

## MOTION LAPSE

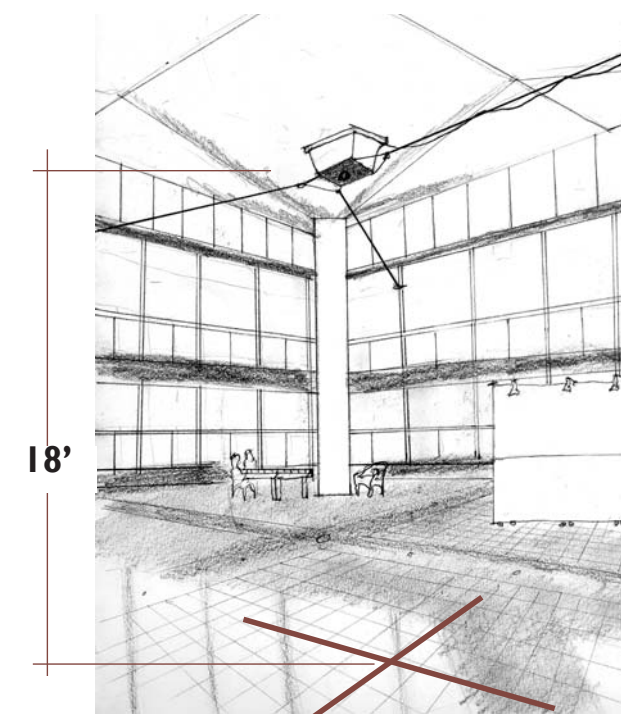
*a photographic modeling tool that prioritizes the experience of architectural space*

Laurie McGinley

Motion Lapse uses a photographic tool placed in a panopticon<sup>1</sup> position that records stereoscopic, fish eye and motion activated photographs in plan view of the center of Rapson Hall courtyard. Through exploration of the panopticon, I discovered a modeling method that prioritizes the experience of space in early stages of architectural design. For the duration of the project, the panopticon collected over 160,000 photographs, which I selectively edited to create multi-frame photographs. These blended photographs compress time and reveal changes in activity and light patterns. Motion Lapse interrogated the panopticon, a photographic tool that represented compressed time, movement, change and 3-D form.

