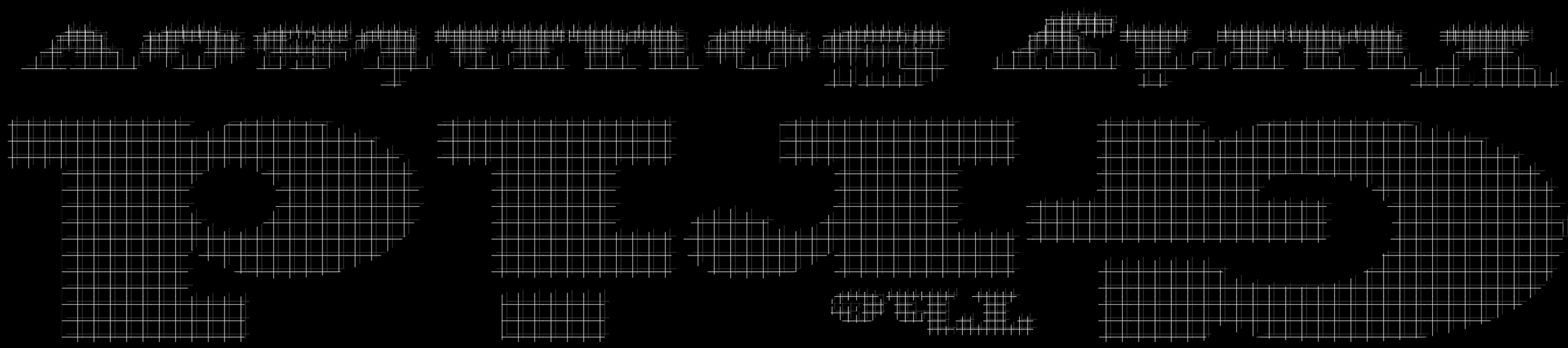

Project Proposal

Contact

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Revision 4 - 9/11/2013

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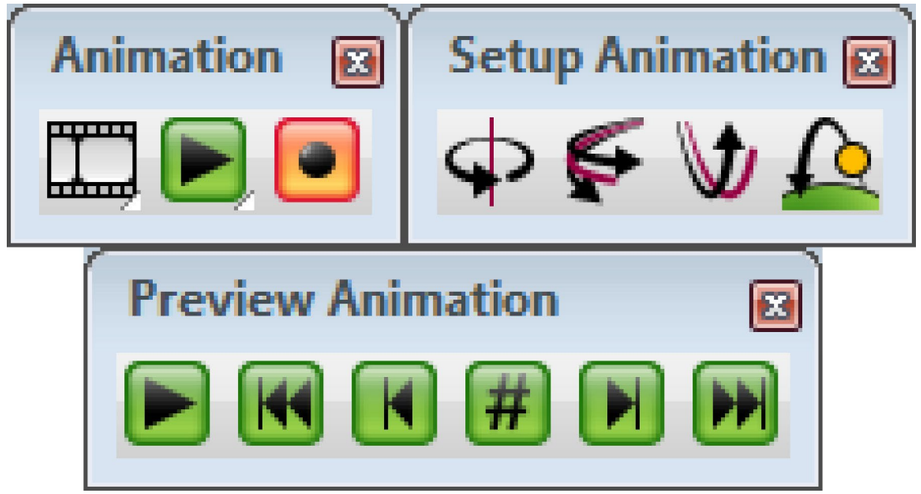
Project Brief

The architectural render has long been the pinnacle of drawn design - a constructed image that shows the viewer an idealized view of an architectural project from a specific location within the project at a specific time of day. Traditionally, the architect's primary tool for image-making was a drafting board. Some time in the last few decades architects have adopted the computer to serve the same role yet advance it in many ways. The digital render was an evolution over what was possible with drafting. Yet, despite the apparent approach towards a visual quality near that of human sight, the digital render failed to fully use the full power of a computer. The digital render took a horse cart and made it into an automobile but failed to then also make a van, a truck, or even a racecar. The main aspect of computing that digital renders have fallen short of is the variable of **time**. A computer can be optimized to make dozens of renders per second in a phenomenon known as video or visualization.

