...the way we model for studio is the same conventional style and process. We have a design, we model it in max, and then we render. When I model in max, I can use a screen capture as reference, but I don't have the feeling like I'm in Blue Mars. When I finish modeling, I export it to Blue Mars to see the results, and to get the experience of what it's like to walk around the design I just made. I think that's a good strategy."

Session 4

We got off to a late start this morning due to 1) there was a new developer and client update and 2) Student B had some modeling issues.

I was able to solve the issue by having Student B resave the model file to an earlier version of 3dsmax. We are using 2010 version because 2011 does not come with Open Collada support. After Student B changed the file I re-exported the file to a .dae, placed their new design on the site and uploaded the level file with the new data for them to the ftp. Student B tried to download the city file while it was being uploaded which caused it to be "missing" from that folder. We learned that when a file is in transit of being uploaded, it will cause data loss if someone is trying to download it at the same time. A large file needs to be 100% uploaded before anyone can attempt to download it.

[66] Feedback from Student B during Session 4.

Session 5

This morning was a bit of a disaster. The design was not completely finished. We shot for 10:30 but Student B could not finish the model until 11:15. Student B had a few issues with the Item Editor and City Editor so I ended up uploading it to the ftpsite again. Today's presentation was short. The discussion focused more on things that needed to be tweaked and resolved. As their design was about 75% complete, they were spending less time on concept, site orientation, materials, etc., and more time on fine tuning proportions and detailed connections.

The biggest item that needed to be resolved was their roof. It didn't quite match the overall design, nor did it have a strong connection to the rest of the space. The second biggest item to be resolved was their fractured model. Having them break it down in to smaller portions will eliminate the fracturing.

Session 6

We started on time at 11 and finished by 11:45. Since student B was in charge of finishing up the model, he spoke for the final design. Student A was extremely quiet throughout the presentation. The dialogue that went back and forth was more like an intermediate critique. The juror had many questions about the design because it looked un-finished. Although there were about 6 iterations of the project, both students were unable to present a completed design.

When asking Student B about how he designed and what views he took in to consideration, he admitted to predominantly designing in plan view. In this final iteration of the design, Student B reverted to a bad studio habit due to lack of time. When too much time is spent on one facet of the design, it shows. It's even more obvious when you're in a virtual environment like Blue Mars.

In Plan, the design had a different life and energy. The plan looked more refined than the actual space as a whole. It barely reflected the experience one had while being on the guided tour.

There were a few factors that could have contributed to a better final design utilizing the VOW method:

1. Consistent meeting times and uploads
    a. Meetings need to be mandatory. A model needs to be done in order for the design to be critiqued. No upload = no feedback = no way for the student to move on.
2. Critical design feedback
    a. Necessary for directing design evolution. Also provides students with check points.
3. Emphasis on creating an experience.
4. Emphasis on exploration of section and elevation.

New workflows coupled by learning new software do not hinder or prevent any one group or set of individuals from making quality design contributions when collaborating on a project. If anything, it helps to expand the breadth of discussion by giving the context (site or environment) new meaning and purpose. With certain freedoms removed, new one's are given. For example, the inability to actually do a site visit was remedied by having developed a virtual model. Students found the ability to log in and out of the level at their convenience to develop individual ideas was incredibly useful. The asynchronous approach to working allowed them to work at their own pace and progress faster than in a face to face collaborative environment.

In the mind of the architecture student, your design is never really 100% done. When we run out of things to tweak and stop playing the "what if" game with ourselves is when we usually stop designing. There is always something that you wish you could have tweaked or changed about the design once a studio project is over.

Group B

4.3.8 Schedule

Group B
<u>Week 1:</u> **Wednesday**: Come with conceptual sketches and ideas to discuss with your partner **Friday:** Design- Come with own ideas based on wed's discussion <u>Week 2:</u> **Wednesday** Look at materials **Friday** Lock down designs <u>Week 3:</u> **Wednesday** Design tweak and finalize materials **Friday** - Final presentation

At the first session participants assisted the PI in developing a schedule for them (shown to the left). Students were also emailed and given hardcopies of the project description, briefed on the project for 15 minutes and then were asked to sign a subject consent form which clears the way for the analysis and results to be published in the future while preserving their anonymity.

4.3.9 Data and development of coding scheme

	Week 1		Week 2		Week 3	
Day	W 9-22	F 9-24	W 9-29	F 10-1	R 10-7	F 10-8
Hours	1.25	2.5	1.1	1.75	2.75	.5
C	25min	15min	20min	25min		5min
D	20min	15min	10min	15min		5min
Client feedback	15min	45min		15min		15min
Past discussion		2 min				
Silence	15min	40min	30min	55min		

Figure 52 Discussion time table

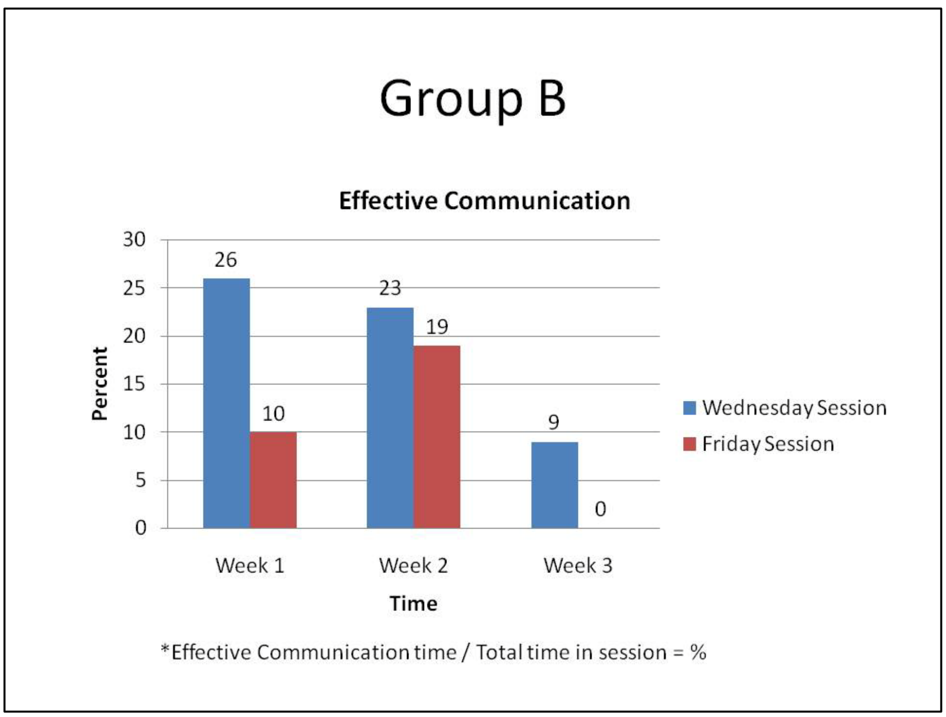

Figure 53 Effective communication chart for Group B

Table 11
Refer to coding scheme in previous section for key.

Session	Topic	Lead to design progression	How
Session 1	SIT+ROI+PRG +SCH CPT+LOC	Yes	Student C had come with ideas to start off with which helped to stimulate a discussion.
Session 2	SIT+LOC+CPT+CLA+ SCH+MTR+PRG	Yes	Both students showed up with sketches and ideas to strengthen concept.
Session 3	F+CPT+CLA+ ACC+ REV+FDB+MTR+F	Yes	Major design issues were discussed simultaneously as Student C implemented the necessary changes.
Session 4	RES+CPT+STS+SC F+PRP	Yes	Drawings were made indicating minor changes based on feedback.
Session 5	INS+ production day	No	
Session 6	CPT+SIT+F+MTR+CLA+LOC	Final Presentation	

Table 12
Group B Tally for amount of times each discussion topic surfaced during meeting sessions.

Frequency of discussion topics for sessions					
5	4	3	2	1	0
CPT	F	LOC SIT MTR CLA	PRG SCH	INS ROI FDB RES REV ACC PRP SC STS	REJ RAN TEC

4.3.10 Concept Design

Students spent every session developing their concept and form making it difficult to summarize. Student's final concept is quoted from their presentation board.

> "The site, deserted and barren, beckons for a stimuli in order for life to flourish. Drawing from two of the elements that stimulate life, **fire** and **water** we attempt to form a lakeside shelter that harnesses the basic necessities of living.
>
> **Fire** is part of our conception of the earth's interior as a phenomenon, one that conveys an instinctive feeling of being inside. As a structure, the fire is the security, the center of our innermost being, i.e. food preparation, surviving the cold and frost. The steps spreading upwards from the earth in a rising circle are the visible extension of the radiating flames.
>
> **Water,** in nature: the lowest point of the existential level is the water surface - beneath it are the depths. The water would be captured at one dam and then released down to another. People appreciate the natural beauty of stones and landscaping from the waterfall; Enjoy the soothing sounds of falling water. These serve mostly as an attraction, beside which parties and conversations are held. Waterfalls contribute motion and sound of splashing water elicits the exciting and calming, energizing and restful. A waterfall becomes a place to gather around, sit, watch and relax. Active water features open up a new sensory perception – the sound."

Figure 54 Group B final design

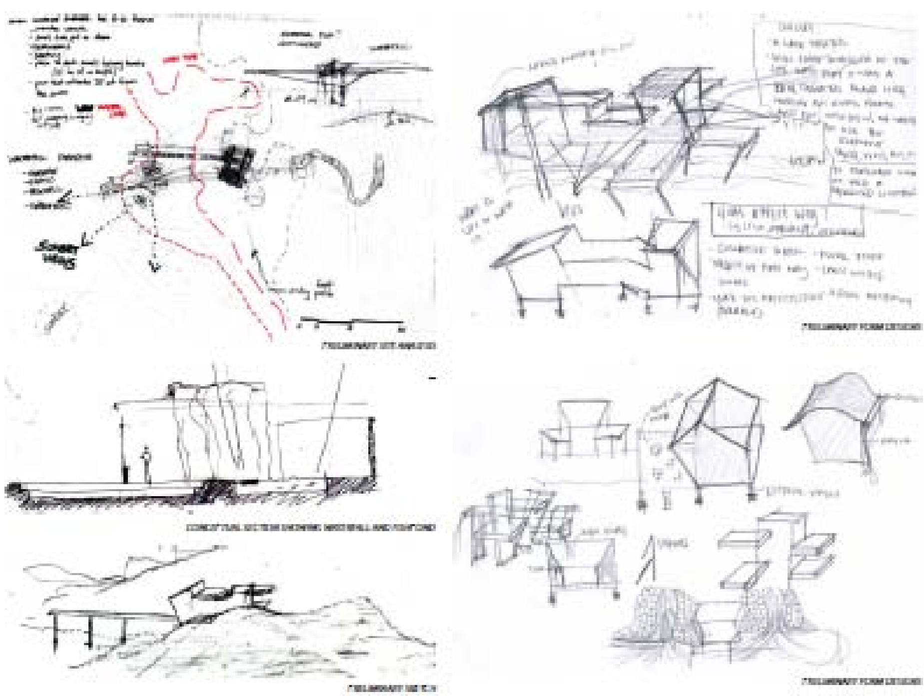

Figure 55 Group B process sketches

4.3.11 Observation

Typical 'collaboration' form of architecture students, jot down your own ideas and then share them with your partner. It was not an additive process where they take turns sketching on top of what the other had done.

Session 1

Student C had come to the meeting with a print out and some sketches overlaid on vellum trace. Student D didn't have any sketches prepared because the zip file was in an unreadable format which wasn't discovered until half way through our meeting. Both students had questions about the site, and it appeared that because Student C was able to open his files, he was able to make more inquiries about contour heights, dimensions and vegetation.

Most of the discussion revolved around these aspects: scale, program, building material, form and exact project location. Student D briefly brought up the idea to expand the program to include a bedroom thereby making it more like a home instead of just a gathering space. I stressed the importance of being able to justify a decision like that. Although the students have an opportunity to design what they want, and to have fun with this project, they still need to support their design decisions. Student C felt that the shelter should remain a public space while Student D explored the idea of making it more private. Adding another space to the program would in-effect make more work for them in the end.

Neither students were interested in putting forth a concept today, but instead were looking at ways to access the site and how to find an appropriate location for the shelter. I was able to clarify the main pedestrian pathways for them and described the texture of the environment. Student C initially felt that the shelter should be placed closer to the shore line because of the pier and dock requirement. Student D felt that the shelter should be placed closer in-land and sketched out a section to illustrate the idea of cutting in to the hillside. Student C opened the reference image folder and began flipping through the images to show Student D. By sharing the images, Student C was able to convey scale and proportion. The reference images kept the conversation going about the site, but both students continued to sketch their ideas separately. Both were open to the others ideas and by 10:30, both had concluded that they needed to spend time separately analyzing the files I had given them. Despite ending today's session early, both students agreed upon having sketches ready for the next meeting.

Session 2

Student D brought a few inspirational images of projects found off the internet to share with Student C. There were also a set of material choices for both structural components and finishes. Students began the discussion by exchanging their initial thoughts about the site. Both students felt that the site was plain, boring and devoid of life.

Student D threw out the idea of creating a paradise on the remote island. Student C listed the words serene, exotic, peaceful and therapeutic in an attempt to describe this paradise they were going to create. A waterfall component was added which they felt would make their site more like a paradise.

Student C imposed a 90 degree axis onto the site as a way to direct pedestrian circulation and dictate an approach so that their building would feel like it had a main entrance. Both students spent about 10 minutes in silence on average to sketch their individual ideas. After a layout was decided, students spent about 15 minutes massing their idea by hand drawing and using a recent version of Sketchup. They moved on by questioning their formal gestures and desire to create a dynamic roof.

As both students worked on their individual sketches I notified them that there would be a guest critic coming to review their design. To help them consolidate their ideas I asked them "how would you explain your ideas and design to our guest?" This got them to focus and regroup so that their idea would sound cohesive.

Our guest critic arrived at 1:30 and Student C introduced their concept and ideas for the site. Student D went in to describing the need to do additional landscaping and briefly touched upon possible building materials. In summary, the feedback received revolved around being able to: 1) support and justify their design decisions; 2) imagine the experience of walking to and through their designs as if they were at an "open house"; 3) be able to impose a sculptural quality to the architecture; and 4) design multiple iterations of their form.

After receiving feedback from the client both students made a quick decision to work on their joint design at the next meeting.

Holding an outdoor critique attracted a small audience. Two other students were drawn to our table during our guest critic's critique. When a design review becomes an informal process amongst students, there lies an opportunity for a designer or critique-ee to gain additional feedback from his or her classmates. Fostering that kind of dynamic amongst students increases their ability to work out the kinks in their design. It may lead to a better solution or it may not.

Students didn't engage in a dialogue with critic. They responded typically by listening intently. The critic didn't have any questions for them because there wasn't anything he could critique. Had the guest critic been present at Group A's meeting, there definitely would have been a dialogue.

During this process of exchanging ideas and words, there were long pauses of silence.

Session 3

Both students didn't have work prepared for today so they used the time to work with each other on coming up with a layout.

Main discussion points included:

- Figuring out the location of the waterfall
- Roof openings
- Interior and Exterior finishes
- Furniture
- Pier dimensions
- Drawing responsibility
- Building footprint
- Pedestrian approach to the site

Student D is not focused on this project and the low energy brought to every discussion thus far is negatively affecting the design. Much of what they discussed today could have been condensed into a 30 minute session. In their defense, both students are also managing a high credit load this semester which is impacting their ability to share creative energies with each other.

Their concept is to integrate the four major elements of earth, wind, fire and water. I believe they're associating the building materials with those elements. Earth is being represented by stone, and is primarily being used as a foundation material. Wind is being represented by their roof structure. Water is being used as a wall system. Fire is yet to be determined.

Session 4

Much of the discussion today revolved around how they wanted their building to be perceived from the main entry points. Student D had printed out a plan and two elevations today, which graphically provided a better understanding of their progress. Student C had expressed the desire to shrink their concept down from incorporating all four elements (earth, wind, fire, water) to just including fire and water. If this were a studio project, they would be able to dedicate more time and thought to the design as a whole.

Our guest critic arrived early and spoke with them for about 15 minutes. Both students, again, fell in to their roles as "intent listeners". This time, both students responded enthusiastically to the feedback.

As an observation on feedback and design reviews with these students, there is no boundary between the critic and the student.

Figure 56 Students giving presentation and referencing presentation material

Figure 57 Critic approaching presentation boards

Figure 58 Critic giving verbal feedback

Session 5

Students spent a total of 4 hours working independently and separated from each other for nearly the entire session. Student C worked on the layout of the presentation boards while Student D worked on the drawings. As the final presentation date approaches, students are in complete production mode. This is a completely typical work habit for architecture students.

Session 6

Both students went through the motions of formal introductions and then proceeded to describe their design to the guest critic. The students nervously gave a 10 minute presentation which was followed up by 15 minutes of feedback. The critic made comments about their board layout and choice of materials, their narrative, formal massing, circulation and access. Dialogue with critic after presentation did not take place.

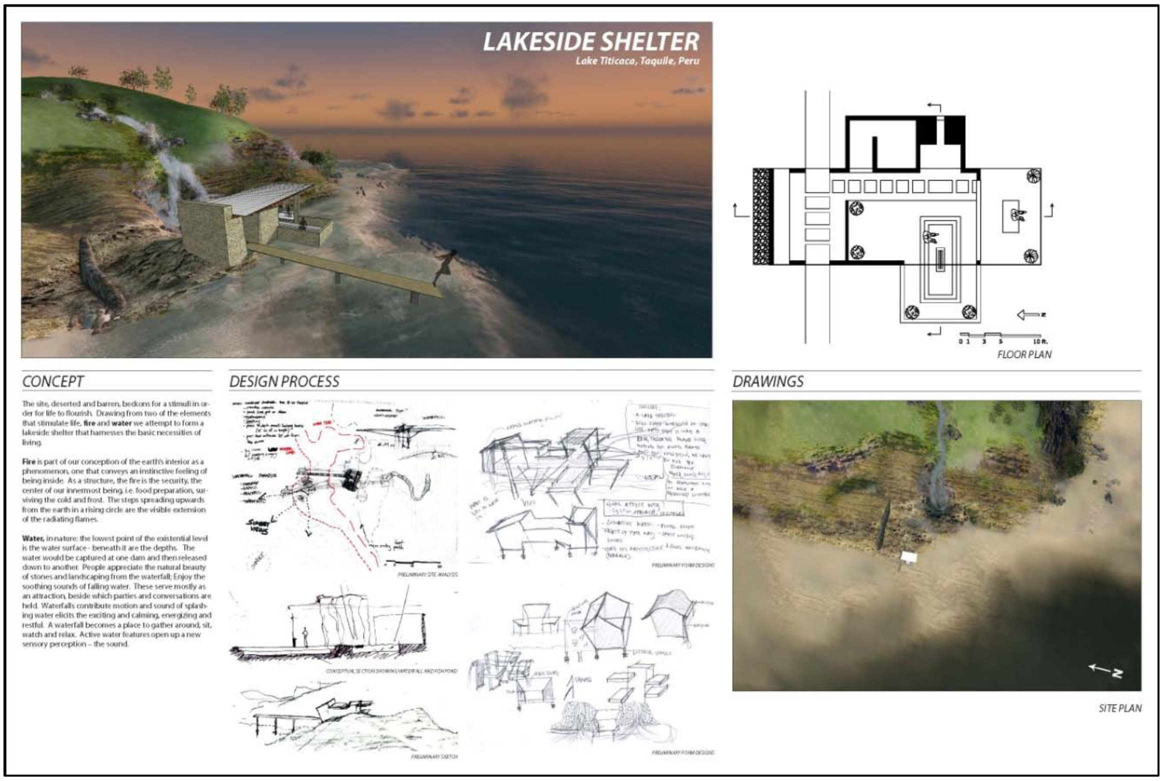

Figure 59 Group B Presentation Board 1

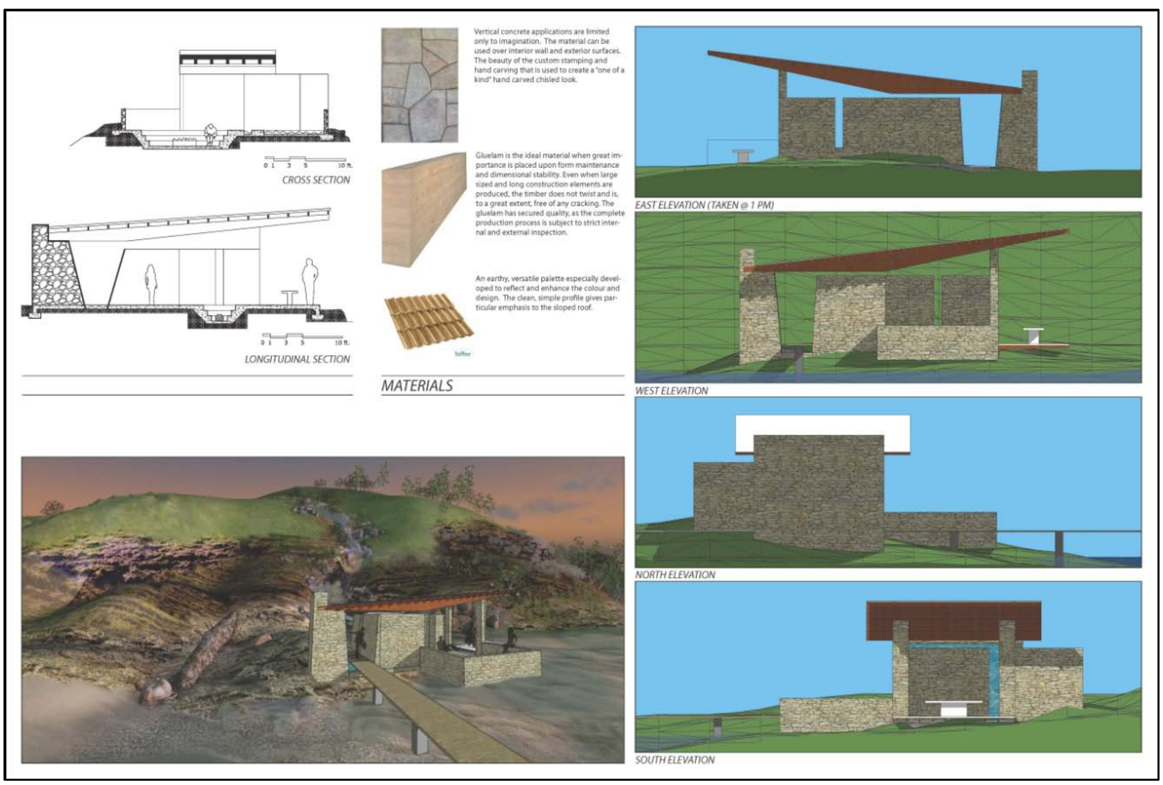

Figure 60 Presentation Board 2

4.4 Comparatives of Pilot I vs. Pilot II

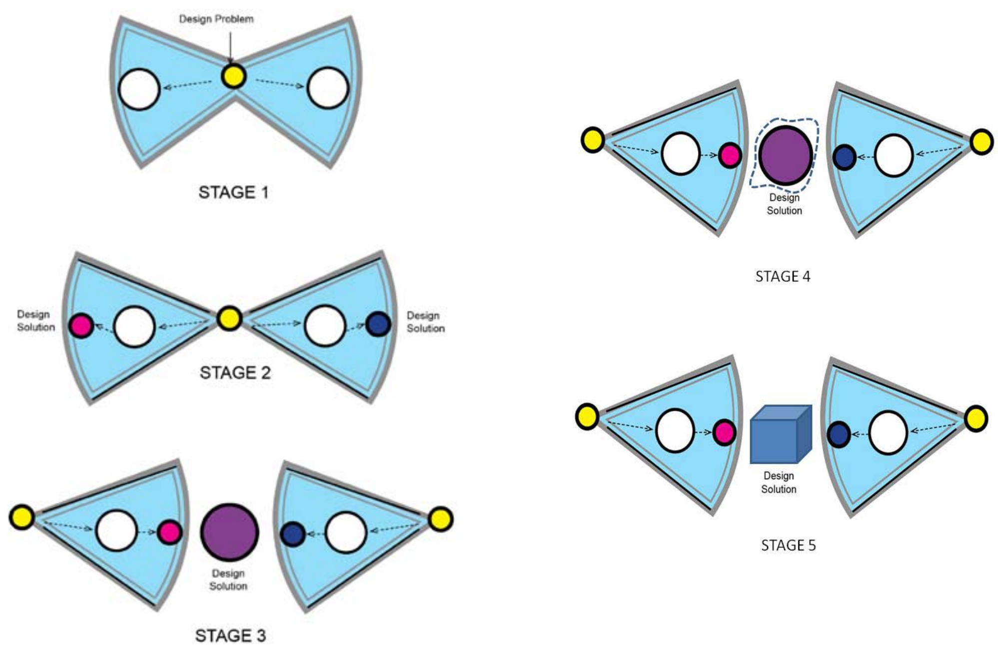

Figure 61 Diagram of different stages of students acceptance and treatment of project program.

Constants

The major constants of both pilot projects were the ways in which students worked. Stage 1 shows the delivery of the design problem to two participants, represented as white spheres. Stage 2 depicts the participants addressing the same design problem and developing their own design solution. Stage 3 depicts the participants combining their design solution after having spent time developing their own individual solutions. It is implied that both participants had come to a consensus while discussing their ideas and that the generation of the combined solution was the resultant. Stage 4 represents a point in which the design solution is in flux. Students are going through multiple variations on design possibilities at this point. Stage 5 represents a final formed design solution. This method of collaboration is true for most group work in an architectural design studio. However, there are rare cases when everyone starts off in stage three instead. In such a case, personality types play a key role in the progression of the design. What matters most is the students' ability to experience their designs in that first person perspective.

In pilot project 1, the students went through all 5 stages. In pilot project 2, Group A went through all 5 stages but Group B jumped from stage 3 to stage 5. Due to time constraints, students desire to develop a well formed concept and working dynamic students in Group B did not enter stage 4.

Table 13
Summer table of errors and solutions.

	Technical Difficulties	*Solution*	*Reasoning*	*Categories*
Blue Mars (In)	How to proceed with updating team design	Students developed linear workflow Student B (start) -> Student A (finish)	To share the work and to defend their design decisions	Work management
	Wrong orientation & location of models	Set up an ftp site where students can access files and place own models	Students to manage own city folder so that everything is accurate	Work management
	Fell through floors & walked through walls	Dedicated 2 sessions on how to fix proxy issues	We needed the ability to walk around their models	Modeling
	Lack of focus	Shrank program and scale to include only 1 project site	To see if design could be pushed further	Design focus
Blue Mars (Out)	Couldn't hear students	Bought them headsets	Microphone settings were different	Hardware
	Blue Mars voice chat system is based on how close you are to another person	Used Skype instead	Everyone should have the freedom to explore the environment without being restricted to a 5m radius for communication	Software
	Students wanted a way to work on models together	Introduced TeamViewer	They needed a way more interactive way to communicate their design intent.	Work management

Realizing what fine tuning a design does to the overall space can cause a domino effect of changes throughout the design. Implementing what needed to be changed in pilot project 1 resulted in new technical errors being realized. The challenges were unforeseen and resulted in additional recommendations for improvement.

Students of the VOW group on both pilots were given level files as reference which included their site model and textures. The site model was prepared in advance so that they could quickly explore the site.

Table 14
Fall table of errors and solutions**.**

Pilot Project 2

	Technical Difficulties	*Solution*	*Reasoning*	*Categories*
Blue Mars (In)	Model Fracture	Break up model	Model exceeded 50,000 poly limit	Modeling
Blue Mars (Out)	City Level Syncing	Re-download city level from ftp	Students tried to download the file as it was being uploaded	Human error
	Model placement	Primary Investigator placed models	Student could not finish on time, which would have resulted in an additional 30 minute delay	Work management
	Dropped call	Recalled	Needed to	Hardware

4.5 Differences between Group A & Group B

4.5.1 Collaboration

One key benefit of the VOW method was the ability to work asynchronously. It was a huge convenience for students in Group A because they didn't have to meet face to face to get work done. Instead of using their session times predominantly for designing, they were discussing and critiquing the work they had done the night before. On average both groups experienced 18 minutes of effective communication. Determining the average amount of effective communication for Group B was relatively easy because they didn't talk much. Every time they entered a discussion it lead to design progression. Whereas in Group A, their conversations would Group B, however, had huge periods of dead silence (see fig. 51) where no discussion took place. In order to supplement the time that didn't get used effectively, both groups worked outside of the required meeting times. Group A collectively worked 7 hours and Group B collectively worked 9.85 hours. Individually, Student A worked 5 hours, Student B worked 9.5 hours, Student C worked 5 hours and Student D worked 5 hours. Group A explained that the work done outside of the scheduled sessions were related to modeling and implementing changes discussed in previous sessions. A slight trend began to develop in Group A that indicated their discussion time shrank as their final presentation date got closer. In Group B, it was the opposite.

A key benefit of working in the traditional method is the ability to discuss changes and have someone implement them as they are being brought up. Student D would make a suggestion and Student C worked on updating the 3D model while they were sitting next to each other. In this environment, there is no lag and no need for specialty software. This way of working is smoother and less technical. Although group A didn't feel like the digital environment posed any problems for them, they had to supplement their natural tendency of modeling side by side by using TeamViewer, which they felt was "laggy".

In general, students are able to work according to their natural processes in either environment—the biggest difference is the amount of hardware needed to accomplish the same tasks. The tools are different but they are able to solve the problem regardless of environment.

In designing, "...it is more important to 'see' what is being discussed rather than observing/listening to a conversation."[67] However, experiencing an 'aha' moment with those you are discussing an idea with can be just as fruitful and

[67] Gerard Cesar Gabriel and Mary Lou Maher, "Coding and modelling communication in architectural collaborative design," *Automation in Construction* 1, (2002):200.

rewarding because it can lead to another iteration of a design in progress. In Gabriel and Mahers' experiment they tried to put together a list of 'needs' that others may use as reference when designing collaborative tools. However, there were already tools being formed whose sole purpose was not to facilitate design collaboration, instead, such tools were to be used for social networking and were platforms for game development. The socializing that occurred, as researchers found out, broke down people's defense mechanisms causing them to feel more at home with the idea of talking to complete strangers in a virtual environment. Going back to the idea of experiencing 'aha' moments during collaborative designing, I observed the frequency in which they occurred for Group A was higher than that for Group B.

4.5.2 Design and output

Group A was more successful at visually and verbally communicating their design, however, it didn't resemble a shelter. Group B was more successful at designing the key elements of a shelter—they provided a strong overhead plane supported by solid walls that "shelters" visitors from natural elements. Designing a lakeside shelter was simply a problem for the participants to solve. The more creative and aesthetically pleasing the solution is, the better the design. The primary goal of the "design problem" was to be the task so that collaboration and communication could be observed. The quality of the design is not being measured here, but, the quality of the contribution.

The designs in pilot project 2 were a result of a series of decisions that *sometimes* related to the consensus reached during discussions. In Group A, the discussion had little to do with what resulted because somewhere down the line, person(s) in charge of implementing what had been discussed did not follow through, or, how to move on to the next steps were unclear. Outside factors contributing to the breakdown in communication were related to additional pressures from other classes. Student A had important obligations to fulfill between sessions 4-6 which increased the work and stress load for Student B. This is not a new phenomenon. Usually, we see this happening right around midterms and finals even in face to face group projects for students. It's a factor outside of our control. In Group B, similar pressures from class schedules influenced their ability to work on their designs. There were no expectations for high quality designs. Although, it was hoped that these outside factors would surface during the project so they could be recorded and later considered when developing further recommendations.

Both groups chose to continuously develop one idea, however, Group A chose to make multiple iterations of that one idea. They made superficial upgrades to the design, which meant the structural elements and finishes were constantly changing. Surprisingly, the size of each space and floor plan remained the same. Group B relied heavily on the design concept—the force which drives most design decisions on a studio project.

Architects should be famous for wasting time. "Great ideas crystallize through an immensity of wasted efforts."[68] Bjarke Ingels is quite right in both cases. Both groups spent a great deal of time designing—sometimes in silence

[68] Bjarke Ingels, *Yes is more! An Archicomic on Architectural Evolution,* 8.

(which was the case for Group B), and sometimes through extended dialogues and discussion (which was the case for Group A).

4.5.3 Presentation

Group A was expected to develop a model at each session while Group B was expected to develop plans, sections, elevations and a 3D model as visual aid and proof of design progress. Group B obviously had more work to do which accounted for the slow progression. During our sessions and in the time between sessions, Group B had to constantly update their drawings and send them to each other for feedback. They chose to work with a program that could easily output the necessary elevations, sections and 3d model. As an architect or architecture student, you learn to set aside time for producing drawings and presentations. With Group A, they just needed to make sure that their models were exported and uploaded on time to the server so we could all download it. The time for exporting and uploading is substituted for the time it takes to layout and print visuals.

Based on the feedback from Group A, it sounds like Blue Mars will be of great benefit to them on future projects. One assumption I could make about this new experience and workflow, based upon Student B's last comment "we can also laugh at the mistakes we've made instead of feeling all stressed out..." is that the alleviation of stress leads to a better work dynamic for all involved. At both final presentations for the students working in the VOW method (pilot 1 and 2), they both seemed calm and collected. Group B on the other hand exhibited signs of nervousness while presenting. Stuttered speech and forgetting to finish sentences happened on several occasions. Student D was so nervous that she couldn't communicate her thoughts in an orderly fashion.

The students in Group A were able to have the material in front of them while presenting instead of to the side or behind them like Group B. By having the final product in front of the presenter, Student B was able to pick out more elements of their design to discuss. It appeared that Student B gave a longer presentation because he could walk around the design and point out the structural material, storage containers, roof treatment, material choices, etc and explain why they were chosen. It became an interactive presentation. Although Student B was allowed to present their collective design, the guest critic was also able to hold a dialogue with him. When a dialogue gets going, more information can be disseminated and extrapolated from the designer. Things that he or she forgot to say can be recalled by simple conversational triggers and questions during this dialogue. Ultimately, it improves the understanding the guest critic has of the design. That interactive dynamic was missing in Group B's presentation.

During Group A's presentation there was a sense of freedom to walk around the site without offending the presenter while he or she is discussing their design. The virtual self (avatar) seen walking about is not distracting. Also, being able to move the camera around the scene while in the VOW versus staring at a static image and having the presenter try to describe what might not be shown in that image allows for a comprehensive understanding of the entire space. As a result of this freedom the student and guest critic end up having a better understanding of the design and of the space.

Group B had generated floor plans, sections and elevations as a way to graphically represent their final design. The amount of work they did while developing their ideas was reflected in the final presentation and was represented very clearly and concisely. Had they been able to provide a virtual walkthrough, the verbal presentation might have been just as strong. However, their designs were so simple that the amount of existing detail would not have had as much of a visual impact. In this case, the combination of project scale, program and final outcome warranted the need for a physical model. Group B's design would have benefitted from a physical model because of the sculptural quality of the design.

There’s a level of interaction that can’t be duplicated when presenting an idea in the normal 2D format. Instead of looking at things in a collapsed dimension, you’re literally running around what you’ve just created in a VOW. The superior graphics quality enhanced Group A's visual perceptions of space in an artificial virtual environment and improved their understanding of the design.

4.5.4 Participants and environment

Group A contained designers who exhibited the characteristics of extroverted personalities. Group B contained designers who exhibited characteristics of introverted personalities. Did this contribute to the quality of communication and ideas discussed? Yes. Had Group B felt comfortable enough with each other to reject a few ideas, they might have ended up with an entirely different design. Since both students were introverts, they created their own safe environments to work in which limited exchanges of ideas and creative input. Group B was more interested in accepting all the ideas that resulted from their discussions instead of challenging them.

When Group A was immersed in the VOW, they were completely engaged with the site and task. By constantly walking around the site and discussing their ideas with each other, it was easy to determine that Group A was focused on this project.

An interesting point was made about 'instant environments' and the speed in which designing takes place. Building design decisions are made too fast to track changes. Because of the collaborative work process and facilitating design software, the privacy of a designer is also negated and no longer exists. However, by using VOWs with tools that limit the kinds of changes mentioned above, it forces a discussion so that students or designers can come up with solid justifications and supporting explanations as to why they made those choices. By using Blue Mars, we are not providing a way to instantly alter someone's ideas; instead, we are allowing the original designer to fully explore his or her own personal design. By working in an environment that doesn't allow instantaneous changes, the designer feels like he or she can maintain control over their design. For some students, losing the right to control their process means losing the battle over design freedom.[69]

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[69] Wojtowicz, Jerzy. *Virtual Design Studio, (*Hong Kong: Hong Kong Press, 1995),21.

In this day and age, geographically displaced architectural collaboration is manifesting itself more than ever because of supporting technological advancements. Architects use e-mail, video teleconferencing, U.S. postal, and now, for at least 7 years, by way of virtual online worlds. In earlier renditions of remote collaboration (use of fax machines and U.S. postal mail) 2D and 3D data had to be broken down in to verbal descriptions. The answering machine even played a pivotal role in passing on important information from one party to the next when being physically present was not possible.

4.5.5 Instruction

Alfred P. Rovai wrote an article about online course design and distance education.[70] Rovai cited factors that two earlier researchers discovered while conducting their own study on distance learning and the stress it imposes on students. "Students reported confusion, anxiety and frustration due to the perceived lack of prompt or clear feedback from the instructor and from ambiguous instructions on the course Web site and in e-mail messages from the instructor. Such findings suggest computer mediated communication particularly from the instructor may be one source of frustration for some online students."[71]

The distance between student, instructor and campus is greater than in the pilot projects conducted, however, it is worth noting that students level of satisfaction, regardless of distance and communication tools, is greatly affected by the instructors teaching methods and the dissemination of information.

[70] Alfred P. Rovai, "A constructivist approach to online college learning," *Internet and Higher Education 7* (2004): 80.
[71]Hara, N., & Kling, R. "Student distress in web-based distance education," *Educause Quarterly 3* (2001): 68.

Students in the fall elective were not satisfied with the class even though they were in a face to face setting. Which then had a negative impact on the quality of work produced and the quality of learning each student had. Instructional methods are one thing, but preplanning the course work and teaching strategy is another.

L. Dee Fink believes that in order to fully address what students need to do during the course to perform well, the instructor needs to carefully consider student characteristics, the characteristics and capabilities of the e-learning system (in this case the virtual online world), and the mix of online and face to face learning.[72] Fink's system seems to support the findings of what has been observed and recorded during the Blue Mars studio, upper level elective and two pilot projects conducted within the past year.

The role and level of responsibility of the instructor continues to increase as the tools to instruct and facilitate effective communication become more complex and technologically focused. Table 15 focuses on the reactions from students working in Blue Mars and the instruction methods used to disperse information. A comparison cannot be made to the F2F group because no specialty software or hardware was needed. Group B used the tools and skill sets they had already developed over the years while at UHM.

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[72] L.D. Fink, *Creating significant learning experiences: An integrated approach to designing college courses,* (San Francisco: Jossey-Bass, 2003), 22-23.

Table 15
Summary of instruction method and adjustments based on VOW method experience.

Course/ Project	Instructional material	Method of dispersing information	Student reaction	Adjustment
2009 Summer Studio	No	Class taught face to face. Demos given face to face. Project information given face to face. Class 4 days a week Morning lab provided to experiment with program. Members from Avatar Reality (AR) would stop by for a few hours to introduce tools and where to locate a few tutorials.	Unable to progress without one-on-one assistance. Unmotivated to continue learning program.	Develop documentation. Realization that hands on demos are needed.
Fall Elective	Yes	Class taught face to face. Demos given face to face. Project information given face to face. Few hands on sessions given. Class held 1 day a week for 1.5 hours. No visits from AR Students required to be self motivated.	Encountered many errors. Confused about how to do things. Became dissatisfied with progress. Zero likelihood of using program again.	Based on discoveries made in previous studio, models were able to be imported. Realization that troubleshooting time is needed.
Pilot Project 1	Yes	Import and Export taught face to face. Project information given face to face and sent by e-mail. Troubleshooting face to face. 4 hands on demos 2.5 hours each.	Students wanted a way to leave notes in-world. Enjoyed working in Blue Mars. Students felt that file management was needed Students felt like there was adequate support. Expressed wanting to use Blue Mars again for future projects.	Troubleshooting sessions were implemented. Documentation was updated to include additional information on how to create separate log-ins from game client. Used Skype instead of built in VOIP tool. Students used TeamViewer to work with each other on models.
Pilot Project 2	Yes	Refresher demo given face to face for 45 minutes. Project info given face to face and sent by e-mail. Support given when needed. FTP site used for storage of files.	Enjoyed working in Blue Mars. Expressed wanting to use Blue Mars again for future projects.	Updated documentation used. FTP site was used

4.6 Survey Results

Group A and B were given a post project survey with questions aimed at getting more feedback from them about the pacing of the project and the effectiveness of the additional project information given to them. SurveyMonkey was used to compile the survey questions with Likert scale response options. Written answers also included.

4.6.1 Survey of Group B

1. Having a 3D topography model and site photos aided your design discussions. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Having a 3D topography model and site photos aided your design discussions	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (1)	50.0% (1)	4.50	2
					answered question		2
					skipped question		0

2. Doing a site visit would have enriched your understanding of the site. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Doing a site visit would have enriched your understanding of the site.	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (1)	50.0% (1)	4.50	2
					answered question		2
					skipped question		0

3. Supplying interior and exterior perspective renderings of your final design are enough to communicate it to people. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Supplying interior and exterior perspective renderings of your final design are enough to communicate it to people.	0.0% (0)	0.0% (0)	0.0% (0)	100.0% (2)	0.0% (0)	4.00	2
					answered question		2
					skipped question		0

Figure 62 Questions 1 - 3.

4. The project was small enough to focus on developing fine details Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
The project was small enough to focus on developing fine details	0.0% (0)	50.0% (1)	0.0% (0)	50.0% (1)	0.0% (0)	3.00	2
						answered question	2
						skipped question	0

5. If this were a studio course, do you think you'd get more done? Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
If this were a studio course, do you think you'd get more done?	0.0% (0)	0.0% (0)	50.0% (1)	50.0% (1)	0.0% (0)	3.50	2
						answered question	2
						skipped question	0

6. Would walking through the design with your client change your choice in presentation media? Create Chart Download

	Response Percent	Response Count
Yes	100.0%	2
No	0.0%	0
	answered question	2
	skipped question	0

Figure 63 Questions 4-6

7. Please list the software programs used during this project: (combined list)

AutoCAD 2010, Photoshop and Google Sketchup 7

8. Please list some outside factors that affected your ability to communicate and collaborate with your partner. (combined list)

- *Observe site visit.*
- *Finding time to meet because of my busy personal schedule.*

9. What was the most time consuming part of this project?

- *Presentation board layout*
- *Sections and 3D modeling*

10. How did you try to engage the site? Please describe. (Answers were combined)

- *We tried to visually incorporate the waterfall and orient the building for views towards the sunset.*
- *Provide public lake shelter. Concept using 2 elements water and fire.*

11. As a follow up to question 4, what would have allowed you to develop more details? (Answers were combined)

- *More time.*
- *Using Blue Mars and Revit.*

12. In your opinion, what is the most challenging part of collaborating with someone else in a team project? (one response only)

- *Apart from having a good group dynamic (your partner matters), the most challenging part is making design decisions and sticking to them.*
- *NA*

13. How did managing two design projects at the same time affect this project? (one response only)

- *I found it difficult to dedicate time to the design for this project because of comprehensive studio. Two design projects at the same time is difficult, however, I believe it is necessary to learn how to manage them.*

4.6.2 Survey of Group A

1. Working in Blue Mars and the various online communication tools allowed you to contribute more ideas during discussions with your group members. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Working in Blue Mars and the various online communication tools allowed you to contribute more ideas during discussions with your group members.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

2. Being connected with your group members via Skype & Blue Mars allowed you to ask your fellow group members more questions related to the design. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Being connected with your group members via Skype & Blue Mars allowed you to ask your fellow group members more questions related to the design.	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	0.0% (0)	4.00	2
						answered question	2
						skipped question	0

3. Each time you met online with your group members, you found it to be an enjoyable process. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Each time you met online with your group members, you found it to be an enjoyable process.	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	5.00	2
						answered question	2
						skipped question	0

Figure 64 Questions 1-3

4. Being connected to the internet made it easier for all of you to quickly reference the same source material and web pages when searching for information or inspiration. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Being connected to the internet made it easier for all of you to quickly reference the same source material and web pages when searching for information or inspiration.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

5. All of your group members made quality contributions. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
All of your group members made quality contributions.	0.0% (0)	0.0% (0)	**50.0% (1)**	0.0% (0)	**50.0% (1)**	4.00	2
						answered question	2
						skipped question	0

6. How long did it take your group to make a design decision? Create Chart Download

	Extremely Long	Not Very Long	Fast	Extremely fast	Rating Average	Response Count
How long did it take your group to make a design decision?	0.0% (0)	**100.0% (2)**	0.0% (0)	0.0% (0)	2.00	2
					answered question	2
					skipped question	0

Figure 65 Questions 4-6

7. Working with Blue Mars allowed you to add more detail to the final design.

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Working with Blue Mars allowed you to add more detail to the final design.	**50.0% (1)**	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	3.00	2
						answered question	2
						skipped question	0

8. Working in a digital medium like Rhino and 3ds Max made you pay attention to the amount of time you were spending on modeling and discussions.