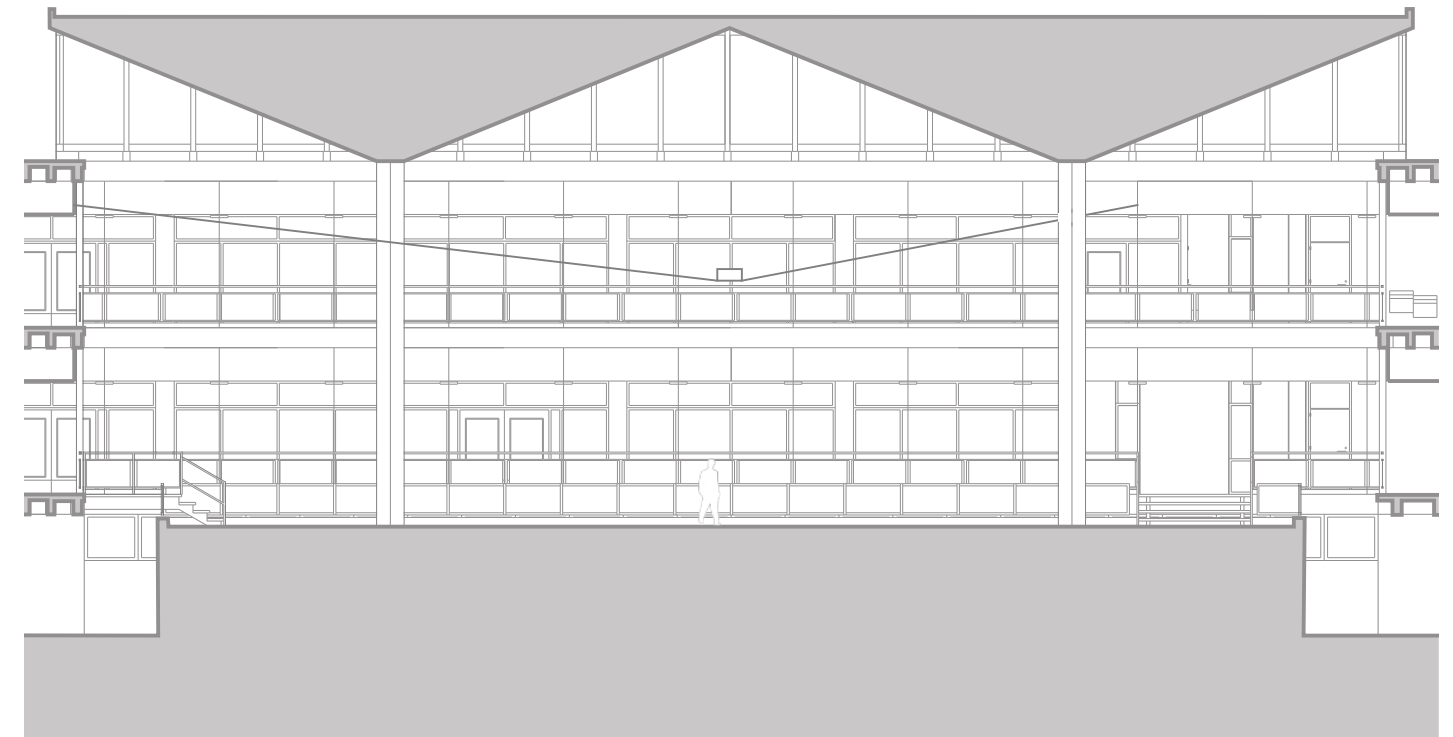
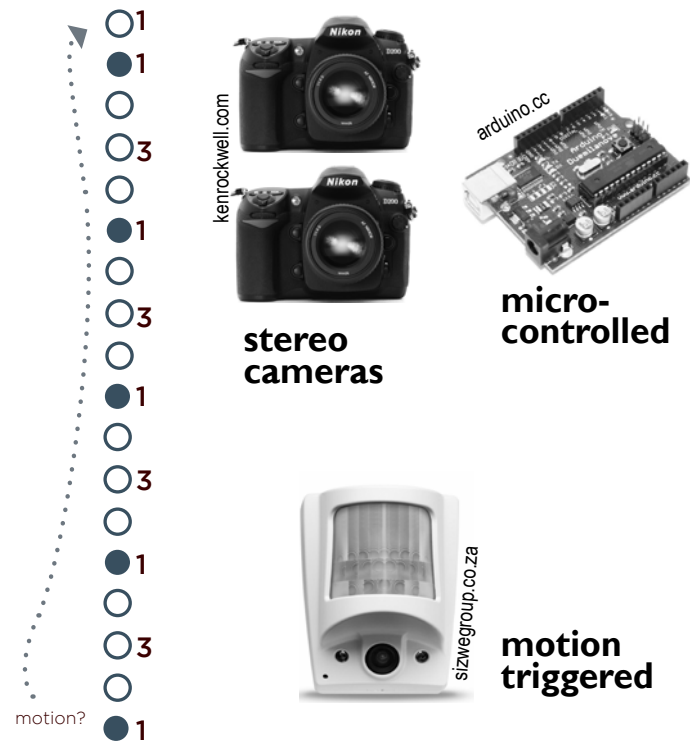
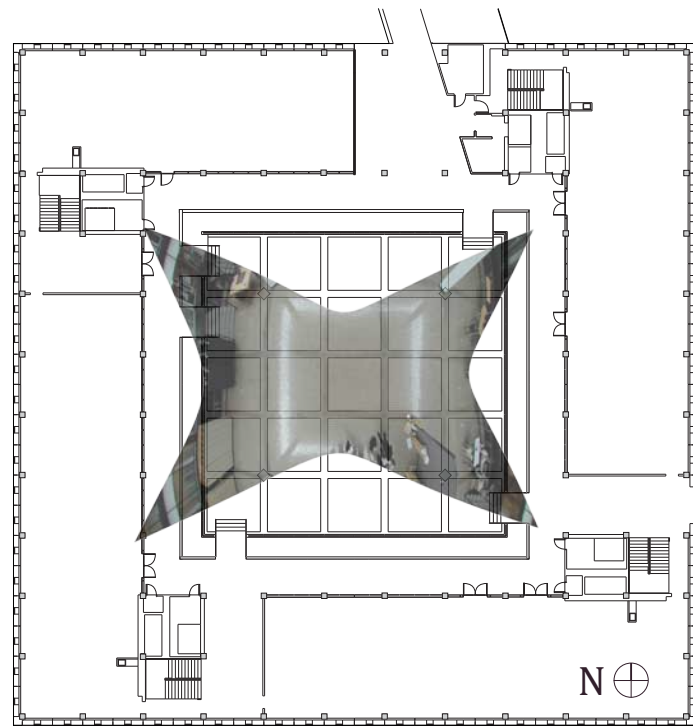
The panopticon was suspended 18 feet above the center of Rapson Hall courtyard between November 21, 2010 and May 1, 2011. I used steel rope, clamps and padlocks to ensure that the camera would remain in place throughout the duration of the experiment. My limitations were budget, safety, and the dimensions of the courtyard. Largely due to the limitations of the height of the camera, I chose to place a fish eye lens on the camera to maximize the view of the courtyard. The camera's placement, settings and configuration are a result of site constraints.