The allure of a digital world has fascinated people ever since computers were able to create early vector and later raster graphics. The idea has been explored in such films as *Tron (1982)* and *The Matrix (1999)* as well as hundreds of student or collegiate art projects. It has led to the development of hardware to augment the human frame, extending what the human mind is limited to by the body. Digitally fabricated films have gradually replaced hand-drawn films and have even entered the mainstream as a respected category of film. Architectural designers have tapped this field, but not as fully as they could have.

Another way the digital world has entered the social consciousness is through video games. While not all video games involve a 3D virtual environment, the ones that do often go for a highly photo-realistic portrayal of a digital environment. The tools video game designers use are often made specifically to quickly develop virtual environments. Students have often tried to use such tools in their projects, but altough they tended to gain success architectural firms have rarely followed suit.



The complete toolset in Rhinoceros 4 for animations.

Project Thesis

The thesis is a field produced by two axes - the horizontal axis is that of architectural image-making: how have designers evolved their tools to match current technological advances; the vertical axis is that of digital interfaces and interaction: more and more society is finding ways to interconnect with itself - various examples exist where high-level members of various corporations engage in Twitter conversations with average users, yet such interaction in architecture, a field entirely involved in the business of being around others, seems largely absent or unused.

The first axis, visualization:

While many designers in the field have advanced the static render into something more dynamic, making videos or flythroughs or virtual habitats, more often than not these cases were one-time gimmicks and have not established as a versatile aspect of architectural design.

The second axis, interaction:

The concept of digital interaction has often been explored by artists trying to cope with the digital frontier yet the possibility of delivering an architectural project with extra-sensory exposure does not seem to have gained traction among architectural designers, even though technology exists to allow interaction beyond that which is seen or heard.

The project, therefore, is to explore and define the extent of such efforts in both directions, identify what was tried, what failed, and how those attempts could be improved, identify the best candidates (by an evolving criteria as the project develops) for a concentrated push into versatility, and produce a working example of the next evolution of drafting.

The primary deliverable will be a software package which parallels or replaces the point in design when a designer of architecture would make a static render and, instead of producing a mere digital render, would create an *interactive simulation* serving as proof of experience much like an architectural model is a proof of assembly.

A distinction has to be made between a pre-rendered animation and a realtime interactive environment. While pre-rendered animation is a side-effect of this under-utilized function of computers, it is absolutely a rut of possibility. It is a linear evolution of a digital render - why stop there when a render can evolve planarly?

An example of a virtual environment that can be explored. It is both dynamic and interactive - it goes beyond what a set of renders could have done and also gives the user something a render could never have - a sense of presence in the project.

How can

Model > Render > Post > Crit > improve >>

Become

Model > Virtual Review > improve >>

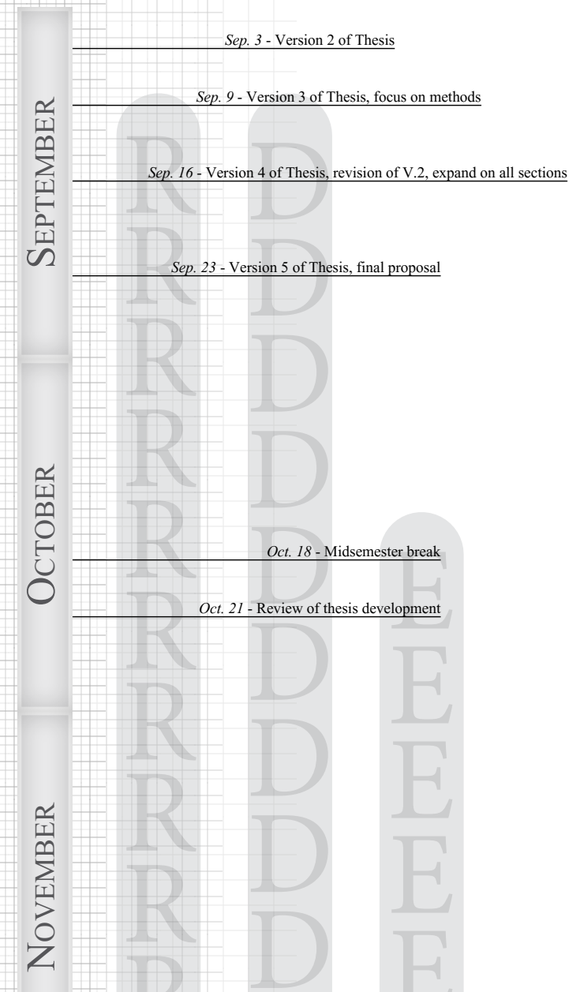
?

