Partnerships in Learning 16

# Digital Media and the Creative Process

2007-08

form·Z

Joint Study Journal

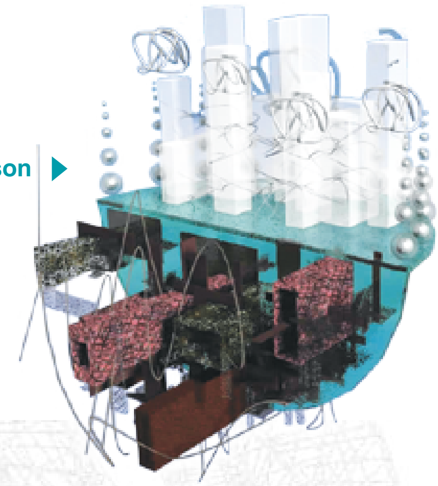
# Invisible Cities

## Florida A&M University, Tallahassee, Florida

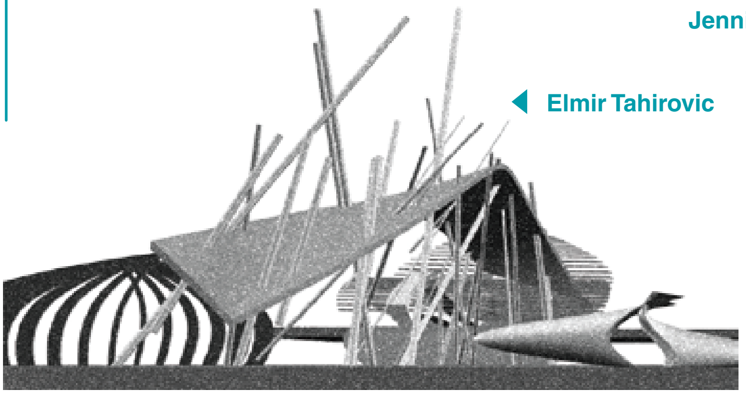
### Advisor: Derek A. Ham

Inspired by Invisible Cities (Italian: Le città invisibili), a novel by Italian writer Italo Calvino, published in Italy in 1972 by Giulio Einaudi Editore.

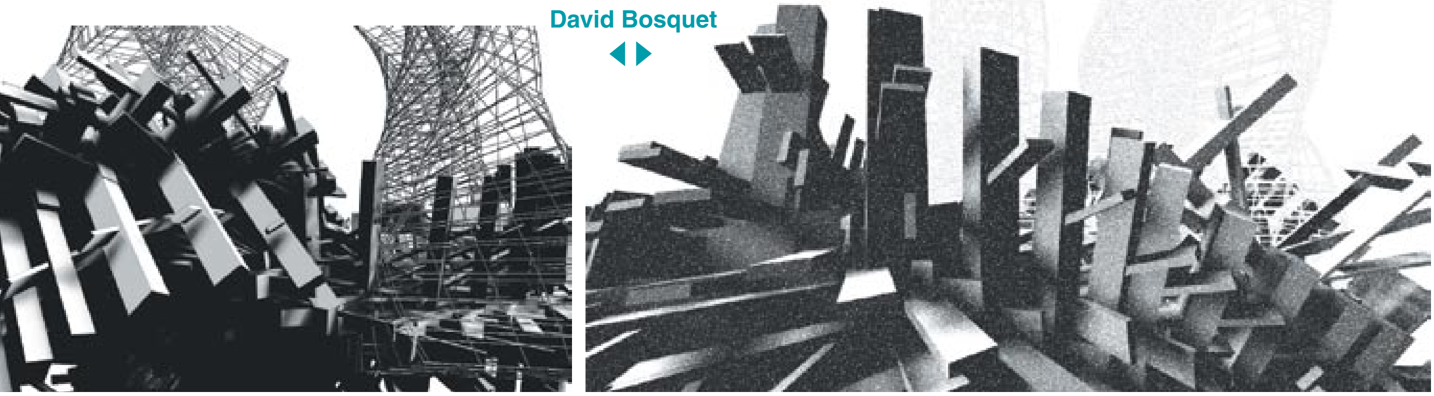
Jennifer Johnson



Elmir Tahirovic

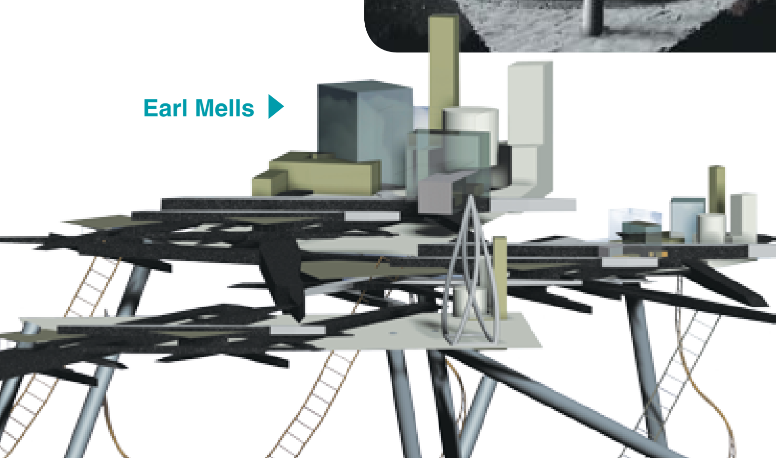


David Bosquet

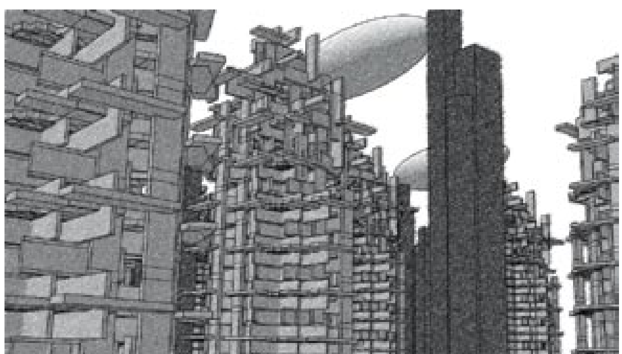


Todd Ebeltoft

Earl Mells



Brian Gladden



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2007-08 form•Z Joint Study Journal

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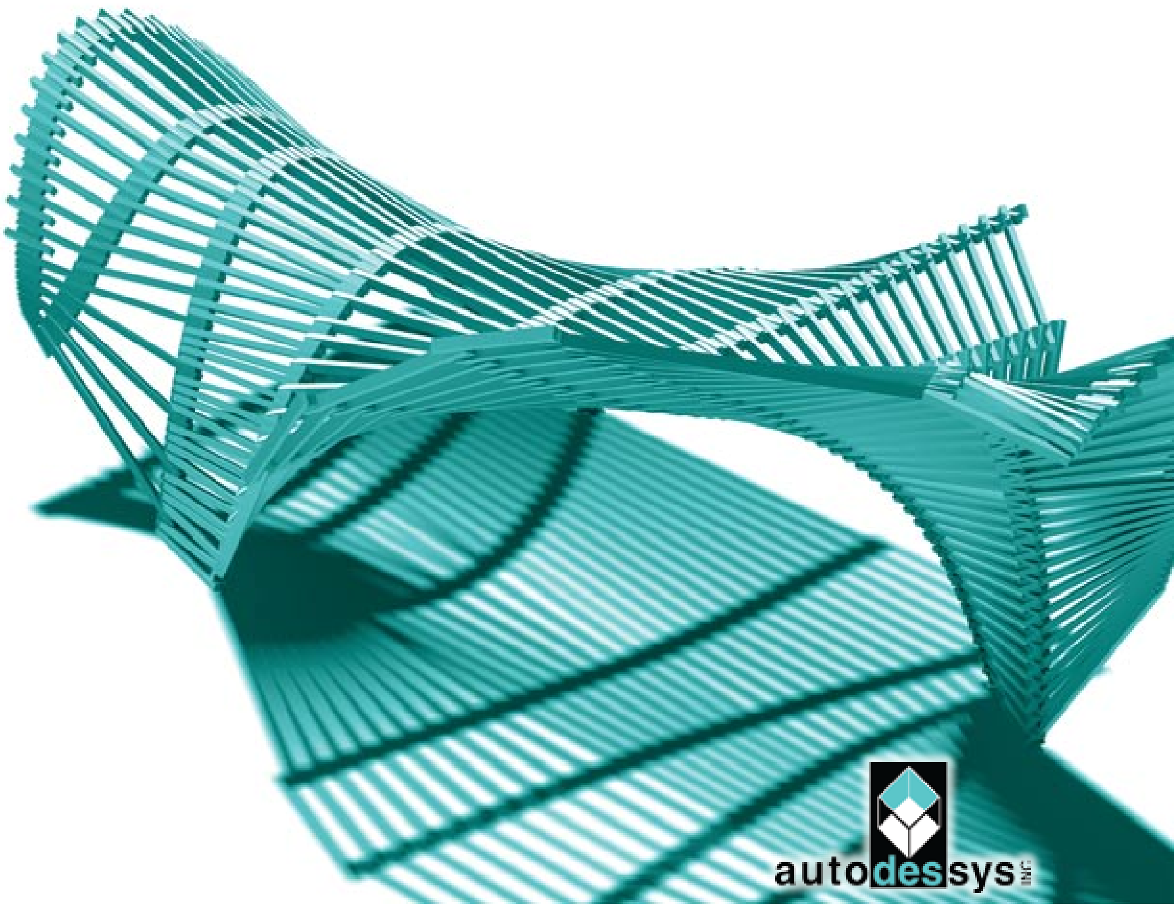