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Working in a digital medium like Rhino and 3ds Max made you pay attention to the amount of time you were spending on modeling and discussions.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

9. Working in Blue Mars with an accurate terrain model allowed you to design within the constraints of the terrain.

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Working in Blue Mars with an accurate terrain model allowed you to design within the constraints of the terrain.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

10. Walking around the site in Blue Mars with your group members generated more ideas.

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Walking around the site in Blue Mars with your group members generated more ideas.	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	5.00	2
						answered question	2
						skipped question	0

Figure 66 Questions 7-10

Response Summary

Total Started Survey: 2
Total Completed Survey: 2 (100%)

PAGE: DEFAULT SECTION

11. Walking around the site in Blue Mars with your group members generated a well thought out site driven design response. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Walking around the site in Blue Mars with your group members generated a well thought out site driven design response.	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	5.00	2
						answered question	2
						skipped question	0

12. Working in Blue Mars allowed you to think about materials. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Working in Blue Mars allowed you to think about materials.	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	5.00	2
						answered question	2
						skipped question	0

13. Sharing your work via Blue Mars resulted in more iterations (versions) of the design. Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
Sharing your work via Blue Mars resulted in more iterations (versions) of the design.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

Figure 67 Questions 11-13

14. The size of the project program allowed you to focus on developing more detailed designs

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
The size of the project program allowed you to focus on developing more detailed designs	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

15. The additional information provided to you assisted you in design development. (autoCAD file and 3d max model of site)

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
The additional information provided to you assisted you in design development. (autoCAD file and 3d max model of site)	0.0% (0)	0.0% (0)	0.0% (0)	**100.0% (2)**	0.0% (0)	4.00	2
						answered question	2
						skipped question	0

16. With respect to question 24, Blue Mars would help you to realize those changes to be made.

Create Chart Download

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average	Response Count
With respect to question 24, Blue Mars would help you to realize those changes to be made.	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	4.50	2
						answered question	2
						skipped question	0

Figure 68 Questions 14-16

17. Please rate your previous level of adaptability to Blue Mars. (1 low, 7 high)

	1	2	3	4	5	6	7	Rating Average	Response Count
Please rate your previous level of adaptability to Blue Mars. (1 low, 7 high)	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	0.0% (0)	**50.0% (1)**	0.0% (0)	5.00	2
								answered question	2
								skipped question	0

18. Please rate your current level of adaptability to Blue Mars.

	1	2	3	4	5	6	7	Rating Average	Response Count
Please rate your current level of adaptability to Blue Mars.	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	**50.0% (1)**	**50.0% (1)**	0.0% (0)	5.50	2
								answered question	2
								skipped question	0

Figure 69 Survey Results from Group A, questions 17 & 18

19. Do you plan on using Blue Mars in the future?

- Yes
- Yes

20. Would you recommend Blue Mars to other architecture students?

- Yes
- Yes

21. What do you think could have sped up the decision making on this project? (Please explain)

- *Share window (in the good internet system), should have a pen mouse for sketching and sharing immediate files.*
- *3D virtual space allowed me to understand the contextual condition with the current design*

22. Because of your prior experience in Blue Mars, were you able to refine your work flow? Please explain.

- *We divided design task and knew how to merge our files later on with much technical issue. And I no longer have any limitation in applying any new material coming up during the design process.*
- *It won't spend too much time on the technical and application, which precede the design development faster.*

23. What could have increased the amount of productivity and collaboration while in Blue Mars? Please explain.

- *Clear task responsibility and files management between members.*
- *The availability of visual and verbal tools as walking through, available import to Blue Mars from other conventional 3D modeling programs.*

24. If you could change something about the final design (because you were able to walk around in it), what would it be? Please explain. (1 or 2 brief statements)

Roof:
- *The roof 's structure would be wooden frame with more detailed connections.*
- *Add a little more details, test a thatch material.*

Gathering Space:
- *More realistic furniture, overhang, cover structure*

Material:
- *Steel would be used some part of the structure to help the design flexibility and the design looked more flying (light weight).*
- *Make a gabion wall look more realistic.*

Structure:
- *Realistic size and proportion and details connection.*

Spatial Adjacency (distances between program spaces):
- *Clear entry point.*

Detail:
- *Need more structural and architecture details like structural connections, furniture.*
- *Connection, size, realistic materials.*

25. Because of your prior experience in working with Blue Mars, were you able to make design decisions faster?
- Yes
- Yes

4.7 Interpretation of Survey Results

The following sections provide additional information regarding question phrasing, why certain questions were asked and answers.

4.7.1 Group B

Question 1 was asked to make sure that the students felt like they had adequate information to proceed with their design. Both seemed to agree that the drawings, models and images were enough to use during discussions.

Their response to question 2 was needed in order to establish that site visits are important to students when trying to understand the context of the design problem.

On question 3, they both agreed that supplying interior and exterior perspective renderings are enough to communicate a design. If I were to ask another group of architecture students the same question, I would probably receive the same answer. The production of a final presentation always requires some form of perspective rendering or viñette to provide additional detail information with respect to material and context.

On question 4, there seemed to be some disagreement in project scale. One student agreed that it was small enough, while the other didn't. Factors contributing to the dissension were most likely related to pressures from other coursework. At the end of the presentation, one of the students expressed that they would have liked more time to work on it. Based on the observations and feedback given during their presentation, again, student's work schedules and own levels of skill in designing were influencing their response to this question.

However, on question 5, when asked about if more work could have been done if it were a part of a mandatory studio project (studio is mandatory for all accredited architecture programs in the U.S.) , there was again some range in response. One agreed that more work could have been done, while the other response was neutral. Giving this a little more context would help in understanding that—if this had been a studio assignment, students would most undoubtedly be focused on the design and not on other coursework and would not be scrambling for extra time. There would be no additional side projects (like this one) and no need to set aside additional times for meeting.

On question 6, both agreed that if they had a choice over walking through their design with the guest critic versus using the same presentation media as their final, they would choose the walk through.

On question 7, students used Photoshop, AutoCAD and Sketchup 7 which reflects what I had previously mentioned in Chapter 3 as being the most basic programs an architect should know how to use. On question 8, again, both students had reinforced that personal schedules and not doing a site visit influenced the progression of the project. On question 9, students felt that the production of presentation material was the most time consuming part of the project. Although in contrast, their discussion times were the most time consuming as indicated in figure 50 . On question 10, only one response should be considered valid because restating the project problem along with the developed concept does not constitute an answer. However, the questions that required an answer were open to their interpretation. An example response might have helped on question 10. On question 11, I wanted to know what would have helped them to develop more details. "More time," was expected, but "using Blue Mars and Revit" were not, especially since one of them doesn't know how to use either program. I was expecting a response like "more feedback" or "a different partner" because I chose not to provide comments during their meeting sessions and had kind of stuck them together as a pair so they had never worked together before. On question 12, only one response was given. In the opinion of that one respondent "the most challenging part of collaborating with someone else in a team project is having the right partner, making design decisions and sticking to them." In studio, this is always the case regardless of working environment (environment meaning physical or digital surroundings). On question 13, only one response was given again. Because I knew that these students had studio, I wanted to get their feedback on managing two design projects simultaneously. The one response indicated that managing two projects is difficult, but believed it to be necessary to learn how to do it. An architect or intern maybe managing two or more projects at a time that require many different types of responses. By taking on a large credit load each semester, students are preparing themselves for the same levels of work related stresses experienced out in the field.

4.7.2 Group A

On question 1, right off the bat both students agreed that working in Blue Mars and the various online communication tools allowed them to contribute more ideas during their meeting sessions. On question 2, both students agreed that being connected online allowed them to ask each other more questions related to the design. The question was redundant and should've been omitted or at least rephrased as follows:

- Being able to connect with your group members via Skype and Blue Mars outside of the mandatory meeting times was a great convenience which allowed you to ask your fellow group members more questions related to the design.

On question 3, both responded with "Strongly Agree." Indicating that they liked Blue Mars.

On question 4, both agreed that being connected to the internet made it easier to share information quickly. Asking this question affirms that although they were in two different locations, they were still able to access the same project files. When in a traditional group project, you have to call over a team member to join you in front of your computer screen to share the information that you've found. When everything is electronic, you're able to scroll to different sections at your own pace. If you both need to be on the same paragraph or image, it gives students the opportunity to practice instruction giving.

On question 5, there was a little disagreement in work contribution, but it was expected. Student A was very clear about needing to focus on his other coursework during the last couple of meeting sessions which caused Student B to carry more of the work load.

On question 6, both responded by stating it didn't take them very long to make design decisions. In pilot project 1, I had asked this same question and the response was different. Both felt that it took "extremely long" to make a design decision because they were unfamiliar with Blue Mars. This time around, they felt personal improvement and responded accordingly.

On question 7, there was a range in response, in fact, both at opposite ends of the Likert scale. One "Strongly Agreed" that Blue Mars allowed them to put a lot of detail in to the model, while the other "Strongly Disagreed." Before Student A was bombarded with additional coursework, he had experimented with importing structural details such as bolts, Simpson ties, and other structural connectors in to Blue Mars. It wasn't as successful as he had hoped it would be. Because the items were physically small in scale but large in quantity, it didn't export properly and the visibility of those items were extremely low. There is a way to import these small detailed items, but I didn't go over that with them. As a response, further documentation needs to be added explaining that process.

On question 8, both agreed that working in a digital environment made them pay attention to the amount of time they were spending on modeling and discussions. The results in Chapter 4 help to support this. It was almost a 50-50 ratio of time spent modeling to time spent in discussion where as in Group B, they spent most of their time in discussion and less time on graphic output.

Oddly enough, Group B didn't feel that way as evident in their survey feedback—they felt the inverse.

On question 9, they both agreed that Blue Mars allowed them to work within the constraints of the terrain. It could also be inferred that because of the project boundary being as small as it was coupled with their prior experience with it in pilot project 1, they understood the need for the design response to be proportionate to the site.

On question 10, both strongly agreed that walking around the site in Blue Mars generated more ideas. Being able to walk around the site virtually was definitely an advantage this group had over Group B. Blue Mars, like many virtual online worlds, allows people to construct an artificial environment complete with sky coverage, terrains, street networks, lighting conditions and the like. Just by having a controllable avatar in the city level walking up and down hills provides an immense amount of information that we can process and let influence our design decisions.

On question 11, both strongly agreed that walking around the site in Blue Mars generated a site driven design response.

On question 12, both agreed that Blue Mars allowed them to think about building materials. It was very clear that at each session, there was exploration in material choice.

On question 13, both agreed that sharing their work via Blue Mars resulted in more versions of their design. If a model had not been prepared the night before, there would be no progress or anything to discuss for the next day.

Although they were passing their models along via ftp transfers, neither of them could comment or question the work done until they met in Blue Mars. They expressed that they could see the model, but they couldn't replicate the experience of checking things out in Blue Mars.

On question 14, both agreed that the project program was small enough to develop a detailed design.

On question 15, both agreed that the additional information provided to them had helped. Evidence of information used can be seen in the 3ds max model they passed back and forth. A chunk of the site (along with site markers) had been given to them so that they didn't have to guess the elevation changes.

On question 16, both agreed that the additional modifications they didn't get a chance to implement could also be realized in Blue Mars. There is an implication that if given the chance to update their designs, they would pursue it and go through the process of re-uploading.

On question 17 and 18, their responses indicate that by using Blue Mars a second time, their understanding of the import/export process and how to use the programs had improved slightly. Both students also indicated that they would like to use Blue Mars in the future on other projects and would recommend it to other students.

The responses to questions 21-25 are mostly requests for improvements to the UI and requests for additional features in Blue Mars. Question 24 was asked so that students could voice their "shoulda-coulda-wouldas" about the design.

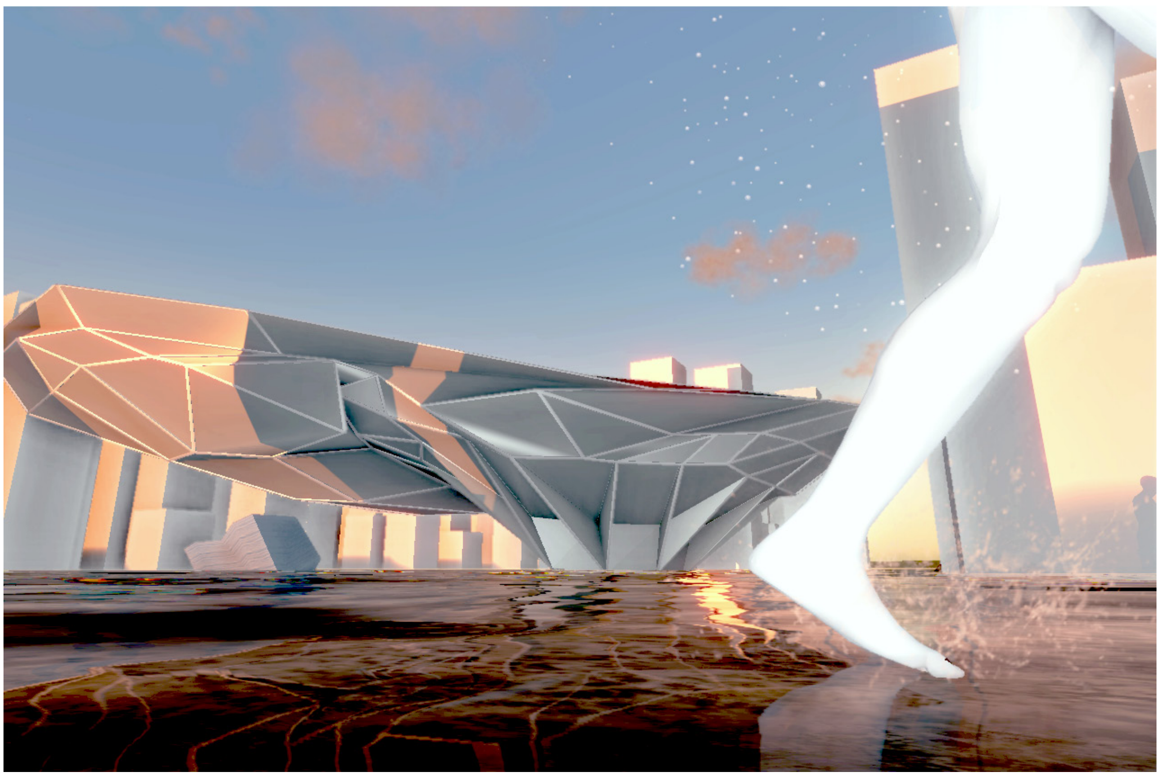
4.7.3 Survey Summary

The survey was distributed to Group B after they had a chance to check out the work that Group A had done in Blue Mars. Group B was allowed to navigate the 3D environment that Group A had been working on in Blue Mars after their final presentation had been given. When asked if being able to "walk around the site" as an avatar would've helped you understand the site a little better, one responded by saying "yeah" and the other nodded. One of them also added that "being able to see the changing lighting conditions would've helped ..." and "... seeing how far the water breaks on the shore would've probably made us shift the location of our design."

Students in Group B placed great value in knowing their site, size of project, length of project and who they are working with. Students in Group A placed great value in being able to communicate, share files, quickly develop ideas, study their site, study the context and existing culture. Both groups also indicated that they would modify their designs if given more time.

The survey was distributed to gain additional feedback from all of the participants in this study.

5



Conclusions

Chapter 5

Conclusions

In general, I feel that more participants would have resulted in greater variations in design, opinions, errors, and data. Having more participants would have also emulated the actual environment of a design studio. Anywhere between 15 and 18 participants would have been ideal. Due to the limited time and available resources, the results from the pilot projects only confirm that the use of VOWs in the design process provided an enjoyable experience for those that used it. It cannot be implied that every architecture student using VOWs in the design process will enjoy it and that their oral and graphic communication skills will be improved. But for the majority that *have* used VOWs, they found that: (1) being able to see and realize multiple design iterations; and (2) being given the opportunity to experience their designs in a first-person-perspective were the greatest benefits of working with VOWs. The participants that used Blue Mars showed improvement in the second pilot project with respect to design progression, minimized technical errors in modeling, quality of discussion topics and quality in presentation.

If I were to state that "we will always run in to issues with general start-up problems when teaching a new program," I think it would be a widely acceptable point of view. I was able to apply what had been learned from the first project to minimize technical errors in the second so that my participants could immediately begin designing. By introducing a new way to share files, we also introduced new technical errors that had to be figured out. Encountering problems and troubleshooting them is just a characteristic of testing anything new.

Through my observations and feedback from participants, it is my recommendation that the following actions be taken before and during the use of Blue Mars for a remote collaborative project in an academic setting. The recommendations appear tedious in nature, but the imposed structure fosters team building and prepares students for working in an actual architectural office.

1. While holding discussions in the VOW, the use of Skype and a dedicated headset for communication is highly recommended to reduce noise and increase audible clarity.
2. Ensure that everyone on the team knows how to model in at least one 3d program. Great success has come from utilizing the products from Autodesk, especially 3dStudio Max — the dominant program used in both pilot projects presented in Chapter 4. If using a different 3d modeling software other than the recommended ones from the VOW creators, than documentation unique to that program must be found and tested or user generated and tested in order to ensure use of the VOW method.
3. Designate a team leader, this person will be responsible for leading the discussion and keeping members on track.
4. Set up a way to share files via an online file sharing database like Filezilla, or Rapidshare, or have the IT department set up an FTP site for the class. Designate an administrator to monitor the overall account, he or she should be in charge of organizing the folders and folder creation. Make

sure everyone on the team has access to it and has a folder within the database with their name or team names labeled. Team members must be responsible for maintaining their own files.

5. Ensure that everyone has the same software.
6. Introduce the team to the VOW user interface and allow several hours of game play. It is extremely important to walk through the set up phases together—this ensures that no one is left behind and that everyone has created an account. This can be done simultaneously while learning how to use the VOW's method for generating and uploading content.
7. Learning how to generate usable content must be learned as a team. It is recommended to use the workflow and checklist created in appendix A. Whilst following the recommended workflow, it is highly recommended that team members A) stick to a file naming convention and B) place their files in the appropriate folders.
8. The instructor must go over how to bring in models to the editors through multiple exercises in a face to face environment. These exercises should vary in levels of design complexity. Students cannot be trusted to learn the workflows on their own. If additional assistance is needed, then a teaching aid (TA) well versed or at least familiar with Blue Mars should be hired.
9. On the day of a critique, students should upload their models during studio time.

The limits discovered here have helped me to understand that if an architect wished to move in to the world of online world making, they would need to learn a second set of skills or hire a company to do the work for them.

To have the greatest effect in physical reality, introducing the use of VOWs in architecture needs to start in schools of architecture around the world. There needs to be more examples published about the use of VOWs within architecture so that the architectural industry can see how these new methods of collaborating could improve or hinder the practice of architecture in other areas. One such area that needs more attention is the affect that VOWs have on the dynamic between consultant and architect. Since our industry involves clients, consultants, contractors and architects, a project involving all four parties would provide a more comprehensive and realistic case study that researchers could draw better conclusions from regarding time, cost effectiveness, communication, quality of design and team work. At least today we are able to decide when we want socially and culturally face-to-face synchronous communication, and need asynchronous remote communication on any project.[73]

I also believe that additional case studies should be implemented with a focus on analyzing how people work together in order to propose a more effective strategy for designing and communicating in architecture. The results of such studies could lead to the development of new strategies for teaching design and provide an alternative way of practicing architecture. Realizing that teaching

[73] Gabriel, Cesar Gerard and Mary Lou Maher. "Coding and modelling communication in architectural collaborative design." *Automation in Construction* 1, (2002): 211.

and learning is not a perfect process will make it easier for new forms of teaching design to be accepted.

I observed how different personalities and environments effect team building and the resulting work. One of the greatest strengths that VOWs have over traditional face-to-face collaboration is the ability to provide a safe environment for students to share their ideas. Students felt that they could be more "candid" than in a regular face-to-face environment which allowed them to flush out more ideas and move on to the next iteration of their designs quickly. Communicating orally and graphically is an essential skill for architects which is why careful attention is given to drawings and presentation images. Presenting *in* the 3D world we've created is a much more effective means of communication than trying to explain a flattened 2D version of it. Light, shadow, ambiance, scale, proportion, depth, texture, materiality, sound, presence and life are now an experience, rather than an image.

The creative process for Group A differed greatly from Group B because of the following influences: different personalities, different working environments and different skill levels. The only real factor that could have been immediately controlled was the environment. Changing the location of where one works is far easier to do than telling someone to behave differently or to teach someone a new program in a short period of time. The environment in which we work can either have a positive or negative impact on the way we collaborate and communicate with team members. For Group A, being in different locations and working asynchronously was a huge success because they could work from home and simultaneously be immersed in the site at every meeting. Unfortunately for Group B, meeting face-to-face in combination with zero 3D site immersion didn't yield the same success or provide an enjoyable experience.

An early critical concern that the architectural industry and its constituents had in 1991 with regard to real-time remote collaboration is their ability or inability to utilize computer technology effectively so as not to disrupt the design process.[74] Nearly 20 years later, they are still facing a mild form of that concern. Due to the fractured nature of our applications, it takes many different programs running independently of each other to get the job done. It's an extremely wasteful environment to work in which is why consolidating programs has been recognized as a factor that minimizes distractions and these inefficiencies.

So where does that leave VOWs? There may be some people who feel that learning another set of programs only adds to the fracturing of our applications, and they're right. The software industry also recognizes this and thanks to the early experimentation done by Shiratuddin, Kvan and Wojtowicz in the mid 90's, the benefits discovered by using gaming engines and advanced communication software in the design process are influencing new features and tools being developed by leading CAD companies. ArchiCAD 14 introduces Virtual Building Explorer and Autodesk is working on a project called Newport—both allow for real-time 3D exploration. These two programs mark the first steps that Autodesk and Graphisoft have made in integrating real-time communication tools, real-time mark ups tools and providing the ability to change visual styles in

[74] Gabriel, Gerard Cesar, Mary L. Maher. "Coding and modelling communication in architectural collaborative design." *Automation in Construction* 11 (2002):200, http://www.sciencedirect.com/.

real-time into their major CAD programs. If a feature like VOIP and real-time markups are integrated, the need for programs like Skype and TeamViewer are eliminated. If you give everyone the ability to simultaneously participate and walk around your design, then you eliminate the need to explore the use of VOWs. If real-time rendering, ray-tracing and global illumination is a built-in feature, then you've eliminated the need for rendering stills and animations. Consolidating features like the ones just mentioned are what's happening today. We save time, decrease opportunities for mis-communications and provide a better working environment for all users.

Although the necessary time, skill, support and training needed to accomplish integrating the use of Blue Mars into a design project has been thoroughly explained in Chapter 4, the advent of new technologies like Autodesk's project Newport and Graphisoft's Virtual Building Explorer will pose new collaborative strategies that have been tested and developed for the use of architects. It is important to remember that VOWs and MMOWs were not developed for the use of only one type of person or industry. The internet and MMOWs are the new petri dishes for Autodesk and Graphisoft's RnD department.

Developing a better method or product always starts with realizing that something is missing or not complete. Seeing the positive results of using VOWs and game engines in studio projects and in actual practice by major CAD companies has pushed the development of products like Newport and Virtual Building Explorer to be realized. Real-time 3D exploration was a missing element to our existing set of tools and the development of those two programs will change the way architects communicate, present and design in the future. Using the tools and features of virtual online worlds is like re-introducing students to the design process. Instead of just responding to the site, context, culture and budget, students will gain a better understanding of fulfilling the needs of their end-users and clients which will result in better designs.

Like Gabriel and Maher, I believe that the nature of virtual collaborative environments (like virtual online worlds) between architects can make a profound impact on the outcome of a design and reshape the way students think about designing architecture.

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Appendix A - Work flow documentation

Read Below:

These set of instructions will not cover troubleshooting for **Rhino Software or Sketchup**. Please consult your local Rhino and Sketchup expert for additional instructions, troubleshooting and support. For officiall instructions on how to use the Editor suite provided by Avatar Reality please refer to suggested websites for that kind of instruction (see below).

You will only be provided possible solutions to common errors experienced in the **Blue Mars SDK and 3d Studio Max** (version 9.0, 2009 & 2010) which were discovered between the trial period of June 9th, 2009 - July 30th, 2009. This document contains helpful hints and is an un-official guide to importing/exporting objects using the Item Editor from the Blue Mars SDK. For further information on the CryEngine Sandbox 2 Editor which the SDK is based off of, please visit www.crymod.com and check out their forums.

The suggested solutions provided in this document have been compiled from testing, reading the help forum threads on crymod.com and from a few correspondence e-mails between Avatar Reality (makers of Blue Mars).

Websites:

1. Specifically for Blue Mars - http://www.bluemarsdev.com/wiki/index.php/Main_Page
2. For Sandbox 2 Editor - http://doc.crymod.com/SandboxManual/frames.html?frmname=topic&frmfile=index.html
3. For Sandbox 2 Editor - http://doc.crymod.com/AssetCreation/frames.html?frmname=topic&frmfile=index.html
4. For Sandbox 2 Editor - http://doc.crymod.com/index.html
5. For Sandbox 2 Editor (Online VIDEOS) - http://www.crymod.com/thread.php?threadid=44140&hilight=tutorial
6. For 3dMax help - http://www.crymod.com/board.php?boardid=127&sid=73948b91c93dbac70188c55dfda5d943

Checklist - Items & Objects (static)

In 3d Studio Max before exporting to COLLADA file type

Static: No moving parts

1. ☐ Established a naming convention for all files and materials
2. ☐ Saving to the MyData folder
    - ☐ 3ds Max files
    - ☐ .DAE files
    - ☐ .tif files (your materials)
3. ☐ Layers
4. ☐ Normals
5. ☐ Unit setup
6. ☐ Texture formats
7. ☐ Materials
8. ☐ Used Reset X-form to ensure objects scale
9. ☐ Created a proxy form
10. ☐ Edit Poly
11. ☐ Height maps
12. ☐ Parallax Occlusion Maps
13. ☐ Creating .bat files
14. ☐ How to change city file names
15. ☐ Furniture
16. ☐ Flow graph

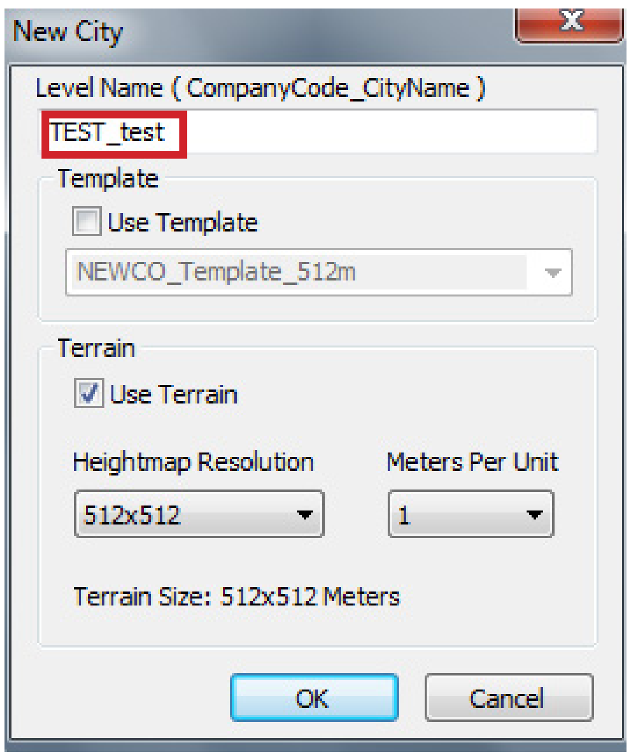
Continue to see examples for each check list item ►

1. Naming conventions

As an architect or student architect you will be working with the City Editor.

When starting a new Level:

1. Use the appropriate Company Codes and City Level names.
2. Carry on the same naming convention throughout the creation of your objects, materials, prefabs, blocks, shops, etc.



Example:
TEST_test

Company Code

City name

Figure 1. Starting a New City

When making a new object:

1. Save the file to the right directory
2. Make folders to store Objects, Materials, Prefabs, Entities, etc.

   * Your .MAX files do not have to be saved in to the TEST_test directory. Those files can be saved elsewhere on your hard drive.

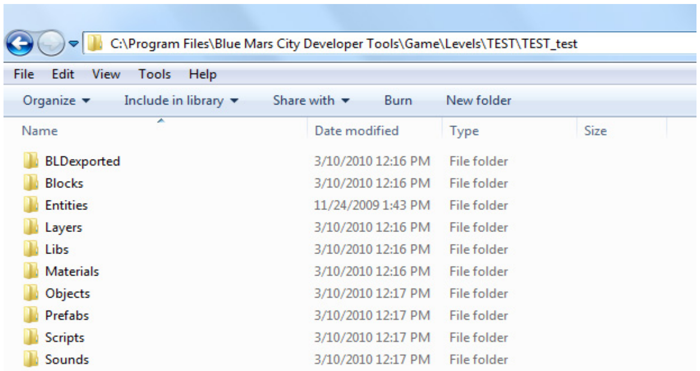


Figure 2. City Folder Structure

Do Not:

1. Rename the City
2. Rename the objects

Why?

If you try to rename the City or the Company Code, Avatar Reality will not accept it. If you try to rename any of the .DAE files, CGF files (objects) or .MTL files (material), you will encounter many problems. You will have to manually re-associate all of the file paths. Fixing that issue will not be covered in this document, if you rename them, you will have to refer to the wiki and developer forums for troubleshooting.

When exporting a document with a .DAE extension, it is best to title that document the same as your MAX file. And if anything should be wrong with that .DAE file, you will need to re-export it. Please try to apply the same kinds of suffixes accordingly in that situation (see Example 1&2). This just helps to keep your files organized.

Example 1:
Test_Studymodel-00.max
Test_Studymodel-01.max
Test_Studymodel-02.max

Example 2:
Test_Studymodel-00.DAE
Test_Studymodel-01.DAE
Test_Studymodel-02.DAE

[1] Blue Mars Wiki. City Developer (Program: City Editor), Overview. http://dev.bluemars.com/wiki/index.php/BlueMars_Workflow_and_City_Editor. Accessed March 10, 2010.

2. Saving to MyData folder

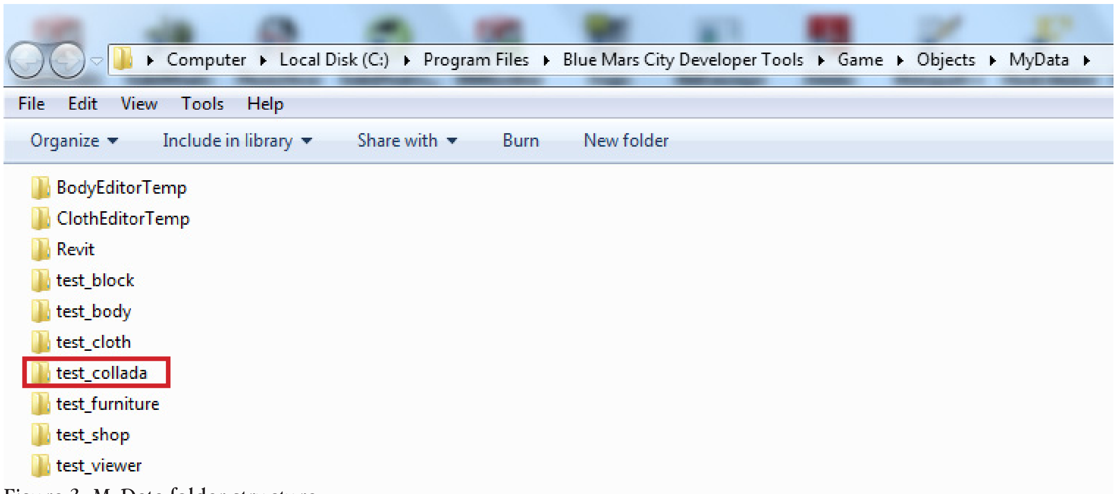


Figure 3. MyData folder structure

Why save to MyData?

Save your recently exported .DAE files from 3ds Max in the MyData folder. Place the .DAE files in their respective folders. The MyData folder can be treated like a place where you keep all your drafts.

Example:
If its a static object or building element, place the .DAE in a folder called test_collada. See figure 3 above.

Where to put finished files?

Finished files (meaning your textures, materials and objects) should be placed in your City folder in their respective directories. You can either use the Blue Mars Asset Browser in the City Editor to accomplish this or you can move all your files manually by dropping and dragging from one folder to the next.

3. Layers

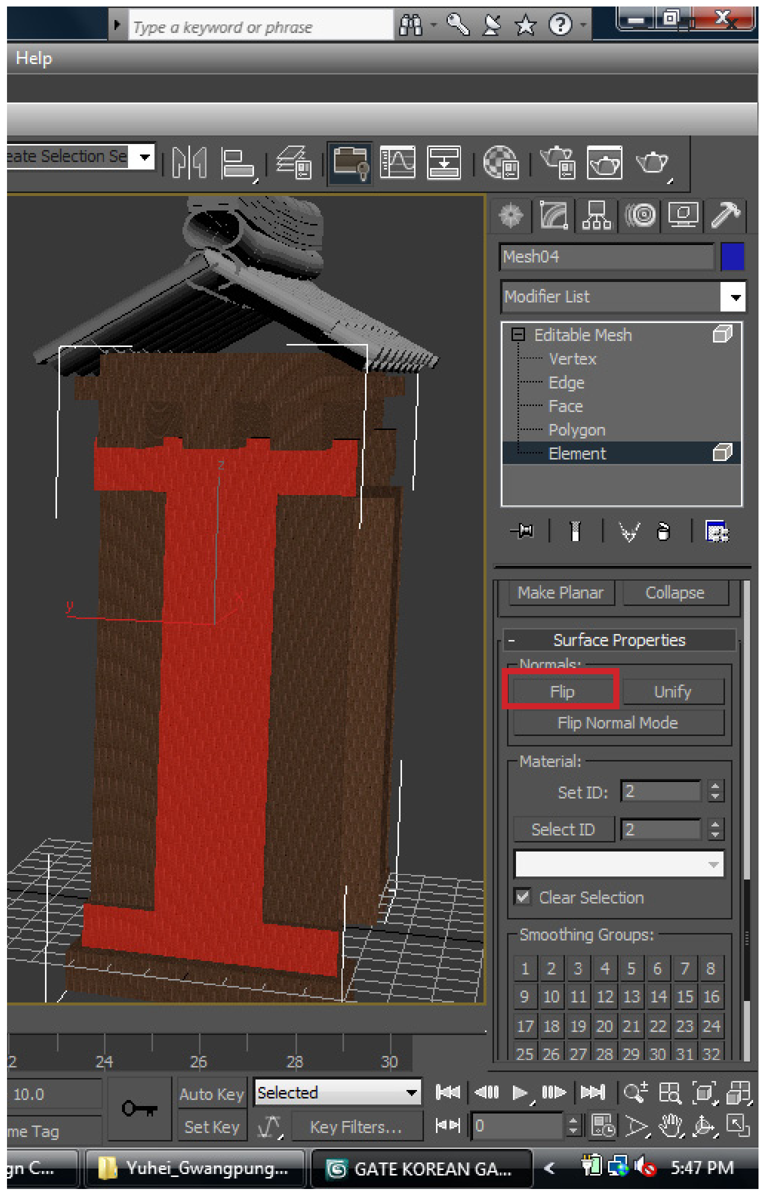
Those of you not using MAX to model really need to manage your layers in whatever program you happen to be building your models in. Complexity and materials are the two major driving forces for setting up your layers correctly. Complexity here means the amount of geometries and complicated form. When you export your model in to a .3ds format or .dwg, it changes the way you can manipulate, edit, select and change the objects in that file. For time sake, lets not get in to that here. Just know that the more objects you have, (1)the harder it becomes to apply materials and (2)its time consuming.

4. Normals

Generally speaking in this context, making sure that all the faces of your objects are oriented correctly means "not inside out". Example 1 shows the difference between an object with its faces oriented correctly and Example 2 shows it incorrectly. It's easy to remedy this.
On the modify rollout expand your Edit Mesh or Edit Poly option and select "Face". Pick all the faces that are black or inside out and then find the "Flip" command by scrolling down the menu of options there (see Example 3).

Example 1

Example 2



Example 3

5. Units

In 3ds Max, you can specify the kind of units to work in, metric-imperial-meters-feet. All the editors provided by Avatar Reality work in metric units and there is no way to change it. In order for your model to come in at the correct size and scale, please change your unit scales to metric. Not just in 3ds Max, but in Sketchup or Rhino or whatever you're modeling in from the start.

You can either specify "Meters" or "Centimeters" in 3ds Max. Both are acceptible.

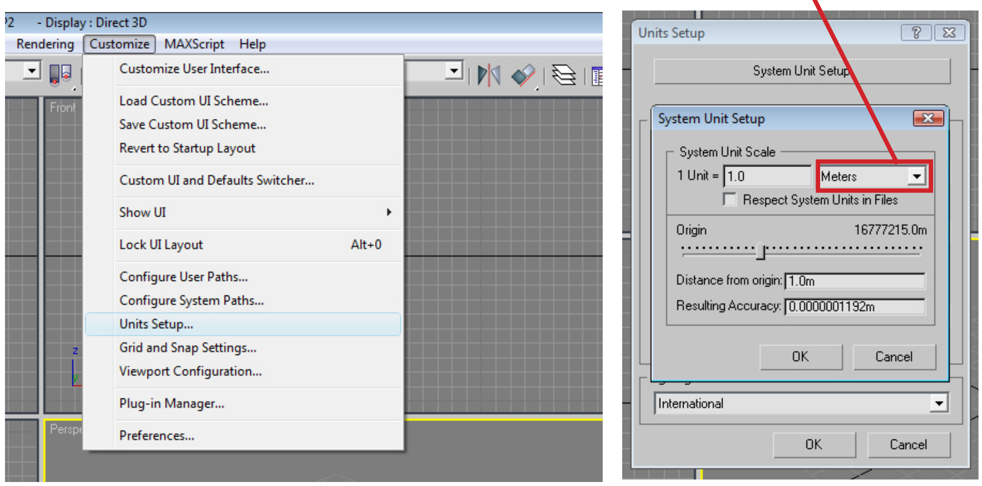


Figure 4. Changing System Unit Setup

6. Texture formats

The City Editor will not except anything besides a crytiff or .DDS file for material. Crytiffs can be converted to .DDS files within the editors. It's also possible to export .DDS files directly from Photoshop. CryTiffs are unique and should not be confused with regular TIF files even though they share the same file extension (.tif). For additional detail, you can create bump maps and normal maps using the CryTiff plug in provided by Avatar Reality. Steps on how to create normal maps can be found here:

http://www.bencloward.com/tutorials_normal_maps1.shtml
http://saschahenrichs.de/midsizedocs/nvidiatut.html

The dimmemsions of these images should be 512 x 512 (some power of 2). The CryEngine programs will have trouble accepting other image sizes. You can alter the dimensions using your favorite photo editing program (Adobe PS, GIMP, Corel, etc.) as long as they can be re-exported to .DDS or CryTiff (.tif).

Example sizes:

64 x 64	128 x 128	256 x 256	512 x 512	1024 x 1024

All example sizes are acceptible. 512 x 512 is perfect for mapping objects and the other sizes should be used on detailing terrain (layer painting).

7. Materials

The reason for saving your materials to file is so that they don't get lost in transfering from one computer to the next. If you take the whole file folder where you've been saving everything and take it to another location, you shouldn't have a problem with disappearing materials.

On the Material editor in 3ds Max (type in "M") and make sure you are on the parent material. Name it to something appropriate. Then save the material to file by clicking on the yellow highlighted icon below. You'll notice in figure 5 that I have the material selected and named as Object_bricks, this is what the edtiors will be naming your material layer when you import your files. Changing this name in editors will cause complications, and it is NOT recommended. Name everything correctly from the start so pick a name and stick with it!

Multi/Sub Object

To create a multi/sub object material

1. Click on the "Standard" button outlined in red
2. Select Multi/ Sub Object and click 'Ok'
3. Set the number of materials to the amount you plan on having <u>plus 1 extra</u> for the proxy material

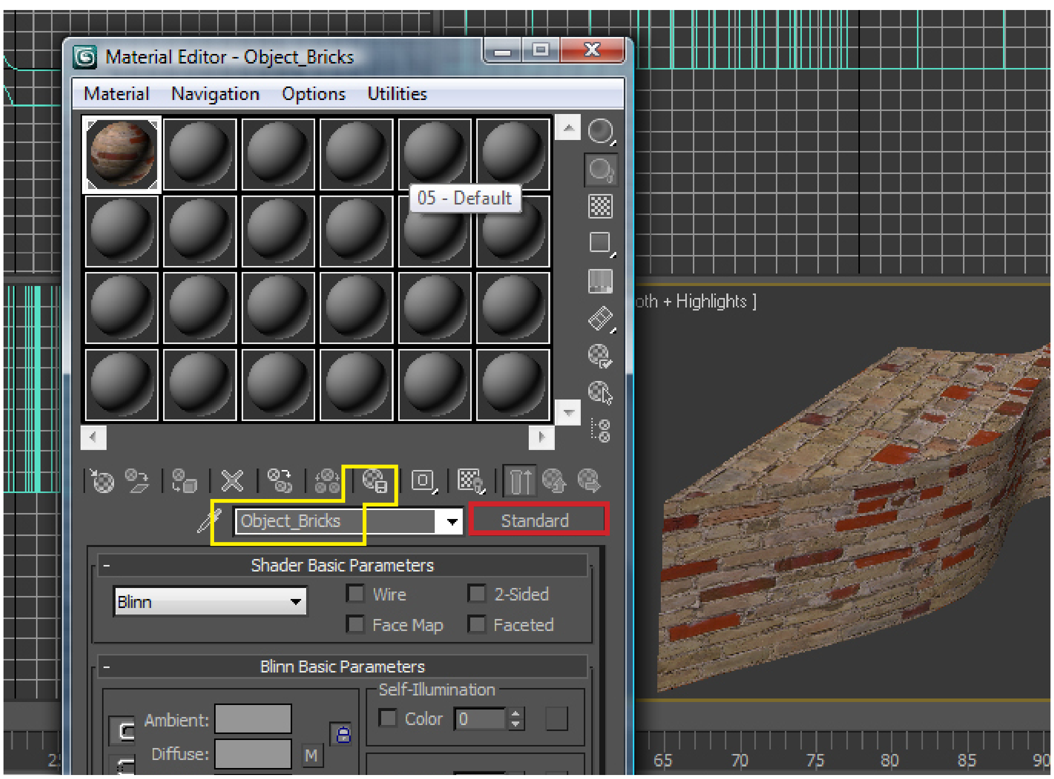


Figure 5. 3ds Max Material Editor

NOTE:

The error experienced by most during our trial period were broken material links which caused a model to appear blank.