Is there a possibility here?

Project Methods and Timeline

Research - the first step of the thesis is to generate a foundation of knowledge in the field of visualization and architectural visualization in particular. The thesis combines several schools of thought - **Representation**, **Automation through Technology**, **Simulation**, **Video Gaming**, **Interfaces**, and, naturally, **Architecture**. Kai recommends to find persons with an affinity to these fields and extract data sources from them. Each field would contain several informative areas: History, Technology, Application or Practice. These areas would inform what is available in the field as well as dictate possible constraints. For a broad spectrum I would expect at least six established literary sources and six other collateral sources (videos, talks, examples of work). That is 72 potential sources.

Definition - in the meantime, I would continue to refine the grounds of my thesis - the product, the deliverable, is a tool. The means is often more important than the end because the means is inherently repeatable. The research would mold the form and function of this visualization tool.



Experimentation and Evaluation - the second step, which may also happen concurrently as the first, is an exhaustive analysis of existing visualization software (or hardware, if it is available through CMU somehow) for the purpose of design (NOT final product; as another step, or a better step, in an iterative process). This would involve its own research on what tools architecture firms have used in the past (and documented) for time-based deliverables (that may exclude diagrams, like the one Field Operations did for the High Line with the trains) and acquire them or versions thereof for purposes of experimentation and the exploration of their flexibility as it could apply in a fluid design framework. Following research on what tools practicing architects use, I would perform research on tools students have used, what artists of various caliber have used, and video game engines. The less time each visualization tool takes to render (from hours per frame to frames per second) the more likely I will focus on it, as that is at the root of my thesis - the possibility for the digital real time. Theoretically this research will come across examples of work, but the focus would be on how those were made, not what they are.

SEPTEMBER

OCTOBER

NOVEMBER

DECEMBER

Nov. 27 - Thanksgiving

Dec. 8 - Review of thesis development

Dec. 13 - Submittal of thesis book

Dec. 16 - Last day of first semester

Compilation - the two threads of research will combine. At this point I would have a steel-hard definition of my thesis. There may be at least two deliverables, one for each body of research. The **literary** deliverable will be an opinion piece drawing from all the sources I compiled that projects the possibility (that I believe is the case) of what architects could embrace in the field of visualization given the power of computers. This opinion piece should predict the possibility of the second deliverable. The **software** deliverable will be a proof of concept or a redistributable software package (depending on if the software I end up choosing is licensed for educational use or distribution). This software package would support the opinion in the first deliverable, ultimately proving architects can evolve the render into something that interacts on a level above the visual or tactile. Much like the architectural model is a proof of assembly, this deliverable would be a proof of experience. There also may be a third deliverable, a critical paper, which ties this applied procedure/tool back to the theoretical foundation that I started with, relating it to the taxonomies of **Representation**, **Automation through Technology**, **Simulation**, **Video Gaming**, **Interfaces**, and **Architecture**.

JANUARY

Jan. 13 - First day of second semester

Jan. 20 - MLK Day, no classes

FEBRUARY

MARCH

Mar. 5 - Midsemester thesis review

Mar. 7 - Spring Break starts

Mar. 17 - Spring Break ends

Beyond - if there is yet more time I may develop two more deliverables to parallel the two main deliverables in the **compilation** step. One would be a website collecting all the research and sources (effectively a thesis website). The second would be a documentation on the use of the software package and tool. A certain amount of basic tutorials smoothening the learning curve would already be part of the software deliverable, but, like any software, much of the tool would be shrouded in mystery. If there is time I could develop detailed explanations of various functions within the software package. Importantly, this would heavily depend on the nature of the software package. If it is a video game engine editor then it may grow to have dozens of tutorials. If it is a small utility (perhaps an architectural firm has developed one), then there may only be a small handful.