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# Partnerships in Learning 16

## 2007-08 form•Z Joint Study Journal

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## Preface

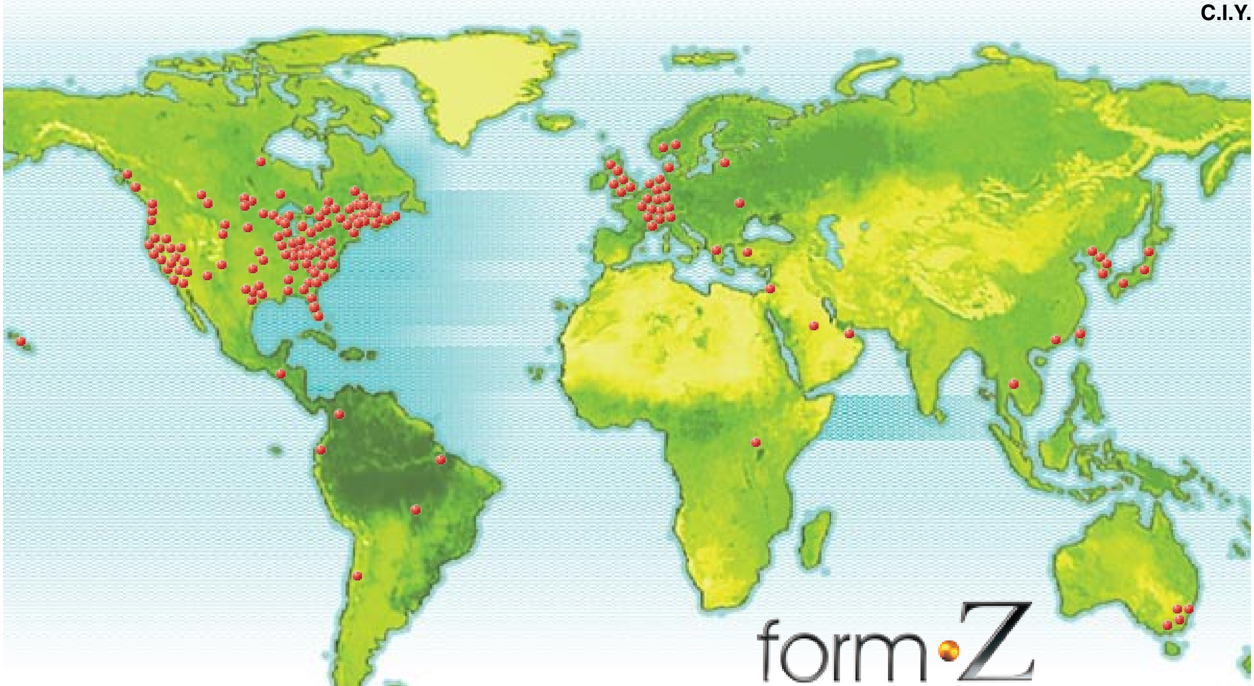
It is with great pleasure that AutoDesSys presents the 2007-08 Joint Study Journal with apologies for its delayed publication due to unforeseen circumstances.

Without boring you with too many details, the initial guest editor, Robert Brainard, had to withdraw due to personal reasons. However, at the time, which was already the end of 2008, the theme had already been selected and we were able to pick up where he left. At the time, the completion of the publication appeared questionable, but I decided to pick up the editorial responsibility myself and after we managed to assemble additional material, we were able to complete the publication.

The result is in your hands! Yes, I believe we were able to complete a high quality publication, albeit at a much later time than it is usually produced. It turned out to be a most enjoyable and even invigorating experience, a task that taught us much to be hopefully used in future undertakings of the Joint Study Journal.

Needless to say that none of this would have been possible if it were not for the great cooperation of the authors, especially those that joined late, which is about half of them. We thank them from the bottom of our heart as we do Robert Brainard for what he was able to accomplish during his rather short tenure. I am confident that this publication will once again become a valuable aid to those that explore and teach the digital tools.

**C.I.Y.**




**Joint Study Program School Locations**

The **form•Z** Joint Study is a program by which AutoDesSys Inc. supports and subsidizes the learning of the new digital tools, primarily 3D modeling, by students at Universities and High Schools worldwide. When schools agree to incorporate 3D modeling in their curriculum, AutoDesSys provides them with **form•Z** licenses, one year at a time, at the cost of material and processing. In return the schools agree to report about their experiences, offer recommendations, and share the projects produced by their students or researchers.

form•Z Joint Study Journal

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# About . . .

***Digital Media and the Creative Process***, as the title suggests, provided a topic to discuss the challenges and the possibilities that designers encounter as they integrate digital tools in their daily workflow. It attracted a number of high quality submissions of articles that insightfully address the subject. We wish to thank Robert Brainard for the selection of the theme, which AutoDesSys chose to maintain even after his withdrawal from his editorial duties due to personal reasons. The articles are summarized and introduced below, in the order they appear.

This Joint Study Journal is again enriched by the display of this year's Awards of Distinction and Honorable Mentions granted to deserving students after a blind review by a jury of experts. As has become a tradition, the awards were handed out last October at a special dinner.

***Animate Topologies*** by Carl Lostritto and Michael Ambrose discusses the exploration of a process oriented design research methodology, as it occurred in a design studio and a complementary digital media seminar at the University of Maryland. They place particular emphasis at investigating animation methods to enliven architecture. As animation techniques begin to permeate the core of software, they are becoming a valuable digital tool in the production of form.

In his ***Deformable and Performative Space***, George Katodrytis of the American University of Sharjah in the United Arab Emirates, discusses and demonstrates how emergent practices of digitally based genetic algorithms and parametric processes are now leading to mimetic and behavioral techniques, as well as performative models of design. The architectural creative process has now become evolutionary, intuitive, and performative, he concludes.

***Outside the Blocks***, by Keith Labutta and Drew Weinheimer of the Pennsylvania State University, seems to endeavor into a dual semantic: thinking outside the conventional block and redesigning a glass block, a prototype of which was also fabricated. The paper is about redesigning a glass block for a real customer, the Pittsburgh Corning Glass Block Corporation. They seem to have surprised their customer and themselves with an outcome that appears to have gone quite beyond the conventional concept of a glass block.

In ***Typologies***, Thomas Rusher of the University of Texas at Arlington raises the question: "How can digital media be used in both an inventive and generative fashion without complete loss of authorship and humanity to the computer?" This is the same question he explores with his students in his studios. He points out the value of animation "as a means of understanding 'real time' processes," and digital fabrication that "opens the design field up to new potentials."

In ***Rapid Visualization***, Murali Paranandi of Miami University in Ohio, points out how students frequently are unable to capitalize on the advantages offered by the digital tools and use them mostly for presentation purposes, rather than for exploring design solutions. He looks into ways of addressing these shortcomings and presents paradigms of some of his better students and some projects done in his studios.

In Bennett Nieman's ***Four Poetic Statements***, projects of a media workshop at the Texas Tech University are presented as "poetic statements." The workshop promotes the act of making as a discourse and the computer is introduced as an interpretive playground for design experimentation.

***Modular Constructs*** by Asterios Agkathidis of the Technical University of Darmstadt in Germany starts with a historical overview of "modularity" and then proceeds with an exploration of how modularity has evolved and has been affected by contemporary digital tools and their parametrics. Sameness tends to be replaced by "mathematically coherent, but differentiated objects."

In ***Giving Our Ideas a Playground, not a Contained Shoebox***, Andrzej Zarzycki, after he points out that the term "design process" may be an oxymoron, he discusses and illustrates mostly generative thinking and design as it is reinforced by today's digital tool. "The digital environment is a rich, prolific, generative medium to pursue unintended consequences and to achieve unexpected goals," he concludes.

In ***Thinking and Making***, Mark Ramirez and Carl Lostritto of the University of Maryland, report on a Digital Media course that applies seminar methodology. They conclude that "digital media is not a tool, but rather a means to explore architectural issues." They present student projects that prove this thesis.

In ***Razor Design***, Robert Brainard reports on his Industrial Design studios at the University of Bridgeport. His goal was the "integration of all the design skills into the design process," which he illustrates with a typical razor design project.

***AutoPLAN***, by Kostas Terzidis of the Harvard Graduate School of Design, presents scripting as a valuable technique for both exploring design and addressing functional requirements. His project is in the latter area. The article is also a useful reminder of an era that a few decades back had given many promises but has been shockingly neglected.

Chen-Cheng Chen's article, ***Designing and Fabricating***, presents the work of a design studio at Tamkang University in Taiwan. Two of the projects are intriguing fabrication examples. The other two that came later in the class are general design projects with an urban design flavor. They are all excellent examples of the impact of digital tools.

In his short diatribe ***Conjectural Intersections***, Ganapathy Mahalingam of the University of North Dakota starts by pointing out that virtual design produced with digital tools seems to imitate what can already be done with real materials. He then introduces "conjectural intersection" as something that can only be produced with digital tools.