Should this happen to you, type in "m" to bring up the material editor in either the Item Editor or City Editor provided by Avatar Reality,

1. Click on the file name in the file subtree, expand it to see the materials applied to your object,
2. find out which material is missing,
3. go to the Diffuse slot under "Texture Map" rollout, click the little file icon next to the name of the missing link
4. and then navigate to the missing file location through the browser that pops up.

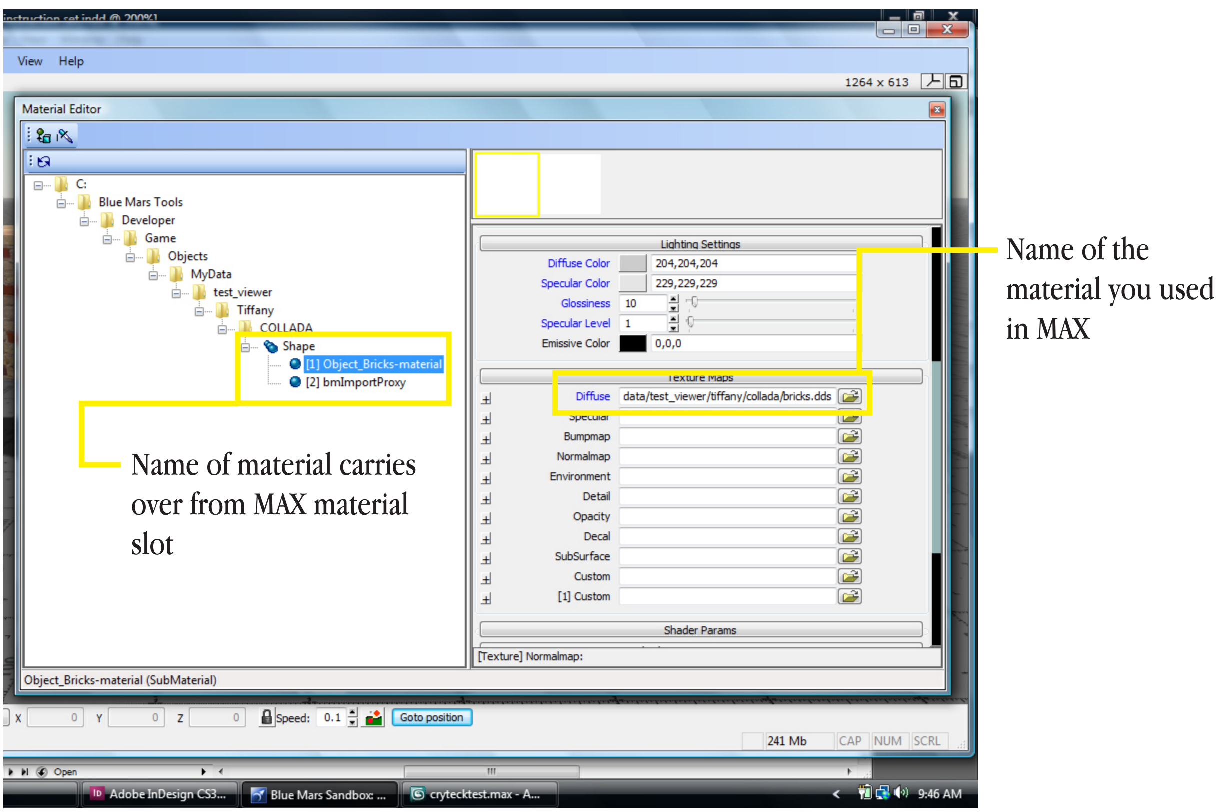


Figure 6. City Editor Material Editor

The 512x512 texture file is called bricks.dds

The layer in the material sub-tree is called Object_bricks. Exactly what it was named while in 3ds Max. If everything was named properly, then your material file should be okay.

8. Reset XForm

Use the Reset XForm (Transform) utility to push object rotation and scaling values onto the modifier stack and align object pivot points and bounding boxes with the World coordinate system. Reset XForm removes all Rotation and Scale values from selected objects and places those transforms in an XForm modifier.

If you change the scale, position or rotation of everything in your MAX file then you will absolutely need to perform this function. Select all your objects (make sure you haven't grouped them in MAX) go to the "Utilities" tab, click the Reset XForm button, and then Reset Selected. You're done. If you're model did something funky like scaling all your objects disproportionately, its because they were grouped. Ungroup them and try it again. If that doesn't work, look for a dummy icon (usually a small green cube) called Scene root - delete that - then try this procedure over again once you've managed to scale everything back to normal. The Scene root dummy only shows up if you've exported from Rhino. Why? I don't know.

Reset XForm ensures that your objects come in scaled and with all the same insertion point location.

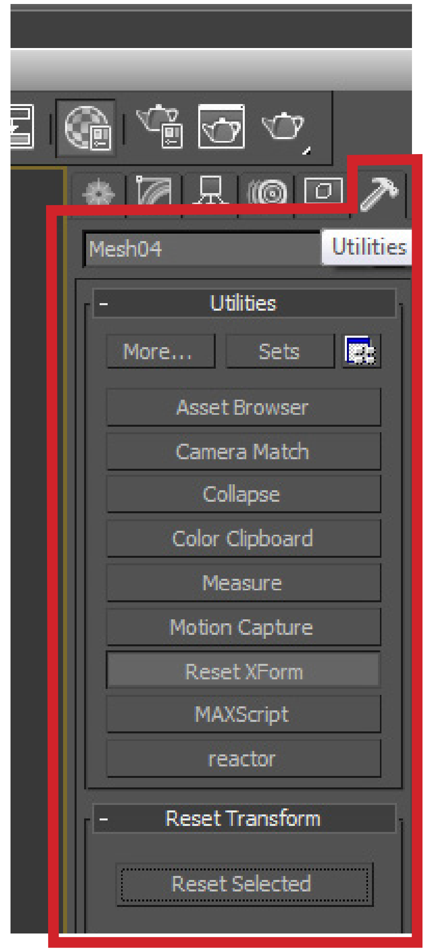


Figure 7 Reset XForm

9. Proxy

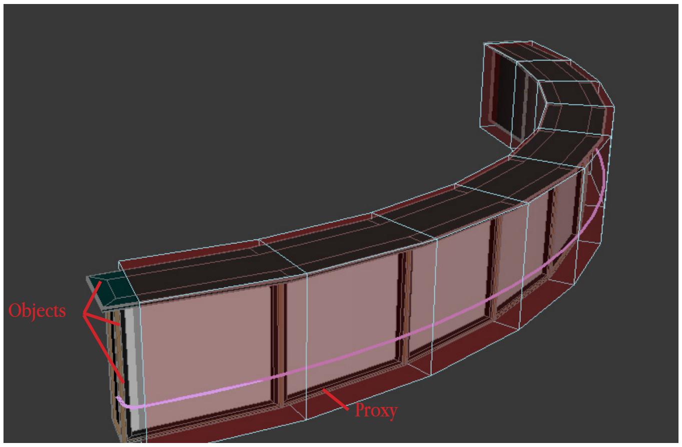


Figure 8 Setting up a proxy object

Proxy geometry makes your objects appear "solid" in the City Editor. This means, you will not be able to walk through them like ghosts.

Just like step no.4, please make sure there are no intersecting vertexes, fractured surfaces, or surfaces with artifacts. You're model will not import properly in either Editor or Viewer. If this happens, you might have to rebuild your model. Try to eliminate any uneccessary faces, points and edges before exporting your file with a .DAE extension and before creating a proxy geometry. This is where knowing how to model profficiently really pays off. You can perform STLChecks in MAX by applying a modifier and you can also reduce the amount of polys an object has by applying an Optimize modifier to it.

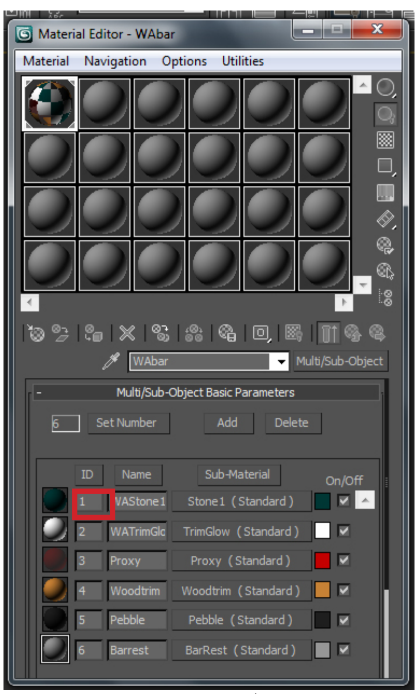


Figure 9 Assigning materials

Creating a Proxy

1. After your objects are created make a very generic geometric shape that matches the overall shape and size of the assembly you've created. Make sure that all of the geometries have an Edit Poly modifier on them.
2. Assign the multi/sub object material to that generic shape. See figure 9.
3. Make sure the Material ID's match up

4. Switch to the Modify tab
5. Select one of the objects and click the “Attach” button
6. Pick each object EXCEPT the generic shape to consolidate it in to one object. The generic shape will be used for the proxy.
7. Deselect “Attach”
8. Click on the Schematic View button and then “Connect” the Proxy shape to the consolidated object

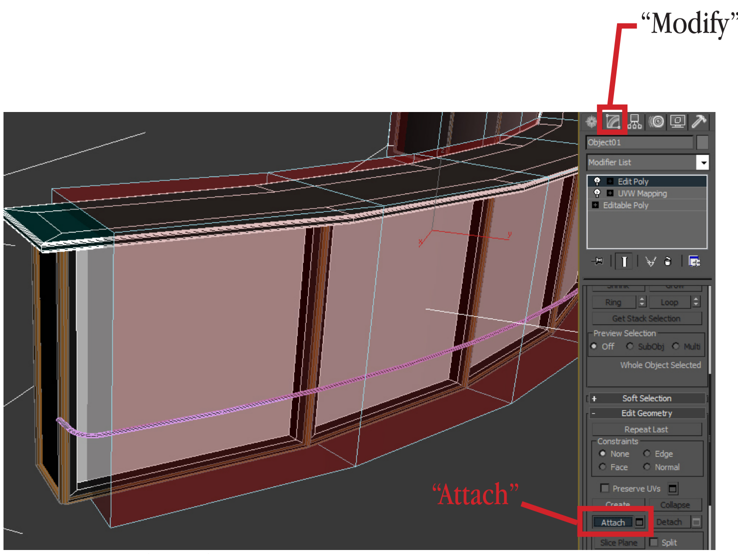
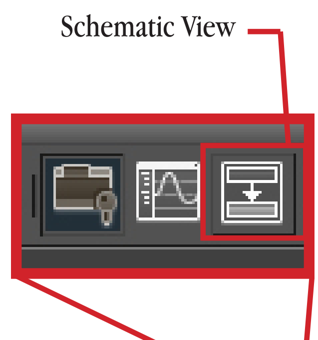


Figure 10 Attaching objects



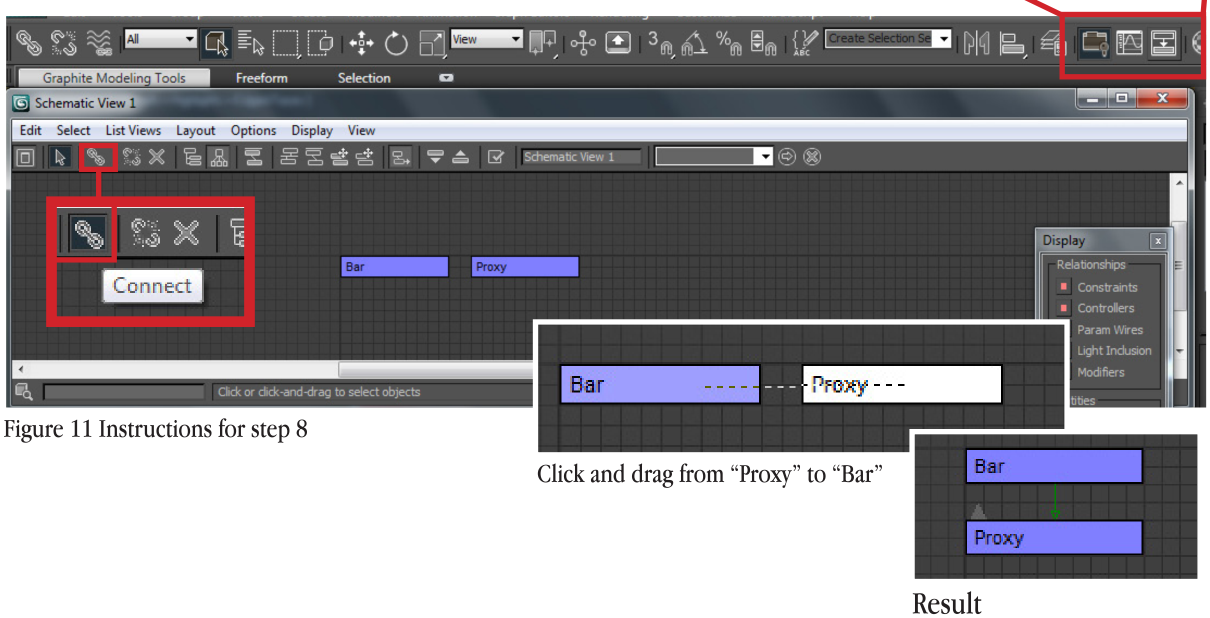


Figure 11 Instructions for step 8

10. Edit Poly

Converting to an Edit Poly allows us to easily assign and change a geometry's material ID's and smoothing groups. It also allows us to keep an eye on the total amount of "polys" or "faces" our geometries have. The more polys/faces, the more complex the shape. The more complex the shape, the more vertices. With more polys/faces and vertices, the chances that we will encounter problems later on will also increase.

Converting geometry to an Edit Poly

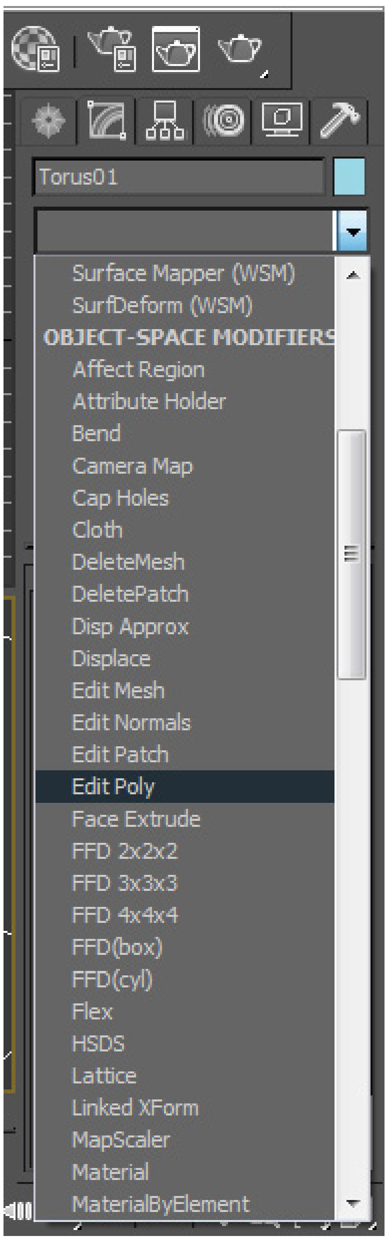


Figure 12 Modifier List

Option A:

1. If starting from a primitive geometry
2. Select the geometry, go to the modify panel (see figure 10)
3. Click on the small arrow to expand the 'Modifier List'
4. Scroll down and select "Edit Poly"

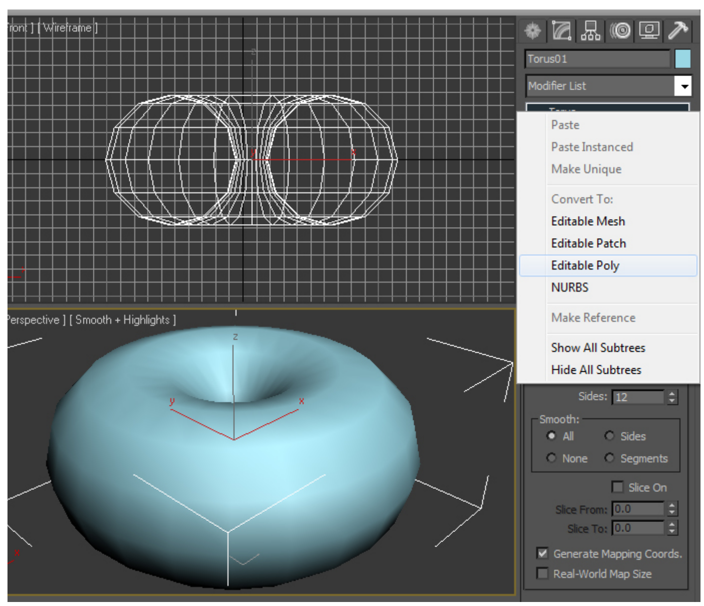


Figure 13 Right-click method

Option B:

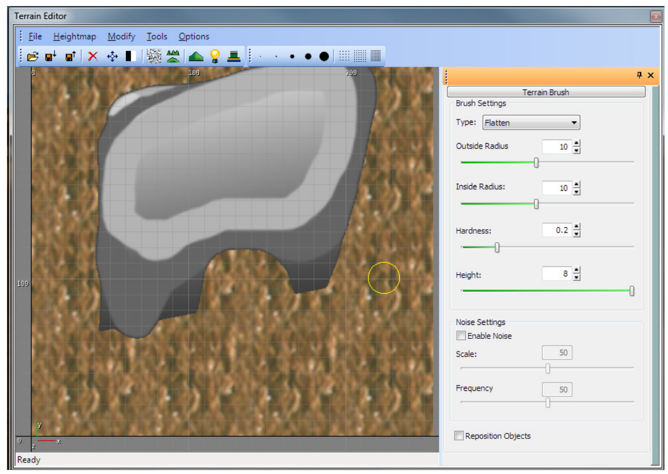
1. Select the geometry or object
2. Right click and select "Editable Poly"

11. Height Maps

Height maps can be used to re-create the actual topography of a site. They are black and white images that can be made in either Photoshop, Ogre 3D, 3dstudio Max or other similar programs. Once a height map is made, you can import them using the terrain editor. Typically, the areas in white represent the highest point in elevation and the black areas represent the lowest. Make sure that the height map is the same size as your intended terrain and that you set the maximum height of the terrain in the terrain editor. 2 methods for creating height maps will be given, the first uses Photoshop and the second uses 3ds Max 2010.

Photoshop method:

Photoshop document



Imported Photoshop document to Terrain Editor

1. Open new Photoshop document with 256x256 or 512x512 pixel dimmensions
   -Keep color mode to RGB
   -Keep bit depth to "8"

2. Go to Image > Mode >
   -Change settings to "Grayscale" and then "16 bit"

3. Go to File > Save as
   - Choose Photoshop Raw

4. Change Byte order to IBM PC , cick OK
5. Done

TIP:
Canvas size was set to 256 x 256 pixels because the terrain will be 256 x 256 meters. Remember that 1x1 pixel is equal to 1x1 meter.

****NOTE:**
1. In the Photoshop document (right) image, the arrow indicates that it will be rotated 90 degrees counter clockwise. The results can be seen in the left image after importing it to the terrain editor.

3dstudio Max method:

You can build the topo model in any program you like, EXCEPT Sketchup. Your model file should only contain your geometry, no lines or construction photos. When you're done, save it as a .3ds file or a .dwg and then open it in 3ds max. . .

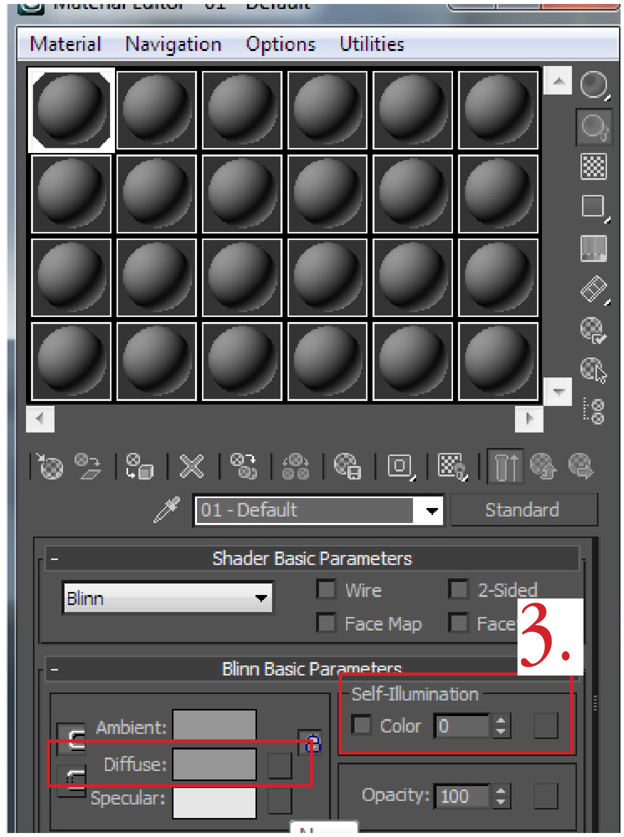
1. Open the material editor box and click on the box next to the diffuse button.

2. Select Gradient, and then change the Black value to White, and the White value to Black

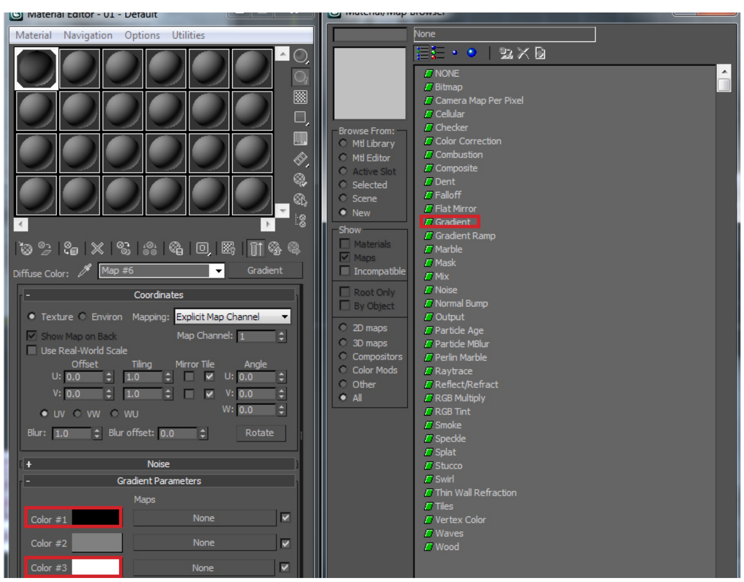
3. Set the Self-illumination value to 100, and make sure your diffuse color is White.

4. Apply the material to your model.

1.



2.

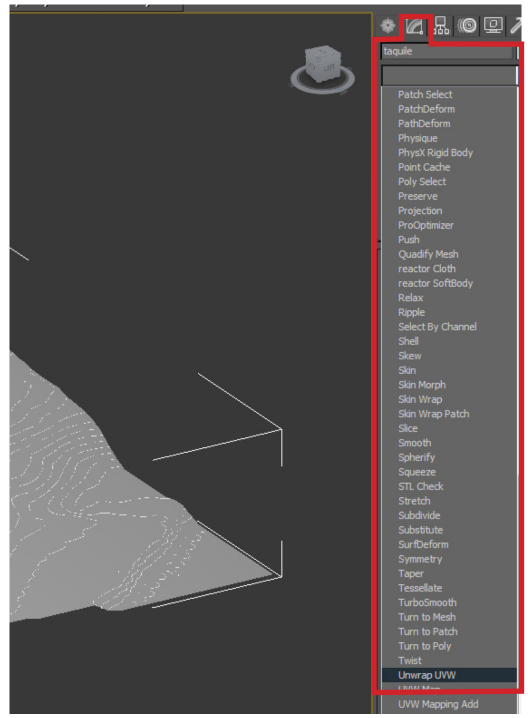


5. Give the model a “UVW unwrap modifier”.

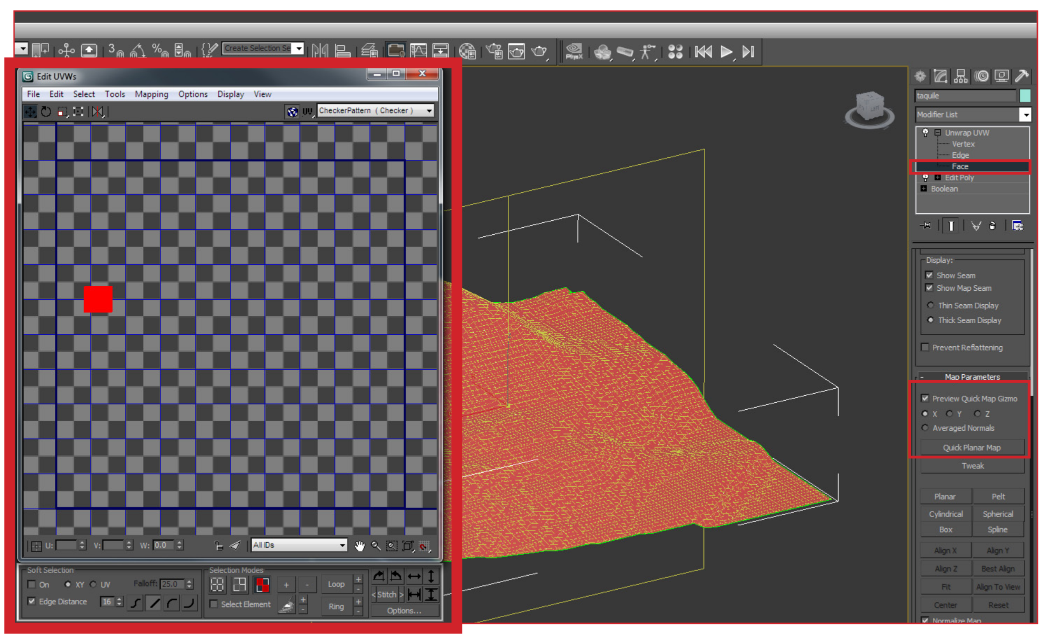
6. Expand the UVW unwrap modifier at the top and select “face”. Then select the model area in the Edit UVW window.

7. Select “X” from Map Parameters and then click on the “Quick Planar Map” button.

8. In the Edit UVW window, notice how it shows the model area in elevation, stretch the model area to fill the square. As you do, the B & W values will change accordint to its accurate height.

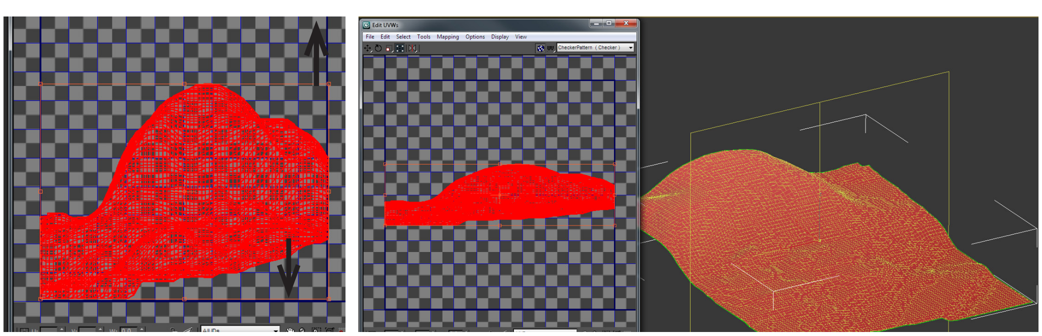


5.

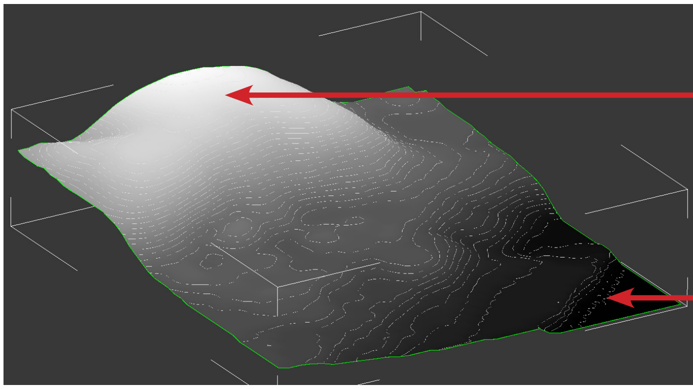


6.

7.

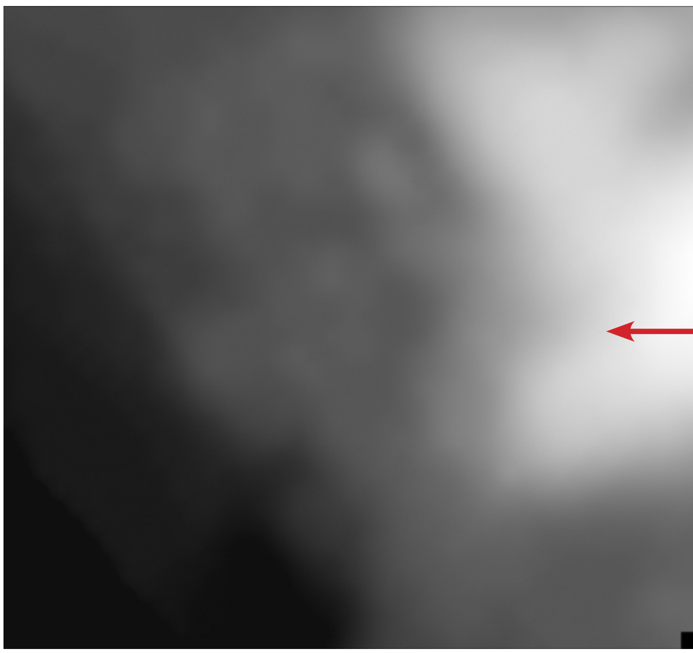


8.



Highest point recieves correct white values of gradient

Lowest point recieves correct black values of gradient



256 x 256 heightmap ready for import.

9. Change the model view to “Top” and Render the image.

10. Save it as a JPEG

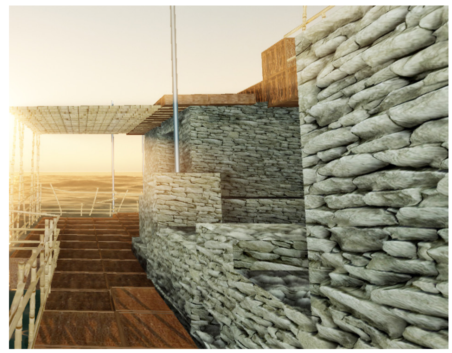
11. Open it in Photoshop, crop it to 256 x 256, then save it using the steps 2 to 5 in the Photoshop method.

12. Parallax Occlusion Map (POM)

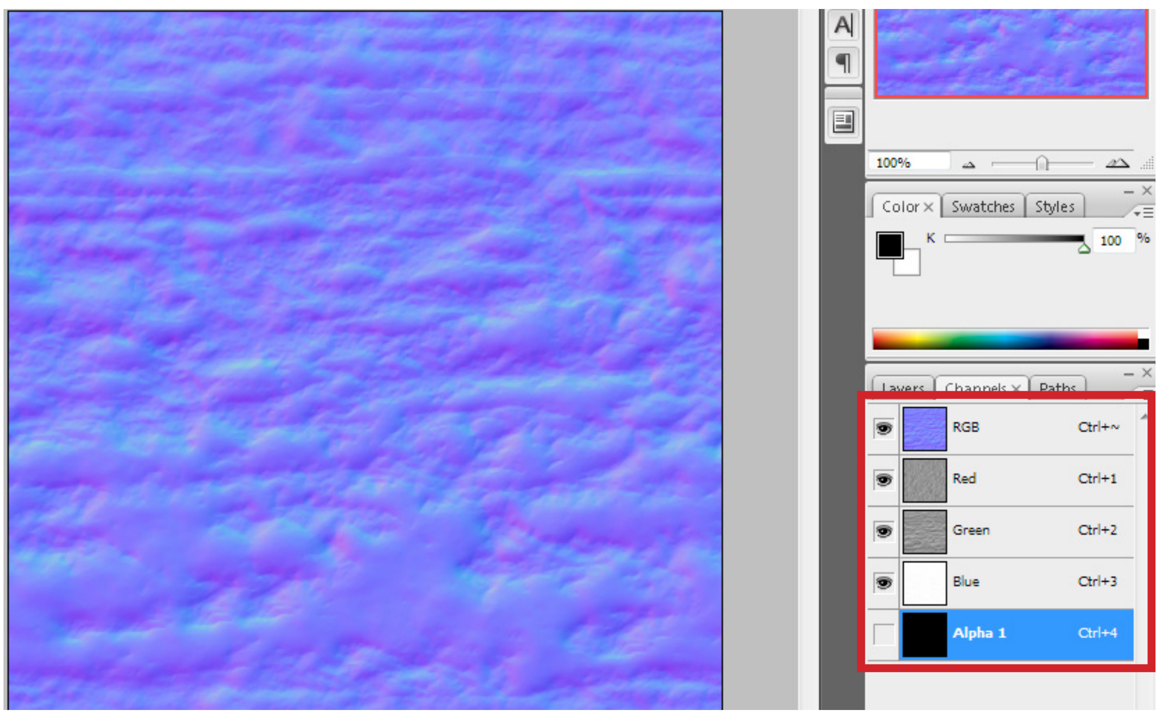
Parallax Occlusion Maps allow the textures to appear to have greater depth and shadow when viewed on the highest setting in both the City Editor and in Blue Mars. Applying the texture once its created follows the same methodolgy covered in sections 6 and 7. You place the .dds file into the respective folder when its completed and then assign it to the object's "Normal" map slot in the City Editor's material editor.


Without a POM texture

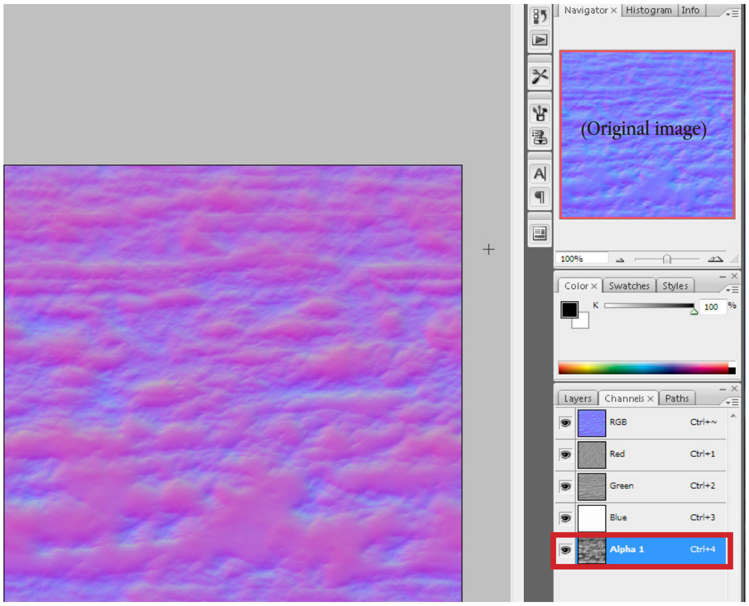
A "POM" texture is created by overlaying both a normal map and a black and white bump map together. Creating the bump and normal map can be done by "Rendering to Texture" in 3dstudio max, or, these textures can be purchased and downloaded from a retailer online. A third alternative is to purchase a program that can turn a regular image file into the needed maps, such a program is called Crazy Bump. If you don't want to purchase it, happy searching for something similar.


With a POM texture

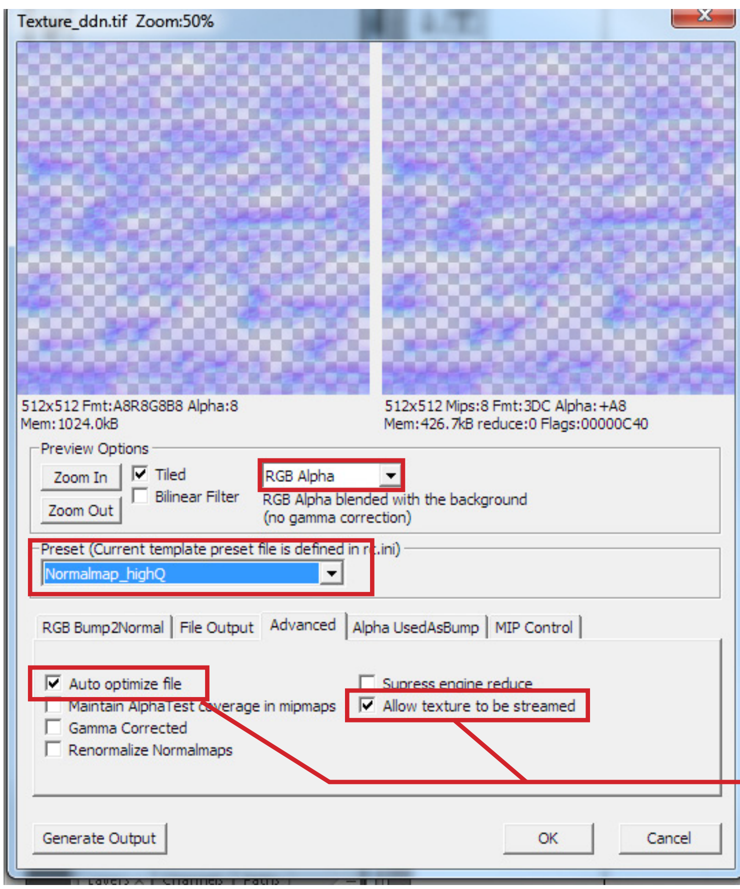
This example will begin by assuming that you already have a bump map and a normal map.



1. Open your normal map in Photoshop
2. Go to Channels> Create new Alpha channel
3. Deselect all the colored channels accept the channel you just created



4. Open the displacement map and then paste it on the new alpha channel you just created.
5. You can do some tweaking to the different channels idividually using the Levels adjustment and also “Unsharpen Mask” under filters.
6. Save to High quality Normal map.. Crytiff
7. Make sure to change RGB to RGB Alpha under file output
8. On the Advanced tab, un check both boxes
9. Done. Rename it to have TEXTURE_ddn.dds as the file format



When putting this together,

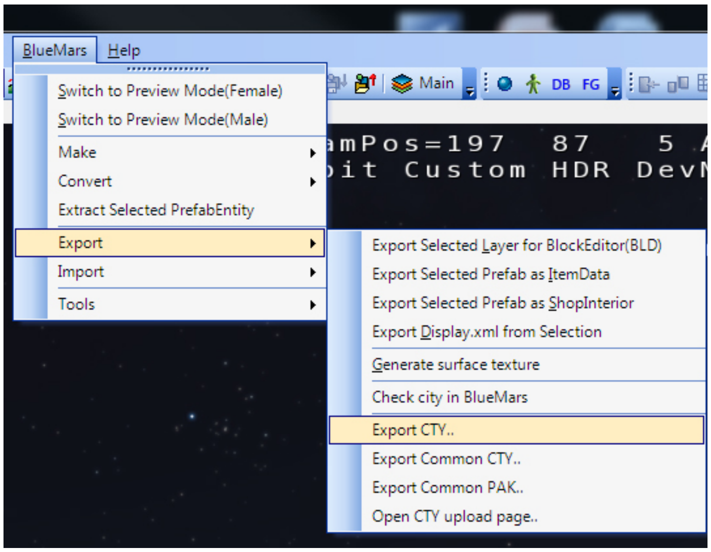
1. Change Config display to Very High
2. Open Material Editor
3. Put the normal map you just created with the Displacement overlay in to the normal map slot
4. Put the regular normal map in the Detail slot.

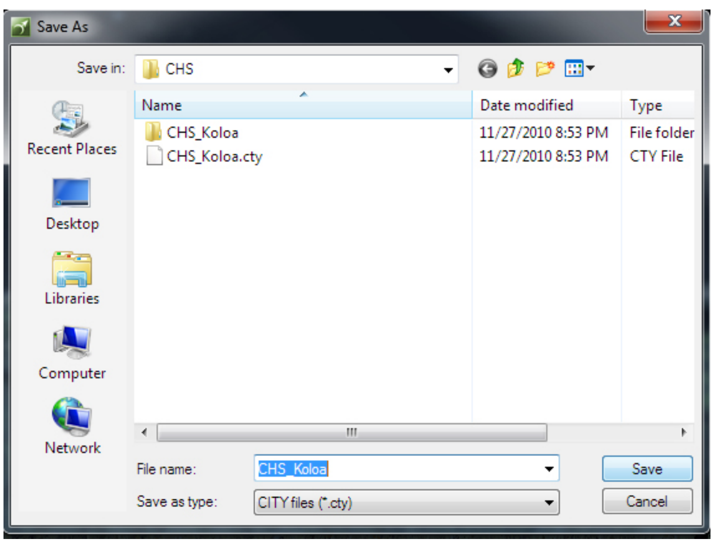
Adjust the settings accordingly until something pops!

*uncheck these boxes

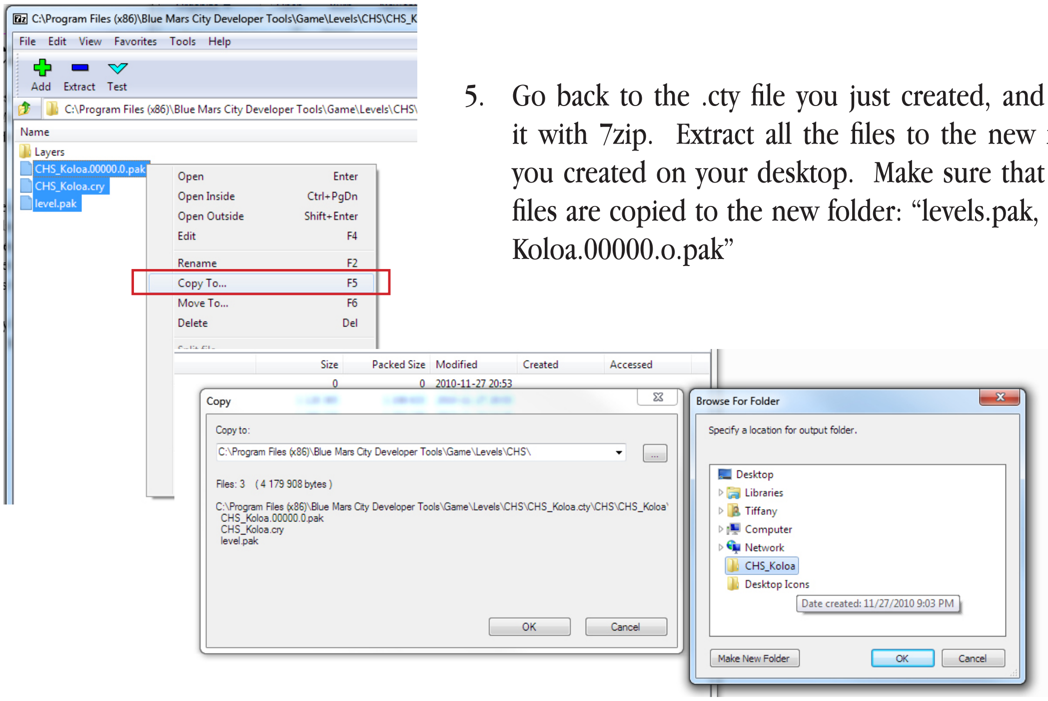
13. Creating .bat files

By creating .bat files you can share your city files with anyone and have them join you on private tours and meetings using the developer client. Make sure the person you are sharing your city level with has a folder in their Levels directory labled with YOUR city level code.