MARCH

APRIL

Apr. 10 - No classes for Carnival

Apr. 13 - Carnival ends

MAY

May. 2 - Last day of classes

May. 5 - Thesis due

Advisors and Primary Contacts

Yuriy Sountsov - Yuriy Sountsov is a fifth year architecture student at Carnegie Mellon University. He is dissatisfied with the digital backwardness of the program he has been exposed to and wonders sometimes whether architects have become so desensitized to the creative world around them that they think they are on the cutting edge when in fact they are on the cutting block. He has experience with various digital design software, various video game engines, has seen many films and has explored film technology.

Arthur Lubetz - Arthur Lubetz is an Adjunct Professor in the School of Architecture. He brings a theoretical mindset, a creative framework, and a rigorous approach. He is also the fall semester instructor. I have not collaborated with Artur before though he once taught a parallel studio. One of Arthur's key driving principles is the inclusion of the body in architecture. This relates closely to my thesis.

Joshua Bard - Joshua Bard is an Assistant Professor in the School of Architecture. He should contribute some digital and media expertise. He may be the spring semester instructor. Joshua is co-teaching a course I am currently taking, Parametric Modeling (the other instructor being Ramesh Krishnamurti) that focuses on integrating a software with Rhinoceros, Grasshopper, although that software is build inside Rhinoceros as a plugin. While I have the most experience using Rhinoceros as a design tool and will try to keep it relevant within my thesis, Joshua may help adapting other software into the design pipeline as I research possibilities with that other software.

Dale Clifford - Dale Clifford is an is an Assistant Professor in the School of Architecture. He has significant background finding simple solutions to complex problems using media not native to the problem. I have had Dale in two previous classes, Materials and Assembly and BioLogic, both of which involved combining disparate systems of assembly to achieve a goal not easily or impossibly reached by any constituent system. Dale may also provide many connections into digital fabrication practices.

Melissa Ragona - TENTATIVE - Melissa Ragona is an Assistant Professor of Visual Culture and Critical Theory in the School of Art. I took her class in the S'13 semester, Media Performance, where I was exposed to many historical examples of people attempting to combine the

digital and the real. She has a vast repository of knowledge in the field of visual interaction and may provide many sources or fields of study pertinent to my thesis. She may also know of people at Carnegie Mellon University who have experience in exploring digital environments.

Drew Davidson - TENTATIVE - Drew Davidson is the Director of the Entertainment Technology Center in Pittsburgh. Much like Melissa, Drew may be a gateway into established and documented attempts to forward human-digital interaction. The ETC is an unexplored arena that may heavily contribute to my thesis.

Jesse Seppi - TENTATIVE - Jesse Seppi is a virtual designer based in New York and the director of Tronic Studio. He appears to be someone who combined architecture, film, the virtual, and sensory experience into projects that conveyed more than was possible technologically before. He may be a source of a concentrated thrust into the field.

His-story

On Models and Distribution and Tools

The following are abstract threads of thoughts to establish where the initial research will go. Much of this needs to be backed with sources.

Traditionally architects created models as the most complete product of the design - the building came from workers toiling away under the whip of what came to be known as a contractor. While historically the architect and the contractor were one and the same and only separated when buildings became too complicated to trivially translate from drawing to construction, the process of design and the process of building always had a chasm between them. That chasm means that the design and the built building will always be separate beasts - what the client could get from the building is never what the design could give, and vice versa. This does not mean the architect can, after designing, develop documents for the builder to follow exactly, but how often does the original design match the one submitted to the contractor? That relationship aside, few designs or CDs portrayed the nature of a building's sounds, shadows, how cold it is on a wintry morning, and so on - but that level of experience before the building is built may never be possible, though the technological envelope must be continually pushed.