The main components of the panopticon are a Nikon D200, a Nikkor 10.5mm lens, an Arduino brand micro controller, and a



Rapson Hall courtyard

<sup>1</sup> panopticon: "Designed by Jeremy Bentham in the late 1700s, the Panopticon provides the architectural means to enhance control while minimizing the actual supervision required." Digital Cross Rhodes <http://www.digitalcrossrhodes.com/2009/10/panopticon/>



motion sensor. When the motion sensor detects movement it sends a signal to the Arduino, which is programmed to execute a simple script that causes a series of five photographs to be captured at a cadence of three seconds. Because the camera is motion activated, the majority of the photographs collected are of people or mobile furniture in motion. A motion lapse photography study is distinguished from a time lapse study because photographs are triggered by motion and therefore made at uneven intervals.

I chose to build a motion triggered camera in order to reduce the number of unwanted frames collected by the camera. In this way, my choice prioritized photographs of people in motion over regular changes in light in the courtyard.

While the panopticon was installed, it collected over 160,000 photographs in plan view of Rapson Hall courtyard. All of the photographs in the collection have some identical characteristics. For example, each photograph was exposed for 1/15<sup>th</sup> of a second, recorded at the same resolution and has the same focal length. There are only three variables that differ between photographs in the collection: aperture, file size and time stamp. These three variables are a record of activity, light intensity and visual complexity, or chaos, of the courtyard.

### Assumptions

Photography's potential to represent time, activity, change, depth and movement in architecture is largely untapped. I use multi-frame, motion lapse photography to express time, movement and full scale interaction with people. Stereo photography allows humans to perceive 2D photographs in a 3D context; stereo images may also be transformed into digital, 3D meshes.

Digital photography is the capture and recording of light as interpreted by a digital camera based on that camera's exposure settings. Photography, at its core, is light.

*phot: light : radiant energy*

*<photon> <photography>;*

source: merriam-webster.com

*graphy: writing or representation in a (specified) manner or by a (specified) means or of a (specified) object <stenography> <photography>;*

source: merriam-webster.com

"Unconscious peripheral perception transforms retinal gestalt into spatial and bodily experiences. Peripheral vision integrates us with space, while focused vision pushes us out of the space, making us mere spectators." -Juhani Pallasmaa in *The Eyes of the Skin*, pp. 13

Pallasmaa's focused vision is the most common form of photography. A focused, frontal photograph is un-distorted and clear. It represents a scene in a way that humans can easily interpret what we see. Peripheral vision, as Pallasmaa states, "integrates us with space." I chose to use a 15mm fish eye

lens for this project because it most closely represents how humans experience space. We both have focused, frontal vision as well as distorted, peripheral vision. The 15mm lens has a 114 degree field of vision and humans have a 180 degree field of vision. Fisheye photography is the best photographic method to represent the experience of space.

### How this work began

Motion Lapse was born from a curiosity to intersect my photographic experience with my architectural education. The initial, critical step of this project was to place a camera high above the center of Rapson Hall courtyard and configure it to record motion triggered photographs. Murat Germe, a Turkish photographer and architect, created a multi-frame photograph entitled *Vigilance*; it is a 200 frame blend of the same view that depicts a season of views from Germe's apartment in Istanbul. Germe's multi-frame photograph made me curious about how multi-frame photography could be used in architectural design and representation.

My father, John McGinley, and I built the motion triggered panopticon and I installed it in Rapson Hall courtyard on November 21, 2010. The panopticon is designed to create one photograph every three seconds when motion is sensed. Rapson

Above: view of Rapson Hall courtyard as captured by the panopticon

Above: The panopticon is motion triggered and controlled by an Arduino brand micro-controller. Once triggered, one photograph is made every three seconds. The exposure is always 1/15th of a second.