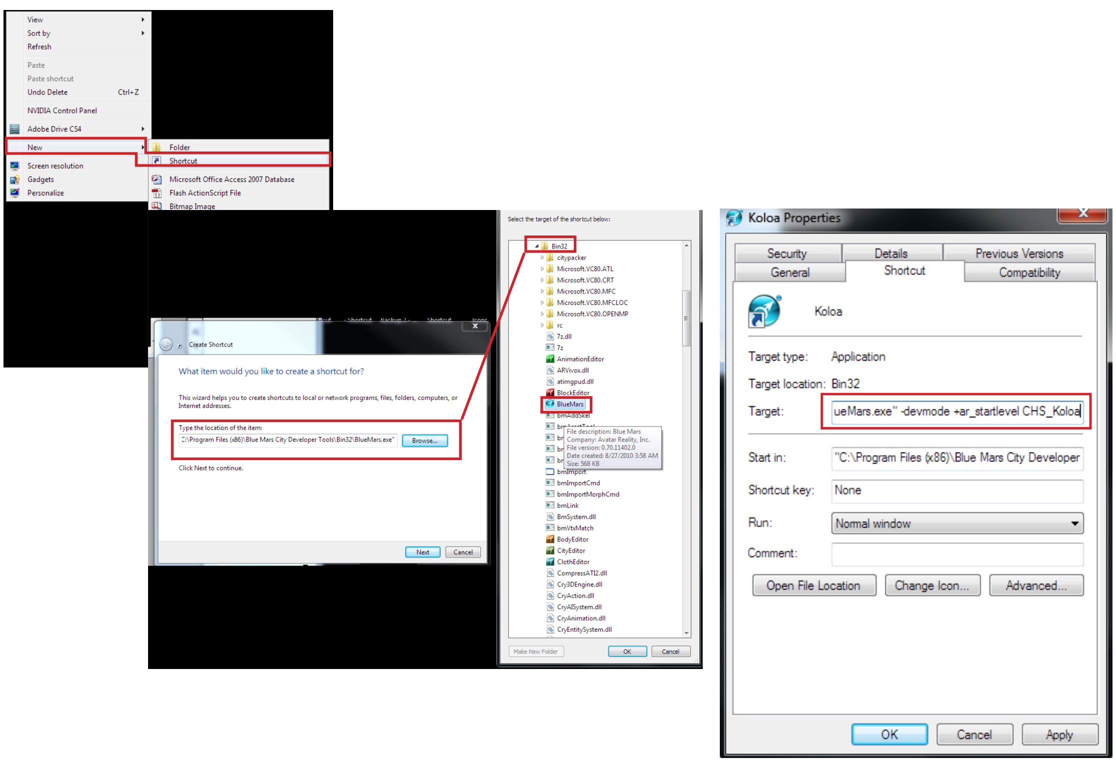


1. Open your city file in the City Editor
2. Go to Blue Mars drop down and choose "Export CTY"
3. Follow the onscreen instructions and specify a location for the CTY file
4. Create a new folder with your city code and city name labled as such "YOURCODE_cityname" (example: CHS_Koloa). This will be where you are going to extract some files to. This new folder can be placed on your desktop for now.



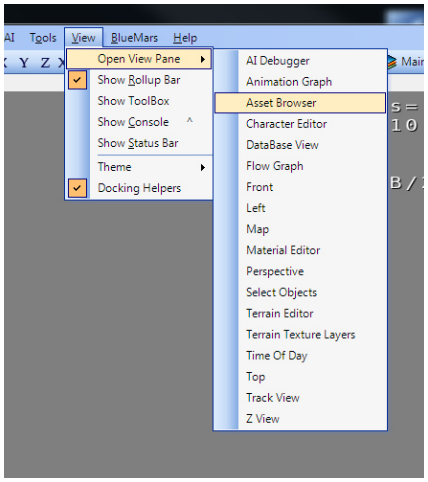
5. Go back to the .cty file you just created, and open it with 7zip. Extract all the files to the new folder you created on your desktop. Make sure that these files are copied to the new folder: "levels.pak, CHS_Koloa.00000.o.pak"

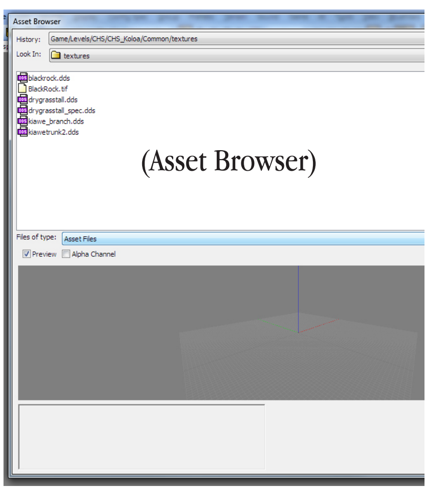
6. Next, you'll need to create a way to access this folder. Create a windows shortcut on your desktop that points to \Bin32\BlueMars.exe in your developer directory, and add the following after the program name: -devmode +ar_startlevel COMP_CityName Where the last part substitute your actual company and citynames as used in your .pak file



14. How to change City Level names

If you need to change the name of your city level, you will need to follow these steps. If you don't, all of the assets, textures, etc. you created will appear "missing" and you will have a list of errors the next time you try to open the city level for editing. Directories are important which is why re-naming your city level "on-a-whim" is a BAD idea unless you absolutely have to.




(Asset Browser)

**Create a new folder in the Level directory called CODE_LevelName

1) In the City Editor open the CODE_LevelName_2010.cry file and then save it in the . . . Levels\CODE\CODE_LevelName folder as CODE_LevelName.cry. Close the City Editor.

2) Move the "CODELevelName2010TOD.tod" file (if there is one) and any 123.xml file into the Levels\CODE\CODE_LevelName folder.

3) Open the City Editor but don't load the level.
  a) Open the Asset Browser and navigate to the Levels\CODE\CODE_LevelName folder.
  b) Just drag the CustomFace and objects directories (directories = folders) from a normal windows explorer window into the Asset Browser.

4) In a windows explorer window, navigate to the Levels\CODE\CODE_LevelName directory.
  a) Make a new folder called CRYFILE (just a temp)
  b) Copy the CODE_LevelName.cry to the CRYFILE dir we just made.
  c) In the CRYFILE directory, extract all the files and open level.editor_xml in Notepad++.
  d) Do a find and replace...
    Find: CODE_LevelName_2010
    Replace: CODE_LevelName
  e) Save the file.

5) Open a new windows explorer window and navigate to the Levels\CODE\CODE_LevelName folder
  a) Browse the CODE_LevelName.cry with 7-Zip.
  b) Drag the level.editor_xml file located in the CRYFILE directory into the 7-Zip window to overwrite the original.

6) The level's assets should all be ready to go now!

15. Furniture

Making furniture follows the same procedures as making an object. However, when it comes to making chairs and sofas (furniture that can seat more than two people), you should consider modeling the cushions seperately. If a couch or chair is to be a static, non-interactive element (ie something you sit on), then just model a proxy for it so people don't walk through it (or not, its up to you).

A chair or seat cushion is made interactive by an AR Chair Entity which can be found under the Entities>Items>AR (see fig. 1). You simply drag and drop an AR Chair Entity from the side window and swap the existing geometry for the one you've created (see fig. 2). If you have a couch that seats 3 people, do this three times for each of the cushions.

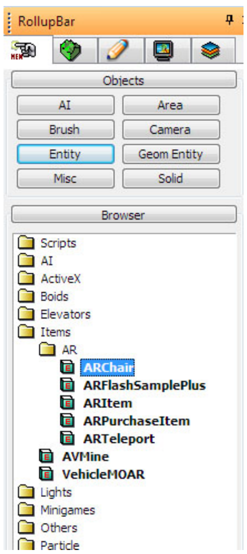


Figure 1

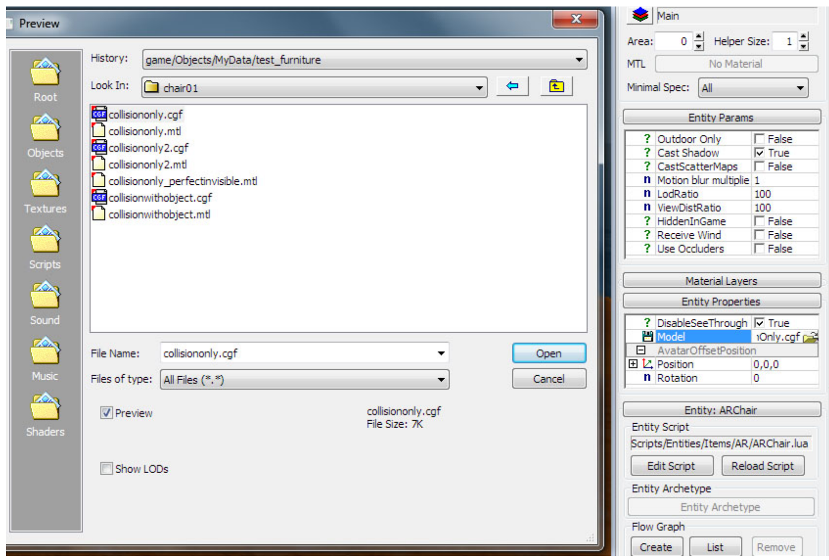
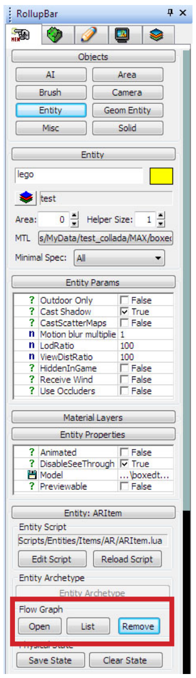


Figure 2

16. Flow graph

Flow graph and lua scripts allow you to add more functionality to your city. Its basically the game programming part of the City Editor. For the purposes of testing things out, here are a few flow graph examples I created.

1.



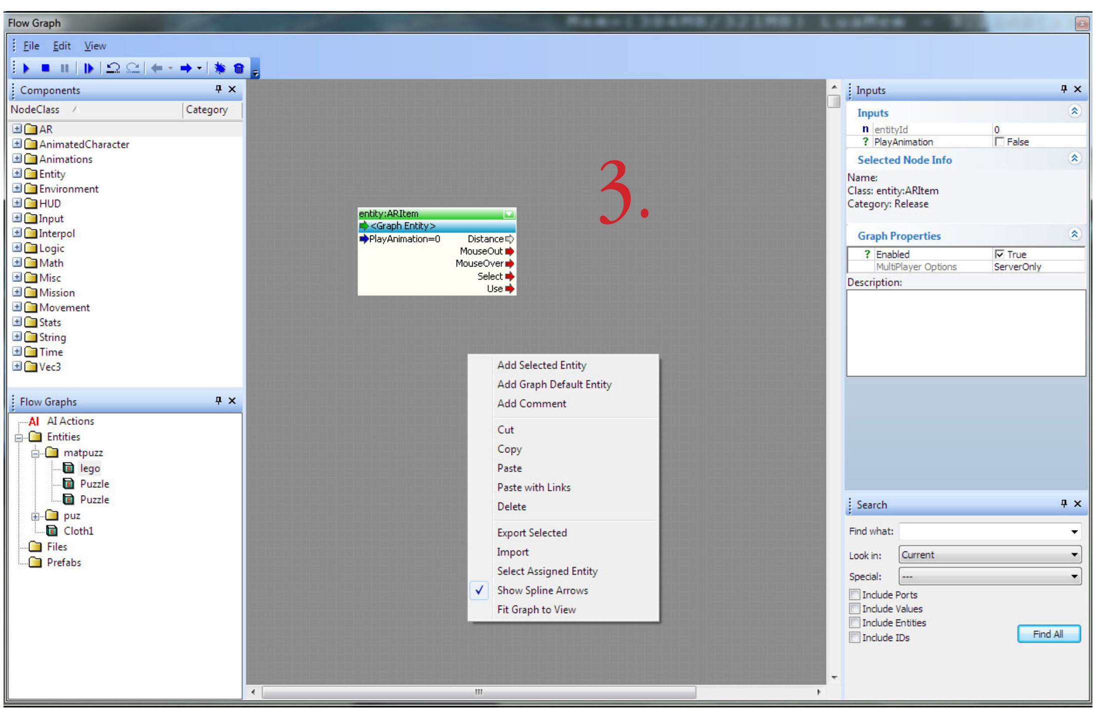
2.

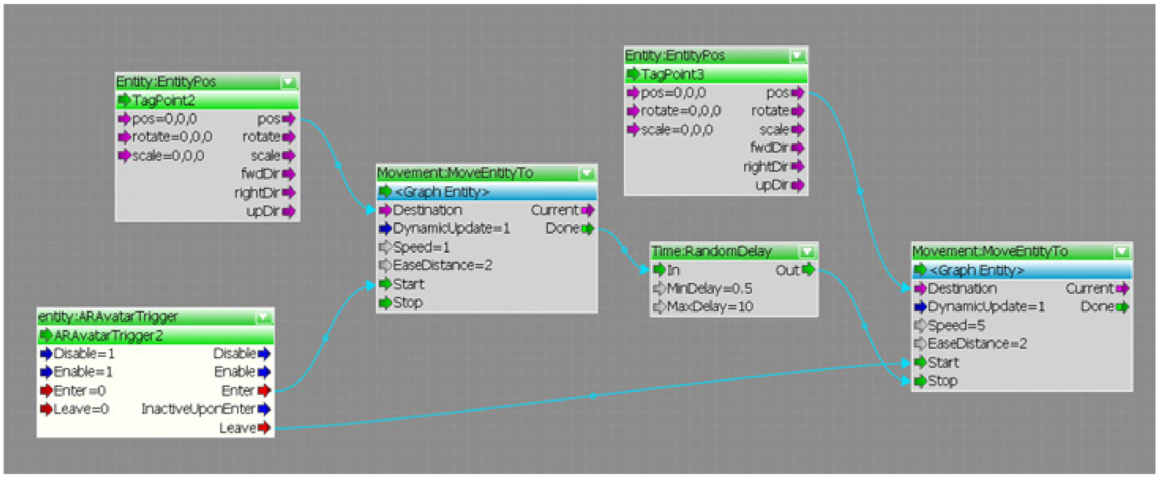
1. Start by going to <u>Entity>Item</u> on the rollup bar. Then drag-n-drop an ARItem Entity into your city.
2. Click on “Open” to start a new flowgraph
3. Right-click in the new flow graph window and click “Add selected entity”

This is the basic start sequence to use when you are going to be working with geometry that moves (see example A on next page. Once you have this started, its just a matter of bringing in other flow graph components from the Components side bar.

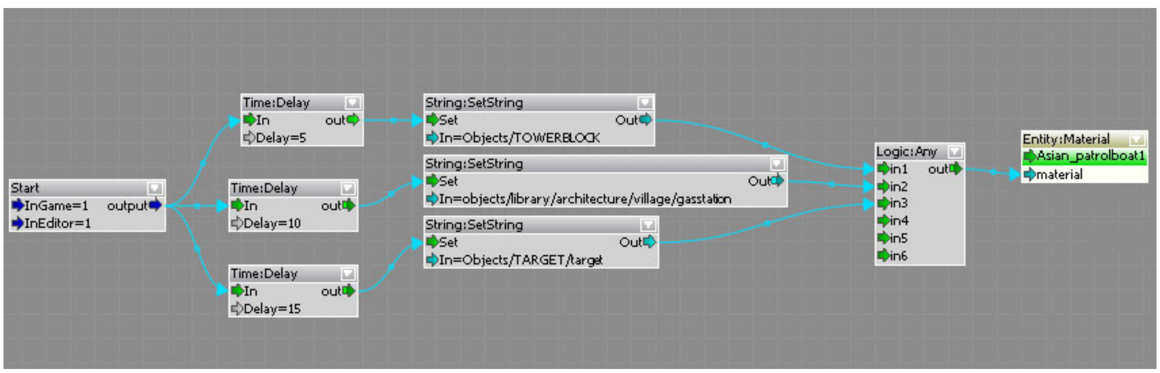
Flow graph examples B and C are for materials and don’t require you to follow step 3. You can just drag the component from the component bar and copy the set up exactly.

To test things, go up to the menu bar, right below File, Edit, View, etc. Click on the play icon to see your effects. To test things in world, follow the usual steps.

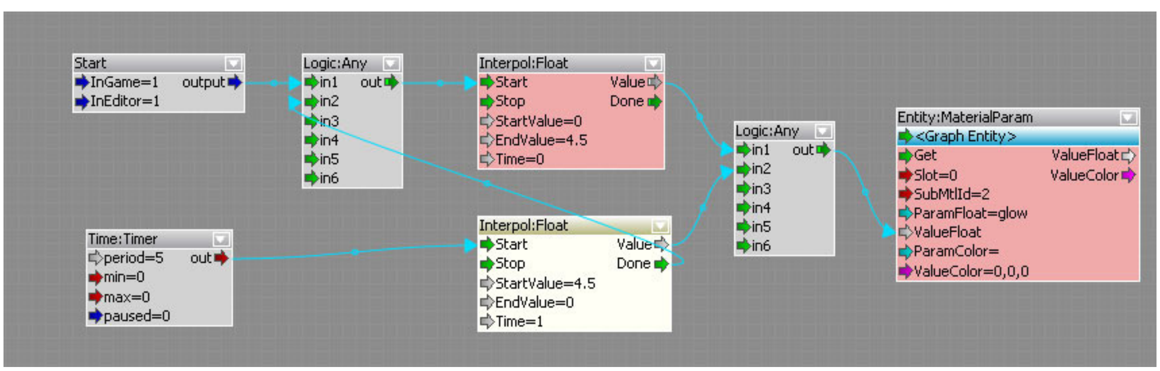




A. Flow graph sample for moving an object up and down.



B. Flow graph sample for cycling an object's material



C. Flow graph sample for making an object's material glow periodically

3ds Max to COLLADA export steps:

*Before you begin exporting the file, make sure you've gone through the checklist.

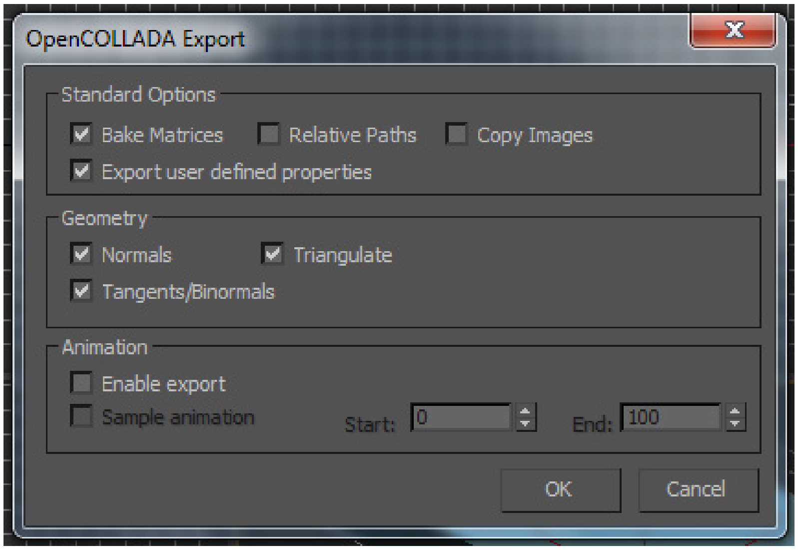


Figure 14 Collada export dialogue box

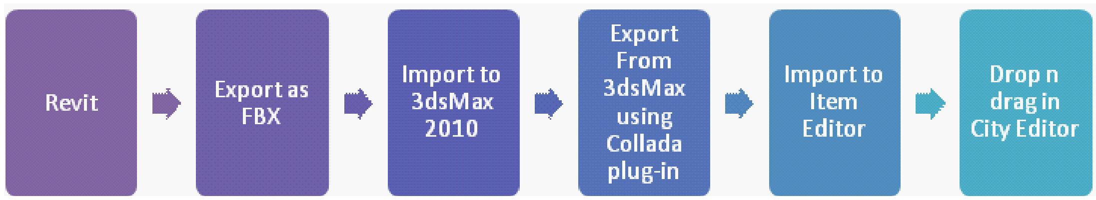
1. File -> export -> Select from drop down menu of extension files COLLADA .DAE
2. Make sure the boxes in the figure above are checked
3. Name the file
4. Find "MyData" folder through C:\Program Files\Blue Mars City Developer Tools\Game\Objects\MyData
5. Create a new folder in MyData folder under either test_collada or test_viewer for a new project (always create a new folder in the MyData folder for new projects to minimize data and file confusion)
6. Click Export.
7. Another dialogue box opens and there are other options presented to you. Accept the standard settings, but double check to make sure "Triangulate" is checked before accepting the export settings.
8. The file will be saved to the location specified in the MyData folder.

9. Open the Item Editor program --> go to File and "Import" or "Open"
10. Locate MyData folder and find the file you just exported from 3d studio max
    a. Two options will be presented to you "Standard" or "Expert". By default, you're already in the standard tabs setting.
    b. You won't have to modify any of the settings in Standard
    c. If your model is static, meaning there aren't any animations or moving parts, then make sure the Static option is selected from the drop down menu
11. Select "convert" at the bottom right corner of the dialogue box
12. When the command prompt window is done converting your file, click on "Load" at the bottom of the screen.
13. Project should've come in, if not, check your model in 3d studio max or Rhino (which ever is the root of the problem). Review check list provided to start a process of elimination of probable causes.

*****Look at website 1 on the cover page of this document for futher instruction*****

Revit to 3ds Max to Blue Mars Editors:

Suggested Revit Architecture 2010 to Blue Mars City Editor Workflow



The following instructions should be followed in order to bring your 3D architectural models from Revit into Blue Mars. Revit Architecture 2010 and 3dstudioMax 2010 were used to test the export settings. The suggested file format to use when exporting is .DWG, and I will explain why this is better in the later part of this section.

Three different exports tests were made and will be included in this workflow. The export presets allowed the original .RVT file to be converted to FBX, .DWG and .DXF formats. Only one method will be suggested as the best option for the following reasons:

- It doesn't triangulate the surfaces upon export and
- It allows the model to be "linked" to the 3dsMax model

All three exports allow a user to:

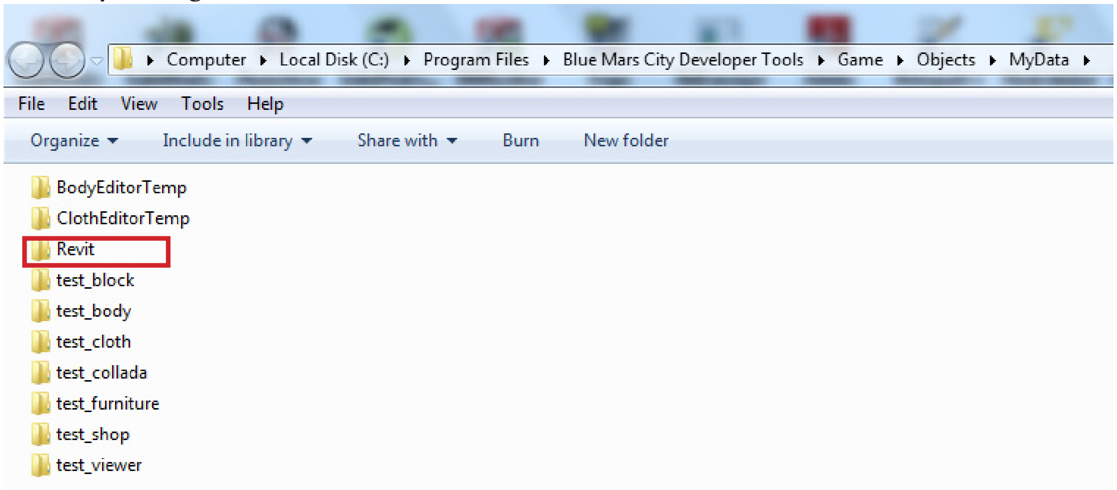
- re-material,
- re-apply material ID's,
- re-assign object names and
- rename layers within 3dsMax.

All three export formats:

- Export layers from Revit
- Geometries retain their inherent names from the Revit Model

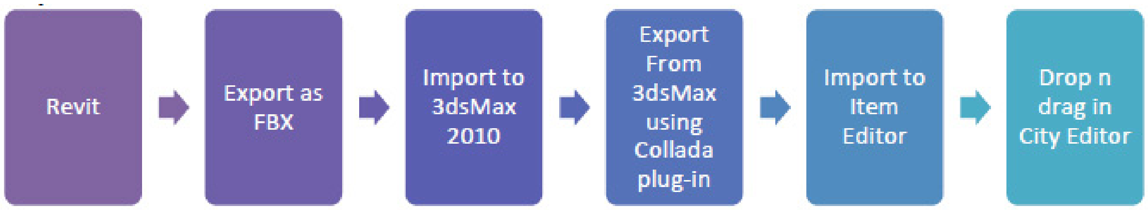
"Linking" your models into 3dsMax instead of importing them is an important feature. As a student or professional refines their designs; materials, structures & forms will get added, shifted or replaced during the process. The ability to reset your materials and material ID's is a key benefit of using this workflow. But also having them NOT be altered when you update the linked file is an even greater feature. If you have to redo the entire model, then you waste time and money.

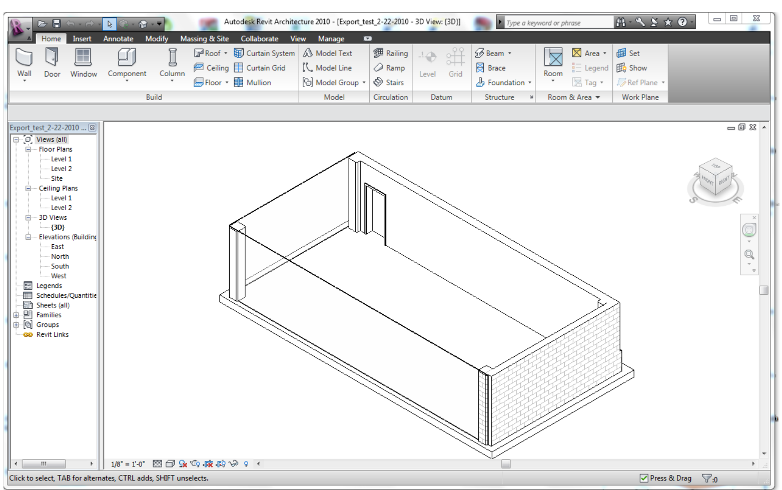
Before you begin:



Create a folder called "Revit" in your MyData folder so that all your files can be easily accessed within the Blue Mars City Editor Developer's library later on.

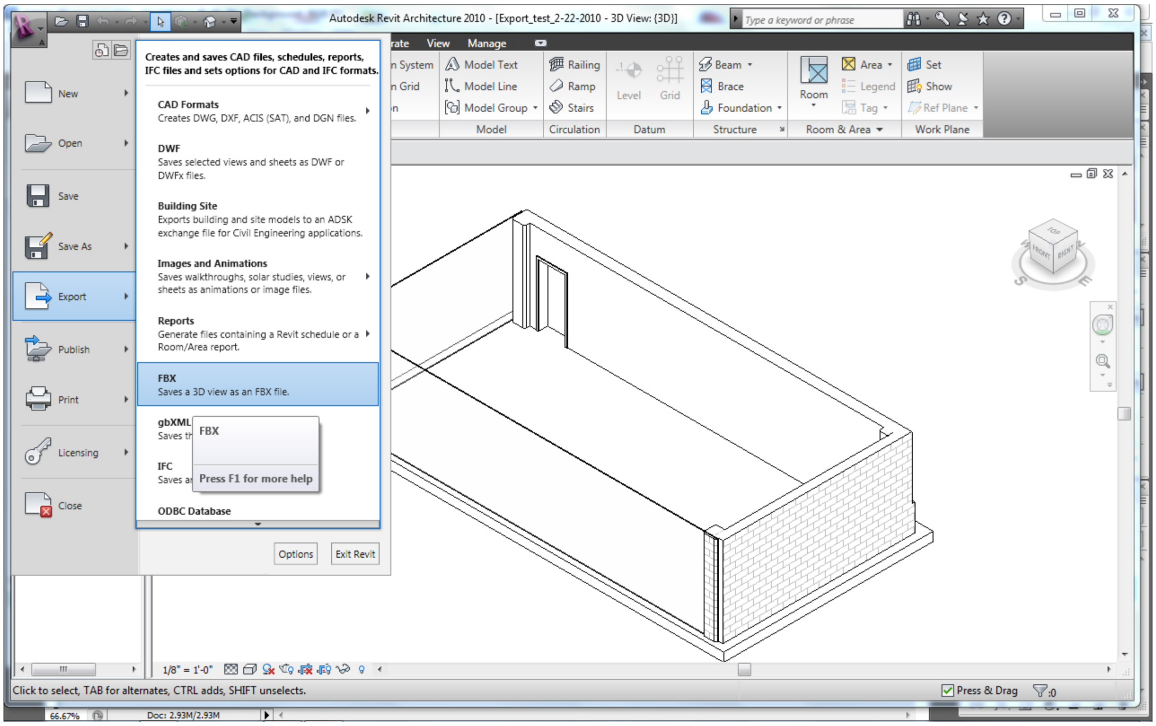
Export 01 FBX:



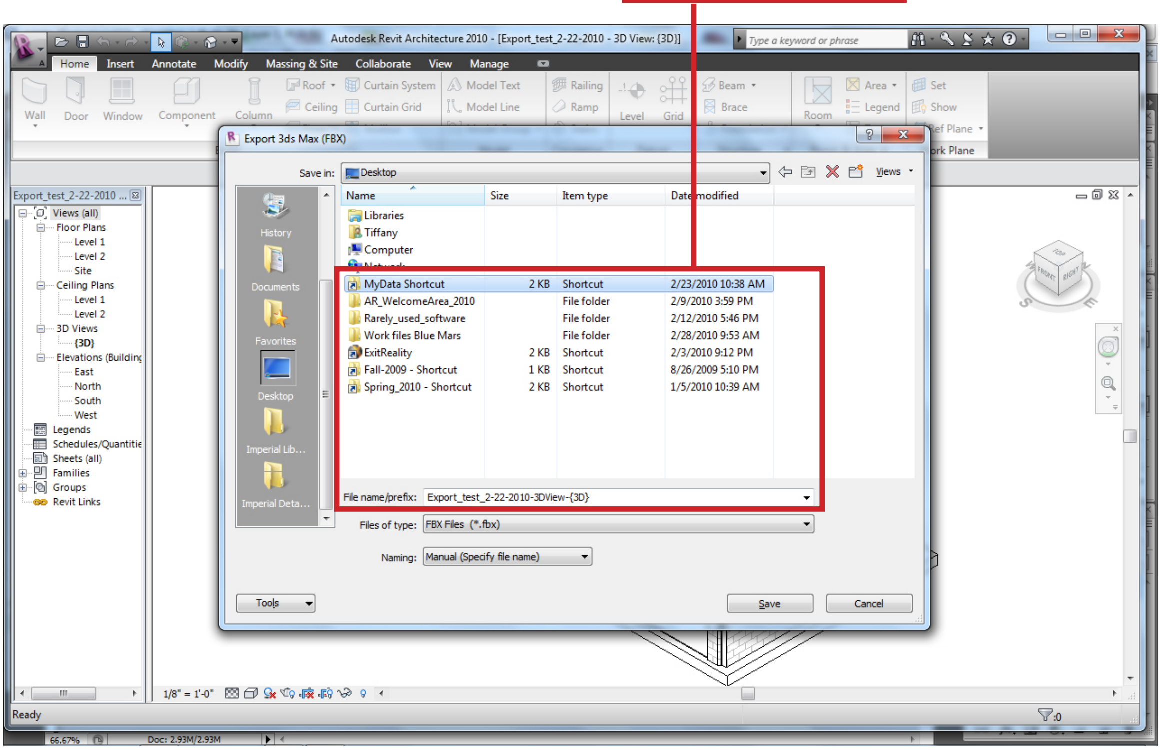


1. Open your Revit project file and go in to a 3D view (see figure2)
2. At this point, please turn off your dimensions, text, schedules, and site model. Otherwise, everything that the camera see's in the 3d view will get exported in the process.

3. Go to File > Export > choose "FBX"

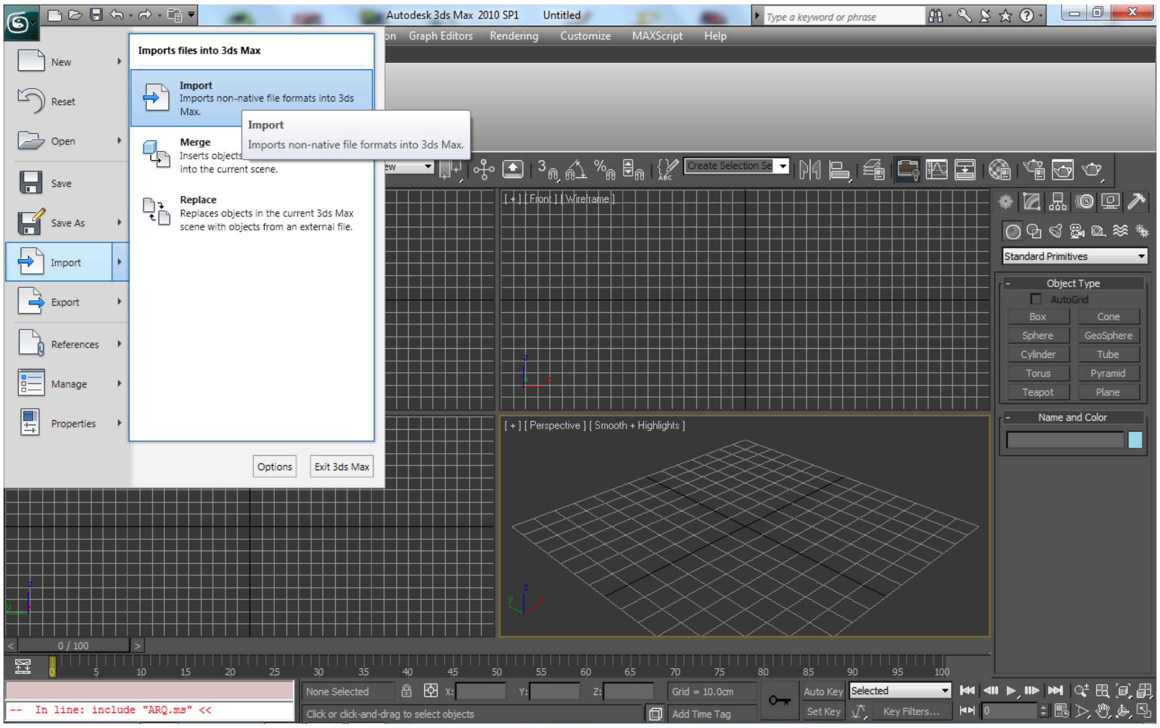


4. Reset the location to where the file is saved to the MyData/Revit folder path,

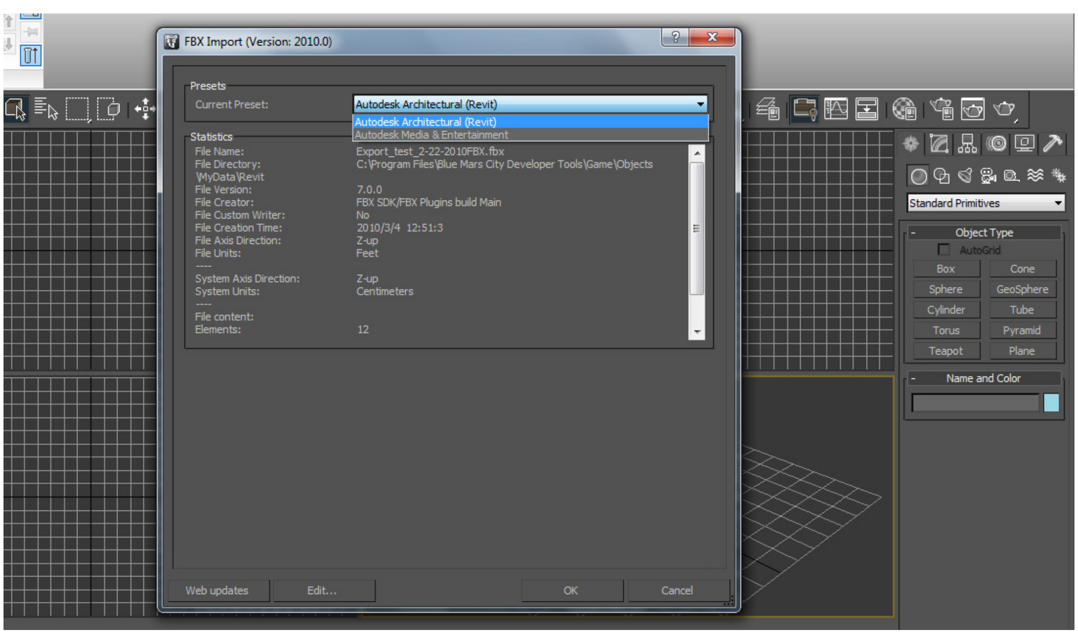


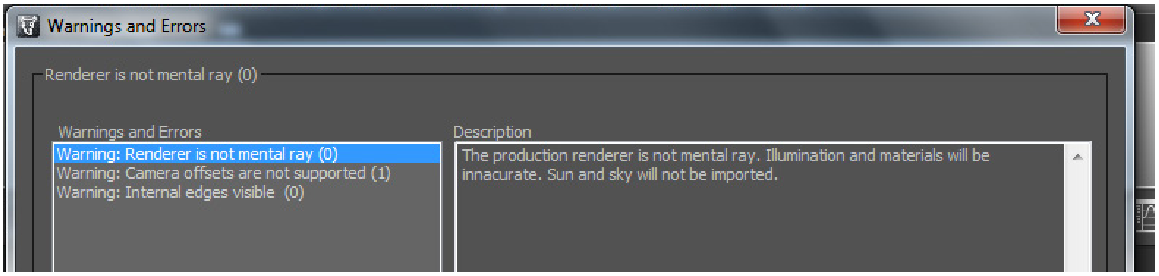
5. Name this file and then "Save"

6. Open 3dsMax 2010
7. Go to Customize>Unit Set up
8. Click on System Unit Set up and make sure it is set to "centimeters" or "meters"
9. Click on the main icon in the top left hand corner of your screen, click on "Import"



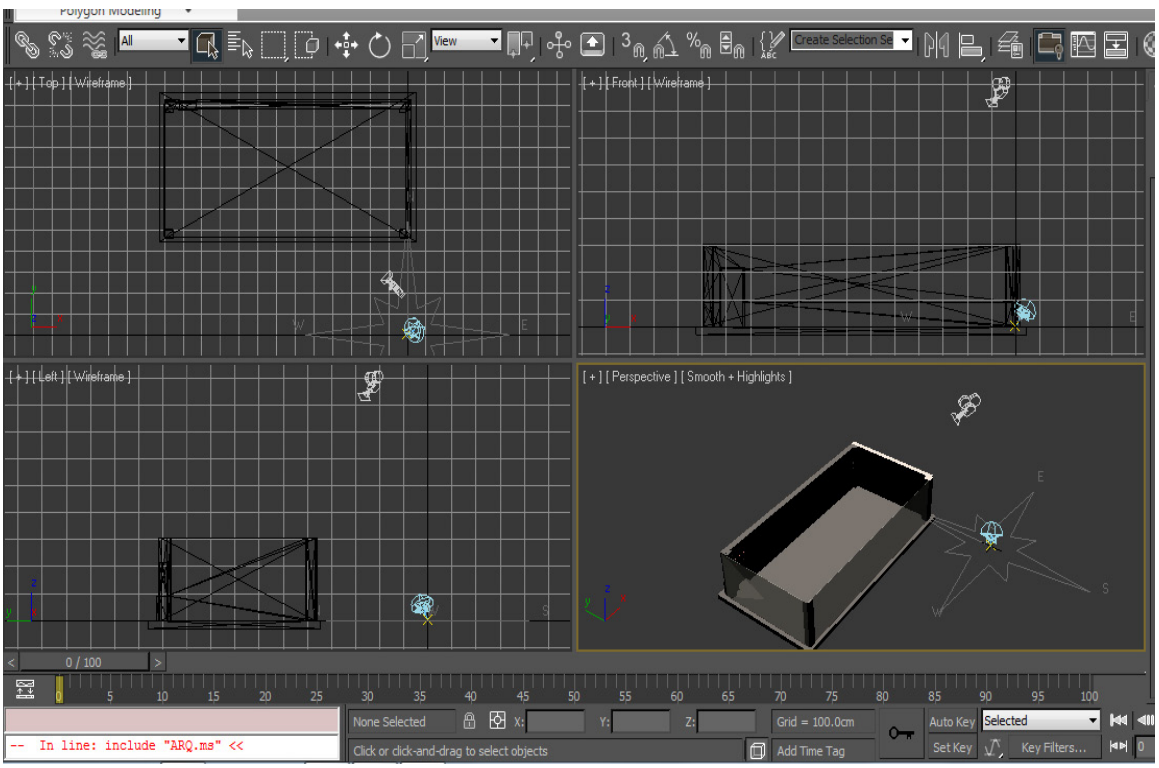
10. Find your file location MyData/Revit/filename.fbx and hit "OK"
11. Change the file Preset setting to "Architecture Revit", and then "OK"





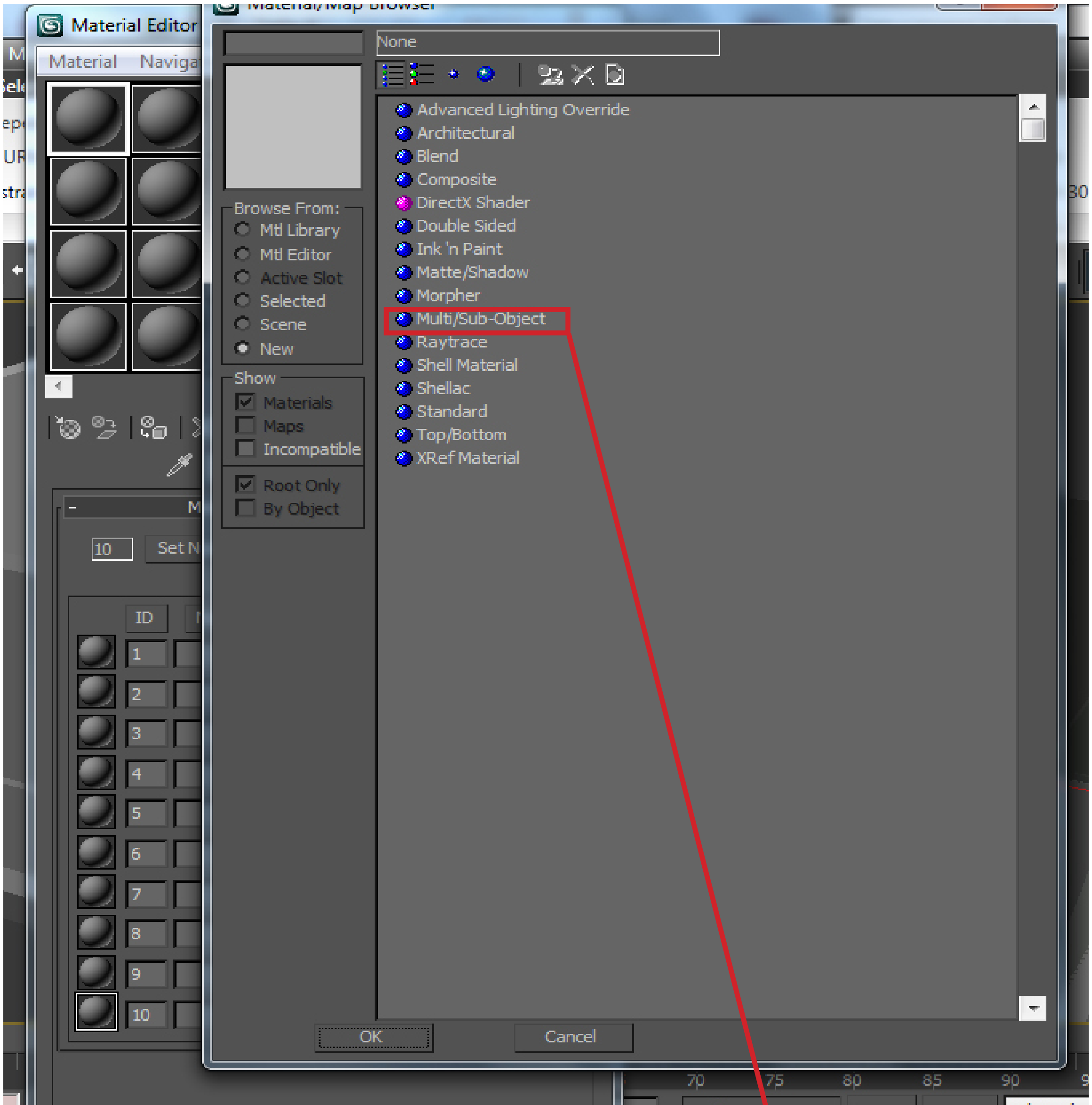
If you run in to the following error message, don't worry. This error just tells you that 3dsMax is trying to assign MentalRay textures and lighting systems to the new scene. Since you will be using the suggested texture files and formats, this error can be ignored. It will not impact.

