SOMETHING'S GOTTA GIVE – ARCHITECTURAL ANIMATIONS

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Abstract

Architectural animations are like Harry Langer, a fifty-something entertainment mogul played by best actor nominee Jack Nicholson in the film Something's Gotta Give. They've been surrounded by plenty of pathetic spiritless gimmicks. And, like Harry in the film, they have suffered a heart attack.
Harry did not die. Architectural animations are still around, barely. Something's wrong with them. When Harry begins to recover, he's surprised to find himself growing fond of a woman his own age (played by best actress nominee Dianne Keaton). This is precisely what should happen to architectural animations. They need to come to terms with more mature attitudes and approaches.
This paper presents a new and different approach to architectural animations.
In ninety nine percent of the cases, architectural animations have been produced at the end of the design process, just when architects or architecture students are ready to present their schemes to an audience or client group. All design decisions have been made. All aspects of the architectural solutions have been set. Tectonic qualities, lighting schemes, construction approaches, everything has been cast in stone. The animation is simply shown as a public relations gesture to broadcast to the audience that the design team is digitally savvy and uses the latest technologies.
The proposition contained herein is that animations be used throughout the design process, that is, from beginning to end.

Introduction

In brief, the following paper documents and presents how several experimental architectural design studios:

1. created a new type of 'rendering farm' using modest resources in terms of equipment, and
2. created a server based approach that allowed the participants to submit projects from remote sites for processing and creation of animation components

Once the 'farm' became operational, it then allowed the participants to:

1. generate quick animated clips not only at the beginning of the design process, but throughout every phase of the project,
2. discover architectural qualities and attributes not readily seen using traditional static design process approaches,
3. apply the newly found qualities to the re-generation of architectural schemes,
4. assist the design process in making better and more informed decisions in relation to kinetic spatial qualities,
5. study design options pertaining to lighting effects and how these were affected by movement of the user through spaces,
6. look at opportunities derived from tectonic qualities perceived through movement,
7. create final high quality digital video recordings (DVD's) that not only were the result of better design attributes obtained through the use of study animations, but high quality films that portrayed a more mature and well thought out architecture.

The paper documents in detail how new 'rendering farms' can be easily put together with very little investment in time and equipment resources. In terms of the architectural design process, the paper documents step-by-step how each phase was handled, what were the difficulties, challenges and success of every phase. The final presentation includes a variety of animation clips showcasing not only the practicality of the approach, but how fun and fascinating the process can be. And like Harry in the film, who has always had the world on a string, we too can discover that a mature approach to animations can be truly unraveling.

Architectural animation in schools of architecture and professional practice

When the technique of using movement and animation for visualizing architectural spaces became available, many instructors and students quickly adopted the technique and saw in it a most wonderful tool. All were very enthusiastic that for the first time we were going to be able to see in real time how it felt to navigate through our creations. Finally, by moving through our designs, we were going to gain an understanding of spatial qualities in a way not possible with blueprints, CAD drawings and even 3D models.
However, something quite intriguing happened.
First, it became clear that one could produce new versions of simple designs fairly cheaply and quickly to then put them into walk-throughs for verification. Here the key word is simple. The walk-through in isolated instances prompted some changes to the design. But, in the majority of cases, there was no real questioning of what we were getting out of the production of walk-throughs. It too was difficult to note those changes and record them for future use. The designer had to leave the immersive environment and make the changes in a more traditional way using modeling and rendering software. And, finally, the effort required the production of a new walk-through animation –

a process which in many cases took hours or even days of tweaking and producing. Finally, the cycle began again with another time consuming walk-through.

The process left many exasperated. The majority quit using the approach. Others began probing into other ways of dealing with the problem. For them, the solution called for virtual environments where applications were extended so that they became active, rather than passive. The plan was to convert the traditional walk-through into a design session, where models could be changed and created, not only viewed. It was in this manner that immersive modeling came into being. Many research and commercial development groups launched ventures in this direction. Among them was the work by the College of Computing at Georgia Institute of Technology, were users could create simple buildings in an interactive, intuitive manner, simply by choosing vertices on the ground, then adding the third dimension by specifying a height for each vertex. The walls and ceiling were created automatically by the application.

As visionary and exciting these projects were, their final results were unconvincing. The immersive imagery was rough and unsophisticated. Many researchers acknowledged that complex visualization operations were quite difficult. Because of the imprecision of the trackers, the difficulties of pointing and acting in three dimensions, and the physical limit to the amount of time one could easily work in an immersive environment, many concluded that, at least for the time being, designers were not able to create any significant architectural models within this approach. On the other hand, there was a lack of constraints on the software side. When designers were placing objects, for example, there were too many degrees of freedom to control everything all at once. Some provided motion control mechanisms, but getting the pieces of an architectural model in the correct position was a problem that we have not found a solution to. The question of shadows, gravity, and object impenetrability compounded the problem. And the final outcome was that the actual models themselves were of little further use.