Above: section of Rapson Hall courtyard and placement of panopticon

Above: Image caption information.



Hall courtyard is a commons that is heavily used by students, faculty and visitors. As a result of the activity in the courtyard, the camera recorded over 160,000 photographs.

The individual photographs reveal an omnipresent perspective of the daily activity in Rapson Hall. Each frame records a single instant in time. Much like Germain compressed a season full of views into one photograph, I used Adobe Photoshop to blend individual photographs together. The blended photographs compress periods of time into single images. I scanned the collection for relevant packets of photographs, created multi-frame photographs and carefully curated a selection of them to describe the lessons learned. The resulting multi-frame, motion lapse photographs represent various activities that take place in the courtyard.

### Project stages

Motion Lapse is a process-based project that has had three distinct phases. The first stage, described above, was tool development. Once the tool was built and tested, I began observing Rapson Hall courtyard through the lens of the tool. For four months, the panopticon objectively recorded motion lapse photographs and I critically selected relevant packets of photographs and blended them together. I constructed ephemeral models and explored 3-D translations during the third stage, which will be discussed in detail below.

The initial exploration of photography as a tool to understand space revealed lessons about behavior in the space, temporal light qualities and mobile furniture use. Curating tens of thousands of photographs of the same view of Rapson Hall courtyard allowed me to internalize lessons about the space. As a result of observing the courtyard, I became acutely aware of

*Above: Tech 2 invasion of Master Final Project review. February 23, 2011. 103 photographs recorded in 5 minutes, 9 seconds.*



daylight changes in the courtyard, how furniture configurations affect foot traffic and how the space is configured for the variety of uses it hosts.

After four months of observing the courtyard, testing the panopticon and internalizing observations, I was inspired by colleagues and advisors to shift from observer of the courtyard to designer in the courtyard. By observing through the panopticon, I learned that night time photographs of illuminated surfaces produced high visual contrast photographs. That observation informed my decision to create models out of light and time beneath the panopticon after sunset. My initial tests of the tool revealed that modeling with illuminated or reflective materials after sunset is an effective way to model architectural ideas in full scale while inhabiting the design iterations.

My classmate and collaborator, Elizabeth Turner, observed that the models were ephemeral, or short lived. She coined the term 'ephemeral modeling' to describe the method of rapidly

iterating full scale, inhabitable models.

A critical lesson about modeling with the panopticon emerged when I invited several other architecture students to participate in night time modeling. I had become too close to the technical aspects of the tool and was too focused on the resulting photographic blend of the activity. Amber Sausen, Erin Stream and Dan Green participated in a group modeling session and helped me expand my understanding of ephemeral modeling's potential.

Elizabeth Turner volunteered to ephemeral model her Master Final Project for Great River School in St. Paul, MN. Turner brought experience in improvisational theater, dance and performance to the modeling session. She also invited four Great River School students to model spaces. Turner's modeling session allowed me to see the full potential of ephemeral modeling. She broke her design program into small events and asked the students to inhabit those events. Turner was able to

*Above: Elizabeth Turner's ephemeral modeling session. The blended photograph informed how Turner wanted her building to hold its occupants. March 27, 2011. Fifteen photographs recorded in 45 seconds*



rapidly iterate several variations on each event design and modify the design on the fly as she observed the students interact with each other, illuminated materials and furniture.

A final lesson learned from ephemeral modeling was how to capture the experience in a 3-D format. I modified the panopticon with only two weeks remaining in the experiment. I patched a second, identical camera into the electronics of the panopticon. The second, parallel camera mounted above the courtyard allowed me to capture synchronized, stereoscopic photographic pairs. AgiSoft makes a software called StereoScan that converts photographic stereo pairs into digital, 3-D meshes. Adding a second camera and using StereoScan to convert the stereo pairs into 3-D meshes opened a new kit of photographic, architectural tools. I orchestrated one final ephemeral modeling session and created 3-D meshes of the ephemeral models we created.