12. Import process complete



You'll notice how the faces were triangulated, ie., broken up in to several triangles. This makes applying materials more difficult. If you want any control over how big your textures are and the appearance of a "seamless" texture, you will need to apply a UVW map or a UVW unwrap.

13. After importing, you will now have to convert all your objects in to an “Editable Poly”. Do this one by one. Do not try to select all the objects at once and convert them that way. A full explanation on how to do this will be covered in step 10 on the checklist of this document. Student or professional may be familiar with this process.



14. Once objects are all “Editable Poly” types, Set up your material file (Standard to Multi/Sub Obj) A full explanation on how to do this will be covered in step 7 on the checklist of this document. Student or professional may be familiar with this process.

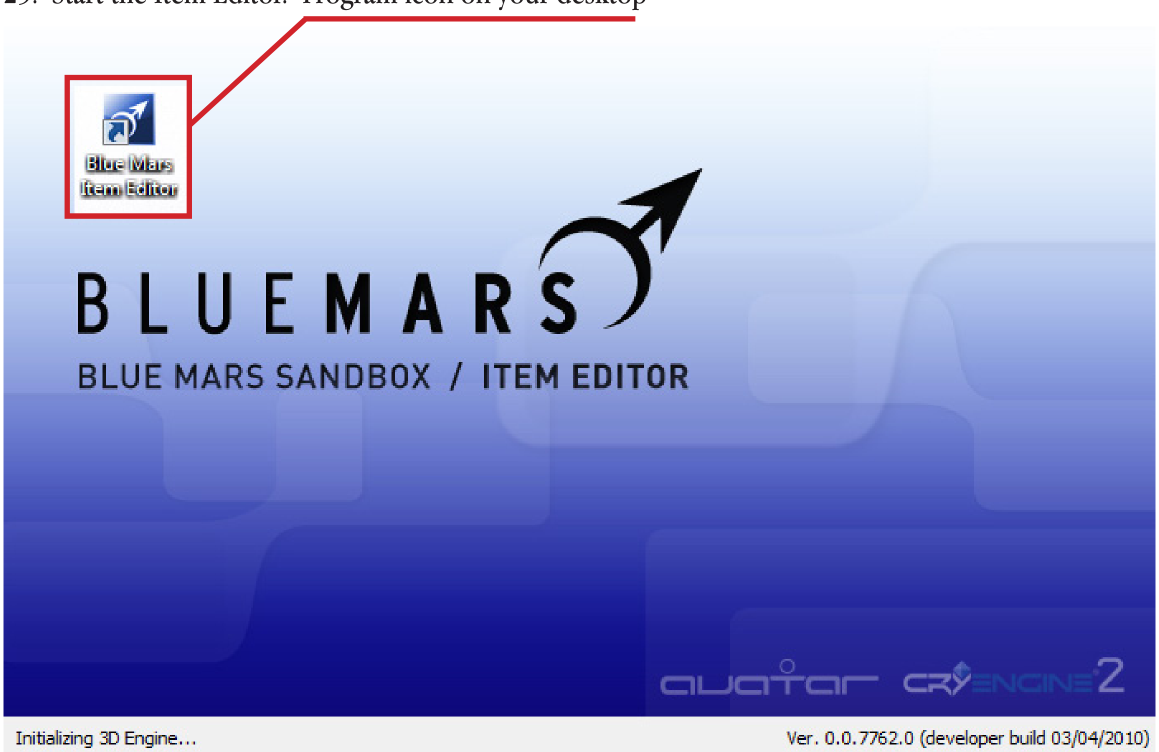
15. Make sure the number of material slots = the number of materials
16. Change your material ID’s to match the material ID you specified in step 15

17. Select all your objects and then assign the material
18. Save your 3dsMax file first to the .max format
19. You can save this .max file in a subfolder within your Revit folder, but it isn't necessary. Folder hierarchy should look like this:
    MyData/Revit/Max/filename.max

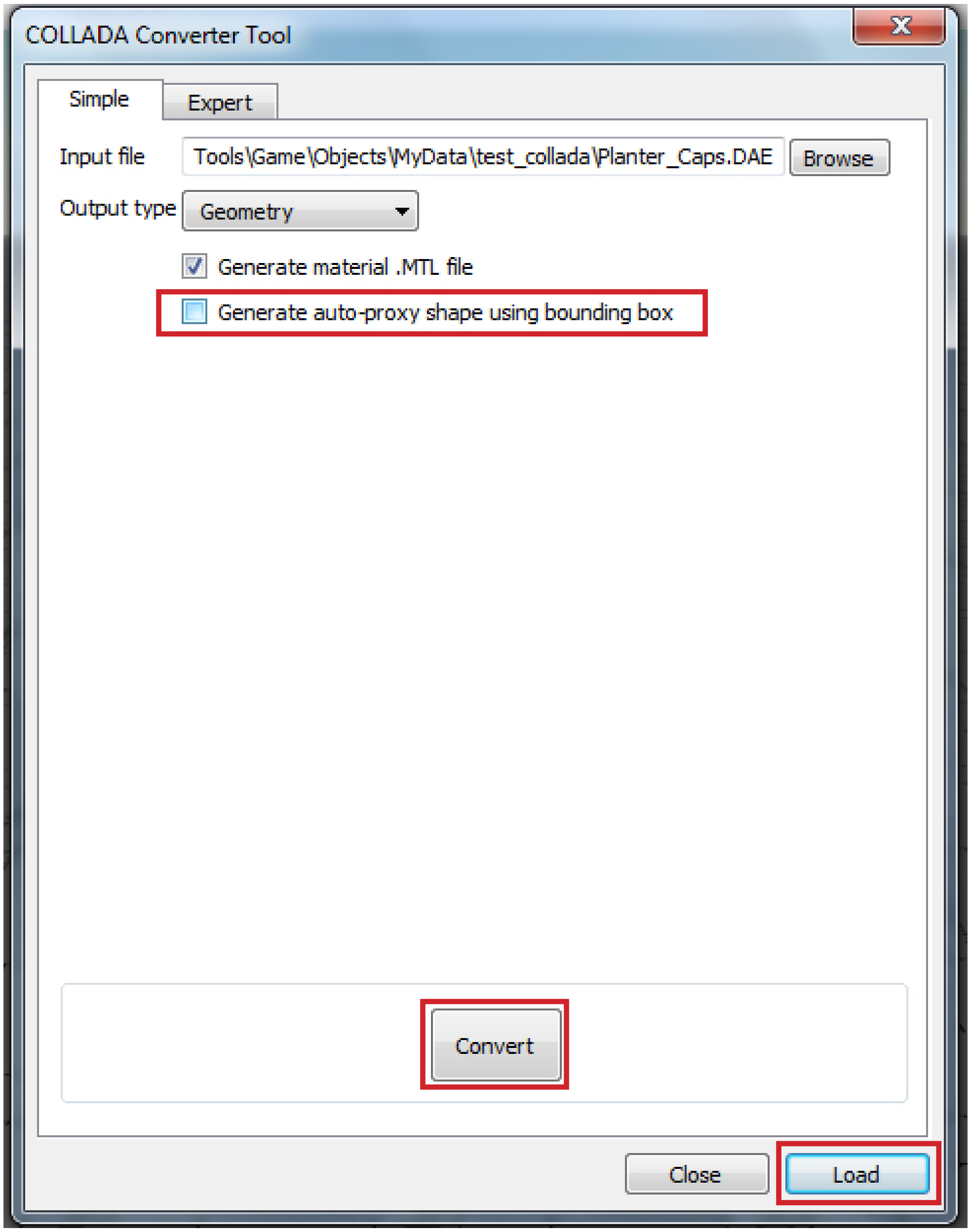
20. Create a Proxy form from the geometries in your max file. A full explanation on how to do this will be covered in step 9 on the checklist section of this document. Student or professional may be familiar with this process.
21. Reset X-Form. A full explanation on how to do this will be covered in step 8 on the checklist section of this documentOR student or professional may be familiar with this process.
22. Save
23. Export your file to OPEN collada. Follow the 'Export to Collada' section of this document.
24. If you're just testing this workflow, the file name will not matter. Save the file using the OpenCollada .dae extension.

Steps 13-22 just allowed you to prepare your model for import to a sub editor called Item Editor. The item editor allows you to preview your models and items before they are brought in to the City Editor for compiling. It also creates a .CGF file that you will need to detail your cities with.

25. Start the Item Editor. Program icon on your desktop



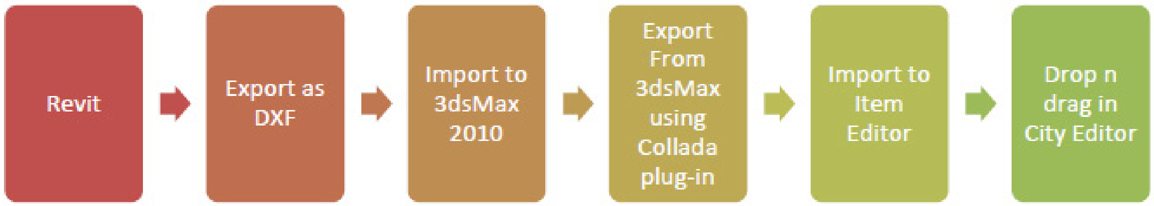
26. Go to File>Import and import the file you just exported from 3dsMax 2010



27. Uncheck "Generate Proxy . . ."
28. Click Convert and then Load
29. Your model has now been imported to the Item Editor

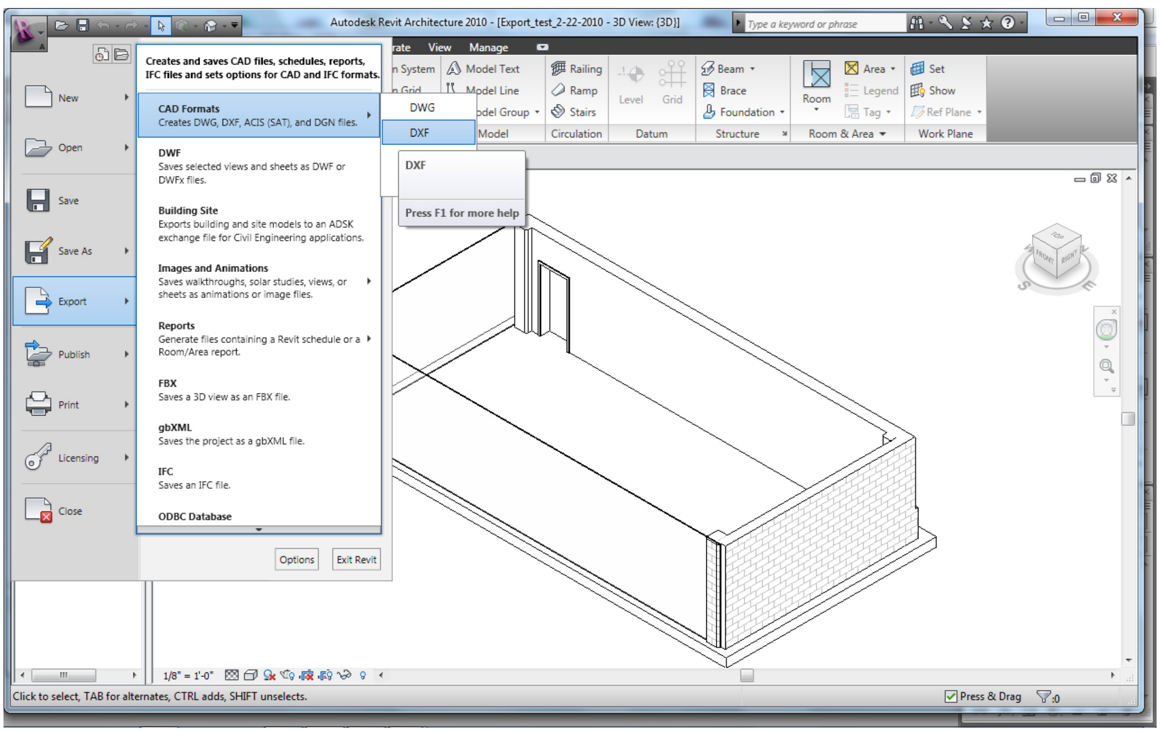
30. Check out your material that was just created, you'll notice that all the material ID's were carried over. This is where you will apply your materials. Do this one by one until the model has been fully textured. You can also apply materials in the City Editor. Refer to step 7 in the checklist section of this document or go to the official Blue Mars wiki guide online.

Export 02 DXF:



There is virtually no difference in the export process between FBX to DXF, however, instead of choosing FBX, you will choose DXF as the new file extension from the CAD Format drop down menu.

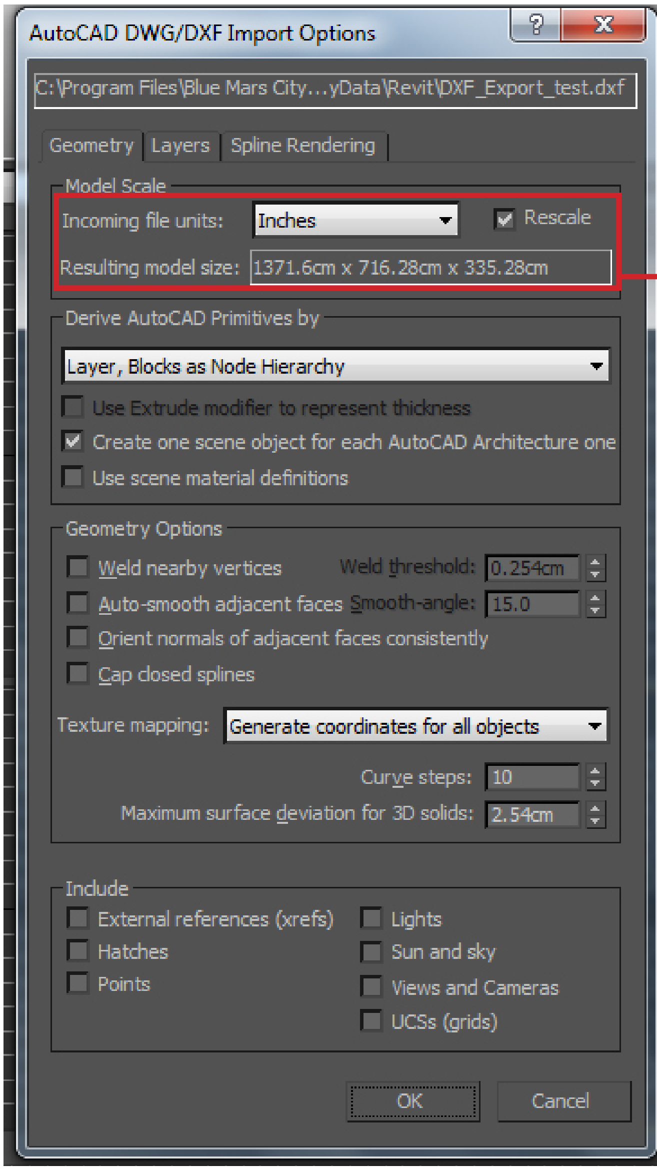
1. Open your Revit project file
2. Go in to a 3D view
3. At this point, please turn off your dimensions, text, schedules, and site model. Otherwise, everything that the camera see's in the 3d view will get exported in the process.
4. Go to File > Export As>CAD Formats, choose "DXF"



5. Reset the location to where the file is saved to the MyData/Revit folder path,
6. Name this file and then "Save"

You have just saved your Revit file as a DXF.

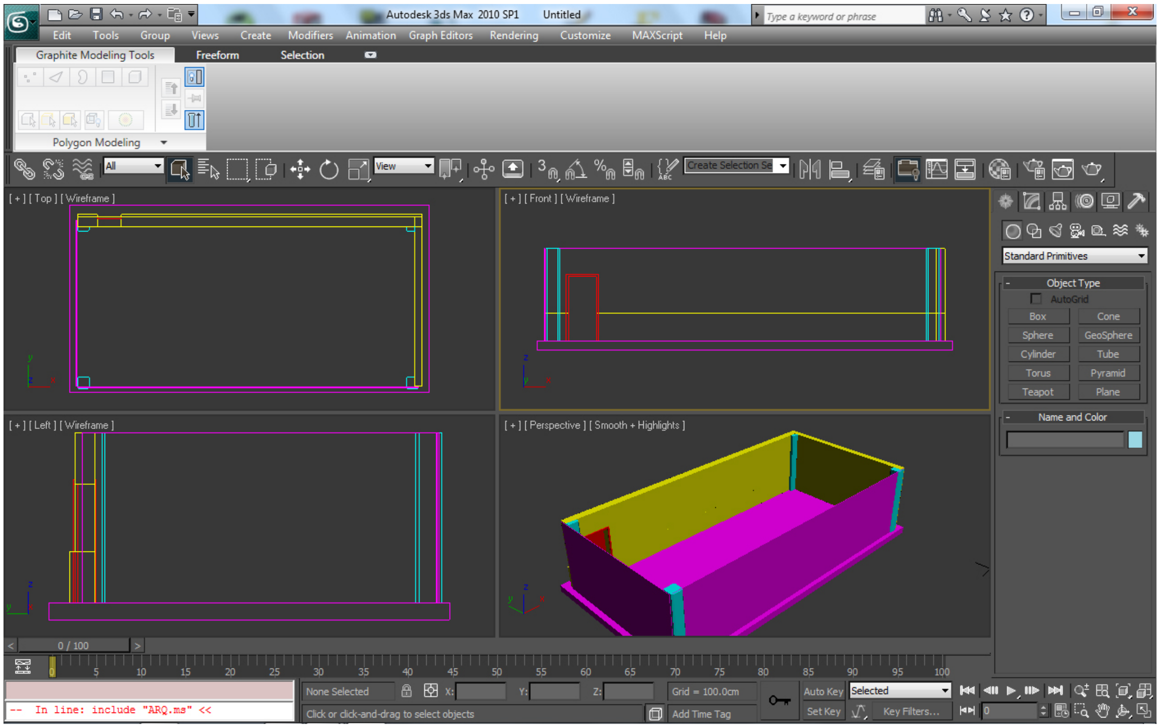
6. Open 3dsMax 2010
7. Go to Customize > Unit Set up
8. Click on System Unit Set up and make sure it is set to "centimeters"
9. Click on the main icon in the top left hand corner of your screen,
10. Click on "Import"
11. Find your file location MyData/Revit/filename.dxf and hit "OK"
12. A new Dialogue box pops up, mimic the settings and then hit "OK"



Make sure that your settings look similar to the figure shown here.

Although the incoming units are specified as "Inches", by checking the "Rescale" box, you can override that unit setting to the one your file has been set to.

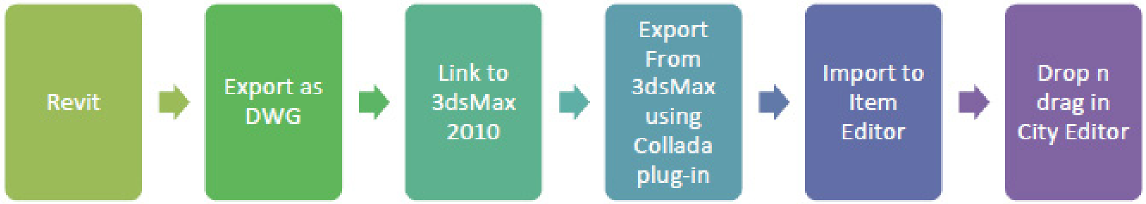
13. Import process complete



You'll notice how the faces were NOT triangulated, ie., broken up in to several triangles like in the FBX example. Exporting the model as a DXF will not triangulate the surface and treats each face as a single poly. This makes the UVW mapping process much easier.

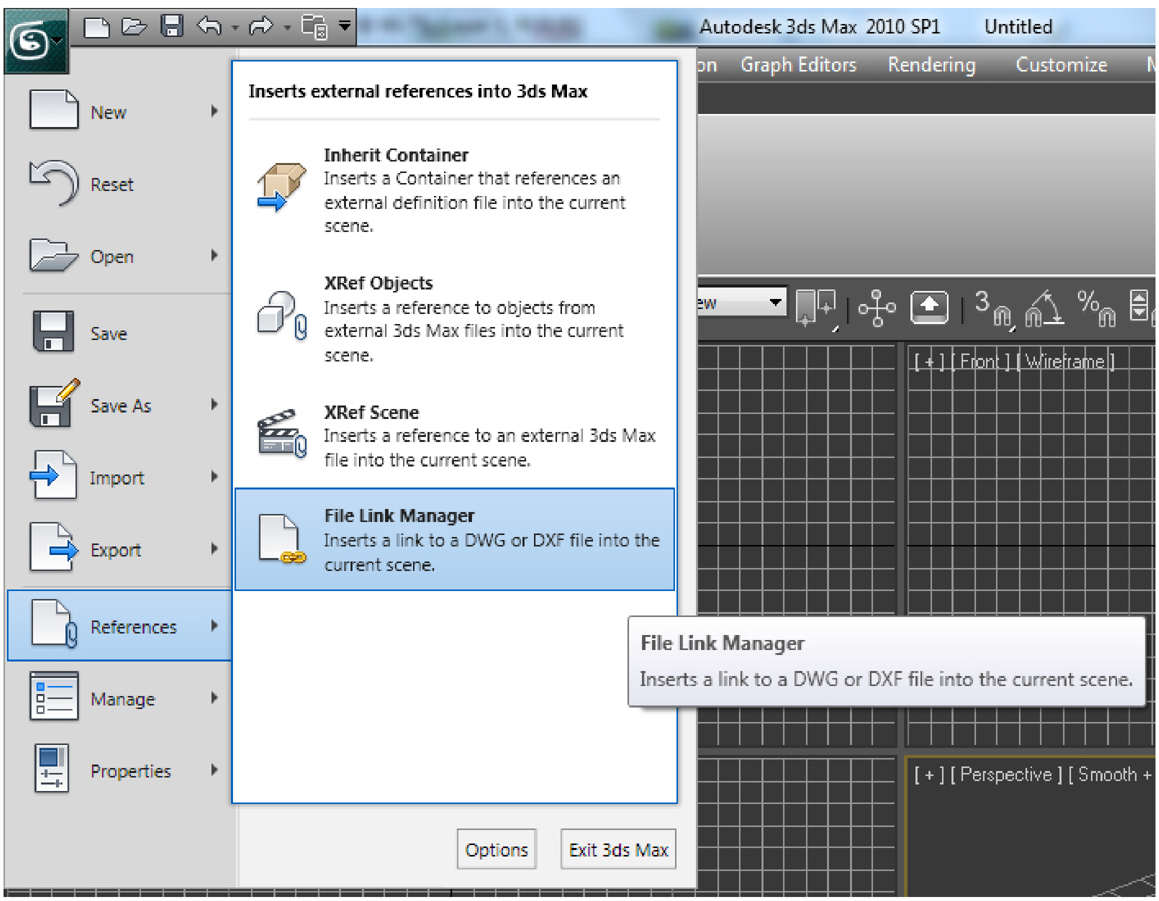
Follow steps 13-25 from 'Export 01 FBX' to complete the export process

Export 03 DWG:

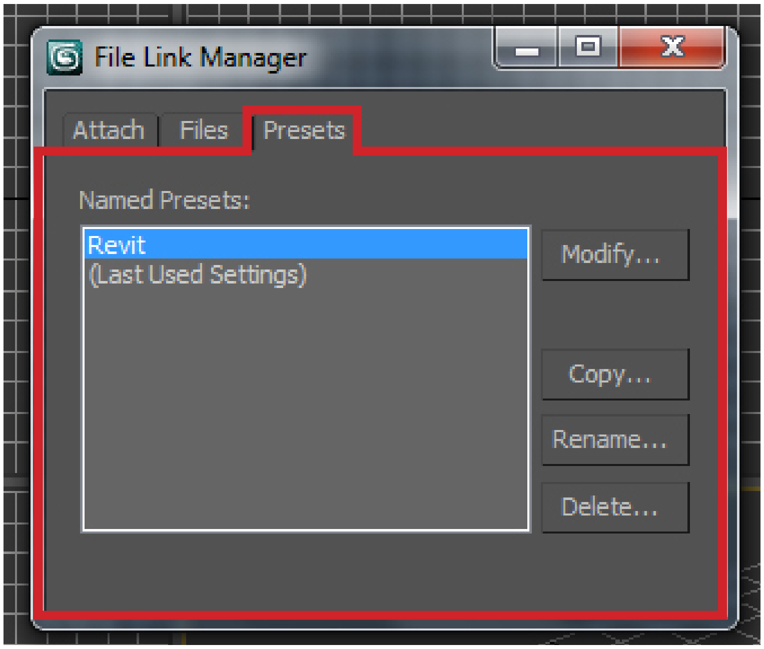


There is virtually no difference in the export process between DXF to DWG, however, instead of choosing DXF, you will choose DWG as the new file extension from the CAD Format drop down menu.

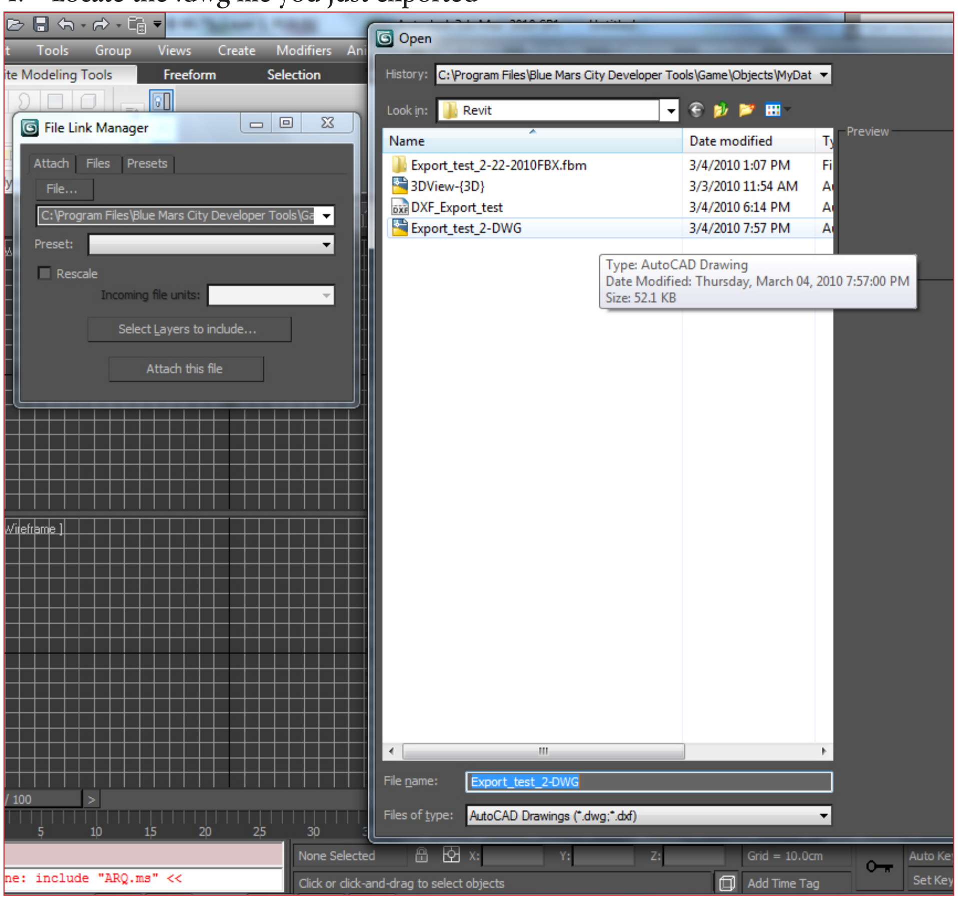
Since the export process requires you to follow steps 1-5 from Export format #2, we will continue from "Starting up 3dsMax."



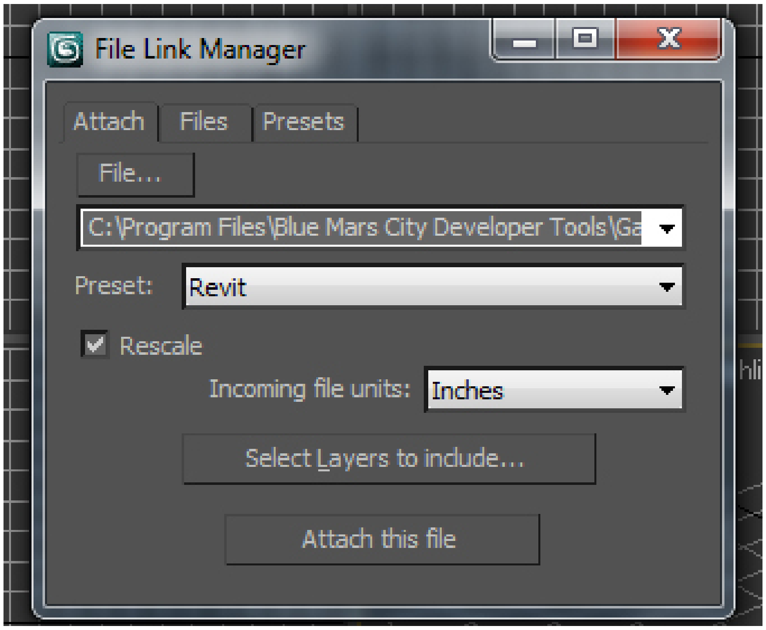
1. Open 3dsMax and go to "File Link Manager"



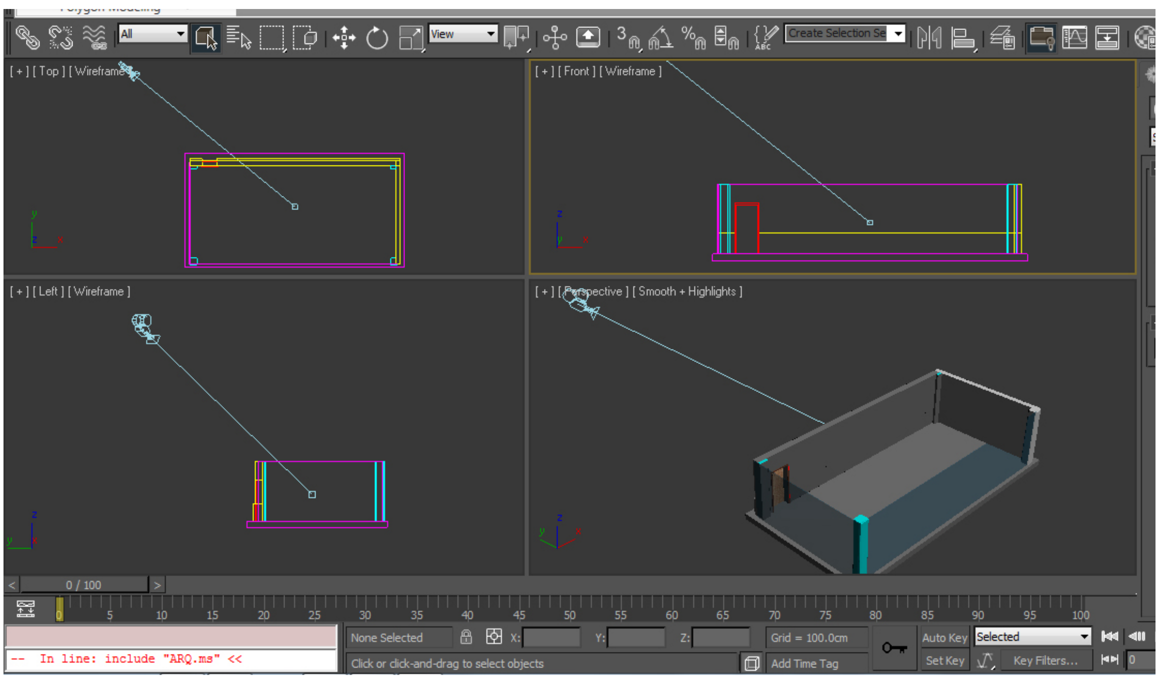
2. Go to the “Presets” tab and change the setting to “Revit”
3. Go back to the “File” tab
4. Locate the .dwg file you just exported



5. Change the preset again to “Revit”



6. Check the “Rescale” box and then “Attach this File”
7. You have just ‘Linked’ your .dwg file to this 3dsMax file



8. SAVE your file as a .max file first. Place it in the Revit folder you created in the MyData folder for Blue Mars (or where ever you have the original Revit file stored).

From here you can turn everything into an Edit Poly, re-assign your Material ID’s and set up your Multi-Sub Object material just like you did in the previous export workflows. Follow the same process to:

a. Export to Collada
b. Import to Item Editor

Linking vs. Importing

Linking will save you time in the end. When changes happen to the Revit model, all one has to do is re-export to .DWG and then update the linked file. Procedures for updating the linked file are as follows:

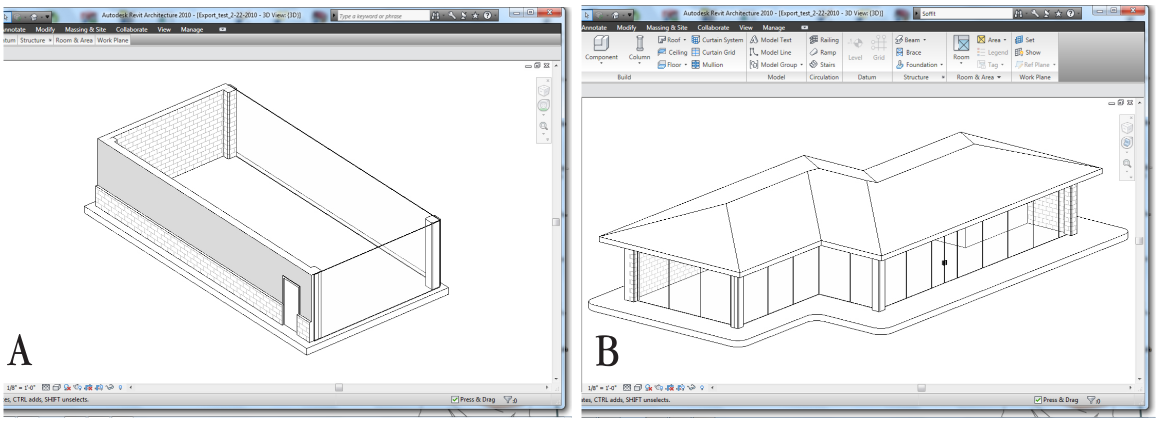


Figure 1 Moving from version A to version B

1. Open the Revit file
2. Re-export the file to .DWG. Save over the original file and make sure the names are the same
3. Open the 3ds Max file
4. Open the File Link Manager

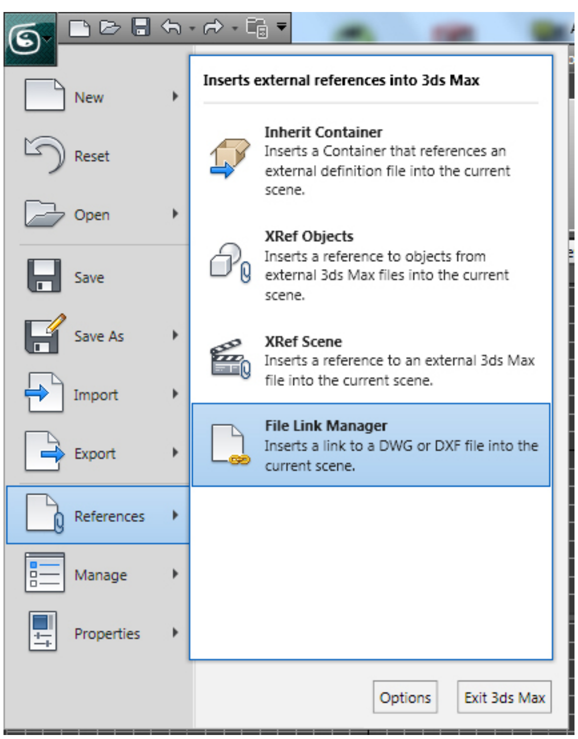


Figure 2 3ds Max File Link Manager

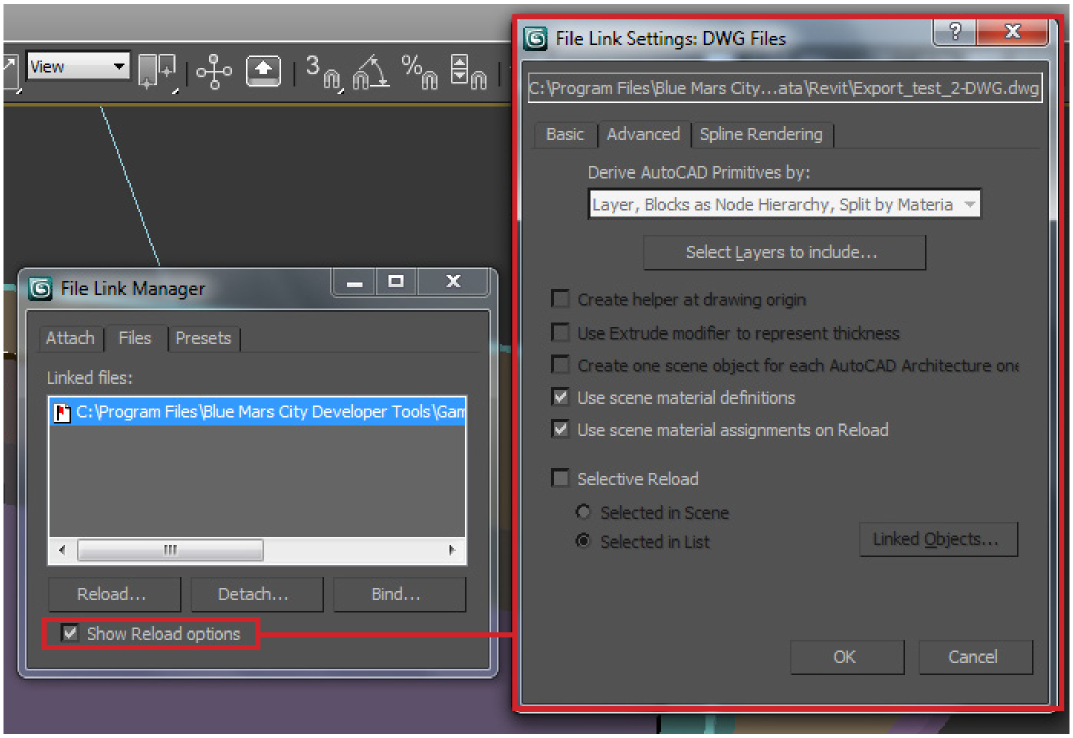


Figure 3 3ds Max File Link Manager Settings

Checking the “Show Reload Options” box brings up another window. Make sure “Use scene material definitions” and “Use scene material assignments on Reload” are checked.

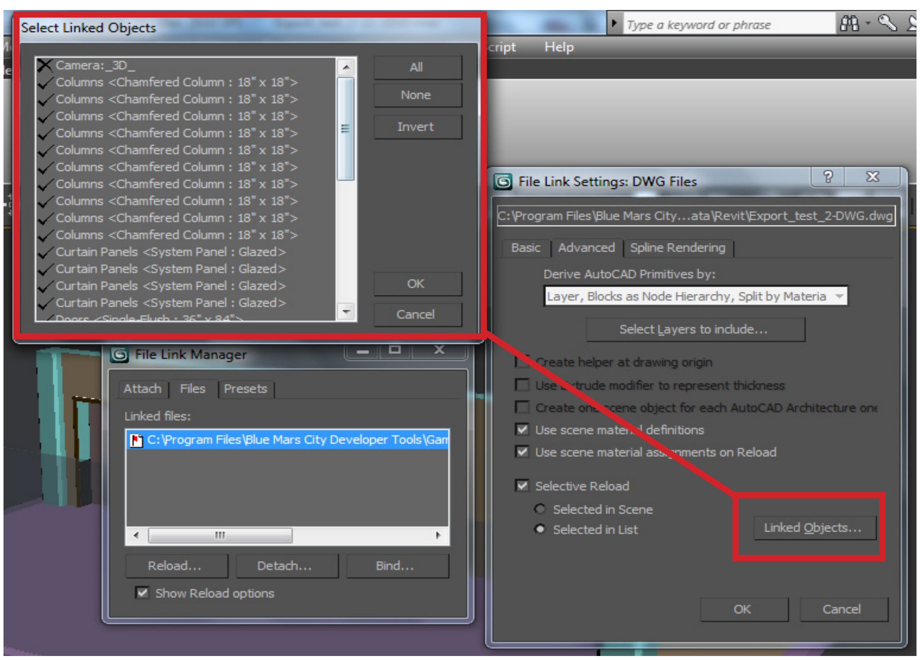


Figure 3 Linked Objects window

By checking “Selective Reload” you’ll activate the ‘Linked Object’ button. When you click on ‘Linked Objects’ you’ll be able to see a list of all the objects coming in from Revit. You’ll also be able to pick and choose which ones you want to link again.

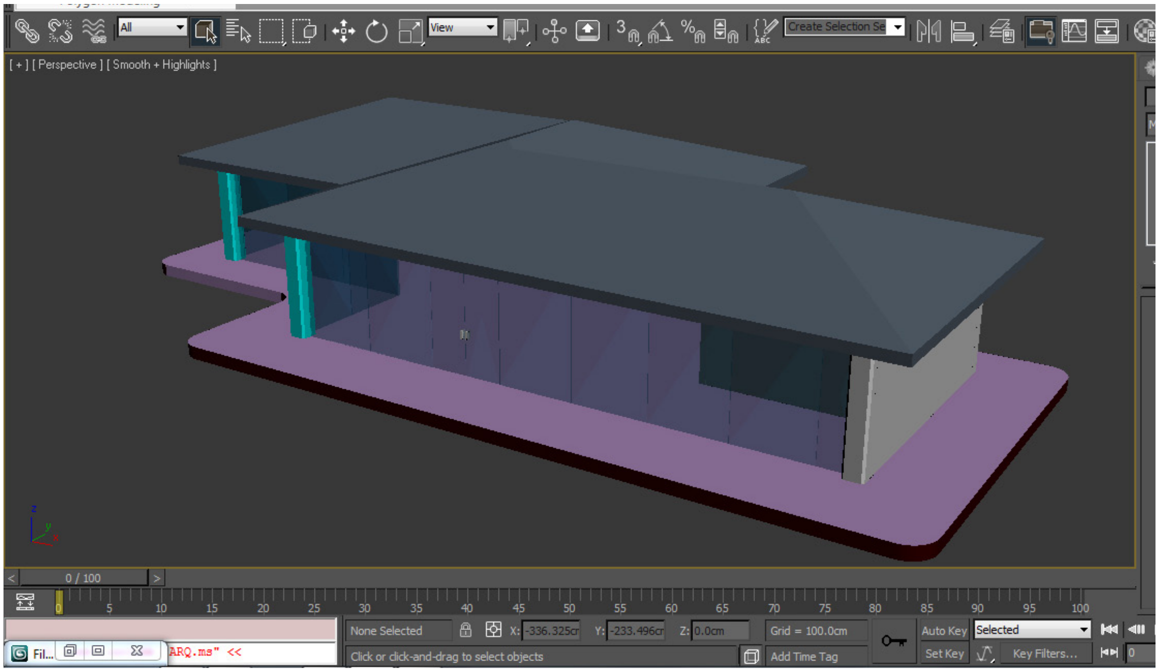


Figure 4 Updated file

In the end, your model will be updated and ready for re-exporting to Collada.

Appendix B - 2009 Summer Journal

Journal: Blue Mars Studio

WEEK 1-WEEK 9

Meet time: TWRF 1:30-5:45; and TR 9:00-10:45 unless cancelled

Summary

This was a journal I kept during the 2009 UH Mānoa summer school session.

After week 3

Day 1-Week 1

The Blue Mars studio course is comprised of 14 students in the UH Mānoa School of Architecture program. All are varying in age and studio level; but have a basic understanding of 3d modeling software. The primary interface being learned is the one used to create the Blue Mars environment/online world.