The previous notes are not intended to cast negative shadows on these types of research efforts, but to highlight the fact that the architectural ideation process is more complex than simply being able to place virtually a series of walls, ceilings and furniture.

What also happened was that because animations were difficult and time consuming to produce, little by little they began to disappear from the radar scope in terms of design assistants during the design process. And, they began a transformation journey that converted them in public relations tools rather than architectural design tools. More and more we began to see short animation clips accompanying finished architectural presentations at the school of architecture level and in professional practice fora. Students and architects used and use them today to only highlight general features of their designs once all design decisions have been made. This becomes evident when visiting architectural design studios or attending architectural presentations to client groups.

Architectural animations – a second look

There are several reasons why architectural animations used as design tools merit a second look.

First, even though we have witnessed enormous advances in virtual reality immersive technologies, the process and final outcome of these efforts is still unconvincing. We need better lighting models, shadows, gravity, collision detection any many more features of the real world. And even with faster processors, specialized hardware and interface techniques, we still are not able to perform complex and abstract operations with ease. The time and costs associated with these undertakings are still well beyond the reach of most students and practitioners.

Second, recent advances in processing power at the desktop level are today allowing the generation of short animated clips that just two years ago took many hours to produce. Software is too more capable in generating more diverse types of animations. Joining several clips together in order to generate a longer film is a snap.

Third, animations are still unbeatable in terms of investigating the real, total qualities of architectural constructs. The final visual statement in well conceived animations is not a crude, simplistic visualization of some abstract volume, but a fully rendered series of images that depict the total characteristics of architectural spaces, even reaching the point of being able to communicate feelings and emotions.

Architectural animation– a second look – steps

The following are notes, observations, and steps taken by an experimental animation/film studio offered by the College of Architecture and Planning at the University of Utah in the Spring and Summer Semesters, 2004. The experimental studios included two basic and fundamental goals:

1. To revisit the use of animation within architectural design studios
2. To make valid the proposition that animations be used throughout the design process, that is from beginning to end, and not just as a final glossy final presentation executed once all design decisions have been made.

Rendering farm

The rendering farm used by the studio consisted of old equipment and a number of obsolete computers that the College was about to throw away. It became evident that the obsolete machines could be put to some use. The first step involved refurbishing the older systems and stripping them of hardware that was not necessary. Old video cards, very low capacity disk drives and other peripherals were removed leaving only the basic operating system running on a very small drive. Almost everything else was discarded. The computers had their enclosures removed in order to place them on a simple rack. This rack was placed inside a janitor's closet. Because the computers had only their barebones installed, additional fans were not needed to cool down the machines.

The next step involved connecting the machines to the College network. Very fortunately the College already had a highly efficient network with a good number of nodes, routers, and servers. Because the College had also acquired a networking license for 3DStudio VIZ, this application operated as the rendering manager. At the end, students were able to submit their projects for rendering to this farm from their own study cubicles. Animations that used to take several days to be rendered only took a couple of hours. Students also used batch rendering of individual stills. 3DStudio's VIZ Ram Player was used to generate the animated clips

Process

The process the animation studio took involved the following steps. The ordering of the listing does not imply that one item preceded the other. Actually, students were encouraged to skip steps or to change the order in which they proceeded.

1. Generation of quick animated clips at the beginning of the design process,
2. Continued application of newly found qualities to the re-generation of architectural schemes,
3. Assisting the design process in making better and more informed decisions in relation to spatial qualities derived from moving through spaces,
4. Studying design options pertaining to lighting effects and how these were affected by movement of the user through spaces,
5. Looking at opportunities derived from tectonic qualities perceived through movement,
6. Linking a script or storyboard to the creation of final high quality digital video recordings (DVD's).

Creation of quick animated clips

Probably the most critical component of the experiment was that animations were to be considered a key component during the design process. The plan was to use them as design assists and not as presentation devices at the end of the process. Accordingly, the very first step involved instruction on how to use the rendering farm and how to generate quick animations. Using the rendering farm was a rather easy process because the network allowed students to login from remote sites. It also allowed the users to define the rendering parameters which in most cases involved rendering animations no longer than 30 seconds. Once the video clips were produced, the user retrieved them through the network. In most cases, the short clips did not take more than fifteen minutes to produce.