## Classify findings

*ephemeral : lasting a very short time; the autumnal blaze of colors is always to be treasured, all the more so because it is so ephemeral;*

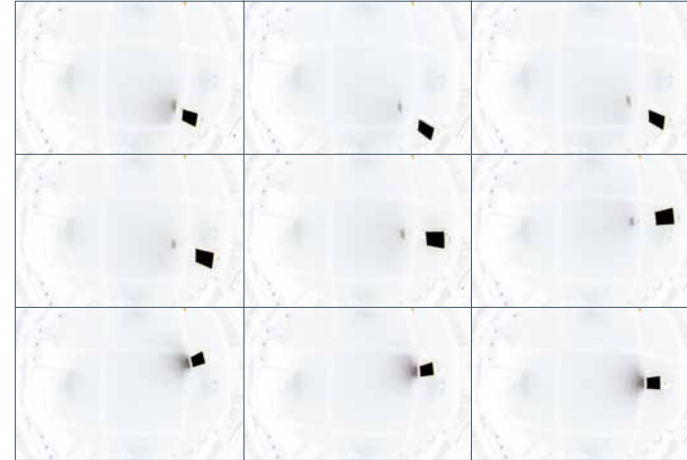
source: merriam-webster.com

Ephemeral modeling enables architects to transform occupant design needs into full scale, interactive, four dimensional experiences and rapidly iterate design ideas. I built a panopticon that records ephemeral models. This tool is capable of producing individual photographs, stereo pairs, multi-frame blended photographs and digital 3D meshes.

## Drivers

Photography has been a well-used and sharp tool in my

Above: Wax cast of vacuum formed PETG. 3-D mesh was exported from AgiSoft StereoScan, CNC milled, vacuum formed and cast in wax.



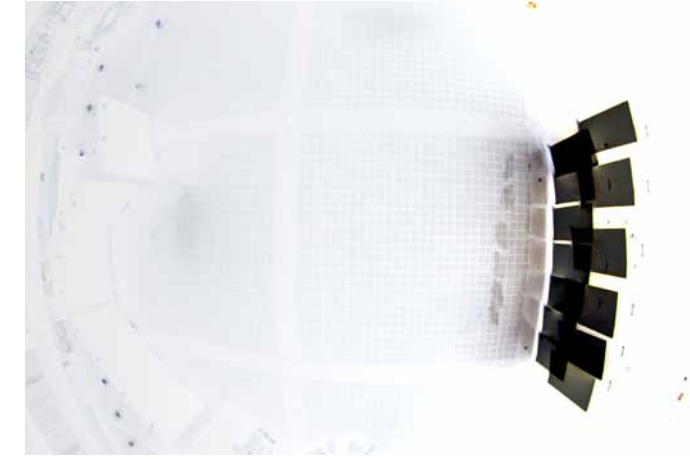
architectural design kit during my Master of Architecture career. I chose to study architecture via photography in order to push my understanding of both. I created a tool that took my camera out of my hands and placed it in a location where no human can dwell. This released control of the shutter to the occupants of the space. The outcome of these three drivers have enabled my understanding of photography and architectural representation methods to evolve simultaneously.

## How architecture is affected

The experience of space is central to architecture. Architects design memorable spaces. Those spaces are remembered by humans in full scale as they experience the building. Ephemeral modeling places the experience of space in the forefront of the architect's mind.

Architects use digital and physical models to convey design ideas. Most modeling techniques remove the architect from the experience of space and cause them to focus on the building as an object. Ephemeral modeling places the experience of space at the forefront of design iterations and representation. A modeling technique that focuses on space as actually experienced allows the architect to prioritize designs more realistically than was capable before. This technique will create memorable spaces.

Above: Inverted, night time photographs reveal light as a material. Individual photographs are loaded into Photoshop and auto blended together