What is a model? Simulation and representation at the core level. Consider Webster's definition of simulation: *imitation or enactment, as of conditions anticipated*[i]. The model is never the built thing, nor can it be said that the building will be of the model. Even a model of a system is reductionist in a different way. What is it to look, or touch, a model? Unless the architect used extremely advanced techniques, the model is a visual tool only.

Every model is limited by its existence within the world - it is a finite spatial object before it is a source of experiential information. A model therefore can either move to a client or a client can come to a model. An architect can bring this model to a museum where the public can come and view it, or she can invite other architects to come and critique the model.

While interacting with the model, either by sight or touch, however, it is more often the user that moves. Many architectural models are too cumbersome to lift and the ones small enough to be twirled in the hands of a user may have issues of fragility.

All of that can be seen as an extension of the nature of a model. Much as the model references the

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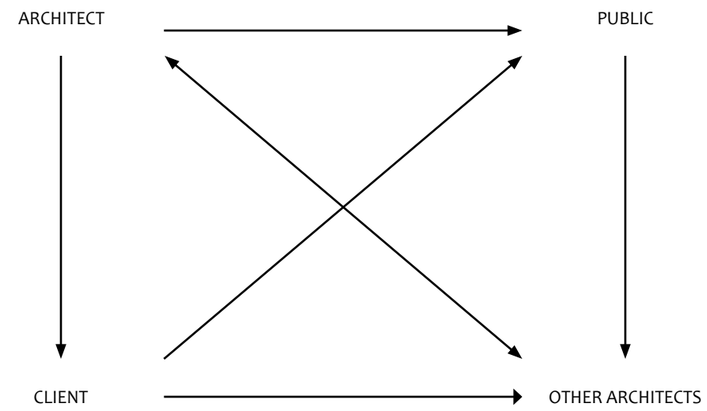
i

building but in a limited way the user approaches the experience (walking, seeing, touching) of a building without actually doing it in any significant amount.

The tools of the architect - used for herself - translate mind to matter, but can also be used for the client in reverse - matter to mind. Whatever is inside the architect's head passes through the medium of pencils, paper, computers, knives, and hard surfaces to produce an object of matter that correlates to a mental construct. This object of matter in turn works in reverse when a client or user interacts with it, through that interaction converting the mental construct inherent in the object of matter back into a mental construct to be processed inside the mind of the client or user. The idea of the design must pass through a phase traditionally occupied by model, because the plan is a construction tool. While many architects display plans as well as models the plan is actually a construction tool. Just as showing the outline of a story next to the story itself is useful in evaluating the story, the plan is useful as a means of complimenting the information given by a model. Yet despite its apparent usefulness, nobody would value the outline of a story when they read the book of that story. The model is the ultimate tool for transferring information.

However, before (or after? What does history say?) that dominance of model, architects developed the ability to draw their projects, and what used to be only useful for construction, after the idea phase (given that architects work idea to drawing to model), became useful for mind-matter-mind transfer. Drawings eventually became useful tools for representing the project, explaining assembly and various spatial qualities. An architect would develop some drawings and models as part of a presentation package for a client. Over time, drawings became more realistic while models peaked except where extreme measures were used to replicate small scale behavior.

On BIM - again there is the ambiguity of what a model is. Still data, still images...at the end of the development cycle a client can walk through a building. She can touch the walls, smell the floor, lick the rugs. Why is this not possible at some point before, during the design? Think of nearly any other field - a fighter plane cockpit can be mocked up (though maintenance of the rest of the plane perhaps cannot be simulated), a piece of software has alpha or beta stages, a chair can be roughly assembled before the pieces are finished, a piece of food can be made in a small quantity, a police officer can shoot a gun before they are street ready, at best a painter may not be able to give a notion of the complete image, but they can focus on key areas to convey the impression of the final image. A writer develops a story by fleshing out an outline. Perhaps eventually fighter planes or cars could be rapid-prototyped.



The network of delivery.

Digital Frontier

How the architect holds the pencil, how the pencil translates to the page, how the page becomes a model. These are steps in design with each one encompassing the previous. Theoretically, only the second two steps have advances in a computer age. The page can exist within a computer, with the pencil being replaced by keyboard and mouse. The model is both a digital model and the image of the digital model, a render.