Carmina Sanchez-del-Valle and Sean Creque, in ***Learning and Teaching***, discuss a course at Hampton University they offered together, with an emphasis on the preparatory stages. Each of a different generation and level of experience, they discuss their points of agreement as well as disagreement and the aspects they found most challenging.

In ***Digital Iteration***, James Eckler of the University of Cincinnati presents a design exercise where digital design achieves a synthesis with the conventional ways of making. This is in contrast to the common practice where 3D modeling is relegated to a presentation tool. As designers we think through making and, when the digital tools become part of the making process, they also become reinforcers of our thinking process.

In ***Hylomorphic Surface***, John Cirka of Ryerson University in Canada, presents a diatribe on how form is (or may be) generated in today's world of digital media. Force is a major factor and he quotes a number of notables to defend his position. He also displays examples, but recognizes that "In spite of the increased complexity possible in today's designed components, they do not approach the levels of complexity in the cellular matrix of organisms."

Lastly, in ***Journals of a Digital Design Studio***, Sarah Jester (the student) and Thomas Fowler (the teacher) of the California Polytechnic State University, present a weekly journal of a studio. The student writes her thoughts and impressions of the week. The instructor lays out and describes the tasks of the week. Then both express their reflections. All together an interesting record of nine weeks of studio that concludes with final reflective essays on the entire quarter by both the student and the instructor.

This Journal begins with a display of ***Invisible Cities*** by Derek Ham's students at the Florida A&M University, on the inside front cover, and concludes with a mini article, ***Computing the 'Holy Wisdom'*** by Oliver Hauck of the Technical University of Darmstadt. While these are not part of the overall theme, they present some intriguing usage of digital tools, form•Z in particular. They were selected from among a good number of reports we received this year.

We wish to wholeheartedly thank all the contributors and authors for the valuable information and experiences they provided to this year's Joint Study Journal. We hope that its readers will share our excitement in producing a beneficial and instrumental educational aid.

**C.I.Y.**


# 2007-08 Joint Study Award Winners

One of the traditions the Joint Study Program has established is the presentation of annual awards for the exceptional work of deserving students. This year five awards of distinction and six honorable mentions have been granted. The nominated projects were in five categories: Architectural Design, Interior Design, Visualization and Illustration, Fabrication, and Animation. They are displayed on the next 11 pages of this Journal.

## The Jury

The selection of the awards was made by five jurors outside of AutoDesSys, all experts or theorists of computer aided design. They are listed below, in alphabetical order.

- **Craig Beddow**, Craig Beddow Design, Architect, Minneapolis, MN
- **Beth Blostein**, Associate Professor of Architecture, The Ohio State University, Columbus, OH
- **Robert Brainard**, IDSA, RBID, Industrial Designer, Danbury, CT
- **Frank Elmer**, FAIA, FAICP, Principal, Lincoln Street Studio, Columbus, OH
- **Susan Melsop**, Assistant Professor of Interior Design, The Ohio State University, Columbus, OH

## The Process

The projects of all the nominees were sent to the jurors as Acrobat documents on DVD that also included animations that accompanied some of the submissions. Names and school affiliations were not included. The jurors returned their selections for the awards and grades (0-10) for each of the other projects. Selection of a project for an award was considered equivalent to a grade of 15. The grades were averaged and the one project from each category receiving the highest grade was selected for the award. Projects receiving the second highest grade were selected for the honorable mentions. The jury was also asked to comment on why they selected these particular projects. Their comments are included with the displays of the award of distinction and honorable mention winning projects.

## The Prizes

All awards of distinction received $1,000 and a **form•Z RenderZone Plus** license with one year technical support and updates. They were also invited, expenses paid, to attend ACADIA 2008, where the awards were officially announced. Honorable mentions received one year licenses and diplomas acknowledging the award. This year's happy award winners that attended ACADIA are pictured below:

From left to right are: **Farzam Yazdanseta**, Award of Distinction in Architectural Design, University of Maryland; **Poppy Weston**, Award of Distinction in Interior Design, University of Wales Institute-Cardiff; **Keith Labutta and Drew Weinheimer**, Award of Distinction in Fabrication, Pennsylvania State University.

# Architectural Design

## Public Radio International

by **Farzam Yazdanseta** : Graduate, Advanced Design

Advisor/Principal Investigator : Michael Ambrose

School of Architecture, Planning and Preservation
University of Maryland, College Park, Maryland

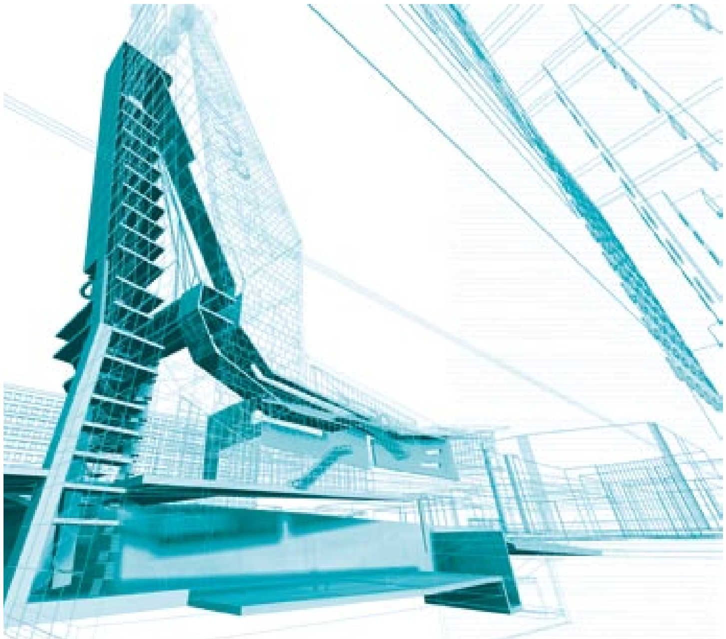
### Summary description of project:

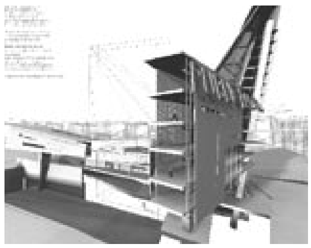
Twenty-first century media is filled with lies and deception. News conglomerates force their biases by filtering the truth and as a result, heighten the chaos and conflict in the world of politics. Public Radio International is a result of the multiplicity of cultural conflicts that come together at the context of District of Columbia, a zone filled with political chaos and imbalance. Public Radio International is a space of contention where both its private and public realm are tasked to bring together conflicting political viewpoints.

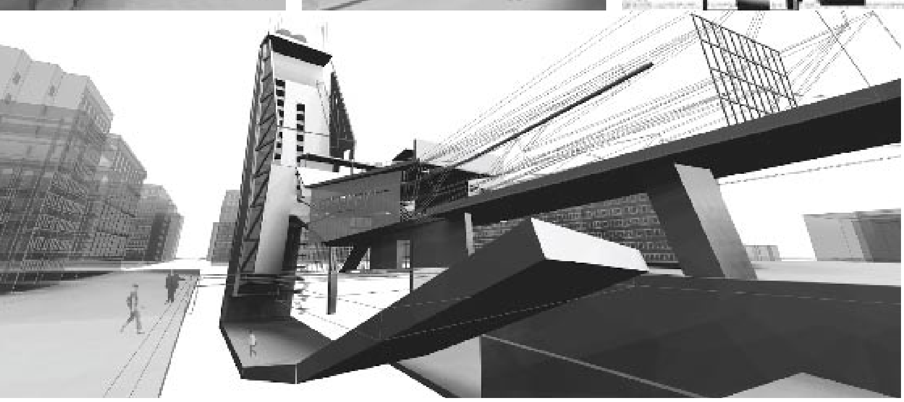
Public Radio International uses two conflicting physical geometries of District of Columbia and cultural and the never-ending political imbalance existent in the District, nation, and the world to establish its architectural language.

These constant multiple forces fragment and deconstruct the landscape of Washington D.C. to contextualize the site in order to embed the building as part of the landscape.

Public Radio International overcomes the speed of the world of news and media by establishing a transient architectural language. Fragmented pieces are in constant motion to demonstrate a dynamic environment to encourage contentious debates aimed at revealing the truth.