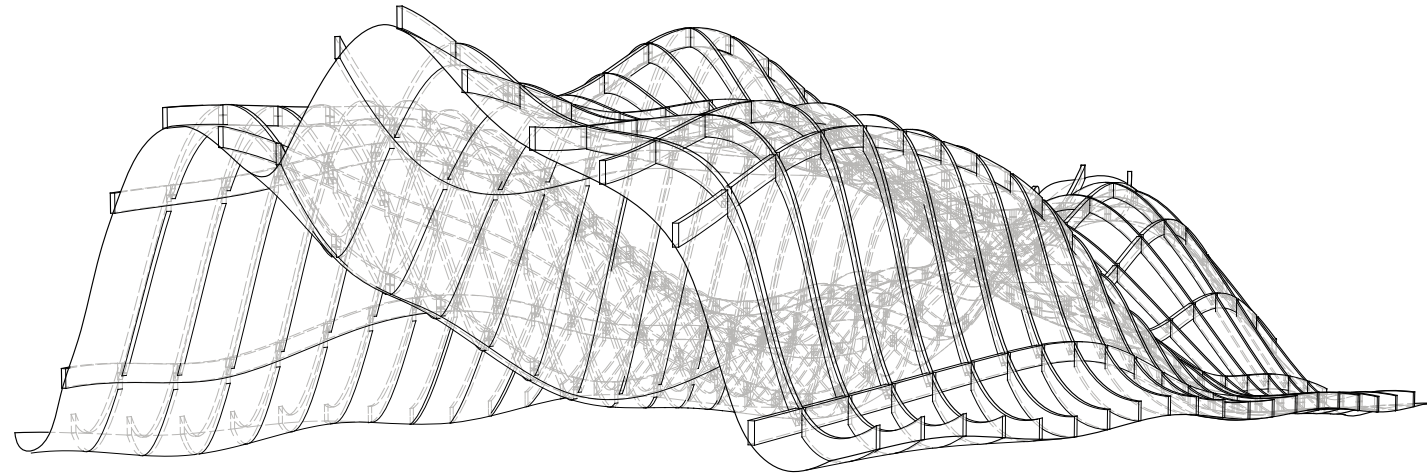


Ephemeral modeling is a useful exercise to rapidly iterate design ideas. It can produce 2-D, blended photographs of the session in plan. The blended photographs reveal a view no one in the session experienced. They serve as memory artifacts of tested events and lessons learned in person with occupants. Ephemeral modeling also produces digital, 3-D meshes of tested events. I used StereoScan to convert side-by-side, blended, fish eye, photographic pairs into digital meshes.

## Essential

Ephemeral modeling sessions must occur after dark beneath elevated, stereoscopic, motion triggered cameras. Illuminated materials are the main modeling material. Architects literally interact with occupants during the modeling session as motion triggered photographs objectively record activity. I select packets of relevant events from the session and blend them into multi-frame photographs which I use to make 3-D meshes. The products of an ephemeral modeling session are 2-D blended, stereoscopic photographs, 3-D meshes and kinesthetic memories.

Above: Once individual photographs are blended together a view of an ephemeral model is constructed. The model never existed in its entirety and the panopticon reveals a model that existed over a moment.



**“Ephemeral modeling allows us to inhabit prepositions.”**

Amber Sausen

**Related technologies**

Virtual reality (VR) is the architectural representation method that is most closely related to ephemeral modeling. VR requires that a designer create a digital, 3D model that they “inhabit” via a VR environment. Ephemeral modeling puts haptic materials in the designer’s hands and forces them to inhabit the spaces they are designing with occupants.

Physical sketch models are related to ephemeral modeling in the sense that they allow architects to rapidly iterate design ideas. Ephemeral models are created in less than one minute each and they are documented as they are created. Sketch models can be made rapidly out of cheap materials and must be documented after they are completed.

Architectural modeling and representation methods focus on architecture as an object. Buildings are experienced by humans at full scale through time. Ephemeral modeling focuses on the experience of space and prioritizes experience over object in the early stages of design.

**“ ...it is the possibility of shifting our attention from the object to the experience of the object and in so doing re-conceptualizing architectural design as the design of architectural experiences.”**

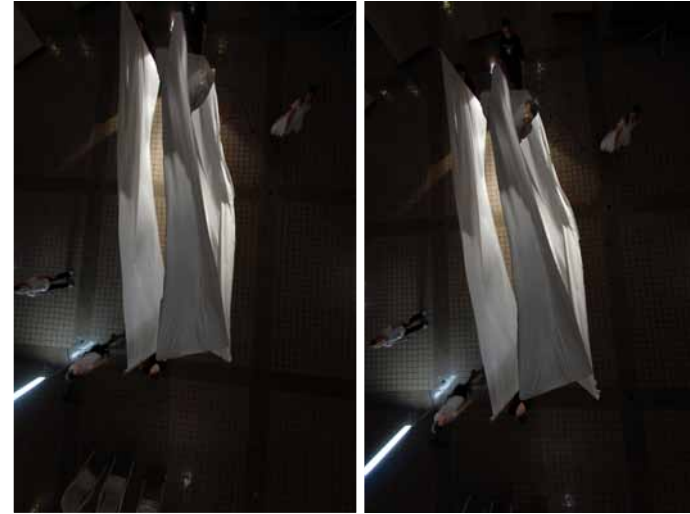
Dr. Julio Bermudez on Virtual Reality, 1994