Palagi's primary teaching approach for the semester studio is inspired by a book, *The Against Method* by Paul K. Feyerabend. Students have been expected to read chapters one to six as well as a few chapters from two other books, *Pflitz: A Novel* by Andrew Crumey and *Borges: Collected Fictions* by Jorge Luis Borges. Palagi leaked a few project details as to the kind of designs we would be focusing on but did not disclose or provide a complete project description. The initial research to be done within the first two weeks will require the students to find an inspirational thing (object, poem, medium, person, etc.). The other part of the project will require students to chronicle the life of their building design, if in fact they will be designing a single building.

<u>The assignments expected to be completed this week are:</u>

1. Answer the following questions in loose essay format:
    a. How would you take the ideas in *The Against Method,* and apply it to your own process of designing
    b. What is your process of creating?
        i. What inspires?
2. Gather articles relating to virtual world making
3. Create a timeline of virtual world making
4. Read *Pflitz: A Novel* (first 10 pages) and *The Against Method* (chapters 1-6)

Palagi's key points and posed questions to his students were:

- As students, you only reach the design development stage of the project procurement process; designing in a virtual environment changes the pre-conceptual, schematic, design development and even construction document phase by almost collapsing it.
- There is no margin for error – In drawings, things can be forgotten and purposefully omitted, but in the virtual 3d, you can't fool the audience if something is missing. No fudging allowed because everything has to be designed.
- Designers (ie, architects) will need to be the instigators and initiators
- How does one begin to present an atmosphere and sell the driving idea behind the design of a building?
- Presenting one's ideas gets taken to a different level within an interactive model.
- The readings are intended for students to make realizations about the process of design and compare the ones in the readings with their own.
- Students are to be encouraged and expected to explore their idea potentials. If a decision is made, then it has to be on purpose for a purpose.

Observations

#1: Studio habits

Students with studio experience automatically, almost instinctively gravitate towards claiming a desk for territory. They decide to sit next to people they have an established relationship with, in some cases perhaps not. Today, everyone was a little hesitant to select their desks.

#2: Readings

Not all students were aware of the books and readings required for the studio.

#3: Realization

Students want a syllabus. Some of them have not experienced a class that has never provided them with one.

Day 2 May 27, 2009 (Wednesday)

Agenda:

- Discuss readings
- Answer questions about Blue Mars
- Meet with the Dean
- Due dates for assignments

Today, students were given a better description for the purpose of reading the recommended books and articles. Kris placed the idea of defining a site as the first part of solving the problem for designing something that doesn't exist. Ultimately, the site analysis will help to inform the type of programming each student comes up with. It's yet to be determined if the site or sites will be designed in teams or individually. Santiago Perez will stop by the following day to introduce himself and give a presentation on his work. Both professors can be described as having an interest in technology's relationship with architecture, but their application, process and teaching methods are completely different.

The experience of having two different professors for the same studio will be a hurdle that most students will need to overcome. This studio structure is a first for a few of the students. However, I will assume that the professors will want the students to observe, analyze, synthesize and process their arguments and then come up with a more unique solution if the ideologies of both professors clash in any given situation.

Clark Llewellyn, Dean for the School of Architecture dropped by to describe Blue Mars and its competitor Second Life. He also mentioned that towards the end of the summer session, the Blue Mars studio class would be entering a competition for the 2009 Gwangju Biennale in South Korea. Students will be expected to design a cube of some sort (2 meter dimensions). Details to the competition and its requirements were not specified and it left many of the students puzzled.

After Clark's visit, Kris asked the students to write down their method/approach to designing in studio. They weren't required to list their studio professors or to label the professor's requirements for a specific project. It was more of a way to gather information about his students and their overall design approaches. Due to the fast paced nature of this unique summer studio, there isn't enough time for a professor to discover the design approach for his/her group of students by assigning a two or three week long project. A charette might be one way to gather this Intel but having a written response instead of going through an observational period saves a lot of time.

Due dates for this week's assignments:

1. May 29, 2009 Friday:
    - Read first 10 pages of *Pfitz* and come prepared to discuss
2. June 2, 2009 Tuesday:
    - Time line: to include one or two new items posted that day
    - Prepare questions for speaker from Avatar Reality
    - Prepare ideas related to the potential avenues that the field of architecture *could* potentially have in this budding market.

Day 3 May 28, 2009 (Thursday)

Agenda:

- Introduction of Santiago Perez
- Further research on VOW's
- Reading articles

Santiago Perez stopped by and began to describe his background to the class. His forte lies in helping students realize their designs on a 1:1 scale level. He expects students to build their designs- jumping out of a modeling program and into the shop. All of the projects presented to us were comprised of modular pieces that needed to be fabricated without the aid of CNC machines or laser cutters. His former students relied on the "old-school" method of building things. Perez also takes an interdisciplinary approach to designing and has looked to physics, science, math and engineering for inspiration. Currently, he is also looking at what it means for a material to be "intelligent."

Perez tried to gain the class's perspective on the studio's objectives and received very few responses. The students were definitely puzzled. Whenever a class is silent, it usually means the subject matter just went right over their heads, they're confused, they weren't paying attention or they were scared to say something wrong. All that was explained in the first two days of class about Perez was that he would be co-teaching with Palagi. Perez seemed un-informed about the studio's objectives and left a few students feeling like the two professors' hadn't communicated enough.

Perez is really here to teach the boot-camp studio in the next classroom, so the Blue Mars studio is a secondary concern to him (from my perspective). I also feel like he's only here to provide consultation for building the biennale cube. He's got an impressive background on electrical mechanics and building models that can function but he doesn't seem to know what the objective and end goals are for this studio. Even he's a little confused. He wants to help but doesn't really know how.

Before class ended Palagi came in and tried to clarify most of the questions the students had in regards to Perez's presence. It was implied that the two of them would be speaking more with each other over the weekend.

Day 4 May 29, 2009 (Friday)

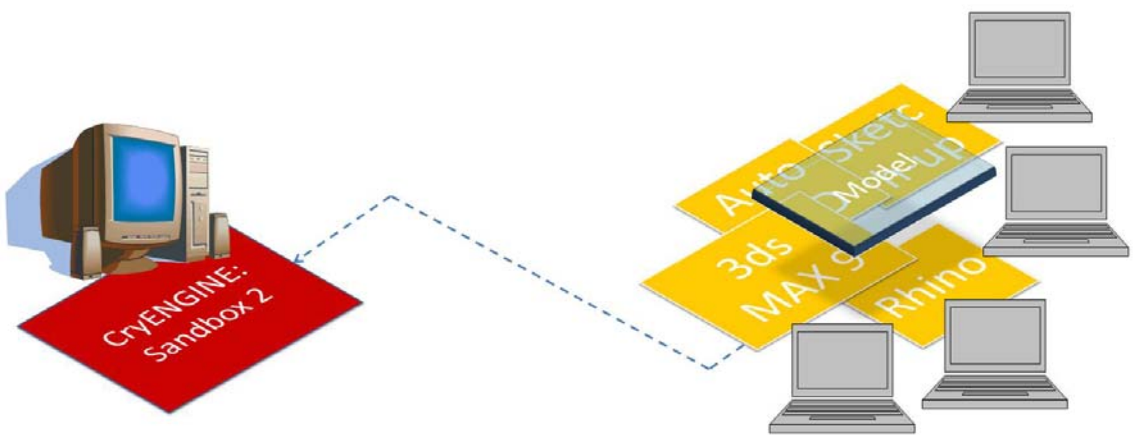
WEEK #2
Day 5 June 2, 2009 (Tuesday)
(9:00-10:45) 690-class

Jim Sink, President of Business Development at Avatar Reality stopped by to demo Blue Mars and to answer any questions students had about the program and his involvement. The class will be given a crash course next week on how to import and export files into Blue Mars by one of Jim's associates. A few more items were mentioned in the presentation today that weren't the last time Jim stopped by.

1. The import plug-in chain for 3D Studio MAX has been built (CRUCIAL)
2. Users will not be able to change the time of day in real time
3. In order to create rain and have every character and object appear to be wet, new texture maps will have to be created
4. The environment editor (sandbox 2) has been tweaked to suit the needs of Avatar Reality and Blue Mars.
5. When importing objects in to Sandbox 2, it's best to keep them plain – no materials, lighting,etc.
6. When creating a terrain, it's important to create a 16 bit grayscale height map that goes along with the geometry. Also, if the program you're building the landscaping in has a button or command specific to creating terrains, its best to use that instead of creating topography from scratch.

Palagi asked how the uploading process would work and Jim proposed two scenarios that the class could follow.

1. Scenario: The easy way

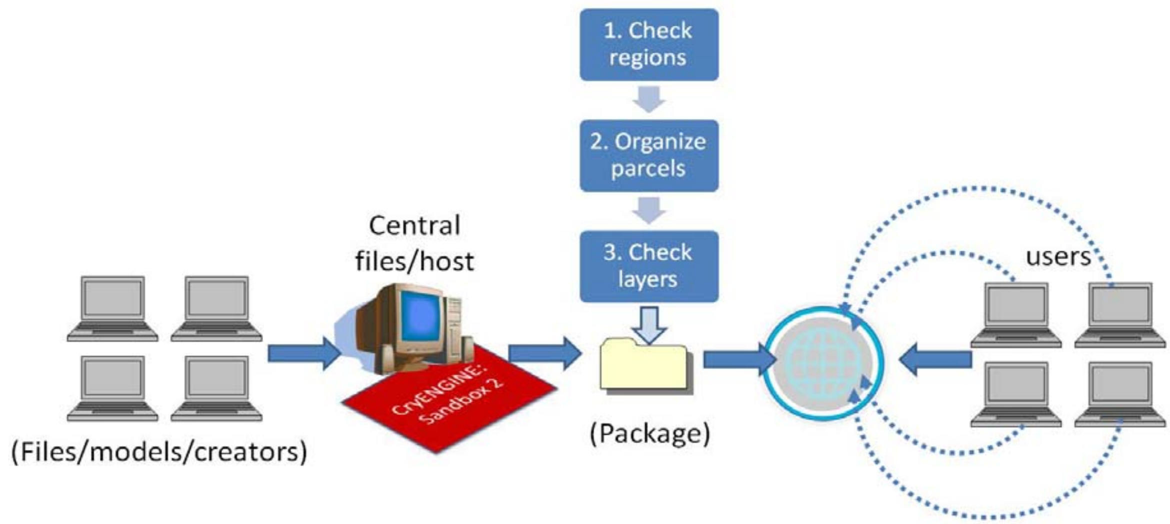


Analysis

Basically, every student manages their own files and prepares it appropriately for Sandbox 2. I would recommend following this layer naming system → firstname_objectname, which would look something like this in their layers- tiffany_ground. For sub-layers within the major object name, I would continue it like so: tiffany_ground_rocks. The more organized the file and layering system are, the fewer the problems. I don't recall Jim saying that everyone in the studio would be receiving an SDK, but for now, I'm assuming that every student has one. If students aren't provided with Sandbox 2, then it defeats the purpose of having this studio. On top of re-assessing the typical manner in which students design, they are also provided with the opportunity to learn a new program.

More than any project I have experienced, this comes the closest to mimicking the kind of team work that goes on in an office. Professor = Project Architect; Student = Project manager/Draftsperson. From start to finish a project will remain on paper and in the computer until it's time to build. The process in which this project needs to be executed is systematic, but there is no system established. Perhaps it's a secondary or tertiary goal of this course to develop a system for future students to follow.

2. Scenario 2: The hard way



This process picks up where the first scenario stops. After everyone's individual designs are completed, they still need to upload their files on to a server which allows their designs to be viewed online. The packaging process was not described in-depth but it sounded as though there was an additional layer of translating that needs to be done for the web. Either the students will do it or the professionals at Avatar Reality will be doing it.

Students are willing to generate a discussion with other students to discover what's going on. Now, because we are incorporating a different kind of professional in to the discussion, it's an entirely different situation and studio dynamic. When we entered the Q & A segment of the presentation, it was as if students had totally forgotten what to ask. Jim described his function within Avatar Reality and began to describe what Blue Mars can and can't do which probably eliminated over half of their questions. Students probably hadn't realized this but they were gaining experience in interviewing a consultant. What they should have done was adapt to the new situation to keep a dialogue going.

Next week students will be given their first crash course on working within Sandbox 2.

Day 6 June 3, 2009 (Wednesday)

Discussion of everyone's crit and how it plays in to the next assignment. Research.

Day 7 June 4, 2009 (Thursday)

Students were given the task to research the difference between Korean gardens and other Asian gardens. From the websites provided to them by the instructor, students are to select three images of a Korean garden that relate to their designs, create a narrative with those images and then present them. This is a one day assignment. Students are to submit before studio ends.

The garden will eventually be built digitally. Blue Mars has data tracking capabilities and its one of the key functions of this MMVW which sets itself apart from Second Life.

Process of project:

- Students to familiarize themselves with the project specifications, culture, and new software
- After students have finalized designs and have built the digital garden they are to begin communicating via the internet through the Blue Mars interface.
- Blue Mars, UH, and other students/architects will be invited to the digital garden to view cube designs.
    - UH SoA and professor want to get feedback from visitors
- Blue Mars will be tracking the amount of people who visit the garden, how many times, how long they stand, if they try to interact with a cube, etc.

Day 8 June 5, 2009 (Friday)

Students met to discuss their ideas.

WEEK #3

Day 9 June 9, 2009 (Tuesday)

(9:00-10:45) 690-class

PRE-CLASS

Over the weekend I did a little research on how to assess students' performance at the collegiate level. Students can be monitored, their efficiency tracked through a performance/data tracking program, surveys and essays. The first two methods are too intrusive and might probably piss some of the students off. The later are the two safest recurring methods in which to gain feedback but it's more or less a system of questions and answers. None of those methods will be applied, however, I will be making observations based on the class's performance as a whole and will be critiquing my own learning ability.

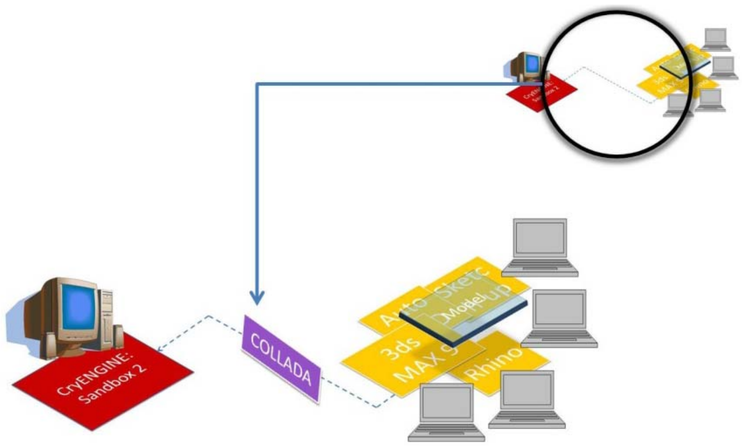
The excel sheet I have created is solely based on my perception of students abilities to grasp, utilize and navigate the new software adeptly. Since students will not be modeling directly in the application they will be able to focus on more important aspects like:

- Importing & exporting files
- Materials
- Lights
- Scripting actions/reactions

If students have been able to retrieve the package of files necessary to run the Blue Mars SDK, then Tuesday's lecture will go smoothly. However, if the download is too complicated then the only thing the students will be doing is troubleshooting their problems with the speaker.

CLASS

Jim Sink stopped by with Andre, the man who created the Sandbox 2 Viewer for Blue Mars. Andrei began showing us the basics of the Viewer's interface. The most important thing he showed us was where to access the user manual for said Viewer. Blue Mars via Avatar Reality is currently working on creating an environment which will host an artwork competition. The competition environment is what was being used to introduce us to Viewer. The second most important thing he mentioned about importing and exporting files from our external 3d modeling program was a little plug-in called COLLADA.



COLLADA is the missing plug-in that allows Blue Mars Viewer to import our 3d studio max files. It allows users in 3d studio max to export their files as .DAE files. However, in 3d studio max 2010, there is already a .DAE file extension exporter which was developed by Autodesk.

The process of exporting begins in 3d studio Max. (Follow on next page)

Due to the lack of people being able to download and install the necessary files, the tutorial session was cut short. The presentation began at 9:20 and ended at 9:47. Jim began working with students who were having trouble downloading the SDK, Viewer and plug-ins.

3D Studio MAX to COLLADA export steps:

***Before** you begin exporting the file, make sure that your model is layered properly AND all of the surfaces are normals, don't overlap and all the surfaces that are supposed to be closed are closed.

In 3D Studio MAX:

1. File → export → Select from drop down menu of extension files COLLADA .DAE
2. Name file
3. Find "MyData" folder through C:\Programfiles\BlueMars\Objects\MyData
4. Create a new folder in MyData folder for a new project (always create a new folder in the MyData folder for new projects to minimize data and file confusion)
5. Click Export.
6. Another dialogue box opens and there are other options presented to you. Accept the standard settings, but double-check to make sure "Triangulate" is checked before accepting the export settings.
    a. The file will be saved to the location specified in the MyData folder.

Now in Blue Mars Viewer:

7. Open Blue Mars Viewer program → go to File and "Import"
8. Locate MyData folder and find the file you just exported from 3d studio max
    a. Two options will be presented to you "Standard" or "Expert". By default, you're already in the standard tabs setting.
    b. You won't have to modify any of the settings in Standard
    c. If your model is static, meaning there aren't any animations or moving parts, then make sure the Static option is selected from the drop down menu
9. Select "convert" at the bottom right corner of the dialogue box
10. Project should've come in, if not, check your model in 3d studio max or Rhino (which-ever is the root of the problem).

The Viewer allows a user to see the environment that they've created exactly as it would appear in its final online form. Previously, we were told to apply materials in the Blue mars editor. With the Viewer and COLLADA, we were told that exporting materials is now possible (out of 3d studio max). Instead of using JPEG's or JPG's, we need to use TIF bitmaps. The size of the bitmap should not exceed 512x512. The level of detail and information captured in a TIF is used by the Viewer.

Blue Mars VIEWER

There's also minor editing capabilities such as:

- Material/mapping
- Lighting
- Daylight settings
- Camera setup

- Geometry manipulation
- Terrain editing(?)
- Physics scripting (?)
- Dummy handling

Major differences between Blue Mars the game and Blue Mars Viewer

- Can only change resolution of game in Viewer
- Can only change time of day in Viewer

Day 10 June 10, 2009 (Wednesday)

Students were asked to continue working on their designs and received more critiques.

Since I have not been given a pass-code or confirmation email, I wont be able to test run the Blue Mars Viewer or online game. I've confirmed that all except two students (including myself) have not been sent invitations to gain access to the Blue Mars online world. I've also confirmed that only six students were able to successfully run the Blue Mars Viewer program and the online demo game. Students for the remainder of this week will be focusing on developing their cubes.

Yesterday's demo didn't leave the students with an air of excitement. In fact, they all looked disappointed. There were little pools of discussion in studio today that focused on the hardware requirements of the game. It appears that only a handful of students can afford to upgrade their systems. I made a suggestion to bring in a few of the desktops from the computer lab because I think they'll be powerful enough to handle the GPU and RAM requirements of the game. However, the biggest problem we'll be having over the next two weeks is communicating with the Blue Mars guys. I'm not sure if they know what we need from them and vice-versa.

With that said, I think I would like to modify the process I listed out in last week's journal entry:

Process of project

- Get hardware specifications/requirements from guest lecturers and then make students print out their computer specifications. If they can't meet the requirements, then provide another way for students to learn about lecturer's product.
- Make sure that students understand and know how to use current 3d asset building software to its fullest capabilities.
    - Students should be able to demonstrate their abilities to create animations with moving elements.

- Have a project package ready. It should have all that apply
    - site topography (3d model or CAD)
    - geographical location/context
    - Information regarding specific plants
    - Any existing structures/adjacent structures
    - Materials (existing or proposed)
    - Project description
    - Due dates/deadlines
- Smaller assignments should be made to test students ability to produce their proposed effects
    - explosions, sprays, bouncing, action/reaction, etc.
- Students to familiarize themselves with the project specifications, culture and new software
- After students have finalized designs and have built the digital garden they are to begin communicating via the internet through the Blue Mars interface.
- Blue Mars, UH, and other students/architects will be invited to the digital garden to view cube designs.
    - UH SoA and professor want to get feedback from visitors: Blue Mars will be tracking the amount of people who visit the garden, how many times, how long they stand, if they try to interact with a cube, etc.

At this point, the only things students are able to do are the assignments that the professor issues them in class for non-Blue Mars related work. If Kris can get those desktops from the computer lab and set them up with the Viewers, then I might be able to start testing things out.

Day 11 & 12 June 2009 (Thursday & Friday)

Students continued to work on their designs on Thursday and Friday. However, on Friday I was able to test out the Viewer program since Kris was able to set up two desktop stations in studio.

Both attempts tested on one of the desk top computers loaned to us by Tony Cao, computer lab manager.

Attempt 1:

I created a simple extruded object which started off as a shape I arbitrarily drew and then assigned an extrude command to in 3d studio max 9. I applied a material, saved it to the material editor and then exported the whole file using the COLLADA plug-in. After I saved it to the MyData folder, I tried to bring it in to the Viewer program. It didn't work. I tried it multiple times and then gave up.

Attempt 2:

My second attempt worked, but I used one of the standard primitives in 3d studio max 9 to create a generic cube. I repeated the same steps as above and this time it worked. I tested this file on four different computers. Only one out of four of them worked. What I know so far, is that the other three downloaded the Viewer installation files from the internet. The one that didn't get his Viewer application from the internet, but from a fellow classmate on a jump drive, was the successful one. My procedures were consistent.

Test File: Cube with brick texture map
Hypothesis: Will this work
Procedures: Kept consistent

1. Drag and drop folder with Collada file and texture map in to MyData file folder on to student's laptop/desktop
2. Move it in to test_collada folder
3. Open Blue Mars Viewer
4. File→Import
5. Select .DAE file and then make sure file path is correct
6. Convert
7. Load in to viewer

Pass/Fail: 1 out of 4

I can only think of two reasons why this didn't work on all four computers, the first being that their installers were inconsistent, and the second is that they might have installed the new software wrong. The root of the problem here is the installer and installation process. I used the same files on all four computers and yet only one of them was successful. In my first attempt, I think the problem had to do with my 3d studio max file. I forgot to save the texture map to disk and just assumed that all the faces were closed. I'll attempt that same file next week after I fix those two problems over the weekend.

For next week:

I'll have a series of questions for Jim Sink and his associate next week Tuesday. Blue Mars has a link that takes you to an online help section (looks like a Wikipedia page) that needs to be developed. It's possible that our trials and tribulations with the Viewer will be added to this help page. Since its possible to create and import through Maya and 3d Studio Max, Blue Mars developers might create different sections for both programs.

WEEK #4
Day 13 June 16, 2009 (Tuesday)
(9:00-10:45) 690-class

This morning we were joined by Jim and his associate Bryce from Blue Mars. They were better prepared for this week's demo.

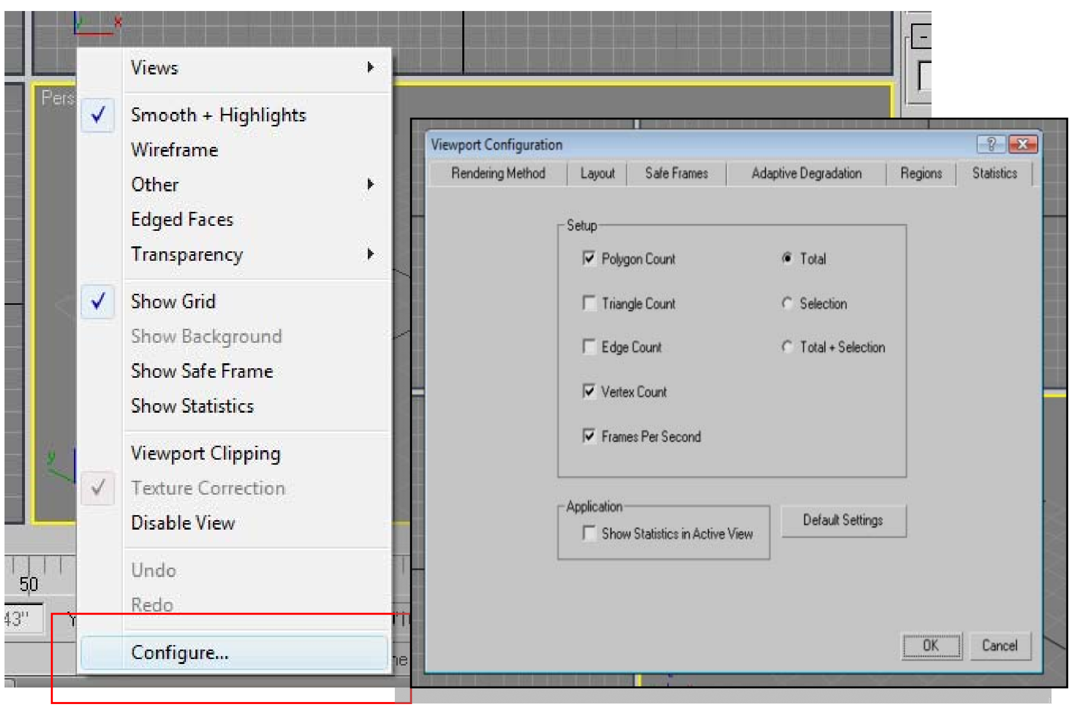
Jim and Bryce stopped by studio before giving the demo which was very helpful because they were able to fix the import issue. The real reason why my objects weren't coming in was because they didn't have a material assigned. But what I still can't figure out is why the box file with the brick texture map worked on only 1 out of the 4 laptops I tested last week.

We started around 9:30 and ended around 10:15. Bryce was the primary speaker and talked about the user interface (UI) in 3d Studio Max. All of the tips he provided about the program will come in handy later on in the semester when the students will be re-working their cubes.

<u>Tips</u>

Poly-Triangle count

Right click over the area that indicates what view you're in, locate configure at the bottom of the new window and click on configure. Choose the statistics tab and check Triangle count and Selection boxes. When you have the right settings, close the window and your settings should be saved.

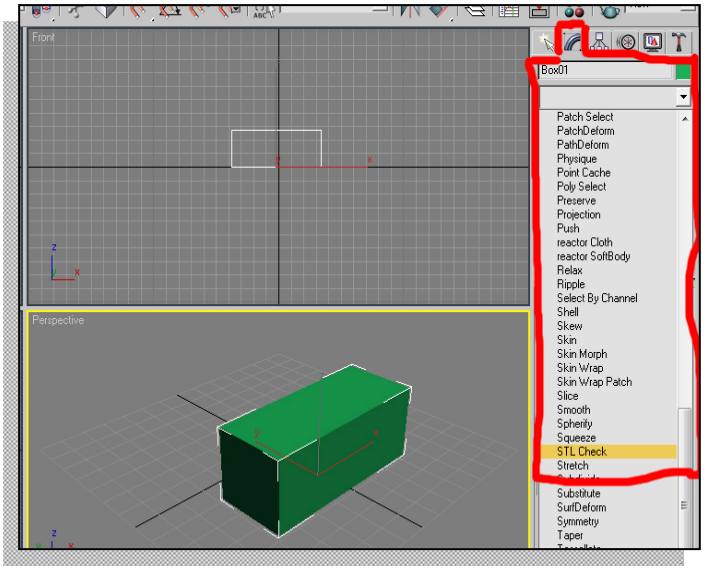


Right click over "perspective"

Navigate to "Statistics" tab

STL Check

This modifier checks your object to see if it has any conflicting faces, vertices or lines. It can be accessed under the modify tab. Make sure that you have an object selected before you apply the modifier.



←Click on modify tab and then scroll down to find STL check.

UVW Unwrap

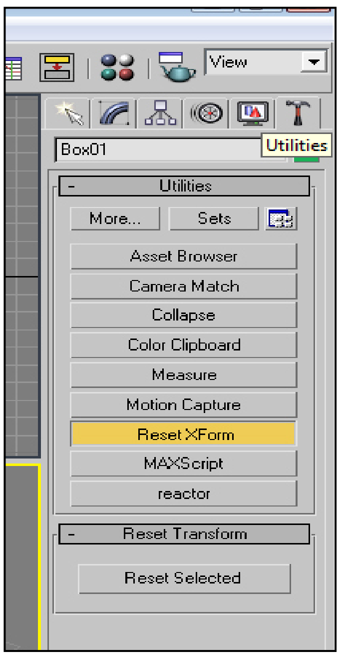
Students will definitely need to follow the tutorial online provided by AIAS on how to use the UVW unwrap. Although Bryce gave a really nice crash course on this tool, it's got a long list of tedious steps to go through. This modifier is really useful when there are a lot of objects in one file because it doesn't eat up all your material slots. You'll need a consolidated image file, something that you would create in photoshop or another paint program that contains all the images you will be applying per face on to a target object.

Reset Pivot & X-Form

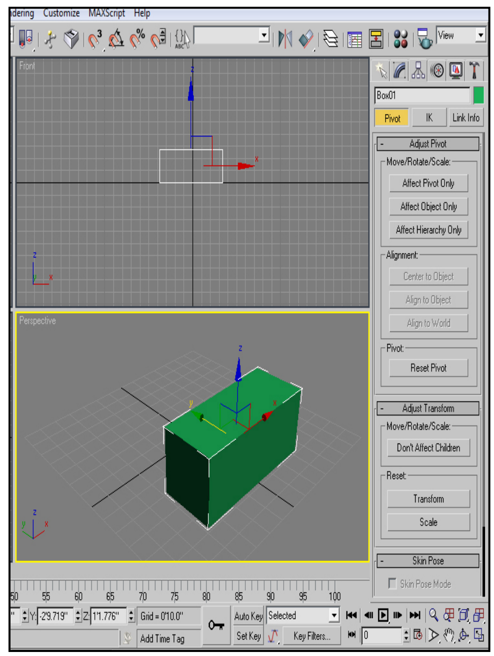
When bringing in a model to the Viewer, its beneficial to have the pivot or objects "anchor point" to be located somewhere that makes sense.

Resetting the X-form location can be done in 3d studio max and its accessible under the utilities tab (the hammer icon). Start by positioning the object(s) in the center of the grid and current window. Keep the objects selected and go to the utilities tab, locate Reset X-Form and then click Reset Selected. When you bring in the model from max to the Viewer, it should appear in the same location as it does in the max file.

Resetting the pivot point of the object(s) selected affects the way your object scales and rotates. There are some pre-determined anchor points to choose from, but Reset Pivot allows you to make your own. This can be done under the Hierarchies tab which is right next to the modify tab. Select your object, open the hierarchy tab, click the pivot button and then under adjust pivot select affect pivot only. You can move the pivot freely or select from three options listed below in the Alignment roll-out. Once you've found something that works, un-select affect pivot only.



Reset XForm



Reset Pivot

After the demo, Jim notified us that next week we'll be speaking with someone that works a lot with topography and possibly animations.

For the rest of the week, students will be working on their cube designs and getting desk crits from Kris.

I might have implied this in my earlier journals, but students really need to be much more proficient in their 3d applications. Design is definitely important, but learning how to build in both reality and virtual reality is important too. Architects today use digital and physical models as tools to help communicate their formal expression. If they can't draw it, then they should at least be able to build it.

Day 15 June 18, 2009 (Thursday)

I was finally sent a confirmation email from the Blue Mars folks. The installation didn't take very long and I was able to test the Viewer on my machine. My laptop can handle the Viewer fairly well but the game speed is really slow. There's also no way for me to load the content I created in to the game. I'll be asking Jim and his new demo guy how to upload my objects in to the game.

Tuesday's pre-demo talk in studio allowed me to figure out what works and what doesn't work for the Viewer. From my experiments today, I've learned how to import and export my 3d studio max files without any problems. I haven't tried doing an animation yet, but I will definitely attempt something after next week's demo. Maybe a simple morphing object might work.

<u>Viewer information facts</u>

1. Triangle size: 77,610 total
2. For every object that has a material in the 3d studio max file, one material slot will be created in the Viewer file
3. Changes are automatically saved in the Viewer
4. Instead of re-importing the same .DAE file over and over again, just open the .cgf version of that same file
5. Must name materials in 3d studio max accordingly
6. Materials have to be 512 x 512 in dimension
    a. I've tested smaller dimensions and they don't come in properly
7. It's possible to record the transition from day time to night time
8. The Viewer's display resolution is automatically set to Very High. To improve performance, lower it to High.
9. Change default speed from 1.0 to 0.5 for better frame rates while navigating

I'm satisfied with the way things are turning out with the Viewer application but I need to re-install the game. I don't think I had all the recommended files installed so there are some errors. I get a black screen when I try to launch the application. I let it idle for about an hour before I did a force-quit-shut down of the application. In order for me to actually launch the game I went to the program file, picked a random level .pak extension and then dragged it to the game icon. I was then brought to an Avatar creation page (which worked well) where I could create my virtual self and then picked a game to load. I didn't have any option buttons or a menu window which was probably due to the faulty installation.   I'll probably have better luck with the game after I reinstall things.

WEEK #5
Day 16 & 17 June 23-24, 2009 (Tuesday & Wednesday)

Jim and his co-worker Dean stopped by to give us a demo on how to use the Sandbox Editor. Dean has been working at Avatar Reality for two years and is the go-to guy for animations and building complex environments. His most impressive contribution to the game was designing the waterfall in the taki level. Dean actually worked on the VFX (virtual effects) team for a company called Digital Domain, which is a digital production studio. Digital Domain is responsible for movies like *Transformers, The Curious Case of Benjamin Button, G.I. Joe,* and many more, visit http://www.digitaldomain.com/ to find out more about their tech and company bio. I learned about Dean's background on Wednesday since Tuesday's class didn't happen. Students were given a demo that went from 1:45-4:25 in the old computer lab. Dean provided the class with some handouts and some plug-ins for Photoshop and 3dsMax. He definitely had questions for the class- what's your time frame like?, do you have a plan on how to divide the work?, who knows how to use 3dstudio max?, do you want to be an architect or a game developer..? Students responded un-enthusiastically with moderate chuckling. Some were definitely architect and some were re-evaluating their careers goals in that instant.

By the time Dean was done with the demo, I would say about 2 or 3 students were really excited about the Editor's capabilities and couldn't wait to get their hands on the program. I don't know what the agreement is between the school of architecture and Avatar Reality, but Dean seems to be under the impression that the students will be building the Korean garden. Students, on the other hand, were under the impression that Avatar Reality will be building the Korean garden. There is definitely a lack of communication between both parties. Students will need to be on their toes for the next couple of weeks because there was a professor swap. Santiago Perez will be teaching this class for the next 3 weeks and has another design project in mind for the class. At the end of the two week session, students will be expected to fabricate their designs which may or may not relate to their current design problem.

Perez and Palagi have similar interests but their teaching styles are completely different. Palagi is looser with the course structure while Perez has a more organized approach. Students have responded positively to Perez's teaching style and his project proposal. What I'm mostly concerned about is time. Perez and Palagi have both explained the goals of their projects and for the next couple of weeks; one will take priority over the other.

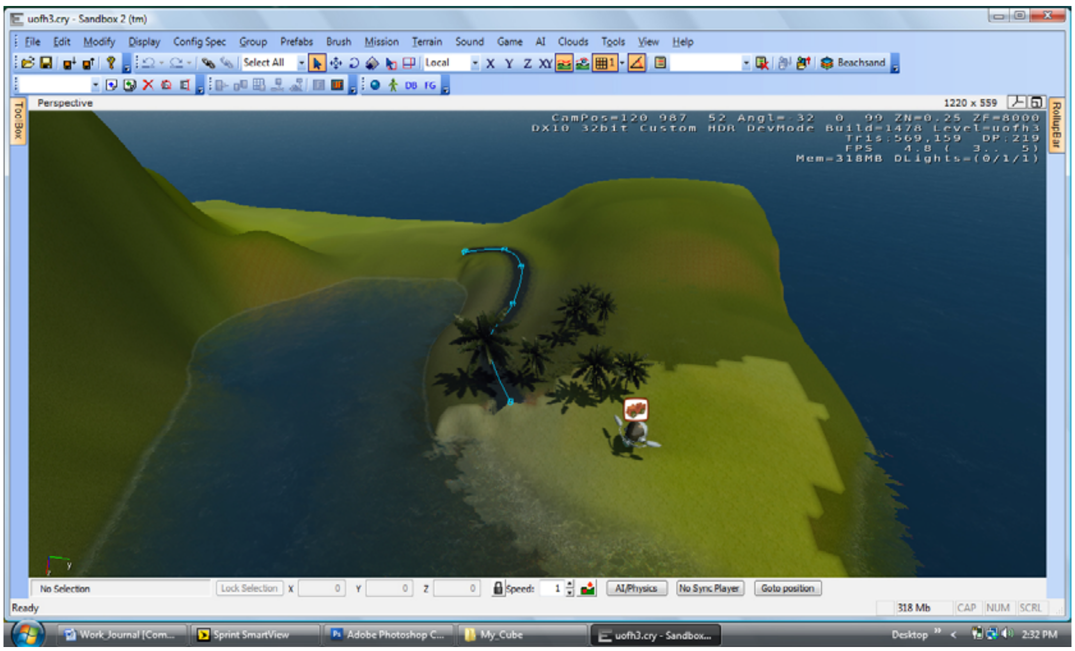
Blue Mars & Sandbox Editor tutorial links:
http://wiki.crymod.com/index.php/Category:Official:Asset_Creation
http://doc.crymod.com/SandboxManual/frames.html?frmname=topic&frmfile=index.html

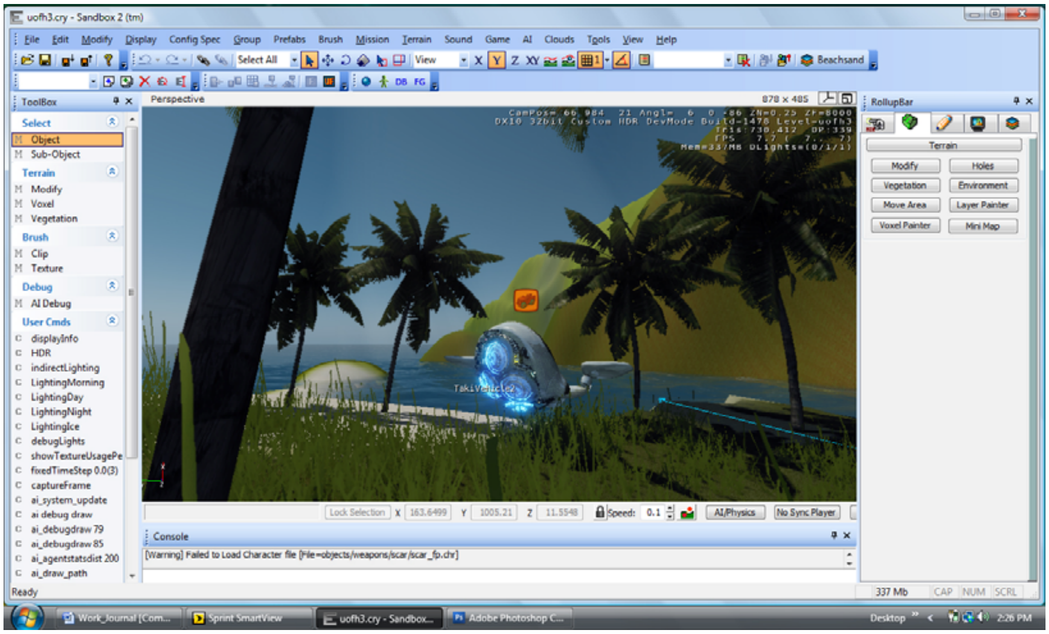
http://www.bluemarsdev.com/wiki/index.php/Sandbox_Viewer_Manual

Day 18 June 25, 2009 (Thursday)

For the rest of the week I will be working at home. I gave three students the Sandbox Editor program and asked them to distribute it to the rest of the class. As for the plug-ins, everyone received a copy on Wednesday from Dean via a USB drive belonging to one of the students. I will be testing out the plug-ins for Photoshop and 3d studio MAX today and tomorrow. Today, I will be reviewing my notes on how to navigate within the Editor, how to build, import, apply materials and edit terrains.