### Jury comments:

Detailed and complex model. Elegant use of **form•Z** in rendering. The intentional lack of colors and textures demonstrates what **form•Z** can achieve without getting carried away with the goodies. Nice lighting. — ***Frank Elmer***

The elegance of this project lies in a balance between the abstract and real. While the views are commendable and enough architecturally convincing information is present, much of the structure, enclosure and material are only suggested, encouraging ones own imagination to fill in the gaps. I couldn't help but notice Peter and Rem seem to admire the indeterminacy as well! — ***Susan Melsop***

# Architectural Design

## Urban Structural Park

by **Ben Mokri** : Graduate, Master's Degree

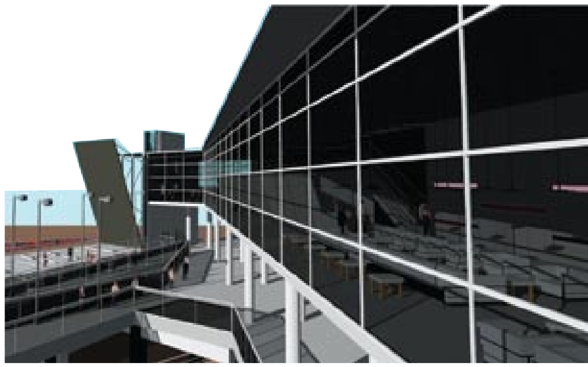
Advisor/Principal Investigator : Alan Rosenblum
: Avery Caldwell

Digital Media Arts Program
New School of Architecture and Design, San Diego, California

### Summary description of project:

The structural park is a response to the need for public space and facilitation to the future revitalization of Harbor Drive. The structural park is a new urban fit for downtown San Diego; connecting Gaslamp to Barrio Logan through Harbor Drive. The structural park acts as a blurring agent, blurring out the boundaries of downtown zoning system by acting as a node, making a mental and physical connection from Gaslamp to Barrio.

Through a series of studies and meta-diagram studies it was realized that the structural park will also act as an agent, normalizing the revenue generation and exchange between Gaslamp and Barrio.



### Jury comments:

This project for an "Urban Structural Park" in San Diego begins with a convincing, three dimensional analysis of the modern city's infrastructural logic, using **form•Z** to both understand that logic and then to clearly visualize and communicate it. The project merges a series of new readings of this logic, transforming latent patterns into overtly coded ones. The merging of connectors between cultural event space and a negotiation of existing and planned movement in the city produces a new program of exhibition and loosely programmed space. Renderings and conventional drawings generated from the model are compelling and show the designer's digital skills. — ***Beth Blostein***

An excellent collage of images – showing both the planning / overview, the technical side of the proposal and the emotional overview – that all together makes a great project because it quickly gives the viewer a great understanding of the proposal. — ***Robert Brainard***

# Interior Design

## Rambert Dance Company

by **Poppy Weston** : Third Year, BA (Hons) Interior Architecture

Advisor/Principal Investigator : Patrick Hannay
: Charlotte Bull

Department of Interior Architecture
University of Wales Institute-Cardiff, Cardiff, England

### Summary description of project:

The Rambert Dance Company is Britain's flagship contemporary dance company and needs a new home for the 21st Century that reflects these qualities.

The company has outgrown its current home in Chiswick, West London, and now needs a new base in a more central London location. This would give Rambert the space it needs to create new productions and more of an opportunity to work with the community.

The Rambert Dance Company archive was set up in 1982 to record and preserve the company's repertoire for future generations but currently it has no space to display it. This new facility to house an archive / exhibition space, dance studios, café / bar and theatre in a dramatically re-modelled central London building on Clerkenwell Road designed by this student, creates a place for all the Rambert operations and dreams to flourish.

### Reasons for the nomination:

The project is set in a large building and comprises a variety of vast and complex spaces intertwined with each other and the original building. This means that modelling the project accurately is no simple task. Add to this a great variety of materials specified in the project and this task gets harder still.

This student has not only succeeded in modelling her designs, she has also managed to produce a set of highly stylish and striking renderings with strong graphic, as well as descriptive qualities. She has captured the vibrancy of the spaces she has designed in these images, and presented them in a highly individual manner appropriate to the project and her original design intentions.

### Jury comments:

A very detailed model. Takes good advantage of **form•Z**'s textures, materials, transparency, and lighting to represent the interior design intent. — ***Frank Elmer***

This interior design project demonstrates the capacity of **form•Z** to help students visualize and compose beautifully executed interior spaces. The strength of this project is the combination of dramatic views and the use of light to effectively enhance the color palette and subtle material articulation. — ***Susan Melsop***

# Interior Design

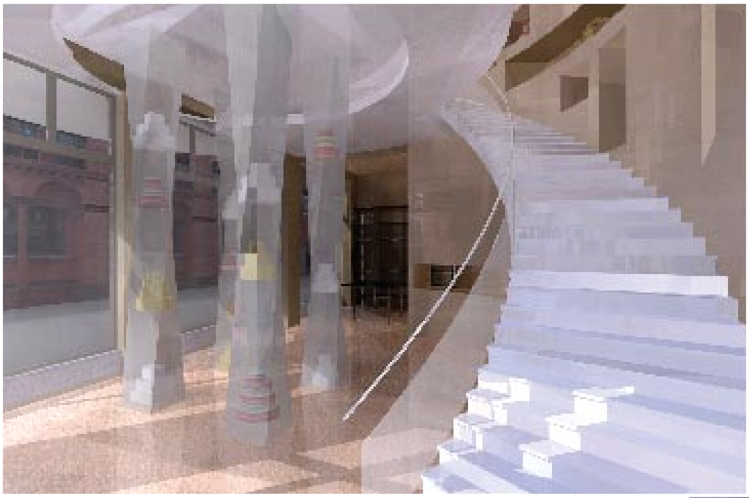
form•Z Joint Study Program 2008 HONORABLE MENTION

## A Cake Boutique

by **Rachel Chotin** : Graduate, Advanced Digital Studio

Advisor/Principal Investigator : Andrzej Zarzycki

Department of Interior Architecture
Rhode Island School of Design, Providence, Rhode Island

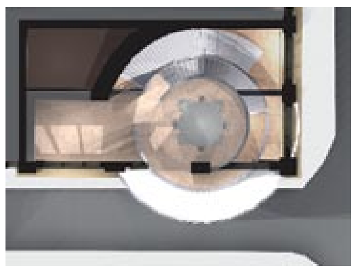


### Summary description of project:

Designed to accommodate the programmatic spaces: display, design, construction, and the consumption of the product--a cake. Directly inspired by the form of the wedding cake, the space will adapt the signature tiered/layer layout creating curved out spaces, and projecting through the existing façade of the Smith Building.

### Reasons for the nomination:

Rachel developed a strong project with a carefully crafted design and presentation. The use of digital tools is visible in all the stages of her design and culminated in a spatially interesting solution. The final design is an integration of spatial expressions, materials and natural light.



### Jury comments:

I felt the cake store concept lent itself very well to the idea of a "cake museum." The presentation was very nicely rendered, with a very real sense of materials, light and atmosphere, but also maintaining a schematic, whimsical feel. It would be fun to detail the "floating cakes" in the twisted glass columns. For the finishing touch a fun animation and great song…who doesn't "like cake". — ***Craig Beddow***

# Interior Design

## Ma: Fine Japanese Cuisine

by **Oriel Poole** : Third Year, Hospitality Studio

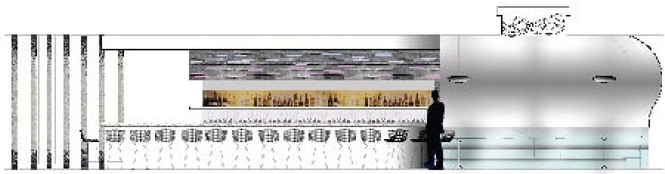
Advisor/Principal Investigator : Timothy Powell
: Don Rushton

Department of Architecture and Interiors
Drexel University, Philadelphia, Pennsylvania

### Summary description of project:

The object of this assignment was to design a restaurant for a self-defined client along the Camden Waterfront in New Jersey. The restaurant was expected to seat a minimum of 90 guests for dinner and 20 guests at the bar.

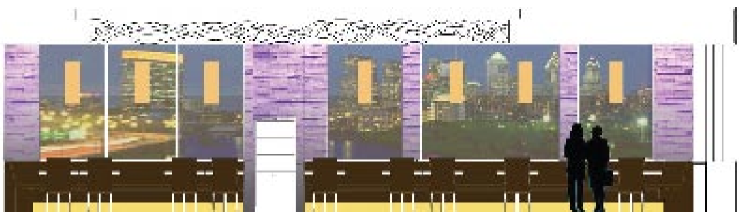
The goal was to design a restaurant that would draw inspiration from the people of Japan and their approach to life. Japan is a paradox land where one can find the harmony between two extremes. It is a nation where many of its people believe in Zen, practice meditation, and strive for simplicity. At the same time, Japan is a world leader of advancements in technology, extreme design, fast-paced lifestyles, and people who gather by the masses. With the culture of Japan in mind I set out to design a restaurant that would demonstrate juxtaposition through the use of form, texture, light, and color.



### Reasons for the nomination:

The designer was very successful in the process and presentation of her design concepts, thanks in large part to her ability to use **form•Z**. Issues involving form, material, and lighting were all explored and integrated into the development of this project.

The designer should be applauded for having a set of design intentions and utilizing **form•Z** as a means of communicating those intentions. While at the same time, allowing the exploration of the project by way of modeling (using Nurbz and Sweep) and lighting (using color and intensity) to inform the design process; and in turn, the end result.