As for the computer, that which computes, in general - the design of the computer only went in one predominant direction, the visual. In architecture this led to a visual development of the architect's mind to matter, completely avoiding the other senses. Despite architects "designing" within the computer, the results were merely a version of drawing (an interpretation much the same way physical models were, but severely lacking in experientiality).

The computer could have theoretically replaced the model phase, not the drawing phase. Drawings produced models...but models had to remain relatively at a scale because of human limitations. It was simply impractical on a repeatable level to create large models of entire projects.

The machine, however, is unlimited. Theoretically, a digital world could provide a full sensory experience that is faithful to the drawings yet is not limited by spatial constraints, achieving what a physical model does but more. This represents a somewhat romantic view of digital technology - the realm within the computer is complete, but cannot translate to the real world. The real world can only interpret it - the architect can put ideas into a computer, but the computer cannot push those ideas into architecture. The ideas have to come out and become a model first, returning the design process to what it has been since the beginning.

On the topic of interpreting computer data into the real world, the technology to replicate anything but sight and sound is lackluster at best. Until significantly advanced simulation technologies become mainstream design has to remain visual and sometimes aural.

The notion of video - film CGI has advanced a lot since the days of Tron (1982). Architects have picked up the technology, but not the theory...nobody experiences anything via a flythrough or a flyby (except birds) and such shots in film are extremely boring. Also, architects attempt to use the technology without the same resources,

resulting in an inefficient pipeline that rarely produces results that can be iterated (videos are made for final products). Does it work (in terms of an evolution over mere snapshots)? Uncertain, but there is no class that teaches it and it seems like a gimmick.

And what of other renders, for example spherical renders, like Google street view? Or renders that overlap into the realm of diagram - diagrams are children of the plan, inhabiting a world between drawing and construction tool. While other types of renders exist, it is the regular perspective view that dominates because that is the closest technology has come to reproducing human vision short of using virtual headsets, like Oculus Rift and the entire history before it. Headsets are impractical however, and as the subject of film, as it was brought up, shows one does not need a binocular display to believe an image.

Renders are often prettified for no apparent purpose than to make up for the deficiencies of the digital model. Video games and sometimes film do this inherently, but there the aim is not so much to make up for deficient geometry as it is to achieve a certain hyper-realism. Typically this is not necessary as most buildings start rotting as soon as they are built, so renders create a false reality. That false reality, on top of renders being already a falsification due to their specific nature (certain view, certain time of day), exacerbates the illusion renders provide.

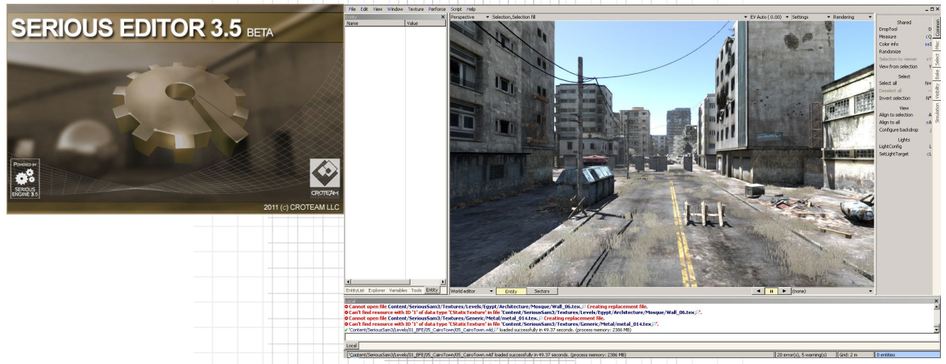
The render is a tool with only one configuration, and every new render has to be (re)made from scratch. A way to convey a more complete sensory experience in a repeatable manner would amount to a toolbox. Yet if one were to set out to make a hammer that does not break every time it is used, one would not begin designing various screwdrivers and wrenches and measuring tapes along with a better hammer. One would make the hammer first, then move on to bettering other tools.