I misplaced the materials to my cube but was able to load another student's cube in to the Sandbox editor. Here are some screenshots.




uofh3.cry - Sandbox 2 (tm)
File Edit Modify Display Config Spec Group Prefabs Brush Mission Terrain Sound Game AI Clouds Tools View Help
Select All
View
Beachsand
ToolBox
Select
Object
Sub-Object
Terrain
Modify
Voxel
Vegetation
Brush
Clip
Texture
Debug
AI Debug
User Cmds
displayInfo
HDR
indirectLighting
LightingMorning
LightingDay
LightingNight
LightingIce
debugLights
showTextureUsagePe
fixedTimeStep 0.0(3)
captureFrame
ai_system_update
ai debug draw
ai_debugdraw 79
ai_debugdraw 85
ai_agentstatsdist 200
ai_draw_path
Perspective
RollupBar
Terrain
Modify
Holes
Vegetation
Environment
Move Area
Layer Painter
Voxel Painter
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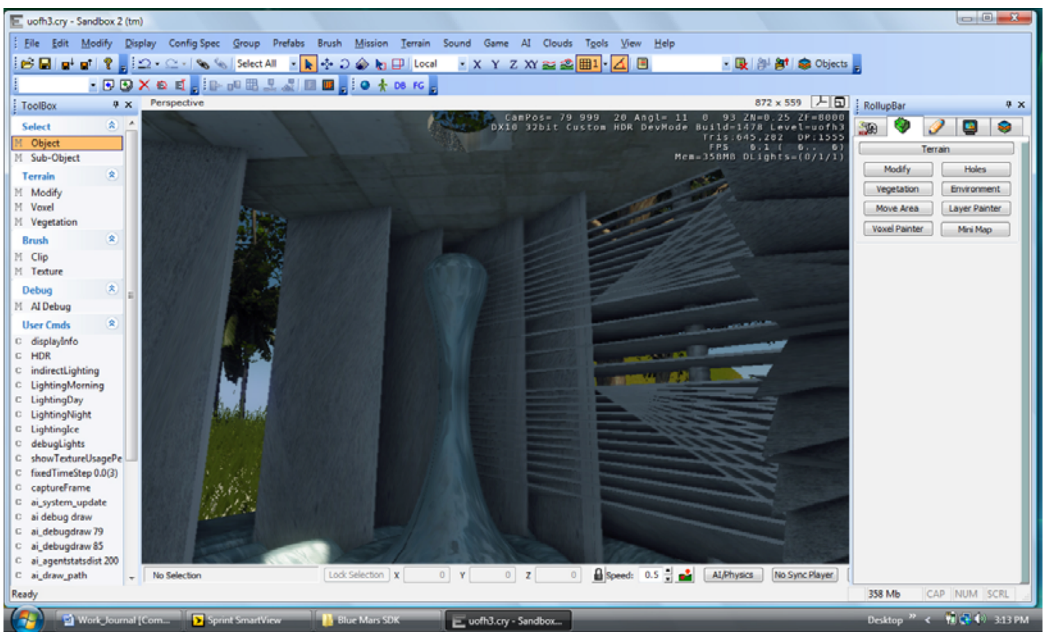
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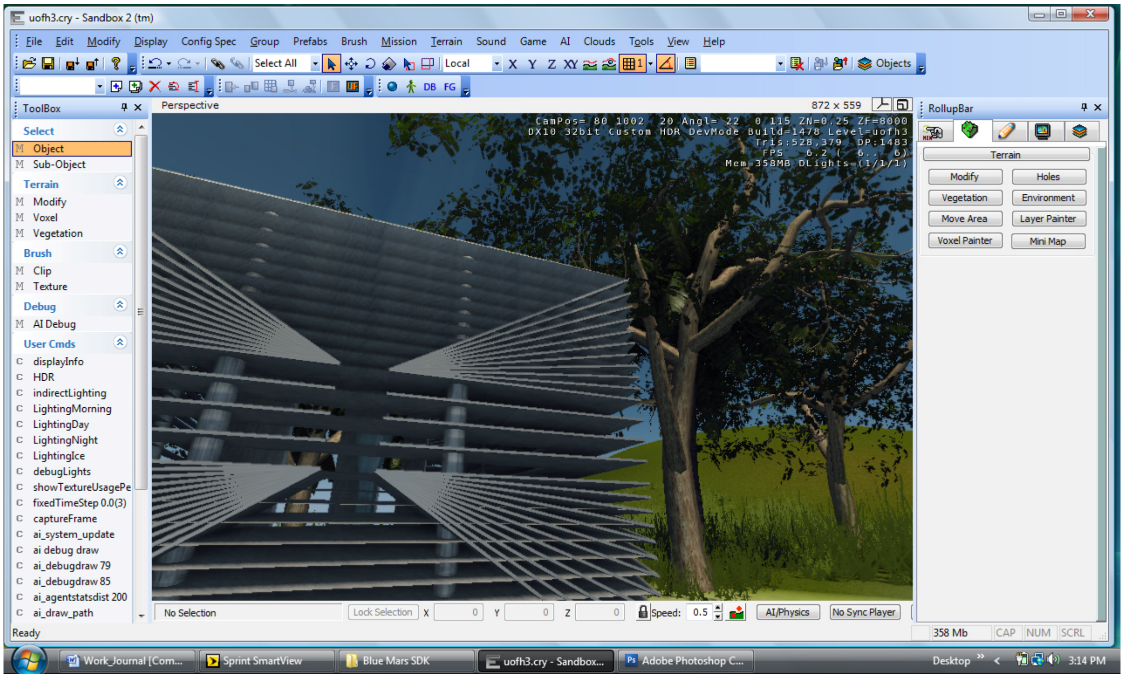
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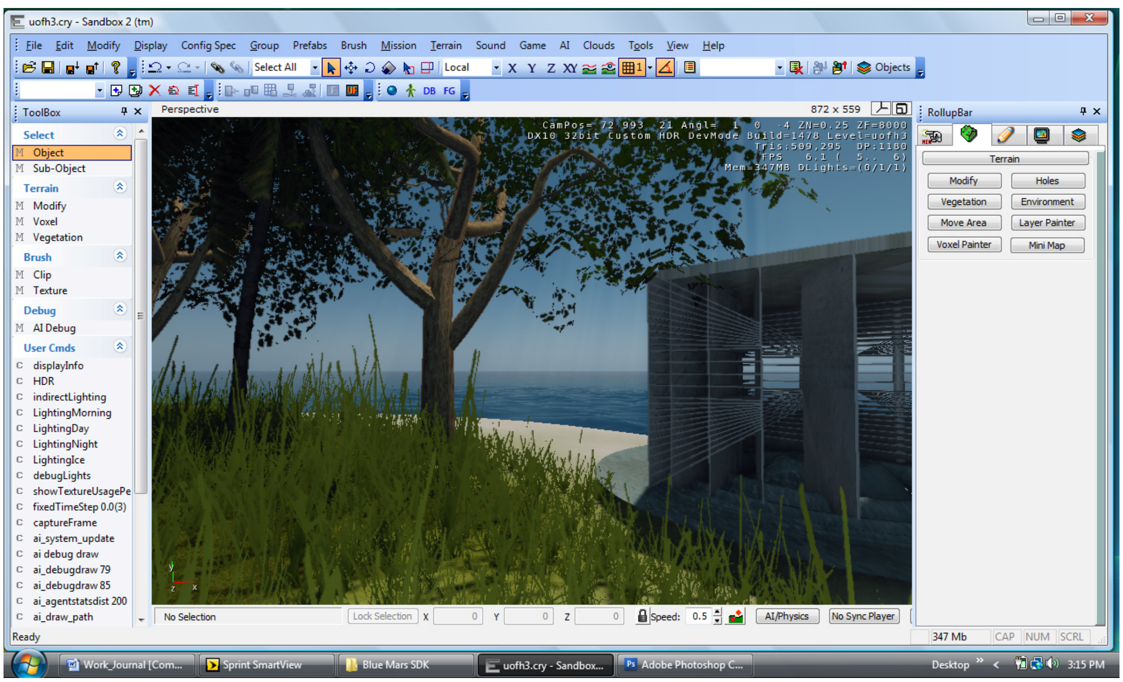
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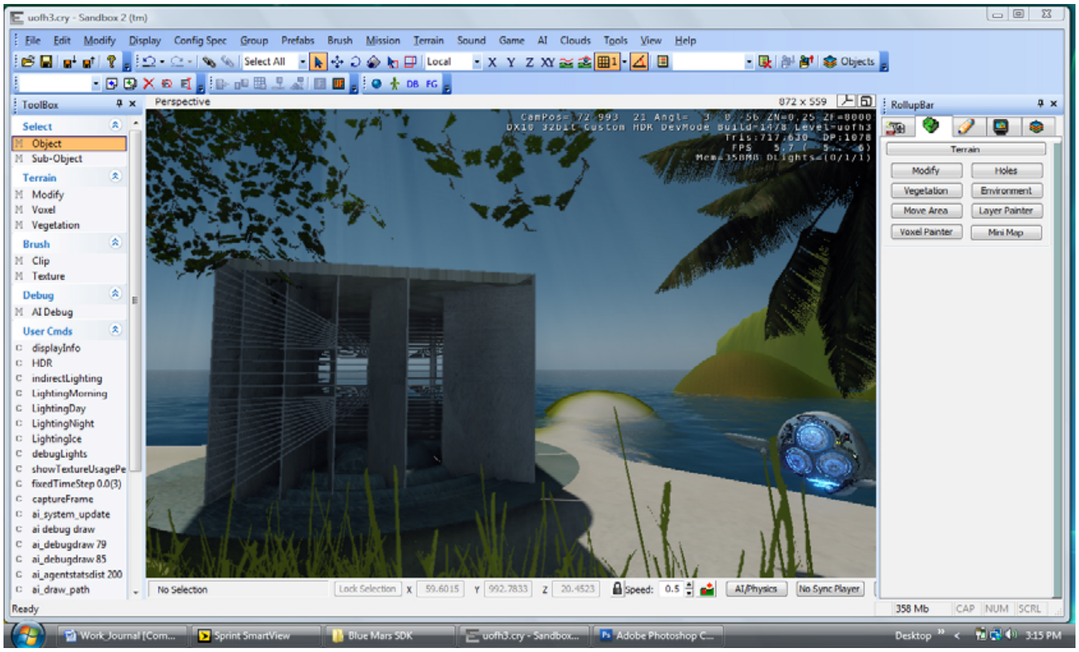


When I brought in the student's cube, I had to relocate the materials and reapply them utilizing the same procedures from the max to viewer exercises. Entering the game mode allows me to walk around and fly the taki vehicle that Avatar Reality created. The demo and the online reading material are very useful teaching guides which is why I will not list out my procedures for this entry.

I will be creating a simple kick-able box and importing that in to this file. Hopefully it will be ready to check out next week.

Problems

I would highly recommend using the Blue Mars Viewer and the Collada exporter from now until the class ends. The 3dstudio max plug-in has only worked on version 9 and 2008. However, I have found through researching the crymod forums that it is possible to have the plug-ins working on 2009. I haven't found any procedures relating to the 2009 set up. Students will need to find a later copy of 2008 or version 9 in order to use the CryEngine plug-in. As for the Photoshop plug-ins, they're used to create crytiffs, image files specifically formatted to be used with the cryengine sandbox 2 program. Through a few correspondences back and forth with Dean, I was able to install them. The files provided to us on Wednesday were not all in the file folder. I forwarded the email containing the remaining files that Dean sent me to the rest of the class and relayed the instructions on how to install the plug-in.

Students will be able to learn the editor's functions and interface within two solid days of playing around in the program. At least, that's how long it took me. I'm still following the tutorials, but by the time this class ends I should be adept at using the software. If students follow the tutorials and read the manuals they will have no problems with the editor.

WEEK #6
June 30, 2009- July 3, 2009

Architecture is a multi-facetted discipline and the School of Architecture is doing a pretty good job of exposing its students to the different opportunities this field of study has to offer. Asset creation for game development, graphic design, furniture design, digital fabrication, historical preservation, architectural theory, the practicum and sustainable design are some of the current offerings at the school thus far. The practicum in relation to the rest of the course offerings allows students to test what they've learned in an actual office setting. Which means they get to see whether or not they can actually use what they've learned in school.

With respect to asset creation for game development, students are learning how to take advantage of 3d applications. Offices now-a-days don't build models unless the client requests them, and even then those jobs get outsourced. Clients are requesting images, animations, and walkthroughs to help them understand the final product. Architects use whatever means necessary to save time and to produce a high quality product. Thanks to this summer studio I now know that using 3d game engine software cuts down the time it takes to light, render a scene and to create animations.

Like any new application, it takes time to learn. **My assessment of the software being used in the summer studio is this:**

1. Have students become proficient in either 3d studio max or Maya (in Tony and Parks classes)
2. Make sure they have the hardware to run 3d engine technology
3. Use only 1 instructor to teach the class so that students can focus and manage time appropriately
4. Prepare a software package of all necessary plug-ins and have the instructor walk them through the installation process
5. Have a set of projects (easy, intermediate and advanced) for students to go through so that they can learn how to use the program in combination with other software like MAX and Maya
6. Like the previous computer aided design courses that Tony and Park teaches, split the course in to two classes; 1 lecture and 1 hands-on.
7. In terms of the easy, intermediate and advanced projects I would recommend 3 easy projects, 2 intermediate projects and 1 advanced project.
    a. The advanced project could require students to develop one of their favorite projects
    b. Here, they can learn how to apply interactive functions (explosions, movement, etc.)

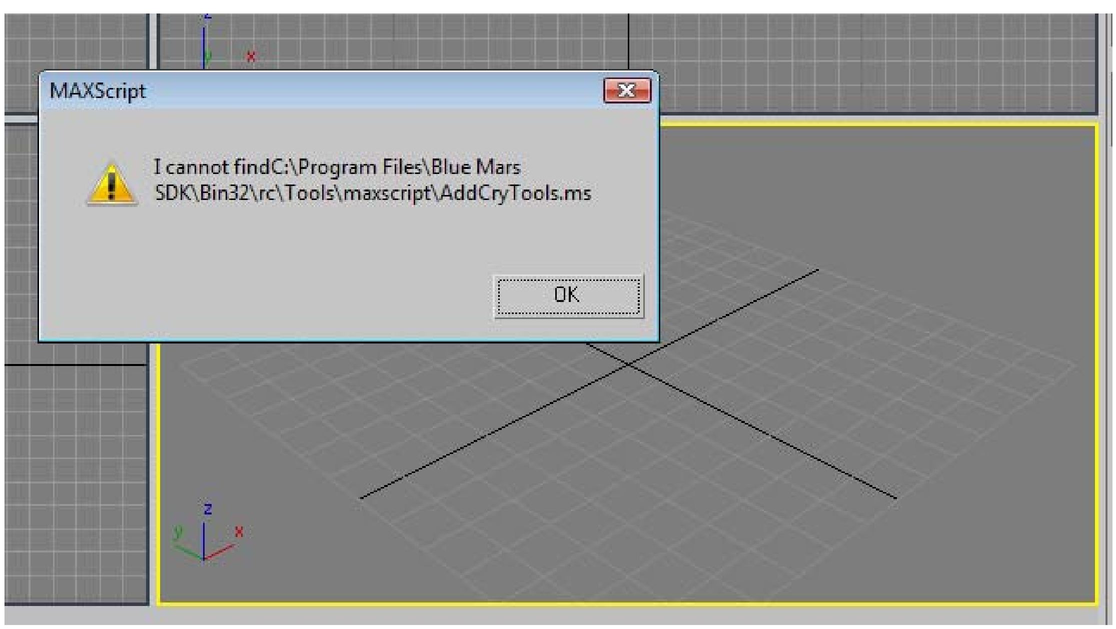
8. Daily exercises in the hands-on should be relevant to student's project focus
9. Maybe as an added bonus, teach students how to import Revit models in to 3d game engine

When the students who have taken this course graduate, they will seriously have an ace up their sleeve. What I'm seeing in this studio now is a primitive form of what may come in the future as far as CAD applications go. If the demand exists or if architects can stimulate a demand for this kind of project delivery, then these students will have no trouble adapting to it in the future. About four years ago, the school had hosted several Revit and ArchiCAD workshops through AIAS. It was offered to students and to working professionals. Revit was at version 6.1 and I think ArchiCAD was on version 5 or 6. Being exposed to future technology while in school is a valuable asset that I hope the school will continue to pursue.

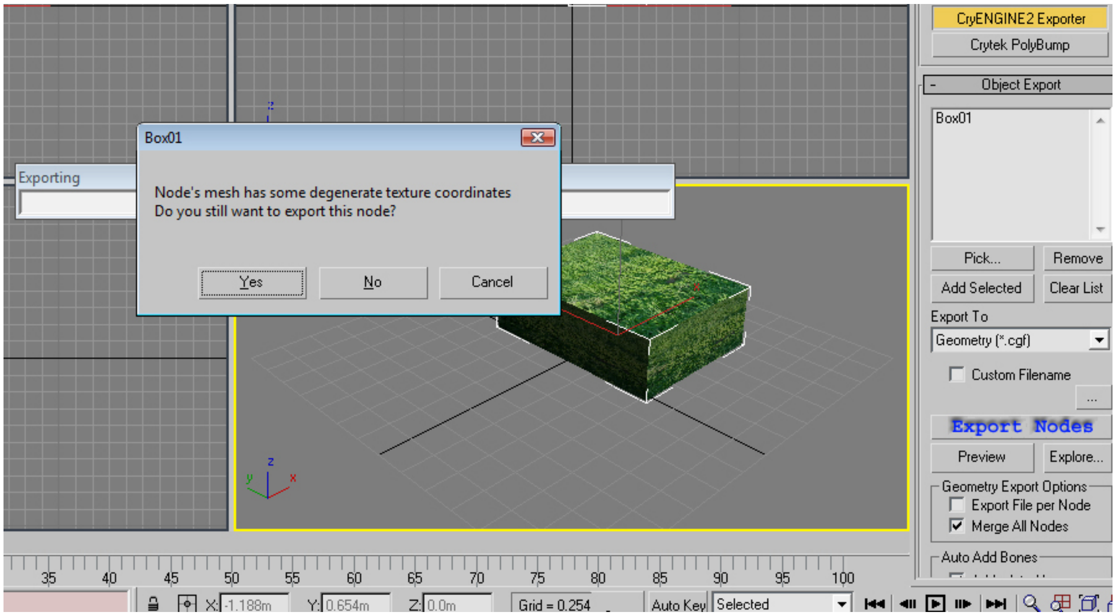
Next week, students will be wrapping up Santiago's project. It has been assumed that students were working on building up a library of textures and objects for the garden so that in the final summer session, they can focus on bringing everything together in to one file. Tony, the school's IT manager has been given an okay to purchase some extra hardware to upgrade the current desktops in studio. One of them will be the main computer that hosts the final garden file containing everyone's cube designs.

Additional Software Conflicts

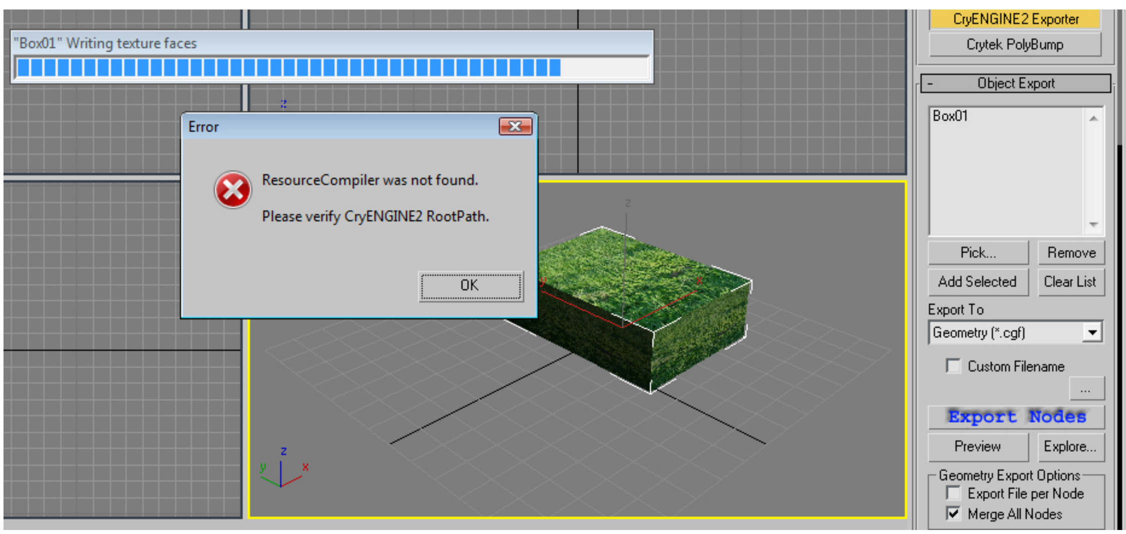
I have yet to solve the plug-in issue for 3d studio max. Every single time I try to export using the CryEngine 2 Export plug in, this series of error boxes come up:

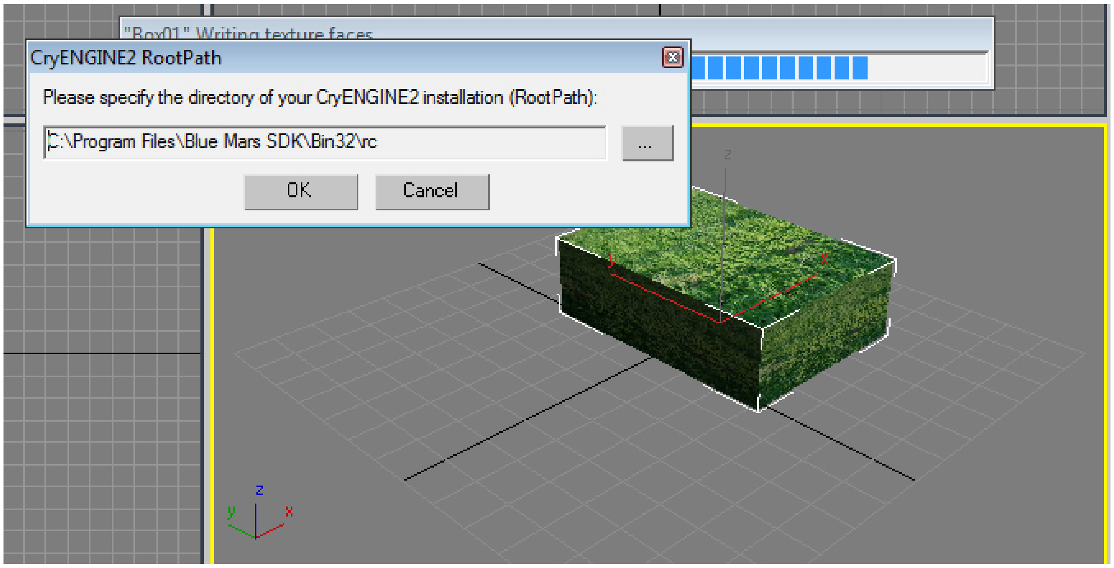


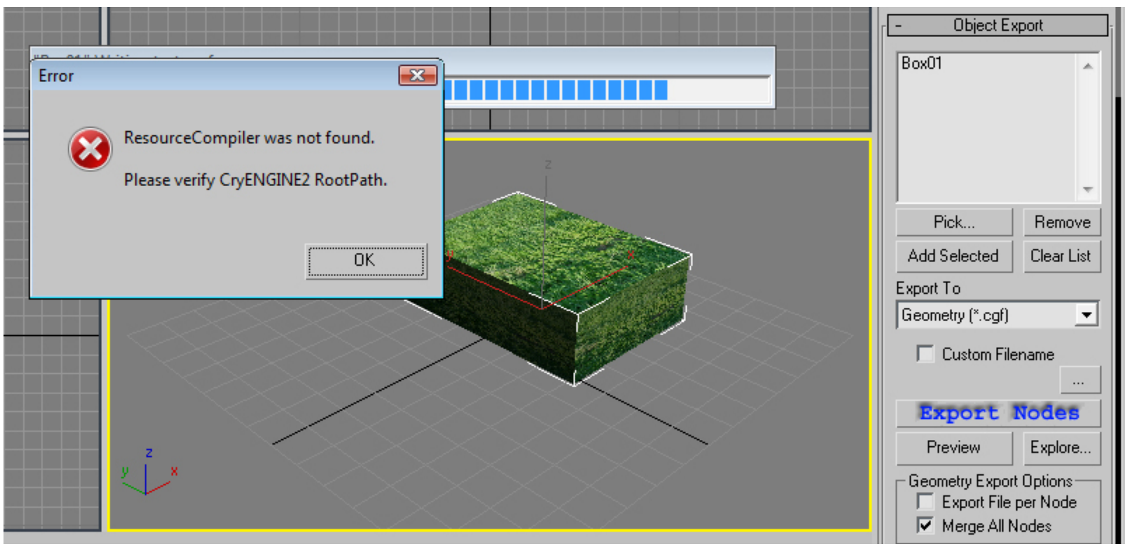
This one pops up after just starting the program ^.



This one pops up after clicking on the CryEngine Export button







I honestly don't know why it won't except that file location for the root directory because that's the exact location for ALL the Blue Mars files. I ran in to this same problem in Photoshop CS 3, but it was solved when I gave it the same file path.

C:/Program files/Blue Mars SDK/Bin32/rc

There really isn't any point sending Dean another email because it's probably a CryTek issue. Crytek is the company that developed the plug-in and their crymod website forum doesn't have a solution for a problem like this. I might just end up re-installing the whole Blue Mars SDK.

My next steps in the second and final half of the summer session will be:

1. To re-write my D.Arch project proposal based on the information that I have collected in the first half of this studio

2. I will also be working on refining my journal so that it contains the specifications I had stated in my work agreement
    a. Also, I will be working on a list of "things" that students should know how to do prior to taking a studio like this
    b. Journal refinement also to include recommendations to sites and tutorials to follow as additional teaching references
3. I will also be experimenting with the additional functions in the Sandbox 2 Editor at my own pace. I will be testing animation effects and so forth.

By looking at what I've submitted so far, all the raw data is there, it just needs to be edited, refined and re-organized. The final journal submittal will be at that level of detail.

WEEK #7: Summer Session 2
July 7, 2009- July 10, 2009

Students will be finishing up their project with Perez this week and will be presenting next Wednesday at 1:30. The Blue Mars assets will also have to be finished next Thursday at 9:00.

Again, there were no demos from the Blue Mars people this week, so I tried to focus on helping two groups of students. Specifically those in charge of building the topo and creating landscaping items. There's a team for topography, landscape/foliage, buildings and miscellaneous objects. I'm not concerned with the building or miscellaneous object teams because they're already familiar with the process of importing their cubes and applying textures. Creating the terrain and landscaping items is a bit more complicated.

It had been suggested by Jim and his associates to use some of the stock assets provided by Avatar Reality. Instead of building a whole new library of trees and foliage, I had suggested that students swap out the leaf and bark images from the stock foliage with the ones that Kris had brought back from the actual garden. As for the students working on the topography, I suggested they work on creating .tif files of all the ground textures first. Kris and his team were unable to retrieve a height map of the garden so the topo team (for now) will be making the garden from scratch. This poses an accuracy problem. The people working on walls will need an accurate topo model if their items are to fit correctly. I assumed that the main topo modeler had a grip on the situation so I decided to work with the foliage team. We identified the stock trees that could be used and I showed them how to access the vegetation options in the Blue Mars SDK. After that I recommended that they begin to photoshop the images that Kris brought back.

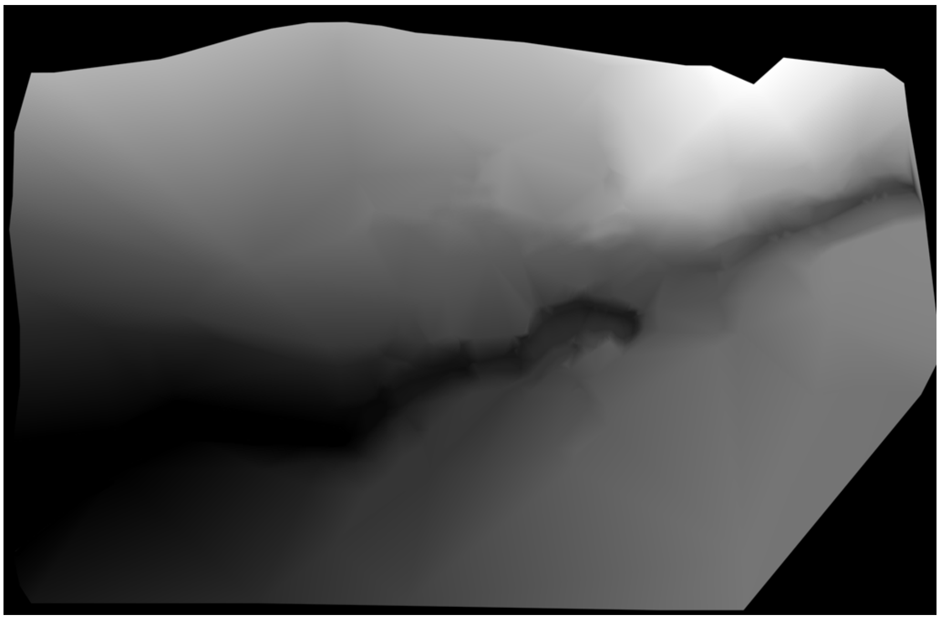
Problems began to surface in both teams. The foliage team could not eliminate the white background from the branch images so we had to stop and troubleshoot. Unfortunately, the foliage team could not work on this problem due to the other project deadline. I sent an email to Dean, the last demo instructor, asking him how to fix this issue. I experimented with his suggestions over the weekend and the problems were fixed. In terms of the topo modeling, the progress was not what I had expected. I came up with an alternative method for the modeler to test:

TOPOGRAPHY test methods
• Draw lines in autoCAD
• Turn lines in to "TERRAIN" in 3dmax
• Render to texture (bake) height maps
• Export height maps
• Import height map in to Blue Mars SDK

The middle step yielded un-desirable results so I spent some time researching an alternative method. There was a tutorial that I found online;

http://www.ogre3d.org/wiki/index.php/3dsmax_Heightmaps

So with much tweaking in 3d max, I was able to create a height map which I then passed on to the terrain modeler to test in the Blue Mars SDK. I sat with the topo modeling team on Sunday from 2:15 – 7:30 to trouble shoot and go over some tutorials. I did so again on Monday around 3:00 – 5:00.



Height map above

Tree without white plane

Getting these students to where they should be took an additional 10 hours of tutoring. I didn't even bother describing the functions of 3dmax or autoCAD to either of them. Teaching them what they need to know in a program versus how the application works is the only time saving way the rest of the class is going to get through this project. I was very surprised that the terrain modeler was not well versed in autoCAD despite taking the required Computer Aided design course here at the SoA. But to his credit, he caught on fast. It appears that some students learn better if you teach them application functions on an as-needed-basis. How the application works as a whole is a connection they can make later when they've accumulated more experience. The Blue Mars studio is set up correctly this summer with a morning demo class and studio classes in the afternoon, however, due to the professor swap out the demonstrations have been inconsistent which is why students are not able to use the program on a regular basis.

Software Assessment

After the first four or five weeks, I was able to determine that this studio was destined to be a difficult one to teach and manage. It's the mixed skill level of program knowledge of each student that creates this difficulty. It's been my experience to find alternative methods of accomplishing a task using a variety of techniques that don't utilize a single solitary program. If it can't all be done in one program, then do it in another and combine the two. However, students can't even *do* that because they don't have enough experience in the right programs.

Students need to know Photoshop, AutoCAD and 3d studio Max or Maya to work in this class. Rhino and Sketchup should not be used ever. If a model needs to be updated, the student will be forced to go back in to Rhino or Sketchup and re-export. It's an un-necessary step which can lead to file problems later on. I had entered this class thinking that the SoA had kept up the tradition of teaching the foundations of autoCAD and Max, but it turns out they haven't. The only reason why I was able to come up with the height map solution this weekend is because of my background knowledge in autoCAD and Max.

Here's the kicker: what I've experienced thus far, in terms of software usage in an office is this; a basic drafting program is absolutely necessary, knowledge of working with at least one 3d modeling program (Sketchup is dominating) and knowledge in at least one BIM software like ArchiCAD or Revit is what most offices need. Students will almost never need to use 3d max ever again unless they get in to gaming or rendering. So, where does this leave students? What kind of software applications will the school need to teach the next generation? I think it would be a great benefit to the student if they could be taught one software application from each category listed and then how to effectively integrate all three. By learning how to integrate and transition from one application to the next in school it takes out a lot of the guess work when in an office setting. Student/interns can spend less time figuring out software bugs in the office and more time learning about the profession (managing projects, coordinating consultants, how to avoid lawsuits, etc.).

WEEK #8: Summer Session 2
July 14, 2009- July 17, 2009

On Wednesday I was able to explain a Photoshop tip passed down to me from Dean on how to control the leaf appearance of the stock trees provided to us by Blue Mars. I expect to help a few more students out tomorrow with asset creation.

This past Sunday's tutorial helped to get the topography team going, but accuracy is still an issue. Palagi and I spent much of Thursday's afternoon session trying to figure out how the Sandbox 2 Editor converts the height map in to an actual terrain. We know that it needs a 16 bit grayscale map equivalent to the size and scale of the document initially created in the Editor. What we don't know, and would like to eventually discover is the height value for each shade of grey present on any given height map. Black represents the lowest peak while white is the highest. Everything in between is a toss up, but we know that as a shade of grey gets lighter in contrast, the terrain will get steeper and steeper.

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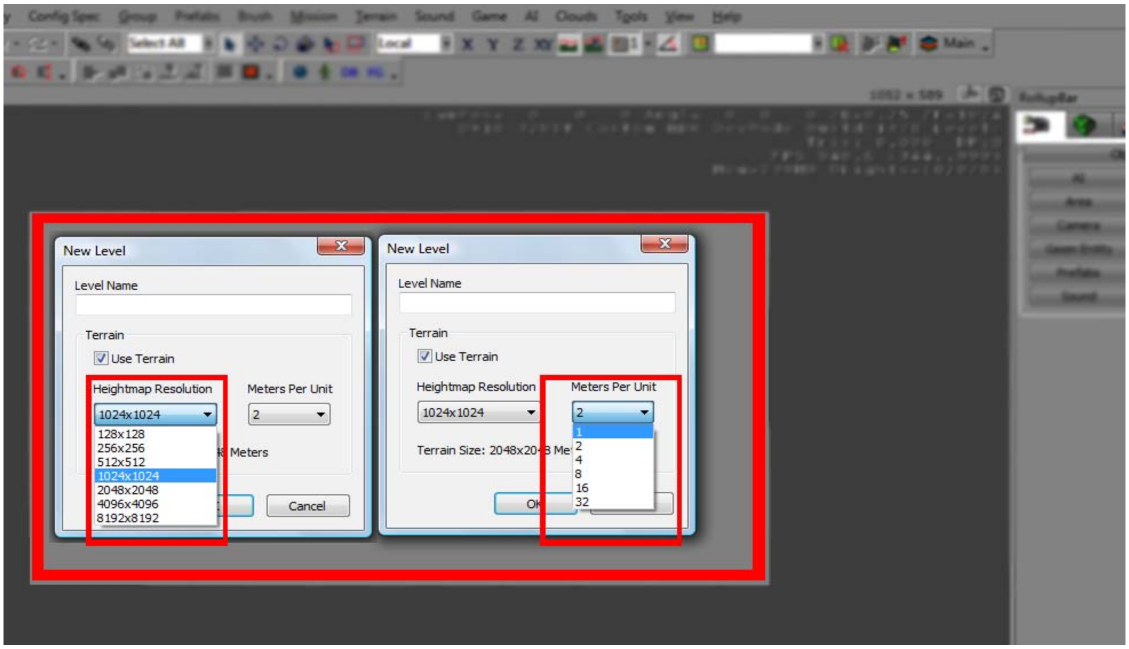
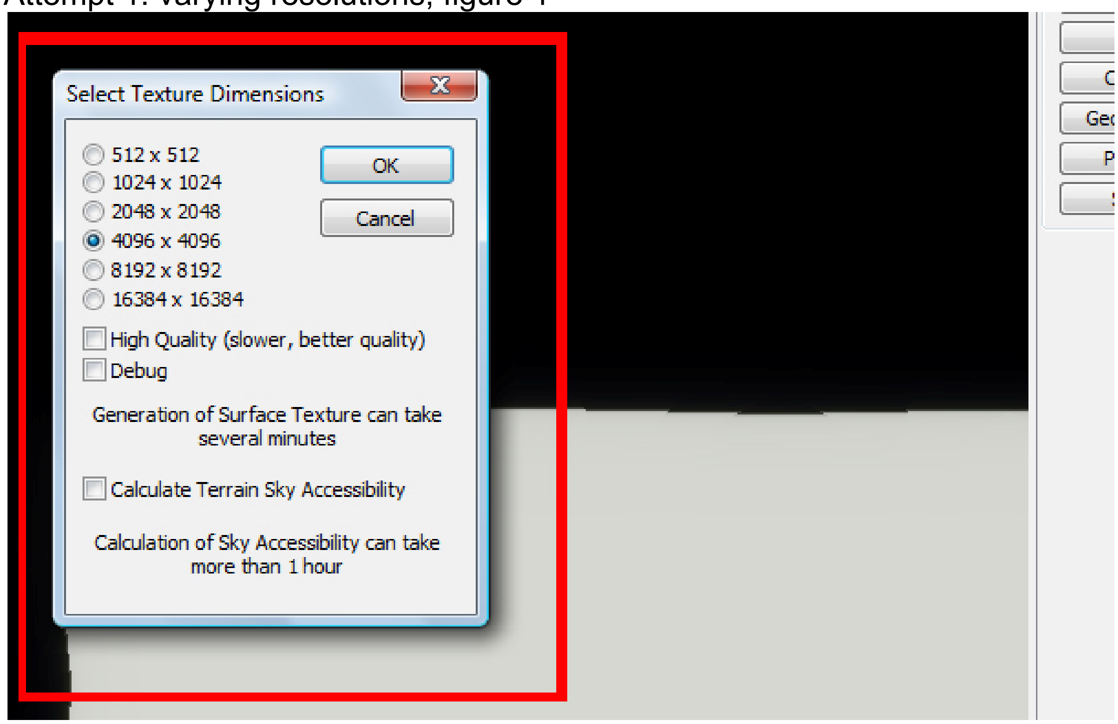
100

Thursday Attempts

We (instructor and I) made two types of attempts with multiple variations in trying to establish an accurate terrain. In the first type of attempt, we tried to bring in the height map created on Sunday by the topography team at varying resolutions. See screen shots below. We tried over 10 different kinds of combinations from the options provided at each window using the same height map.

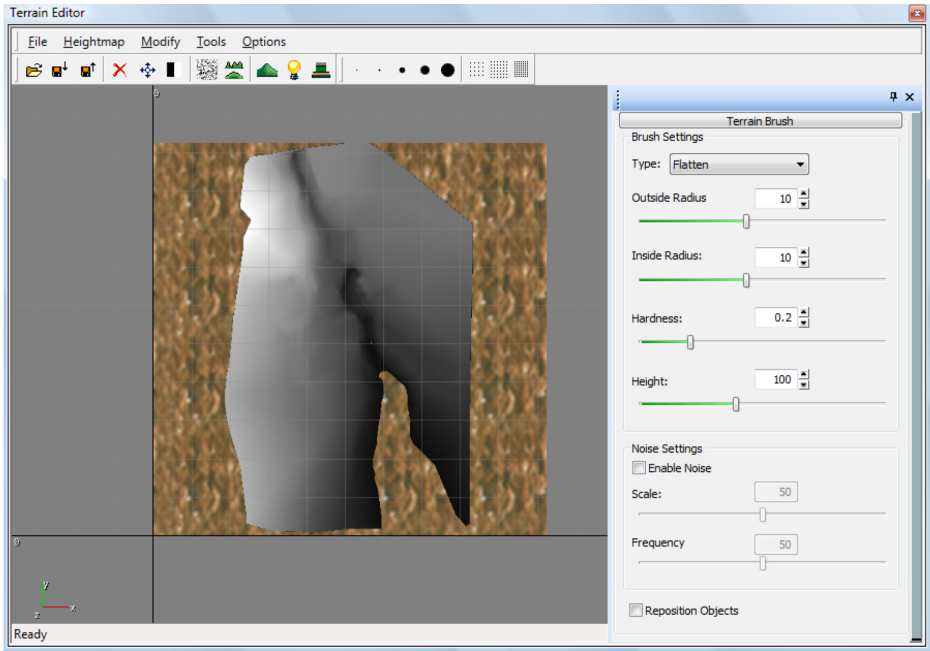


Attempt 1: varying resolutions, figure 1



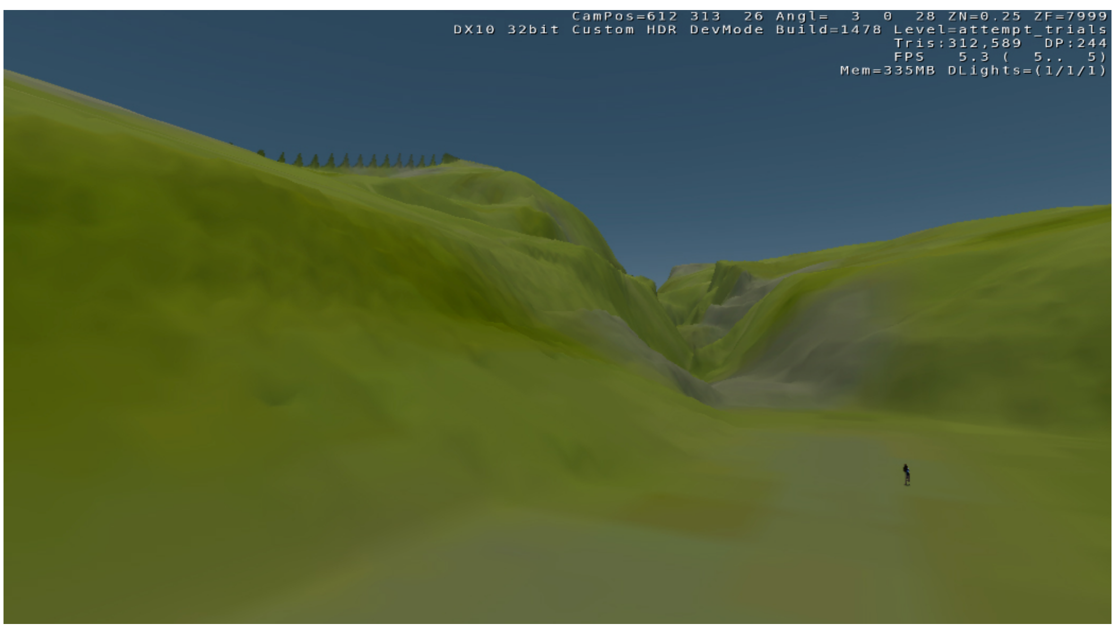
Attempt 1: varying resolutions, figure 2

Each variation yielded the same results. The height map shown in last week's log is the one we experimented with. Each time we made an attempt to import that exact height map, the Sandbox 2 Editor stretched the image to fit the overall document's size, the size established in the screenshot Attempt 1: varying resolutions, figure 1. Which resulted in the image below.



Despite having failed at this attempt repeatedly, we realized that the map size, set to 1024 x 1024 resolution actually means 1024 meters x 1024 meters. Establishing the overall size and meters per unit value didn't mean anything to us in the beginning because we were merely trying to import a successful map. Selecting texture dimensions relates to the grass texture that the editor uses by default and changing those settings affected nothing.

This was not the only issue discovered after importing the height map. Heights and lengths were extremely amplified, resulting in much steeper peaks, hills and longer distances.



The black speck in the bottom right hand corner of the above image is a person (to scale). She is standing in what should be a shallow creek/riverbed. As you can see, the height map was grossly wrong and disproportionate.

Instead of trying to find a resolution to this failed attempt, the instructor began to test another type of height map.

Attempt 2

The autoCAD drawing done by a different student in class was the base drawing that Palagi (instructor) chose to start from. He exported it to a PDF and then imported it in to Photoshop.

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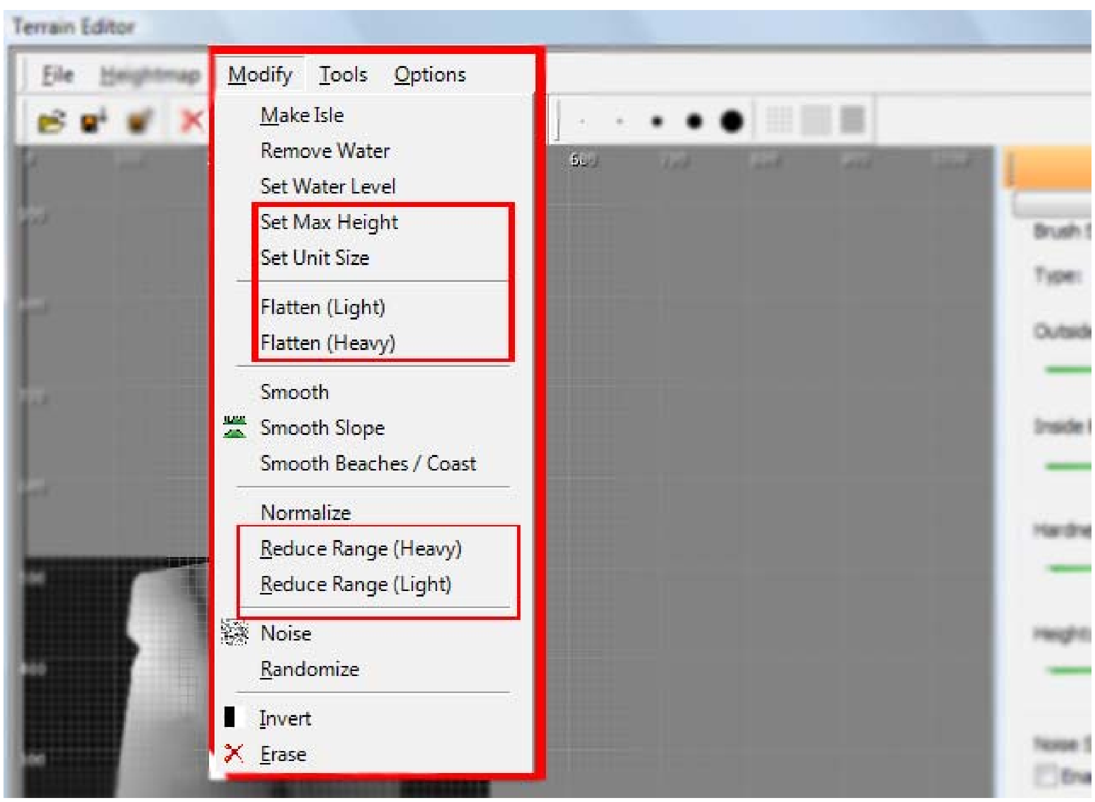
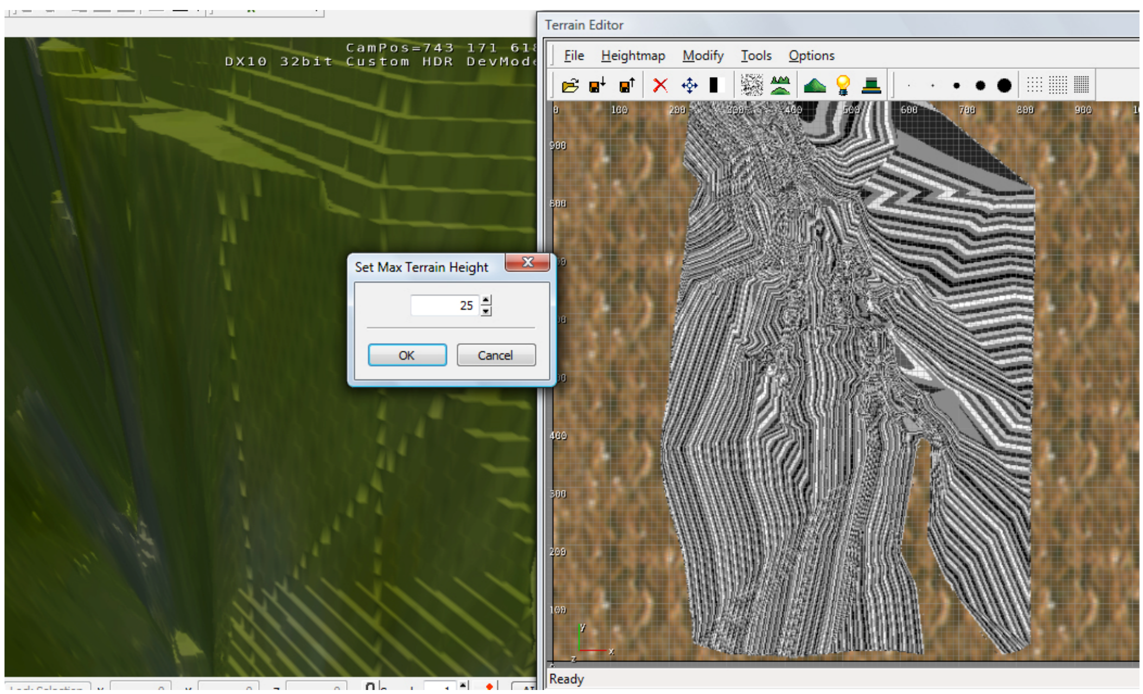
Knowing in a general sense what gives each pixel a height value, Palagi began coloring in the contour lines. After creating a new height map, he attempted to bring it in using the same general procedures above. The resulting terrain had hard defined contours which were about 10x their actual heights and supposed spacing.