### Jury comments:

This project for a waterfront Japanese restaurant interior was skillful in its compositing of renderings and entourage to create a visual mood the designer was clearly working hard to articulate. Moving from warm and cozy to icy and edgy, the seating area and bar design showed how the use of the software, from modeling to material shaping, to rendering, can create the contrasts the designer was after. The project shows off the software's (and the designer's) capability range; the design is controlled and carefully detailed, but in the case of an inset ceiling sculpture, it is allowed to be gracefully chaotic. — ***Beth Blostein***

# Visualization & Illustration

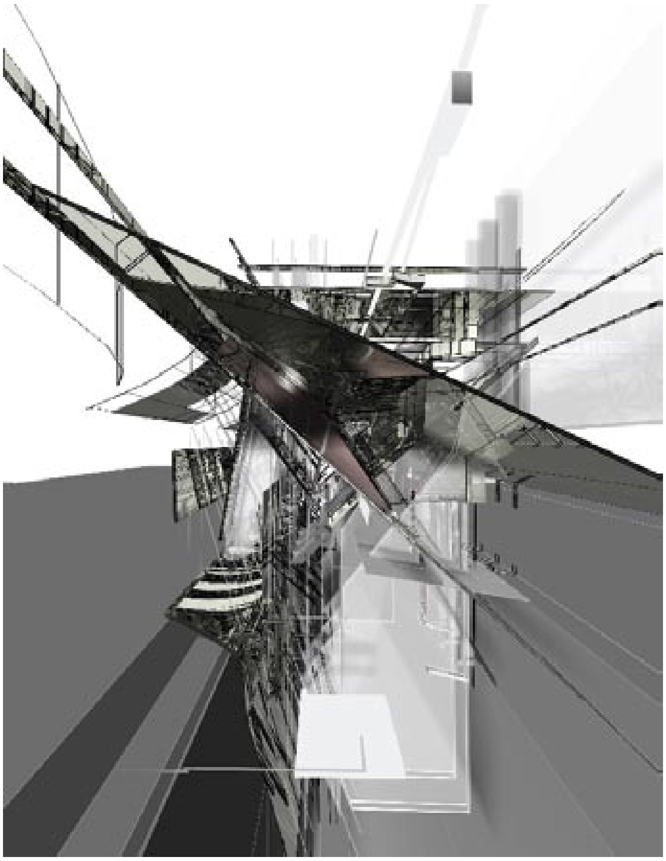
form•Z Joint Study Program 2008 AWARD OF DISTINCTION

## The Transformer Box


by **Lauren Segapeli** : Fourth Year, Media Elective

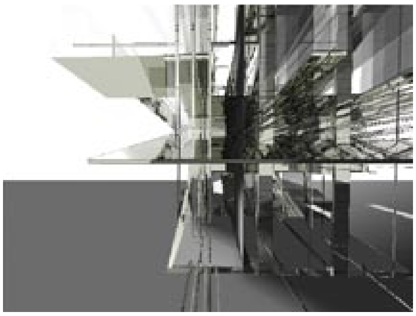
Advisor/Principal Investigator : Bennett Neiman

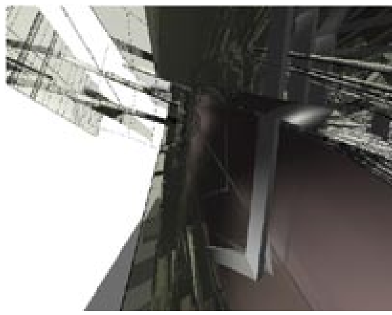
College of Architecture
Texas Tech University, Lubbock, Texas

### Summary description of project:

The Transformer box is an idea that fosters the process of design playfulness. This game of 'Transformer' promotes the creation of something new and unknown through the alternation of design decisions between two individuals. Each mover inspires the next. Each decision poses a question. Design conversation is established. Through the reassembly of formal elements, based on fictitious means, spatial reality is created. This play between what was and what can be is carried throughout the design process. With each decision comes new rules, inspiration, and reality. A move is made and a space is created. A space that is as permanent as its ability to inspire. The kinetic character of such space is the nature of transformers. With each decision, a question. With each question, a new space. Let's play.





### Reasons for the nomination:

The student used **form•Z** to transcode, rearrange, manipulate, and transform a vintage typewriter into a space visualization fantasy. Out of the many possibilities captured, something was made literally out of nothing. A pure creation of the mind is made possible with **form•Z**. A remarkable aspect of this media driven project is that all of the carefully framed perspectival viewpoints shown in these images are generated directly from the **form•Z** model and **RenderZone**, without any manipulation from other post-production software such as Photoshop.

The resultant modeling studies emphasize experimental and sensorial perception. **form•Z** was used as an interpretive playground for design experimentation, exploiting the representational elements of form, space, material, light, shadow, color, transparency, texture, and implied motion.

### Jury comments:

Complex model and bold intriguing graphics. Excellent choice of model views to achieve evocative imagery. — ***Frank Elmer***

The significance of this project lies in the fact that visualization is a key component of a rigorous process, not simply a task completed after design decisions have been made. The techniques deployed are not obvious; the graphics are truly spectacular. — ***Beth Blostein***

I was enamored by this project solely by its visual effect. I have no idea what the project may mean, and it sometimes reads like an Escher, but the depth of visual intricacies and spatial investigation from the transformation of a typewriter all deserve merit! — ***Susan Melsop***

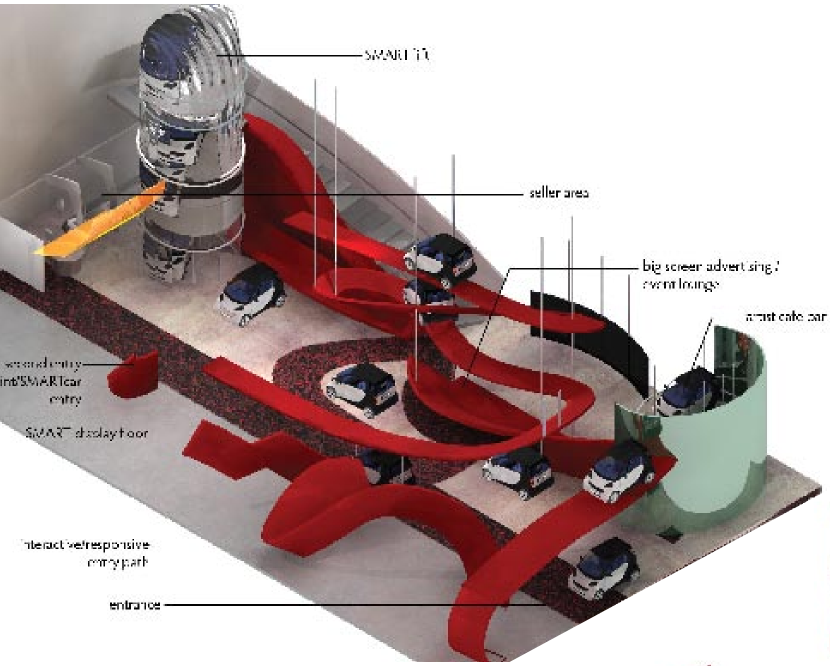
# Visualization & Illustration

## Smart Center USA

by **Marielis Suarez** : Graduate, Advanced Digital Studio

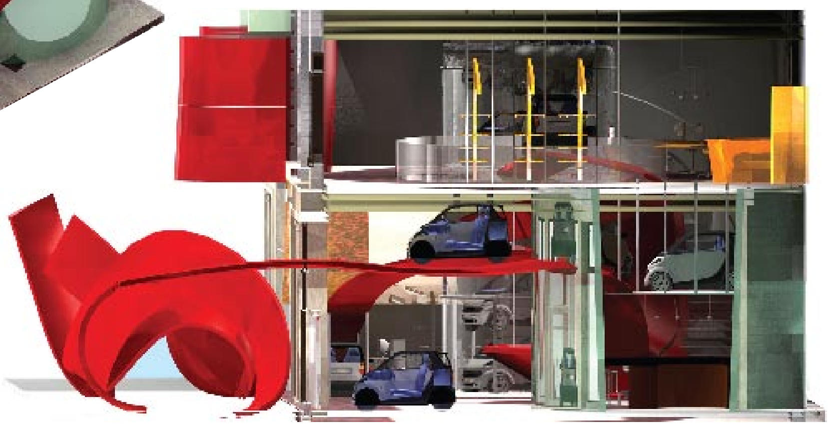
Advisor/Principal Investigator : Andrzej Zarzycki

Department of Interior Architecture
Rhode Island School of Design, Providence, Rhode Island




### Summary description of project:

The SMART center of Providence will be an interactive showroom and event space for the up-and-coming product in the United States. The project explores the spatial relations through a continuous path that will guide and wrap a customer throughout their visit. The SMART center develops around the concept of creativity, versatility and simple modern expression, translated into design through circulation, program and technology explorations, among others.



### Reasons for the nomination:

Marielis developed a strong project with a carefully crafted presentation, combining still images and animation. Her visualization successfully addresses a number of critical points: user's experience, architectural tectonics, spatial continuity, the relationship between the showcased product, and architectural design.