Thus, before making a toolbox the tool must be made, but made in a way it could be reused. One could develop a clumsy way to make touch “renders” or smell “renders” but that would hardly advance the field of architecture, it would only serve as a momentary bauble, a curio.

The analog is a prototype or a beta build - a render is what the building will “kinda” look like, from a particular angle, at a particular time of day. Rarely (or often, but undocumented) do architects make tools specifically for their projects, yet this is the mentality with renders. While it is true that some situations will eventually require specialization, the tools themselves do not change - they become more flexible or new tools are made (Pixar - renderman, Cameron - 3D camera). Again with the hammer example, every nail does not require its own hammer. The nails may and do change, but the hammer is changed only when it wears down or a better hammer becomes available. Renders have worn down. A new kind of render exists.

Precedent Deliverables

Fallingwater in Half-Life 2
by Kasperg
January 23 2006



Serious Editor 3.5
by Croteam
November 22, 2011

House in UDK
by Luigi Russo
2012

Las Vegas Bellagio Comparison in CryEngine2
by IMAGTP
May 2007

Appendix

Sources

http://www.youtube.com/watch?v=hh4nGEAKm4s

- Zumthor's Therme Vals

http://www.crydev.net/dm_eds/download_detail.php?id=4

- In case Sed3.5 doesn't work, try CryEngine?

http://www.youtube.com/watch?v=S8HUj85Cq1s

- Demo by Max Arocena with CryEngine

http://www.youtube.com/watch?v=HPtQyBDpatg&feature=youtu.be

- UDK, not that great, a little old

http://www.youtube.com/watch?v=QdF4rvw64rg

- Another Fallingwater video, in UDK

http://www.youtube.com/watch?v=AV802r_P10k&feature=youtu.be

- More UDK - again, note the cheap quality

https://www.youtube.com/watch?v=EEA5_he3pRk

- Unity3D demo, looks 90s

http://lumion3d.com/ and https://www.youtube.com/watch?v=uoLV8QIm02M

- Lumion3D...seems a little cheap, old?

http://www.youtube.com/watch?v=ioP0CVRJvUI#t=17

- NOT THIS, for reference - this is bad, no experience

http://www.businessweek.com/stories/2007-12-21/unreal-architecturebusinessweek-business-news-stock-market-and-financial-advice

- More old articles

http://archvirtual.com/2013/08/20/arch-virtual-releases-architectural-visualization-application-built-with-unity3d-game-engine-including-oculus-rift-compatibility/

http://www.archvirtual.com/Panoptic/2013-08-19-arch-virtual-panoptic.html

- Premade realtime visualization

http://www.youtube.com/watch?v=xNqs_S-zEBY#t=134

- Tactile? This is the future, but we are not then yet.

Hudson-Smith, Andrew. digital urban. Accessed 9/2/2013. http://www.digitalurban.org/(deprecated page: http://www.digitalurban.blogspot.com/)

- Blogging platform that publishes research about connecting digital modeling and **the real world with an emphasis on the profession of architecture.**

Kasperg. "Kaufmann House." The Whole Half-Life. 1/23/2006, accessed 9/2/2013. http://twhl.info/vault.php?map=3657.

- Website of the Fallingwater digital recreation. This establishes a kind of benchmark for the possibilities of the area.

Russo, Luigi. "Architectural Visualization." Unreal Engine. Accessed 9/3/2013. http://www.unrealengine.com/showcase/visualization/architectural_visualization_1/.

- Website of a project done in UDK. This shows an alternative to SEd3.5 that is already in place to be licensed (educational use included).

Varney, Allen. "London in Oblivion." The Escapist. 7/8/2007, accessed 9/2/2013. http://www.escapistmagazine.com/articles/view/issues/issue_109/1331-London-in-Oblivion.

- Article that mentions several attempts to visualize architectural work in video game engines. This could be a good springboard on collating past efforts in this area.

http://www.thefreedictionary.com/simulation

- Random House Kernerman Webster's College Dictionary, © 2010 K Dictionaries Ltd. Copyright 2005, 1997, 1991 by Random House, Inc. All rights reserved.