In this attempt we both discovered a few more options that could alter the terrain while using the Sandbox Editor.



- By changing the Max Height of the terrain, we can change the range of greys that the editor recognizes. Tinkering with this option yielded undesirable results. (see next image)
- Setting the Unit Size didn't do anything noticeable.
- Flatten (Light), squashed the taller peaks down considerably and evened out the landscape but left spiked fringes around the outer perimeter of the height map.
- Flatten (Heavy), did the same thing as Light, but did so to the darker range of greys.
- Reduce Range (Heavy) caused the contours in Palagi's height map (created in Photoshop) to somewhat uniformly shrink vertically at a greater strength.
- Reduce Range (Light) did the same as Heavy, except at a weaker strength.

By discovering these parameters, it allowed Palagi to scale down his contour heights. However, we ran in to the same problems here as we did in attempt 1. The Photoshop image that Palagi created was stretched to fit at every terrain dimension we tested. The site is only 322' x 491.5', in meters that's about 98.15 meters x 149.8 meters. In any case, this attempt was aborted.



Attempt 2: Resetting the Max Terrain Height from 256 to 25

Results

Height map from topo team:

Pro	Con
Gradients produced smoother transitions from contour to contour	Unable to retain detail as terrain is flattened using modifiers

Height map from Palagi:

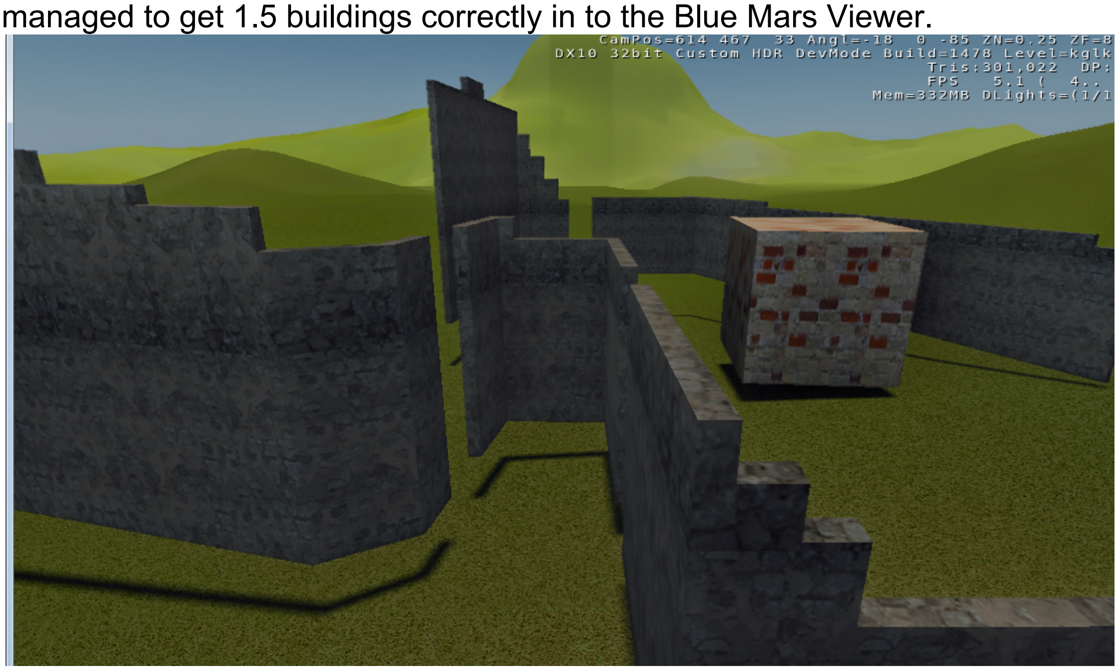
Pro	Con
Scalable contour heights using modifiers	No gradients, therefore harder contour transitions

It doesn't matter what height map the class uses at this point because it needs to be customized to fit the buildings, walls and other objects.

Just because we didn't succeed today, doesn't mean we won't be able to figure this out another time. I'll be testing some other method this weekend to see if I can at least bring in a map that is proportionate to the dimensions of the actual site.

Friday

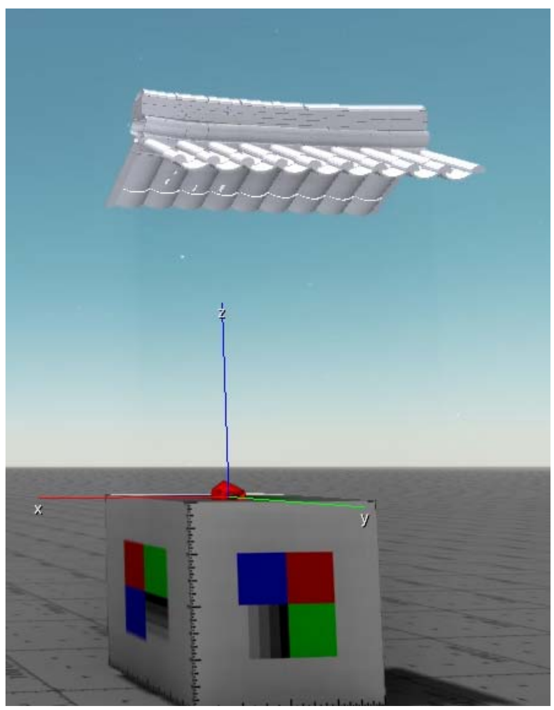
In studio, I took my focus off the terrain editor and started to help students import their buildings. The property walls came in at about half their actual size. Palagi assigned a new paper for students to do over the weekend and gave desk crits on their cube designs thus far. We should be importing objects next week. The process of importing will still be done using the Collada exporter. I've managed to get 1.5 buildings correctly in to the Blue Mars Viewer.



The student in charge of building a gate way entry managed to build his very complicated roof correctly, but not the supporting elements like door way, beams, footing, etc. I broke down the major elements and could not find the cause of this problem. The roof was absolutely more complicated than the entry way and imported flawlessly, albeit I had to re-apply textures but at least it showed up. I spent about 4 hours trying to figure out why the rest of his building didn't import properly, but because the elements were simple I asked him to rebuild it.

Another student had modeled an entire shack like structure which imported 100% in to the Blue Mars Viewer. I walked him through the procedures of applying materials step by step in MAX and then showed him how to re-apply the materials (should they disappear) in the Viewer. We ran in to a little problem at first. The cause of our problem was the insertion point of his model. We didn't see the model with the newly-reapplied textures until after we zoomed out of the immediate viewing range. He didn't do a Reset X-form in 3d MAX, therefore his model was placed elsewhere in the scene when it got imported.

Students should be dropping of their files beginning next week. Thursday and Friday were the only two days that students were really working on the Blue Mars stuff.



Appendix C - Survey to Practicum Office

Original interview questions used during student Practicum B.

Thank you for participating in this survey. The results will be included in a final document titled *Future Online Worldmaking in Architecture*, and will also be presented in a Power point on May 15th @ 5 pm in the back conference room. Your answers will remain anonymous and personal information will not be gathered. This should only take 10 minutes.

1. How many years of architectural education have you received?

   ___________ years.

2. Circle the time frame that best describes your graduation date:

   1960-1970   1971-1980   1981-1990   1991-2000   2001-2009

3. Were there any computer aided design courses available? (If no, please move on to question 6)

   □Yes   □No

4. Which of the following programs were available at your institution? (Highlight all that apply)

- o AutoCAD
- o ArchiCAD
- o Architectural Desktop

- o Microstation
- o Form Z
- o 3D Studio Max
- o Rhino
- o Maya
- o Sketchup

5. Were you encouraged to produce presentation graphics utilizing computer software?

□Yes □No

6. How many architectural offices have you worked for thus far?

1-2 3-4 5-6 6 or more

7. Have the architectural offices you worked for embraced technology and computer aided design?

□Yes □No

8. Have you been able to apply the computer skills you learned in school towards designing and producing documents in architectural offices?

□Yes □No

9. Would you agree that creating presentation graphics consumes a great deal of time? (Presentation graphics = rendering, 3d model making, etc.)

□Yes □No

10. In your opinion, would it be **useful** to have an in-house employee dedicated to producing presentation graphics so that your time could be better spent on solving design issues?

□Yes □No

11. In your opinion, would it be **economical** to have an in-house employee dedicated to producing presentation graphics so that your time could be better spent on solving design issues?

□Yes □No

12. Are you familiar with online world making games (The Sims & Secondlife)?

□Yes □No

13. Do you think that clients and end-users would benefit from virtually touring the designs you've created before they've been built?

□Yes □No

14. Do you feel that the interactive aspects of these games could be used to guide clients through a design and help them better understand the quality of that space?

□Yes □No

Once again, thank you for your participation!

Appendix D - Pilot Project I Description

Project logistics for Pilot 1

Project description

Student Group will be given a project to complete in approximately 6 weeks that will require them to design a boardwalk, a lifeguard station, a gazebo and a pathway that connects the gazebo to the boardwalk along a portion of coast line of Taquile Island [Lake Titicaca, Peru]. Students will not have to do research or a site analysis (but can if they want to), this project is strictly judging the efficacy of designing collaboratively online (VOW) vs. designing traditionally in a face to face (F2F) environment .

At the end of the 6 week project, questionnaires and interviews will be utilized to gain feedback on their experiences. Feedback from students will also be most graciously accepted throughout the process.

Meeting Location

Room 212 @ School of Architecture

Week 1 = Introduction

Week 2 = Going over software

Week 3 = Going over software/Desgin

Week 4 = Design

Week 5 = Design

Week 6 = Final Design and Presentation

Requirements of Student Group:

Student Group Using Blue Mars (VOW)

1. All students must be able to model in a 3d application. Students will meet face to face (week 1) for an introduction to the Blue Mars workflows and 3ds max.
2. They will be required to design collaboratively by using the internet as a means to communicate.
3. All students must meet (Skype or TeamViewer) for the required amount of hours per week.
4. Student using the SoA laptop must return all equipment at the end of the project.
5. All students must meet and discuss ideas in Blue Mars
6. All students must make a presentation of their design.
7. Design must be uploaded to Blue Mars for a “guided tour” of the design

Project Provisions:

Laptops loaded with the following software will go to the students using Blue Mars.

- 3dsMax 2010 + plug-ins
- Rhino 4.0
- Photoshop CS2 + plug-ins
- AutoCAD 2010
- Notepad++

- 7zip
- TeamViewer
- Skype
- Firefox
- Blue Mars (Client)
- Blue Mars (Developer's Kit)
- Students will be shown how to register for a Developer MyPage account
- Where to find additional HELP and documentation
- Workflow packet
- CAD files

Laptop Specifications

2-Qty. of ASUS Republic of Gamers series G51JX-X3 15.6-Inch Gaming Laptop purchased from local Best Buy for $899.

- Intel Core i5-430M Processor 2.26 GHz with Turbo Boost Technology up to 2.53 GHz
- 4GB DDR3 1066MHz RAM, 2 SODIMM Slots; 8GB Max
- 500GB Hard Drive (7200 RPM); Super Multi Optical Disk Drive; Wi-Fi 802.11 bgn
- 15.6" Full HD 1920x1080 LED LCD Display; NVidia GTS 360M Graphics Engine with 1GB DDR5 dedicated VRAM
- Windows 7 Home Premium (64 bit) Operating System; Bluetooth; 2.0MP Webcam; Backlit Chiclet Keyboard

Workflows to be taught

1. Export of models to 3dsmax
2. How to use 3dsmax basics
3. How to export from max to Blue Mars Developers Kit

    a. Item Editor
    b. City Editor
4. Introduction to City Editor and Item Editor interface
    a. Interface
    b. How and where to save
5. How to use the City Editor tools
    a. Terrain
    b. Time/ Lighting/ Location
    c. Vegetation
    d. Entities vs. Brushes
6. How to share the City files so that <u>ALL</u> of you can inhabit a City at the same time
7. How to use TeamViewer to share design
8. How to use Skype for verbal communication

Appendix E - Pilot Project I Survey

Surveys to students - Pilot 1

Name of Study: Virtual Online Worlds: Towards a collaborative space for Architects

Purpose of Study: To better understand how virtual online worlds can affect the quality of contribution from each member when collaborating on a project.

Primary Researcher(s): Tiffany Nahinu [Student Conducting Survey]

Contact Information:

Tiffany Nahinu

email: tnahinu@hawaii.edu; Daytime phone number: 808-561-7109

Kris Palagi [Committee Chair]

email: kpalagi@hawaii.edu

As a volunteer participant in the above mentioned research, I understand that I will be asked to complete a survey that will ask questions related to my work experience. The survey typically takes about 20 minutes to complete although this time can vary depending on each subject. I also understand that I may consider some of the questions personal in nature but that the information I provide will be used exclusively for this project and will in no way be associated with my name, address, student ID or any other identifiable information.

As a participant in this study I am aware that the questions on the research survey may cause anxiety or stress depending on my personal situation but that most find the experience harmless and even enjoyable. As a participant, I am aware that the responses I provide may assist future college students at this University and perhaps other colleges across the country.

By signing below, I state that I have read this consent form in its entirety and that all of my questions have been answered. I understand that I may withdrawal from this study at any time and that my participation or lack of participation will in no way affect my status as a [student, patient, employee, etc.]

Before working in Blue Mars

1. Have you had prior experience in working with 3ds max?

   Yes No

2. Have you had prior experience in working with Skype?

   Yes No

3. Have you had prior experience in working with the Blue Mars Editors?

   Yes No

4. Have you had prior experience in working with Photoshop?

   Yes No

5. What is your favorite modeling program to work in?

6. Did you know what a massive multiplayer online world (MMOW) was prior to taking this class?

   Yes No

7. Have you ever been in a group design project for an architectural studio course at UH Mānoa? (circle one)

   Yes No

8. For your last group project, on a scale of 1-5, please rate the amount your contributions to the project. 1 being the lowest and 5 being the highest.

   1 2 3 4 5
   Very little More than enough

9. Did all of your group members contribute to the discussion of design ideas? (circle one)

   Yes No

After Completing Group Project in Blue Mars

1. Working in Blue Mars and the various online communication tools allowed you to contribute more ideas during discussions with your group members.

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. Being connected with your group members via Skype, Blue Mars and Teamviewer allowed you to ask your fellow group members more questions related to the design.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. Each time you met online with your group members, you found it to be an enjoyable process.

Strongly Disagree Disagree Neutral Agree Strongly Agree

4. Being connected to the internet made it easier for all of you to quickly reference the same source material and web pages when searching for information or inspiration.

Strongly Disagree Disagree Neutral Agree Strongly Agree

5. All of your group members made quality contributions.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6. How long did it take your group to make a design decision?

Extremely long (more than 30min)
Not very long (15 minutes)
Fast (within 5 minutes)
Extremely fast (within 1 minute)

7. What do you think could have sped up the decision making on this project?

8. Blue Mars is a great MMOW to use on small collaborative projects.

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. Blue Mars is a great program to use for presentations.

Strongly Disagree Disagree Neutral Agree Strongly Agree

10. Working in a digital medium like Rhino and 3ds Max allowed you to add more detail to the final design.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

11. Working in a digital medium like Rhino and 3ds Max allowed you to save time by not having to scan in hand drawings.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

12. Working in a digital medium like Rhino and 3ds Max made you pay attention to the amount of time you were spending on modeling and discussions.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

13. Working in Blue Mars with an accurate terrain model allowed you to design within the constraints of the terrain.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

14. Working in Blue Mars allowed you to engage the site by actively manipulating the terrain.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

15. Walking around the site in Blue Mars with your group members generated more ideas.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

16. Walking around the site in Blue Mars with your group members generated a well thought out site driven design response.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

17. Sharing your work via Blue Mars resulted in more iterations (versions) of the design.

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

Appendix F - Pilot Project II Description

Project logistics for Pilot 2

Project description

Student groups will be given a project to complete in approximately 3 weeks that will require them to design a covered lakeside shelter that provides warmth for a group of 8-10 people. Within that shelter, a small fire pit or stove, restrooms and seating. A place to dock small fishing boats (12'-14' in length) and a pier that extends 20' out from the shore should be located near that shelter. There is a heavy emphasis on creativity, design and design communication.

Students will not have to do research or a site analysis because the body of land is fictitious. This project is strictly judging the efficacy of designing collaboratively online (VOW) vs. designing traditionally in a face to face (F2F) environment.

At the end of the project, questionnaires and interviews will be utilized to gain feedback on their experiences. Feedback from students will also be most graciously accepted throughout the process.

Meeting Location
School of Architecture
Group A - Remote locations
Group B - Room 312

Requirements: Student Group A - Using Blue Mars (VOW)

1. All students must be able to model in a 3d application. Students will meet face to face (week 1) for an introduction to the Blue Mars workflows and 3ds max.
2. They will be required to design collaboratively by using the internet as a means to communicate.
3. All students must meet (Skype or TeamViewer) for the required amount of hours per week.
4. Student using the SoA laptop must return all equipment at the end of the project.
5. All students must meet and discuss ideas in Blue Mars
6. All students must make a presentation of their design.
7. Design must be uploaded to Blue Mars for a "guided tour" of the design

Requirements: Student Group B - Traditional (F2F)

1. All students must make a presentation of their design at the end of week 3
2. Site Plan with design, Elevations, Floor Plan
3. Sections:
    a. Colored
    b. No details need to be shown
    c. Human figures need to be shown (1 or 2)

4. Landscaping must be shown in plans and renderings (can be 2D cad with a splash of color)
5. Concept
6. Design Process – Preliminary Sketches
7. Material choice & furnishings – walls, roofing, paint, furniture, etc.
8. Renderings - Photoshop or 3D
9. No need to do a physical model While one group is actually working in the virtual environment there will be another group addressing the same problem, designing face to face (F2F). The traditional method of designing (F2F) is the typical form of collaboration for architectural students. Having both participant groups working on the same design problem will allow me to compare the following:

- Design results
- Development of ideas
- Tool effectiveness
- Collaboration
- Communication (Oral)
- Communication (Visual)

Appendix G - Survey to Group A

Survey to Group A

VOW Post Project Survey - Part II

Name of Study: Virtual Online Worlds: Towards a collaborative space for Architects - Part II

Purpose of Study: To better understand how virtual online worlds can affect the quality of contribution from each member when collaborating on a project.

The survey should take about 20 minutes to complete although this time can vary depending on each subject.

As a participant, I am aware that the responses I provide may assist future college students at this University and perhaps other colleges across the country. I also understand that I may consider some of the questions personal in nature but that the information I provide will be used exclusively for this project and will in no way be associated with my name, address, student ID or any other identifiable information.

Post project survey

1. Working in Blue Mars and the various online communication tools allowed you to contribute more ideas during discussions with your group members.

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. Being connected with your group members via Skype & Blue Mars allowed you to ask your fellow group members more questions related to the design.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. Each time you met online with your group members, you found it to be an enjoyable process.

Strongly Disagree Disagree Neutral Agree Strongly Agree

4. Being connected to the internet made it easier for all of you to quickly reference the same source material and web pages when searching for information or inspiration.

Strongly Disagree Disagree Neutral Agree Strongly Agree

5. All of your group members made quality contributions.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6. How long did it take your group to make a design decision?

Extremely long(more than 30min)
Not very long (15 minutes)
Fast (within 5 minutes)
Extremely fast (within 1 minute)

7. What do you think could have sped up the decision making on this project? (Please explain)

8. Working with Blue Mars allowed you to add more detail to the final design.

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. Working in a digital medium like Rhino and 3ds Max made you pay attention to the amount of time you were spending on modeling and discussions.

Strongly Disagree Disagree Neutral Agree Strongly Agree

10. Working in Blue Mars with an accurate terrain model allowed you to design within the constraints of the terrain.

Strongly Disagree Disagree Neutral Agree Strongly Agree

11. Walking around the site in Blue Mars with your group members generated more ideas.

Strongly Disagree Disagree Neutral Agree Strongly Agree

12. Walking around the site in Blue Mars with your group members generated a well thought out site driven design response.

Strongly Disagree Disagree Neutral Agree Strongly Agree

13. Working in Blue Mars allowed you to think about materials.

Strongly Disagree Disagree Neutral Agree Strongly Agree

14. Sharing your work via Blue Mars resulted in more iterations (versions) of the design.

Strongly Disagree Disagree Neutral Agree Strongly Agree

15. Do you plan on using Blue Mars in the future?

Yes No

16. Would you recommend Blue Mars to other architecture students?

Yes No

17. Because of your prior experience in working with Blue Mars, were you able to make design decisions faster?

Yes No

18. The size of the project program allowed you to focus on developing more detailed designs.

Strongly Disagree Disagree Neutral Agree Strongly Agree

19. The additional information provided to you assisted you in design development. (autoCAD file and 3d max model of site)

Strongly Disagree Disagree Neutral Agree Strongly Agree

20. Because of your prior experience in Blue Mars, were you able to refine your work flow? Please explain.

21. What could have increased the amount of productivity and collaboration while in Blue Mars? Please explain.

22. Please rate your previous level of adaptability to Blue Mars. (1 low, 7 high)

1	2	3	4	5	6	7
Low						High

23. Please rate your current level of adaptability to Blue Mars.

1	2	3	4	5	6	7
Low						High

24. If you could change something about the final design (because you were able to walk around in it), what would it be? Please explain. (1 or 2 brief statements)

Roof:

Gathering Space:

Material:

Structure:

Spatial Adjacency (distances between program spaces):

Detail:

25. With respect to question 24, Blue Mars would help you to realize those changes to be made.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Comments:

Appendix H - Survey to Group B

Survey to Group B

Face to Face - Post Project Survey - Part II

Name of Study: Virtual Online Worlds: Towards a collaborative space for Architects - Part II

Purpose of Study: To better understand the factors affecting quality contribution from each member when collaborating on a project in a face to face environment.

The survey should take about 20 minutes to complete although this time can vary depending on each subject.

As a participant, I am aware that the responses I provide may assist future college students at this University and perhaps other colleges across the country. I also understand that I may consider some of the questions personal in nature but that the information I provide will be used exclusively for this project and will in no way be associated with my name, address, student ID or any other identifiable information.

Post project survey questions

1. Please list the software programs used during this project.

2. Having a 3D topography model and site photos aided your design discussions.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. Doing a site visit would have enriched your understanding of the site.

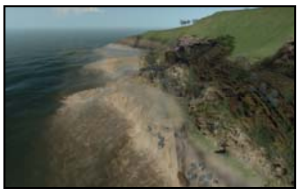
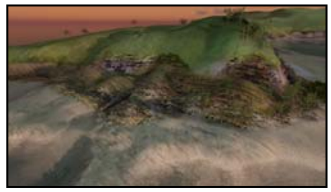
Strongly Disagree Disagree Neutral Agree Strongly Agree

4. Supplying interior and exterior perspective renderings of your final design are enough to communicate it to people.

Strongly Disagree Disagree Neutral Agree Strongly Agree

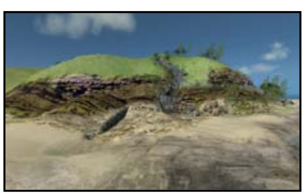
5. Which images did you reference the most? (Check all that apply)
Which images did you like the most? (Check all that apply in the RED boxes)









6. Please list some outside factors that affected your ability to communicate and collaborate with your partner.

7. What was the most time consuming part of this project?

8. How did you try to engage the site? Please describe.

9. Would walking through the design <u>with</u> your client change your choice in presentation media?

Yes No

10. The project was small enough to focus on developing fine details

Strongly Disagree Disagree Neutral Agree Strongly Agree

11. As a follow up to question 10, what would have allowed you to develop more details?

12. In your opinion, what is the most challenging part of collaborating with someone else in a team project?

13. If this were a studio course, do you think you'd get more done?

Strongly Disagree   Disagree   Neutral   Agree   Strongly Agree

14. How did managing two design projects at the same time affect this project?

Comments:

Appendix I - Consent Forms

Agreement to Participate in
Virtual Online World Study - Part I

Tiffany Nahinu
Primary Investigator
(808) 561-7109
tnahinu@hawaii.edu

This research project is being conducted as a component of a dissertation for an architectural doctoral degree. The purpose of the project is to specifically evaluate the effectiveness of a virtual online world called Blue Mars as a tool for design collaboration amongst architectural students in hopes that what is learned can be applied at the professional level. You are being asked to participate because you are an architectural student.

Participation in the project will consist of working with other architectural students to complete a 6-8 week design problem and then filling out a questionnaire at the end of the project. Participants will be expected to work 2 days a week at 2.5 hours/day. Participants will also go through a design review twice a week where feedback can be given on the designs. These design reviews will be audio recorded for the purpose of transcription. At the end of the design project, participants will be expected to present their final designs to the primary investigator, the investigator's advisor and 2-3 faculty from the School of Architecture. The presentation will also be audio recorded for the purpose of transcription.

The questionnaire will focus on your prior experience with virtual online worlds, any prior knowledge about 3d modeling software and the level of ease you had while working in Blue Mars. Data from the project and questionnaire will be summarized into broad categories. No personal contact information will be shared. Participants will be identified as followed:

If there are only 3 participants, you will be identified as followed:
Student A
Student B
Student C

As a volunteer participant in the above mentioned research, I understand that I will be asked to complete a survey that will ask questions related to my work experience. The questionnaire will be a take home, and can be submitted either as a hardcopy or emailed back to the Primary Investigator. There are 30 questions, 4 of which require a written response. It is hoped to get as many participants as possible, but no more than 3. As a volunteer participant in the above mentioned research, presentations and design critiques will be audio recorded for the purpose of transcription.

Participants will be introduced to Blue Mars, Blue Mars workflows, Skype and Teamviewer to facilitate design collaboration over the internet

The Primary Investigator will:

- Go over basic modeling and texturing techniques using 3ds Max 2010
- Attend all meetings and observe all discussion,
- Hand out project descriptions,
- Answer questions pertaining to software and project goals,
- Distribute/Collect questionnaires and feedback,
- Upload designs to Blue Mars for students.

The investigator believes there is little or no risk to participating in this research project.

Participating in this research may be of no direct benefit to you. It is believed, however, the results from this project will help the architectural industry understand the benefits of online and remote collaboration by means of virtual online worlds.

As compensation for time spent participating in this research project, you will be awarded with $150.00 per week for the duration of the project.

Research data will be confidential to the extent allowed by law. Agencies with research oversight, such as the UH Committee on Human Studies, have the authority to review research data. All research records will be stored in the primary investigators' hard drive for the duration of the research project. Audio tapes and files will be destroyed immediately following transcription. All other research records will be destroyed upon completion of the project.

Participation in this research project is completely voluntary. You are free to withdraw from participation at any time during the duration of the project with no penalty, or loss of benefit to which you would otherwise be entitled.

If you have any questions regarding this research project, please contact the researcher, Tiffany Nahinu, at 561-7109.

If you have any questions regarding your rights as a research participant, please contact the
UH Committee on Human Studies at (808)956-5007, or uhirb@hawaii.edu

Participant Consent:
I agree to being audio recorded during presentations, design reviews and interviews.

☐ Yes

☐ No

I have read and understand the above information, and agree to participate in this research project.

____
Name (printed)

________________________________ ____________________
Signature Date

Agreement to Participate in
Virtual Online World Study - Part II

Tiffany Nahinu
Primary Investigator
(808) 561-7109
tnahinu@hawaii.edu

This research project is being conducted as a component of a dissertation for an architectural doctoral degree. The purpose of the project is to specifically evaluate the effectiveness of a virtual online world called Blue Mars as a tool for design collaboration amongst architectural students over the traditional face to face method of collaborating in hopes that what is learned can be applied at the professional level. You are being asked to participate because you are an architectural student.

Participation in the project will consist of working with other architectural students to complete a 3-4 week design problem and then filling out a questionnaire at the end of the project. Participants will be broken up into two groups. Group 1 will work in the virtual online world and Group 2 will work in a traditional face to face environment. Both groups will be given the same design problem. Both groups will also be expected to work 2 days a week at 2.5 hours/day and will also go through a design review once a week where feedback can be given on the designs. These design reviews will be audio recorded for the purpose of transcription. At the end of the design project, participants will be expected to present their final designs to the primary investigator and the investigator's advisor. The presentation will also be audio recorded for the purpose of transcription.

The questionnaire will focus on your prior experience with virtual online worlds, any prior knowledge about 3d modeling software and the level of ease you had while working in Blue Mars or face to face. Data from the project and questionnaire will be summarized into broad categories. No personal contact information will be shared. Participants will be identified as followed:

If there are only 4 participants, you will be identified as followed:

Student A
Student B
Student C
Student D

As a volunteer participant in the above mentioned research, I understand that I will be asked to complete a survey that will ask questions related to my work experience. The questionnaire will be a take home, and can be submitted either as a hardcopy or emailed back to the Primary Investigator.

It is hoped to get as many participants as possible, but no more than 4. As a volunteer participant in the above mentioned research, I understand that presentations and design reviews will be audio recorded for the purpose of transcription.

Participants will be introduced to Blue Mars, Blue Mars workflows, Skype and Teamviewer to facilitate design collaboration over the internet.

The Primary Investigator will:

- Provide all site data (images, drawing files, site models, project program)
- Reserve a room for all design reviews
- Coordinate meeting times
- Go over basic modeling and texturing techniques using 3ds Max 2010
- Attend all meetings and observe all discussion,
- Hand out project descriptions,
- Answer questions pertaining to software, project goals and project site,
- Distribute/Collect questionnaires and feedback,
- Upload designs to Blue Mars for students.

The investigator believes there is little or no risk to participating in this research project.

Participating in this research may be of no direct benefit to you. It is believed, however, the results from this project will help the architectural industry understand the benefits of online and remote collaboration by means of virtual online worlds.

As compensation for time spent participating in this research project, you will be awarded with $50.00 per week for the duration of the project.

Research data will be confidential to the extent allowed by law. Agencies with research oversight, such as the UH Committee on Human Studies, have the authority to review research data. All research records will be stored in the primary investigators' hard drive for the duration of the research project. Audio tapes and files will be destroyed immediately following transcription. All other research records will be destroyed upon completion of the project.

Participation in this research project is completely voluntary. You are free to withdraw from participation at any time during the duration of the project with no penalty, or loss of benefit to which you would otherwise be entitled.

If you have any questions regarding this research project, please contact the researcher, Tiffany Nahinu, at 561-7109.

If you have any questions regarding your rights as a research participant, please contact the
UH Committee on Human Studies at (808)956-5007, or uhirb@hawaii.edu

Participant Consent:
I agree to being audio recorded during presentations, design reviews and interviews.

□ Yes

□ No

I have read and understand the above information, and agree to participate in this research project.

____
Name (printed)

________________________________ ____________________
Signature Date

Appendix J - Practicum Test Run

Procedures

Within this section are my methods for creating a small case study. I had asked permission from Bill Brooks, a principal at Ferraro Choi & Associates, to re-build their office in a 3d environment so that I may test Blue Mars's compatibility with other programs. It is my hope to upload the final model within the Blue Mars SDK program despite it being built outside of its asset generator program using 3D Studio Max 9.

Phases of Procedure

Drawing

Assuming that a design has already been made, the next step would be to digitize it. Digitizing in this case, means to either scan or redraw the design using a CAD program. The digitized version of that design will be used as a reference in the next step. FCA already had the drawing files in a CAD format which cut down the time I would've been spending on measuring things.

Modeling

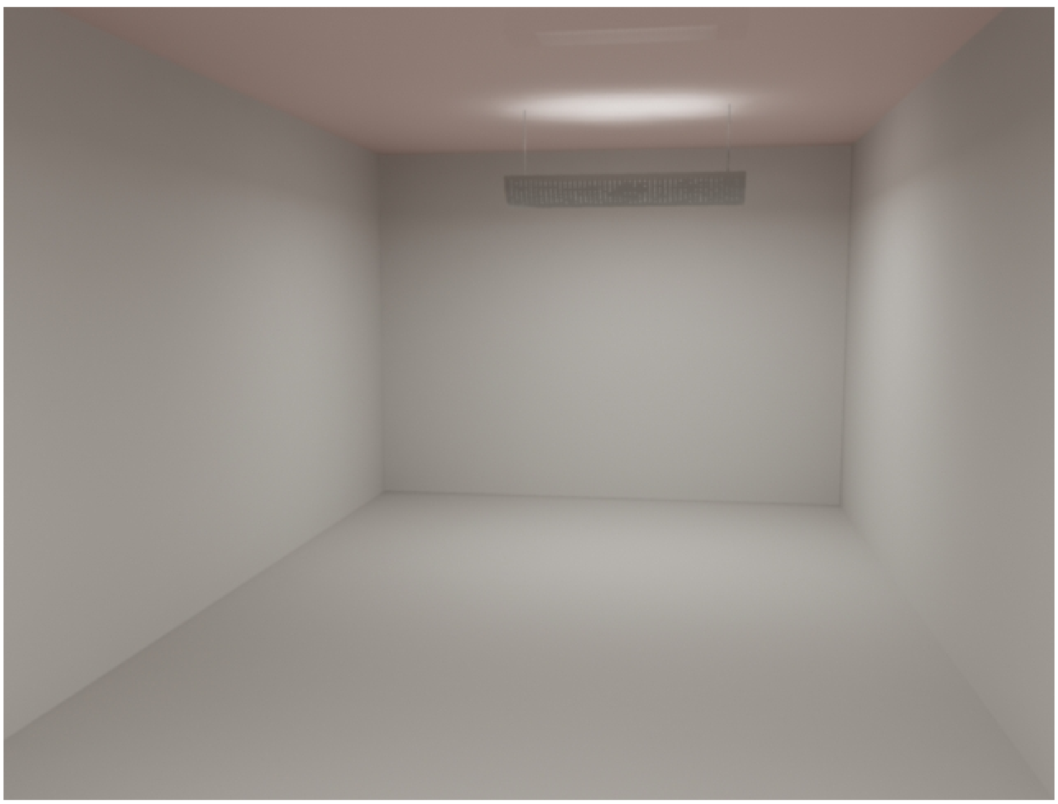
Depending on the level of precision you would like the model to be built at, the design created in the first step may be of little use. It's possible to skip the first step altogether and begin designing in a 3D environment. During the modeling phase the most important step is to organize your geometries. Assigning things to appropriate layers so they can be easily accessed later on will make the next step go a lot faster. Once the model is at a satisfactory level of completion (in terms of geometry), the next step will be to add textures.

Texturing

A texture also means materials. They convey the aesthetic as well as represent the intended finished look for the design. Textures should be applied using the same program that you modeled your design in. By default, all modeling programs come with pre-installed textures and materials which can be manipulated to help you (the designer) achieve your desired look. Typical textures and materials follow JPEG, TIF and BMP file formats which can be made or found in programs like Adobe Photoshop or on the internet, respectively. Decide on the visual style of your model because that will narrow down the choices of materials greatly. It also helps to understand the physical properties of the materials you apply. You will most likely want glass, water and any other translucent, opaque or shiny material to be as accurate as possible.

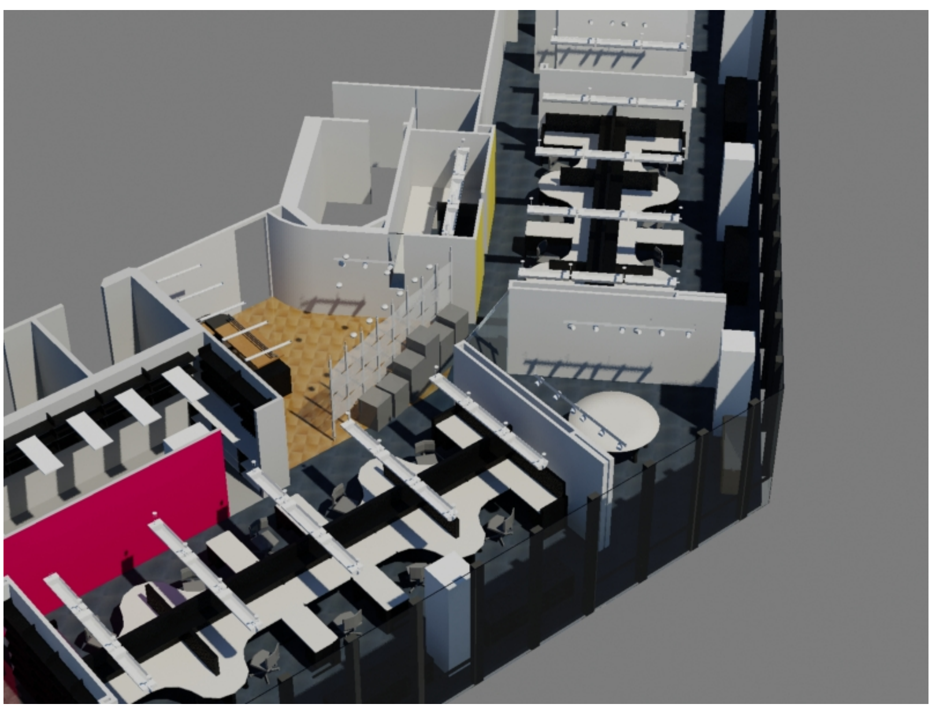
Lighting

Both lighting and material/textures affect the photorealistic qualities of a design when in a 3D environment. These elements become even more critical when it is absolutely necessary to fool the audience into thinking that the design or model is "real." The option to apply lights into the 3D environment may not be available within the program used to create the model. Exporting the model with all of its textures and materials may be a risky move, but there are usually 3rd party programs or plug-ins that are available to circumvent this problem.



There are two distinct families of lights; the generic and the ones based on real photometric data. Not all 3D programs will offer both, but most will offer the generic lights. Powerful programs such as *Maya, 3D Studio Max (3DSM)* and *Renderman* come pre-loaded with advanced lighting systems. Third party programs and plug-ins such as *VRay, IDX Renditioner* or *Maxwell Render* can be purchased and used with a variety of well-known programs.

The type of lighting in this instance needs to be semi-believable and not necessarily accurate. It just needs to "look good." Lighting and materials is where people spend the most time because it has a back-and-forth relationship. Expect to tweak your light and material properties more than a couple of times. If foliage (trees, grass, shrubbery, etc.) has been included, consider hiding them by turning their respective layers off during this step until the other geometries in your design are at a satisfactory level of appearance. Keeping the foliage "turned on" (visible) will cause performance issues.



Render to texture, aka. Texture "baking"

It's really the easiest step in this whole process, but a bit time consuming. This is where grouping all of your objects into appropriate layers comes in really handy. Texture baking is the process of rendering your materials of objects on to one file. The first step in texture baking in 3DSM 9 is to select your object (by default everything grouped with that object will be highlighted and selected as well), then we go to the render tab, scroll down to "Render to texture", click "add", select complete map, change target map slot to diffuse color and then click "render." Repeat these steps and follow the save-to-location prompts so that every texture you bake is stored in a location where you can retrieve it for the next step. These baked images are saved with targa file extensions (.tga), these files are open-able and modifiable in Photoshop which gives you additional editing and texture painting capabilities.

Once all your objects have been baked it's time to reapply those materials. In the material editor dialogue box, select a material slot and click on the box next to the Diffuse option. This will bring up another dialogue box with the location of your saved targa files. Select the appropriate one for the object you have highlighted and apply the baked texture by clicking "okay" at the bottom. It'll ask you if you want to override the pre-existing material if the material you are changing is already being occupied by another, it's alright to override the file. Once all the objects in the file have been updated accordingly with their new baked materials, we can delete all the lights in the scene and swap rendering engines. In this case we'll be swapping mental ray for the default scanline. Each frame will take approximately 8 minutes to render which is a big difference between previous attempts made during the lighting stage.

Uploading

When modeling, texturing and lighting have reached a satisfactory level of completion, the next step will be to upload that file in to the new interface, otherwise known as the Blue Mars SDK platform. The process of exporting a file into another file format can be accomplished by one of two ways. One way is to locate within the *File* menu tab, the actual option of 'export' and the other way is to simply 'Save As.' Understanding file extensions and how they can be used interchangeably from program to program should be something that you are already familiar with. In the version of Blue Mars that I am creating a case study with, I have not been able to directly bring in a file that was created in 3D Studio Max 9 (3DSM9). These are the following file extensions that 3DSM9 currently supports. Unfortunately, the software developers kit (SDK) provided will not import or export in these extensions.

WRML97 =.WRL

3D Studio = .3DS

ASC II Scene Export = .ASE

Lightscape material = .ATR

Lightscape block = .BLK

Lightscape layers = .LAY

Lightscape preparation = .LP

Lightscape view = .VW

Lightscape parameter = .DF

AutoCAD = .DWG

AutoCAD = .DXF

Publish = .DWF

Autodesk = .FBX, .DAE

Wavefront material = .MTL

Wavefront object = .OBJ

Stereo Lithography = .STL

To circumvent this problem, I've decided to visit CryTek's main home page to see if there are any forums that can help me out. Fortunately there is and I've been able to download a few patches off their website (http://farcry.crymod.com/thread.php?threadid=9772) to help me load my files. Saddly, after installing the patches, the 3DSM9 file still did not upload.

Appendix K - Project Recommendations

For complex projects, there are two work flow schemes that the instructor could implement. Scheme 1 addresses a project containing multiple locations within a single project site. Scheme 2 addresses a project containing a single site with a single location.

Scheme 1

1. Set up a desktop in studio with the master files on it and allow students to copy them on to their computers.
2. On days of online critique, have students place models at their site in the master folder on the desktop in studio. After everything is uploaded, have students copy the updated folder to their own personal computers for viewing.

The benefit of this scheme is the low level of responsibility to the instructor. Presenting designs in a VOW substitutes the need to print out boards and build physical models. In the pilot projects, both student participants working in the VOW method were restricted to doing everything online. In the actual studio environment, that constraint could be eliminated. Student teams could all be in the same room together, going from design to design and blurting out their comments to one another. By doing so, it eliminates the need for using a VOIP program like Skype, purchasing headsets and setting up an ftp site or file sharing account. Under this scheme, it's also possible that the students could become more distracted because of all the conversations firing off in the background.

Scheme 2

1. Students need to be taught how to set up a .bat file because the number of teams controls the number of .bat files to be created.
2. Set up an ftp site or use a file sharing account with Filezilla or like. Make sure students have access to it.
3. On the day of the critique, students are to upload their .bat files and folders to the ftp or file sharing account so that classmates and instructor can download.

Again, one of the major benefits of this scheme is the low level of responsibility to the instructor. If students are taught how to create a .bat file and unique developer client icon, all the instructor has to do is ensure that the student uploads the necessary files to the online server. Following this scheme ensures that individual designs can be viewed in their own environment without model overlap. On the plus side, it's the easiest way to accomplish this, on the downside, it requires a large file storage.