### Jury comments:

They've captured the feel and fun of the smart car. The bold colors, the strong ribbon clarifying and accentuating flow, all contribute to the playfulness and "smartness" of this presentation. The animation nicely reinforces all of the above and gives a sense of the user experience. — ***Craig Beddow***

This is a great graphic illustration of a proposed space. These intriguing images draw you into the concept and make you want to explore it further – that is exactly what great illustration should do! The beautiful series of images and nice line drawings are convincing, but then the excellent animation further sets this apart as an extraordinary piece. This all gives a real understanding of an unrealized design proposal. I would want to see it come to fruition in reality. All of it is very professionally done. — ***Robert Brainard***

# Fabrication

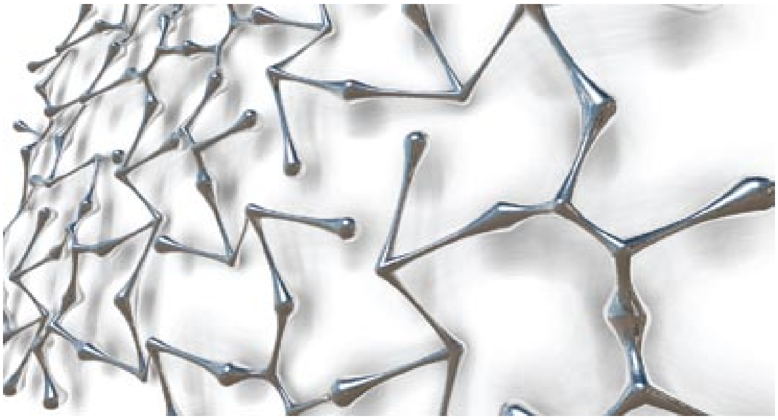
## Reinvention of Glass Block

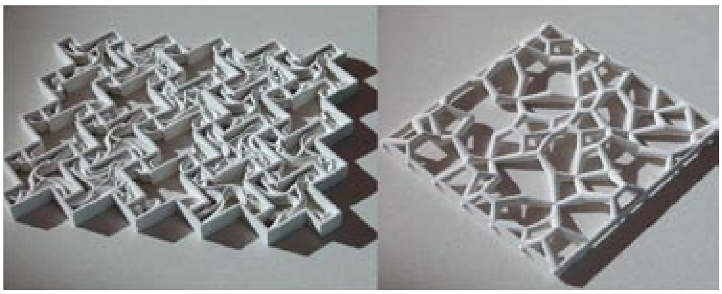
by **Drew Weinheimer, Keith Labutta**

: Graduate, Digital Fabrication

Advisor/Principal Investigator : David Celento
: Reggie Aviles

School of Architecture and Landscape Architecture
Pennsylvania State University, University Park, Pennsylvania

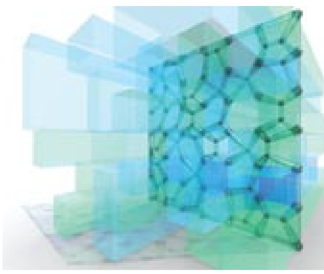




### Reasons for the nomination:

The students' solution was the most unique proposition envisioned. **form•Z** proved a highly useful tool for visualization and rapid prototyping of a model that was presented to the Vice President of Pittsburgh Corning, Pete Atherton.

Through the use of **form•Z**, the students stretched the boundaries of what a unitized glass product might be, while still permitting production of individual units that could be aggregated in a variety of ways. His solution generated a good deal of interest and excitement a Pittsburgh Corning.



### Summary description of project:

Pittsburgh Corning sponsored students in the digiFAB class to reinvent glass block. Students visited the manufacturing plant, studied the processes for making existing block and proposed new ideas that would permit Pittsburgh Corning to re-invigorate their product line, with an emphasis on creating novel and highly desirable outcomes that offered flexibility.

The class focus was creating and visualizing solutions through rapid prototyping using Zcorp printing and CNC mold making. Software to be utilized was of student's choice. Drew chose **form•Z** due to its capabilities and the ease of modeling and rendering that **form•Z** offered.

### Jury comments:

Nicest design of the bunch. — ***Frank Elmer***

This project demonstrates a convincing process of research, design and fabrication. It is exciting to see students realize the potential of **form•Z** in this capacity; I hope we continue to see more pedagogic exploration in this area. — ***Susan Melsop***

This is an intriguing use of **form•Z** to investigate various concepts, generate 3D output of concept variations, and then create the mold to physically make the product. This project shows the process extremely well and creates a beautiful esthetic in the final part. About the only thing lacking is to show how the parts would be used in a typical architectural situation. Excellent Work. — ***Robert Brainard***

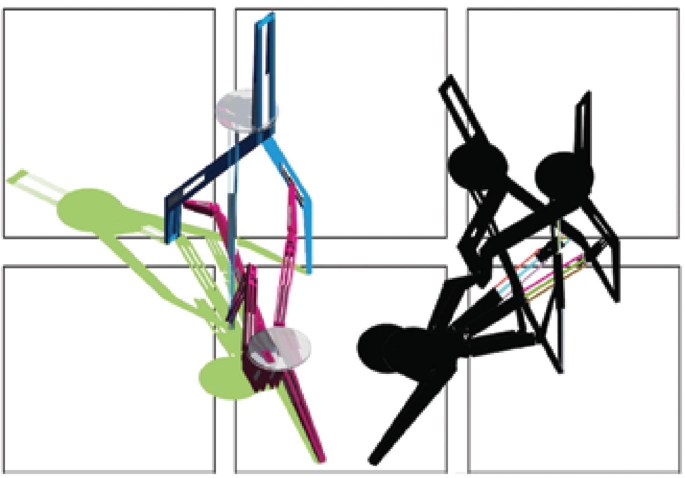
# Fabrication

## 1 or 3 Chairs

by **Cheng-Yuan Huang** : Senior, Architectural Design IV

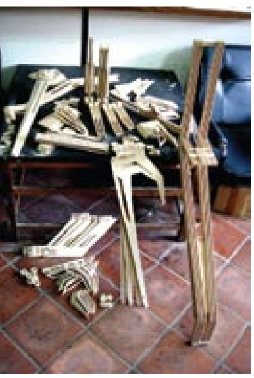
Advisor/Principal Investigator : Chen-Cheng Chen

Department of Architecture
Tamkang University, Tanshui, Taiwan



### Summary description of project:

The chair design is inspired by American conceptual artist Joseph Kosuth's work "One or Three Chairs." In the beginning of this project, a chair is designed in **form•Z** (the higher one), and then the projection of the first chair is calculated by the lighting function of **form•Z**, and the second (real) chair is derived from the shadow of the first chair designed. The third chair is the shadow of the first and second chairs.



### Reasons for the nomination:

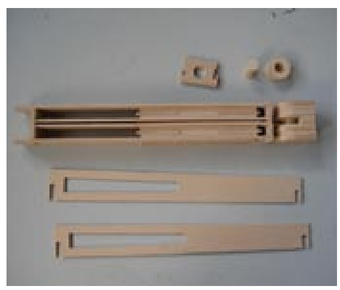
Interesting design concept, and the designer deliberates very carefully of the lights and shadows in **form•Z** environment, and the chair is conducted in real scale by incorporating CAD/CAM process.

The elements and joints of the chairs are incredibly complicated, it's almost impossible to make these chairs by hand only.

### Jury comments:

Interesting application of **form•Z** to use form and shadow to produce a second and third form. — ***Frank Elmer***

This project is interesting because of its use of **form•Z** functionality at all phases of design. The final product is both abstract and obsessively detailed. — ***Beth Blostein***



# Animation

## Bruce Flagship Store

by **Sophia Chan** : Graduate, Advanced Digital Studio

Advisor/Principal Investigator : Andrzej Zarzycki

Department of Interior Architecture
Rhode Island School of Design, Providence, Rhode Island

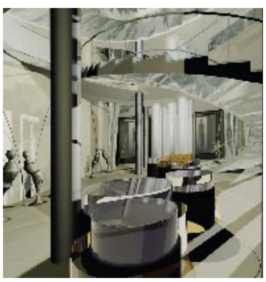
### Summary description of project:

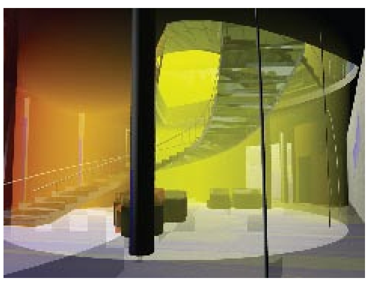
Develop a high-end retail store for Bruce (a European brand) based on playing opposites with their clothing design aesthetics. Using contrasts like dark/light, broad/narrow, and intimate/open to construct the interior and the juxtaposition of technology and how future women will dress.

Upon entering, the coolness of steel racks contrasting warm lights and wood floor is the first visual scene with a central curved display that acts as a motion director toward the back dressing rooms and lounge area. The dressing rooms are part of the curved wall with heat sensors to create opaque and glowing or transparent and semi-dark fitting rooms. Using light to register the contrast between static and motion within the same space and throughout the entire structure. With a central curved staircase as the key progression element throughout the 3 floors of the flagship store. The large staircase is offset by the smaller element of the register area. The idea of public and private space is also represented by the shopping space and dressing room.

### Reasons for the nomination:

Sophia developed a strong project with a carefully crafted design and presentation. The use of digital tools is visible in all the stages of her design and culminated in a spatially interesting solution. The final design is an integration of spatial expressions, materials and natural light. The user experience is well integrated to the store's design through a system of visual clues, thresholds and pointer. This attention to the user's experience is demonstrated in the initial storyboard sketches and consequently executed in her final animation.