In regards to the generation of animations, and rendering parameters, students were advised:

1. that the goal at the beginning of the design process was to be able to visualize spatial and volumetric qualities derived from movement through space,
2. not to spend time and energies developing refined camera paths or sophisticated inverse kinematic effects,
3. on how to quickly generate linear path animations. Actually, on the very first session of the studio students were generating simple linear camera movement animations between two spaces,
4. that once an animation was generated, they had to use it to 'critique' their work. One of the interesting items that came out of this phase was the students' realization that their architectural design process was rather myopic and it did not look at opportunities derived from looking at spatial qualities in a 360 degree global point of view.
5. that they had to search for architectural design aspects that otherwise would not have been pursued if it weren't for the animation. Another item that quickly became obvious to the participants was that by moving through spaces, they were able to visualize many new actions to be applied to the regeneration of spaces. These ranged from simple scale and proportion transformations, to the integration of more sophisticated architectural devices such as diagonal transitions, multi-level hierarchies, etc.

Continued application of what came out of the early visualizations

An important component in the process used from the very beginning of the design process was the critical study of selected films. Here, students quickly realized that film production had many connections with architectural creation. Some of the films studied included The Cabinet of Doctor Caligari, Waxworks, Blade Runner, Space Odyssey, Dick Tracy, Artificial Intelligence and several others. The plan was to analyze how the film industry had approached from its very early days to current times a variety of items such as plots, generation of spaces, camera movement, lighting, and other special visual effects. Of particular note was the study of unique films known for their very unique spatial and emotional content. While watching the movies, the projector was stopped at critical junctures and formal discussions ensued. Students took notes on how actors used the spaces, how the stage sets were designed and used, plus their special color and tectonic qualities. The topic of lighting took center stage too. Camera paths were critically recorded and analyzed. Camera control and lens depth of field were noted too. At the end of each individual scene analysis, students talked about content, meaning, and emotion. This part of the process was perhaps one of the most revealing to all the participants because it demonstrated how the masterful combination of stage qualities and effects, unique lighting, and sound effects could in effect communicate and elicit in the viewer very powerful emotions.

Armed with what was being learned from analyzing the best film production over the years, and the own individual animations, the students began to explore:

1. more sophisticated camera paths. What started as a series of uninteresting camera linear paths running through equally boring architectural spaces, began to evolve into vertical and diagonal paths. The camera target was also the subject of experimentation.
2. still camera and animated elements. At this time students were asked to experiment with cameras that did not move. A new world emerged at this time, because the participants realized that they could achieve unique qualities by keeping the camera in one location, and forcing the camera target to search and focus on special attributes. In this part of the

project the plan was not to create sophisticated inverse kinematic effects, but to look for simple yet powerful effects. Falling leaves, ripples on a pond, birds flying overhead, a simple water fountain, water waves on a still lake, or a piece of fabric floating in the wind, were some of the effects that were explored.

3. lighting effects involving changing intensity, color, saturation, and range. As the project evolved, the animations revealed that lighting was fundamental. At this point a new search was launched involving not only the most ingenious lighting placement and control, but effects such as filtering, moving lights, projected lights, and use of gels placed in front of the lighting source.

While the above items were seen as fundamental in the exploration, the following very intriguing issues were also brought to the foreground by the animations. It is critical to note that these observations came from looking carefully at the animations. In other words, they would not have been apparent without the use of animation.

1. Topological relations. In typical design processes involving traditional design tools these kinds of relations are quite difficult if not impossible to visualize. With animations, concepts of proximity, separation, succession, continuity, closure, segregation, interiority and exteriority are easy to visualize and study.
2. Spatial appropriation. Here, students became quite aware of something that Christian Norberg Schulz citing Egon Brunswick observed. The latter noted that we never perceive a real object, but an intermediary object. Animations proved that if one space is characterized by a determining factor, when we move, we perceive the following space as a function of such determining factor. For example, animations clearly revealed that if one space was very large and was followed by a smaller space, this latter space was perceived as being much smaller.
3. Spatial transition. It was also observed that transitions between one space and another greatly influenced the judgement on the spatial qualities of both spaces, notably on their forms, their configurations, their proportions and their dimensions.
4. Perception of scale. Due to their relative lack of experience, architecture students – and probably many experienced professionals – have a difficult time dealing with scale. Architectural animations turned out to be invaluable tools in helping students deal with what Walter Gropius labeled one of the three most important determinants of architecture: scale. In fact, thanks to the process of realizing multiple animations, students became keenly aware of:
    1. the relation between reality and the drawing which represents it,
    2. the relation between what they imagine a building looks like and the aspect the structure really has,
    3. the relation between the apparent size of a structure and its real dimensions. Needless to say, after developing one or two quick animations, all participants in the experiment went back to their computers and re-scaled everything.
    4. Visual transformation of spaces. On a more subtle note, and thanks to the ability of being able to move through spaces, another phenomenon became apparent – the scale transformation of objects. This is something Gibson had written about, but we had never been able to clearly visualize. Gibson wrote that while we move through spaces, we witness visual (scale) transformations of objects. Those transformations which are continual (because of moving through spaces) relate to the geometry of perspective visualization – expansion, contraction, etc. The other transformations result in the perception of different forms. Actually, animations showed that while the height of objects varied, their scale remained constant, because the object was always visually tied to the dimensions of the background within which it stood apart. In a way, animations reinforced the concept that scale is the difference between geometric spaces and architectural spaces. And, one more time, after looking at their first animations, students went back to their computers, and re-sized every single component in their schemes.