**Similar technology’s shortcomings**

Virtual reality (VR) uses an environment to allow humans to feel as if they inhabit a space. One experiences the space through VR goggles. One may walk around the space and the VR environment will track where they are and alter the images displayed on the goggles accordingly. While VR allows designers to iterate on the fly and test spatial design ideas quickly, the person experiencing the space must always interface with a screen. They also experience a building that is intangible. While they believe they can reach out and touch a wall, there is no wall to be touched.

Ephemeral modeling places haptic materials in the designer’s hands and allows them to iterate quickly in full scale with other people.

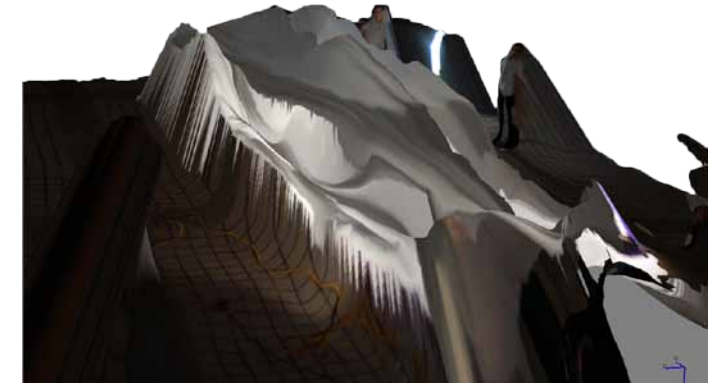
Above: Line drawing of 3-D digital surface created with AgiSoft StereoScan and simplified with Rhino. Justin Kindlespire created a grasshopper script to produce struts and facilitate the digital fabrication of this surface.



**“The aim was no longer the reproduction of objects in the search for a resemblance of life... but the establishment of relations of volume, material, mass, shape, direction, position and light.”**

Andreas Hause on László Moholy-Nagy

Above: Illuminated materials are used after sunset to construct ephemeral models. This is the left/right stereo pair that created the 3-D digital surface to the left.



**Position of work in discipline of architecture**

Photography has long been used to explore architectural ideas, time and activity. Etienne-Jules Marey used multi-frame photography to compress human movement into a single frame in the 1880s. László Moholy-Nagy used photography in the 1920s to explore spatial aspects of sculpture and as a driver for his painting. Balthazar Korab used photography in the 1960s to scale a human into Eero Saarinen’s architectural models.

Ephemeral modeling is related to these photographic precedents because it uses multi-frame photography, it emphasizes spatial aspects of models and it captures human scaled designs. The panopticon used to document ephemeral models reveals a perspective that is different than the kinesthetic memory of the designer. The multi-frame photographs reveal forms, activity patterns and light qualities that can only be captured by the panopticon.

**“Architecture is complex and has complex forces acting on it. How we make choices is critical.”**

Andrzej Piotrowski

Above: AgiSoft StereoScan uses stereo, photographic pairs to create a digital, 3-D mesh of an ephemeral model.

## What about architecture is lost with similar technologies

An architect must gain experience over years of creating scale models and two dimensional drawings of her or his design and experiencing those designs as completed buildings. Modeling techniques that scale the architectural design beyond human occupation emphasize the building as an object. A leap in understanding can be made when an architect is able to inhabit their design as a sketch model instead of waiting for the building to be constructed. Ephemeral modeling prioritizes the experience of space and similar methods emphasize buildings as objects.

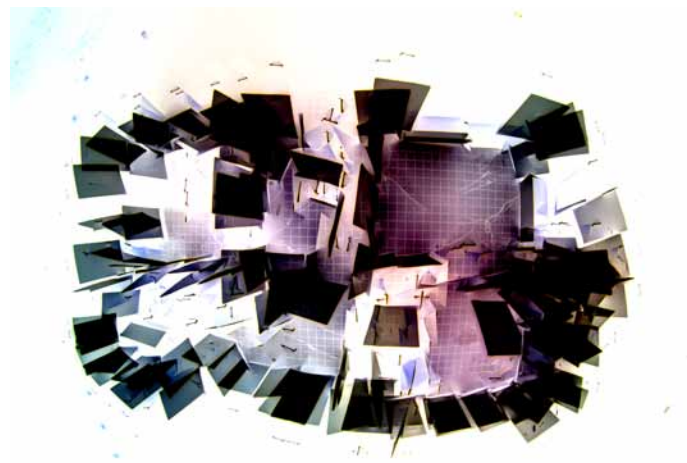
## Why what is lost matters

At the core of architecture is the experience of space. If that experience is lost in the design process then architectural ideas that could improve the experience of space may not emerge as priorities.