### Jury comments:

Very nice use of animation feature and reflection in model. — ***Frank Elmer***

This animation is well-conceived and well-executed. The combination of speeds, spatial narrative, and visual effects enable the designer to create an ambience specific to the user experience. — ***Susan Melsop***

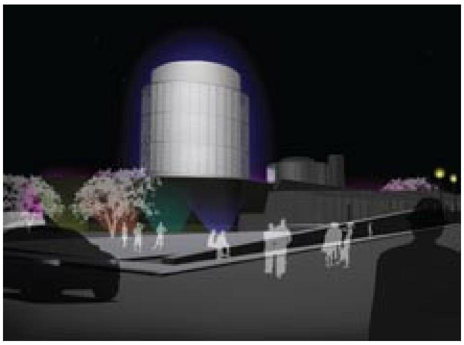
# Animation

## The Gran Velvet

by Andréanne Houde, Sandie Janelle, Simon Leclair, Valérie Ouellette, Ralph Potvin : Third Year of DEC

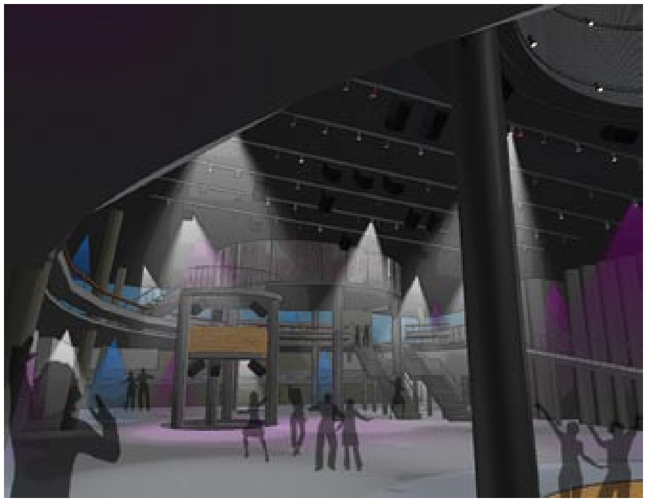
Advisor/Principal Investigator : Simon Goulet

Department of Interior Architecture
CÉGEP de Saint-Laurent, Québec, Canada



### Summary description of project:

This project is a descendent of the earlier Velvet bar of 1987 located in the centre of Barcelona. The Gran Velvet is a multi-use space mainly conceived as a discoteque, but which can easily host a live concert or a business conference without major internal restructuring.



### Reasons for the nomination:

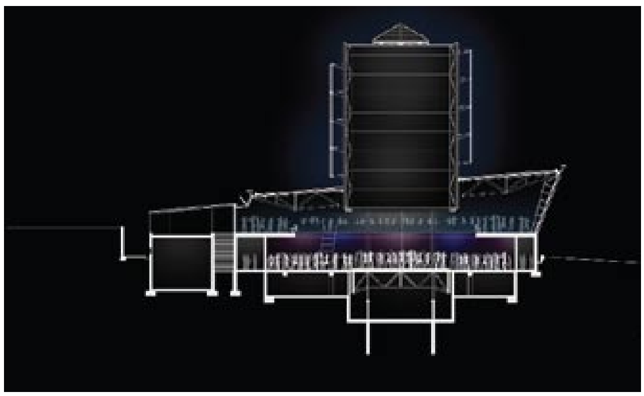
An impressive and expressive animation and a detailed 3D model.

### Jury comments:

This particular project was successful because animation was used as a medium to invoke feelings within the viewer, not simply to depict a rationalized scene. The special effects used here were appreciated and pushed the project beyond the typical fly-through. — ***Beth Blostein***

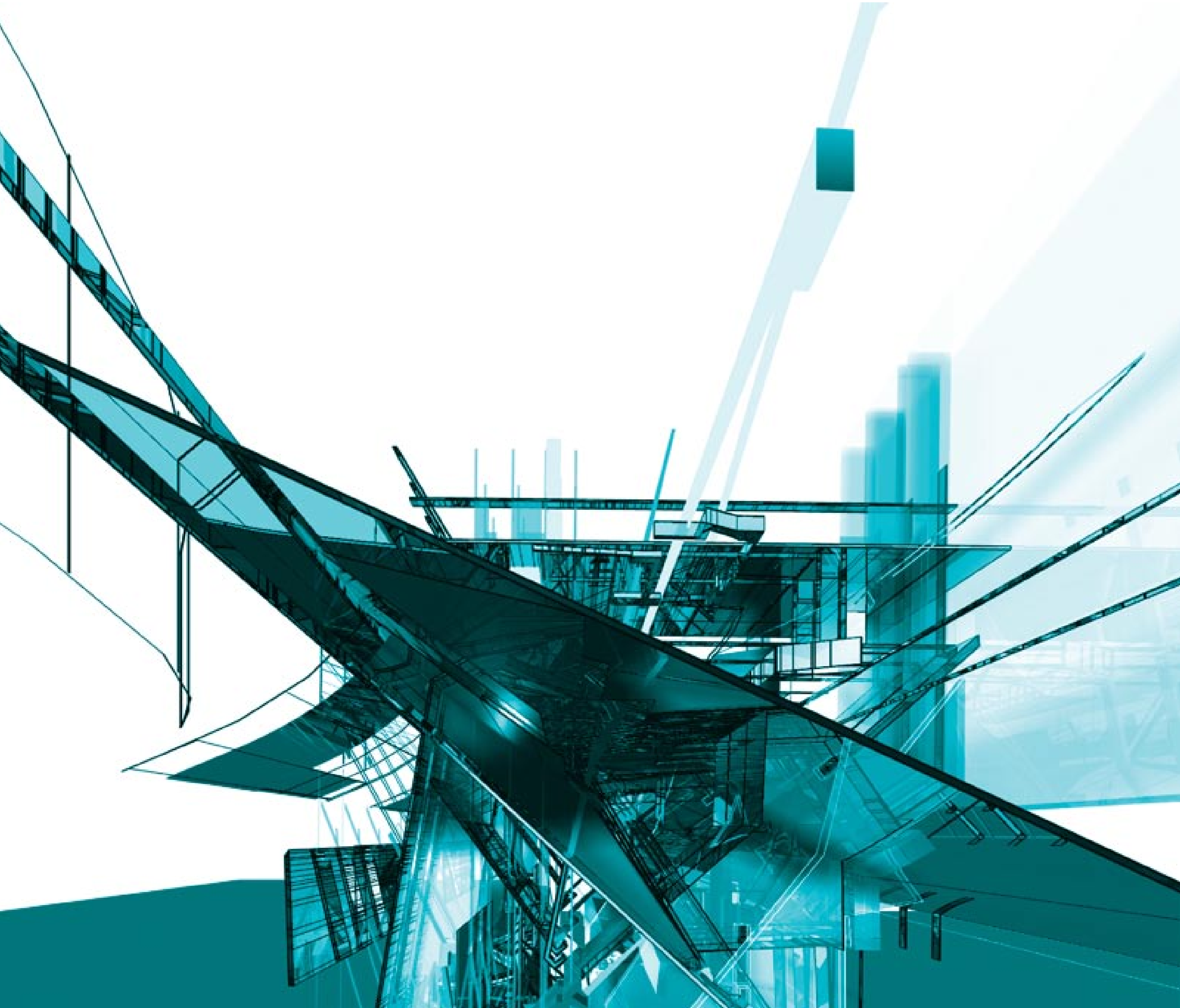
Great use of sound, camera moves and effects all working together to bring a sense of excitement and life to the animation that fit the function of the project perfectly. — ***Craig Beddow***

This is an animation that draws you in from the most general overview to the details so that you walk away with a solid understanding. It is very professionally done. — ***Robert Brainard***



# Digital Media and the Creative Process

## Paper Section



# Animate Topologies:
## Blending Media and Architecture

by Carl Lostritto and Michael A. Ambrose

The work discussed here is the outcome of a design studio and a complimentary digital media seminar taken simultaneously. Assistant Professor Michael Ambrose teaches both courses. The studio explores a process-oriented design research methodology that examines the design of an international headquarters of a radio network interested in the public service of global news collection and dissemination, made tangible through the vehicle of a new Public Radio International (PRI) facility in Washington, DC. The accompanying seminar promotes a similar open-ended research methodology focused on an exploration of formal and procedural meaning(s) discovered through the process of translating between media. A series of translations between film, drawing, form, space, surface, and animation are the control variables against which students expose, and then design topological constants, revealing and exploiting the nature of media. Both the studio and seminar are dependant upon, and draw inspiration from, the multitude of digital means by which modeling and animation within **form•Z** can enliven architecture and the design process with rigorous investigations into form, space, image and animation.

The two courses were interested in design explorations that challenged the student's preconceptions of digital media. Pedagogically, each exercise was developed to simultaneously conflate and decouple image and idea to explore varied means of representation within the digital design of architecture. The underlying question within both the studio and seminar course asked; is how we make directly related to what we make? Animation was used as a device in both courses to allow the students to realize that potential of change. The change of perspective over time, the change of geometry over time, and ultimately the change of context over time were all used as devices within a design studio to explore and expose the juxtaposition of precisely controlled and loosely found moments within a design process. In the design studio simple aspects of program study, site study, and conceptual study were imbued with procedural thinking derived from the animation of situational relationships within each study. In the digital media seminar students deconstructed a select scene from a film to better understand the fundamental structure developed by the cinematographer. In both cases it was a highly controlled set of criteria that allowed each system to have its organizational structure. The use of animation as a medium for design exploration offered the students the opportunity to "loosen" the organizational structures in a way that allowed them to discover overlaps and interpenetrations within the representation of intent and interpretation.