Lighting and tectonic qualities

One critical item that the study animations quickly revealed was lighting control. Because most of the students had not had previous practical experience with types or forms of lighting, at the beginning the animations were rather uninteresting in this area. As time went by, students were fascinated by the ever increasing range of opportunities provided by lighting both natural and artificial. They quickly found too that lighting design and control was not an easy matter. They actually had to change their design procedure and timing to accommodate for very long study sessions to calibrate lighting effects. Along with this topic, students also discovered effects associated with lighting such as the effects of fog, haze, and how light travels through different media. One item that fascinated a number of students was the architectural use of commercial neon lighting. Here it should be noted that the study and application of lighting is something that in many studio settings is not covered. Or, it is covered as a separate area of inquiry. By designing in a holistic way, there was a constant dialogue between general architectural design and all the interactions with light. Schemes that at the beginning were too bright, too somber, or too uninteresting slowly began to explore very unique lighting interactions.

On the building materials and tectonic arena, students quickly became aware that form, light and materials had to be treated in unison. Changes in one parameter had strong implications in how the individual spaces were read as one traversed through them. An interesting observation made by many students was that lighting was more important that the individual tectonic qualities of the different building materials.

Scripting

While the team was busy developing individual animations, the instructor brought to the discussion the topic of scripting. It was at this time that students were asked to develop a script that eventually would lead to connecting the individual animated clips. The plan was to develop a cohesive script that would first present the topic of investigation, and then present the architectural approach, to then arrive at some kind of conclusion.

Along with these goals, students were strongly encouraged to think about the emotional content of their work. The idea was not to simply present a series of isolated clips where cameras were looking at various sections of the architectural construct, but to present with the best emotional effort the total holistic qualities of the project. Further, two additional elements were introduced at this point: the use of additional video clips obtained through the world wide web or through commercial production, and sound files and effects. The idea here was to use this material in support of the emotional content.

Final Editing

We all know that a film is very dependent on its edited quality. The same principle could be applied to architectural production. At this point in the design process, students were informed about the ratios between final edited material and the number of clips in commercial film production. In the particular case of the experimental studios, the approximate ratio was one to three. In other words, students were required to produce three minutes of video for one minute in the final edited version. The editing process was truly mesmerizing. For the very first time students were totally immersed in their design schemes, not only looking at abstract floor plans, but at real spaces with fog, neon, fire, water, and animated objects within their creations. The animated clips were sobering too. Without the assistance of the studio critic, and while looking at their films, students realized that many parts of the projects were not living up to their expectations. And, they began to burn the midnight oil. All students began to spend many sleepless nights re-designing, re-lighting, and re-configuring camera paths in attempt to improve their schemes. The feedback loop provided by the animations was really paying off. Many students asked the instructor to delay the final presentation. Because as time went by their animation skills became more powerful, they saw many more opportunities to upgrade their schemes.

Final notes – evaluation

The final commentary on the experiment comes from direct feedback by students. The following are excerpts from comments expressed by students:

a. One student made the comment that the process had completely changed his design approach. He noted that by looking at his work through the animations he realized that he could be more inventive and take more risks. Now he had a tool he could use to really check whether his ideas worked or not, without being totally dependent on outsider criticism.
b. Another student became absolutely fascinated by light. She had never realized that light had the power to totally transform the reading of spaces. And, more important, the animations prompted and encouraged her to develop a rather impressive series of lighting experiments.
c. One student that in the past had not shown particular talents toward architectural ideation, changed totally his approach. He realized that architecture is not a single track linear affair.
d. Another student noted that animations made her realize that architectural design has many levels of design decision making. Animation clips helped her establish priorities of intervention. Items that at first seemed critical, all of a sudden acquired secondary importance. Conversely, others became paramount.
e. From a purely procedural point of view, the use of computer animation as a design tool, made one student more critical on her use of time for particular tasks. Her design efforts were better directed and more focused.

The list of positive comments could continue on and on.

There were no negative comments.

There was a loud applause when all the projects were projected onto a very large screen with surround sound.

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