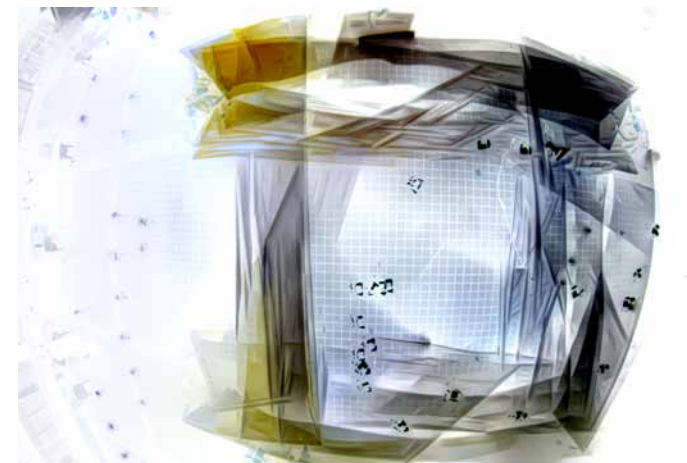
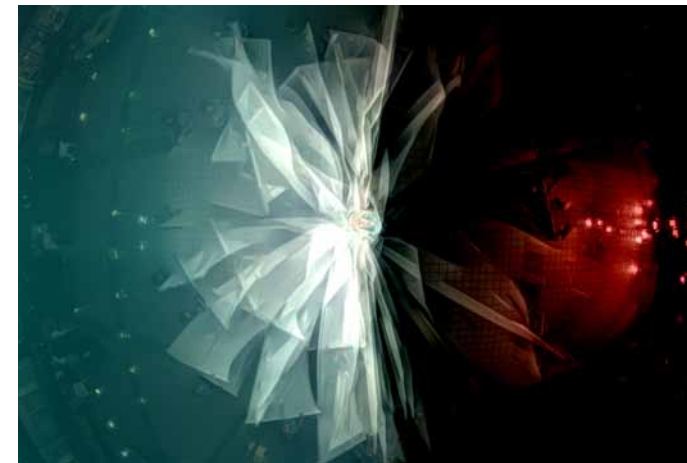
## Conclusion

Motion Lapse uses a photographic tool that records stereoscopic, fish eye, motion activated images in plan view of the center of Rapson Hall courtyard. Through the process of designing, building, interrogating and testing the panopticon I have stretched my understanding of the intersection of photography and architectural design. Multi-frame photographs can represent spatial characteristics such as time, activity, change and light in a way single frame photographs cannot. Ephemeral modeling allows architects to rapidly iterate design ideas in full scale with occupants. The panopticon objectively records ephemeral modeling sessions and the photographs can be used to create 2-D multi-frame photographs or 3-D digital meshes. The panopticon allows architects to prioritize the experience of space while rapidly iterating designs alongside occupants in full scale with haptic materials. It swiftly converts kinesthetic experiences into 2-D and 3-D architectural design artifacts. These findings buttress my understanding of photography as an architectural tool.

More information on Motion Lapse may be found at <http://lauriemcginley.com/samizdat> and <http://flickr.com/photos/lmgotera/sets/72157626337144582/>



Above (from top): Design, Housing and Apparel fashion show, February 19, 2011. 83 photographs in 4 minutes and 9 seconds; right before final critique, December 20, 2010, 94 photographs in 4 minutes, 42 seconds; early ephemeral model, March 17, 187 photographs in 9 minutes, 21 seconds



Above (from top): early ephemeral model test with shop light March 17, 2011, ten photographs in 30 seconds; ephemeral model with Amber Sausen (center), Erin Stream and Dan Green March 22, 2011, 31 photographs in 1 minute, 31 seconds; ephemeral model March 22, 2011, 45 photographs in 2 minutes, 15 seconds

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