The means and methods of a design production within these courses challenge the students to understand the nature of each medium. Every time a model was made, every time an image was made, every time an animation was made, the student had to grapple with the process of that making as a way to challenge the architecture that was being made. The blending of media and architecture within this design research encouraged a broader understanding of animation, topology, and the animate potentials that exist within any design process.

### Media as Program and Method

Designing the headquarters for a world media corporation provides an opportunity for media—that is, design media—to play an active role in the expression of the nature of news media. In a cultural climate where the definition of media, the purpose of media, and the process of broadcasting media is contestable, much less static, the role of architecture carries a mandate to itself to become an animate condition. How then, can architecture express dynamism without being made entirely of moving parts, without being literally animate? The primary agenda of this studio project is to employ animation with a scientific rigor on the design process to investigate that proposition.


***Figure 1:*** Primary spatial-formal-program relationsips in PRI Headquarters, Studio – Carl Lostritto.

Extending upon the mandate to consider media as design product, media provides content—the complex socially weighted bias fueling the investigation, as well as process—the means by which content, parameters and restrictions can be translated, distorted and distilled through, by and in architectural design. The objective is to allow process to be revealed as traces or trails manifest as interactions of static form and space.

While the studio project, endeavored throughout one semester, sought to use **form•Z**'s animation toolset as a method of design, the parallel seminar explored the implications of animation broadly and conceptually. In the seminar, animate conditions (the movement of an improvisational dancer and cinemagraphic datum in a film) are manually documented as geometric information in the **form•Z** modeling environment. The digital craft afforded to the designer in this step is a direct result of the multitude of modeling tools available in **form•Z**.

As the original clarity of the source material is purposefully diminished, new meaning as well as new spatial and aesthetic effects can be discovered and subsequently harnessed. The recorded geometry, the static capture of motion over time and through shifting perception, has direct roots in the traditions of cubism and purism. Re-animating this geometry using tracked variables, many of which are associated with object or camera parameters in **form•Z**, demands these architectural conditions—frame, section and threshold—shift to become temporal conditions. These conditions emerge out of the process of animating. There exists here an important distinction from animation as a means for thorough capture of modeled conditions. In these cases the conditions are not revealed in an animation. Rather the animation is the condition. It is through this achievement that animation, by converse association, can be expressed in static architectural conditions in the studio project for the design of a building.

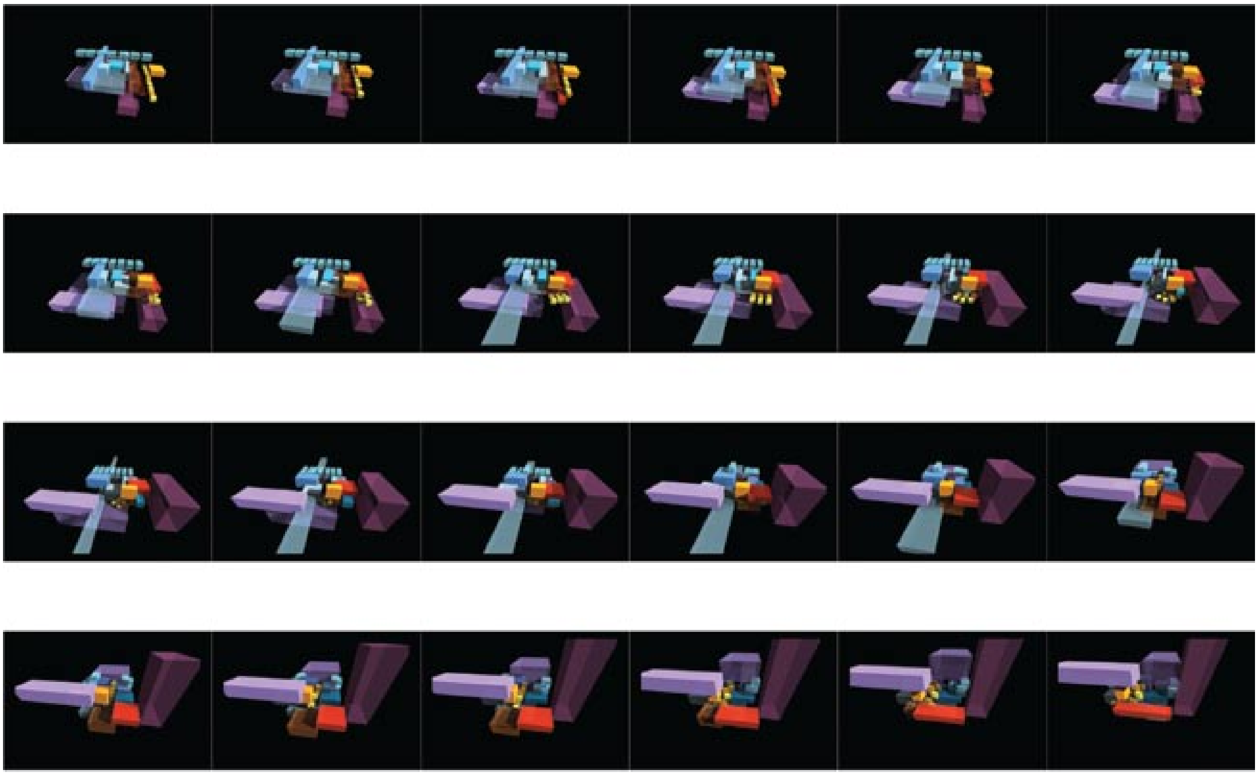


***Figure 2:*** Animation exploring programatic relationships for PRI Headquarters – Carl Lostritto.

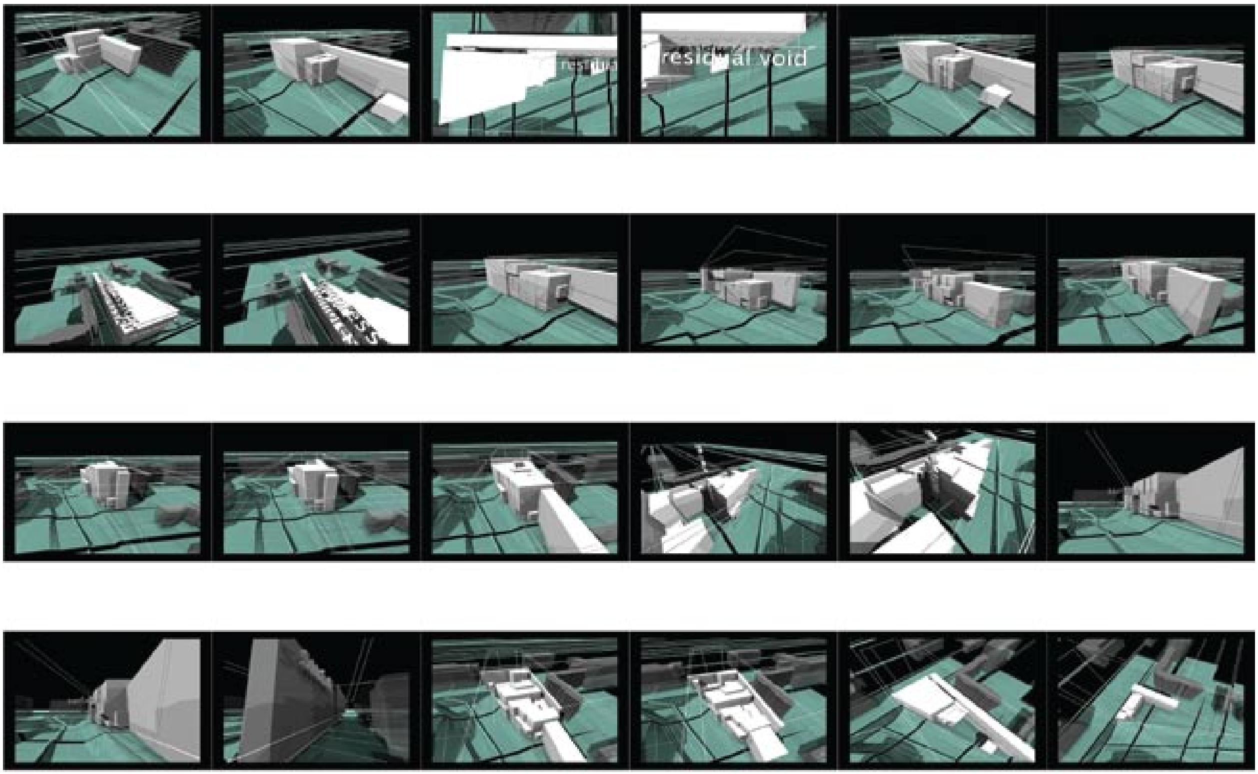


***Figure 3:*** Animation exploring programatic relationships for PRI Headquarters – Carl Lostritto.

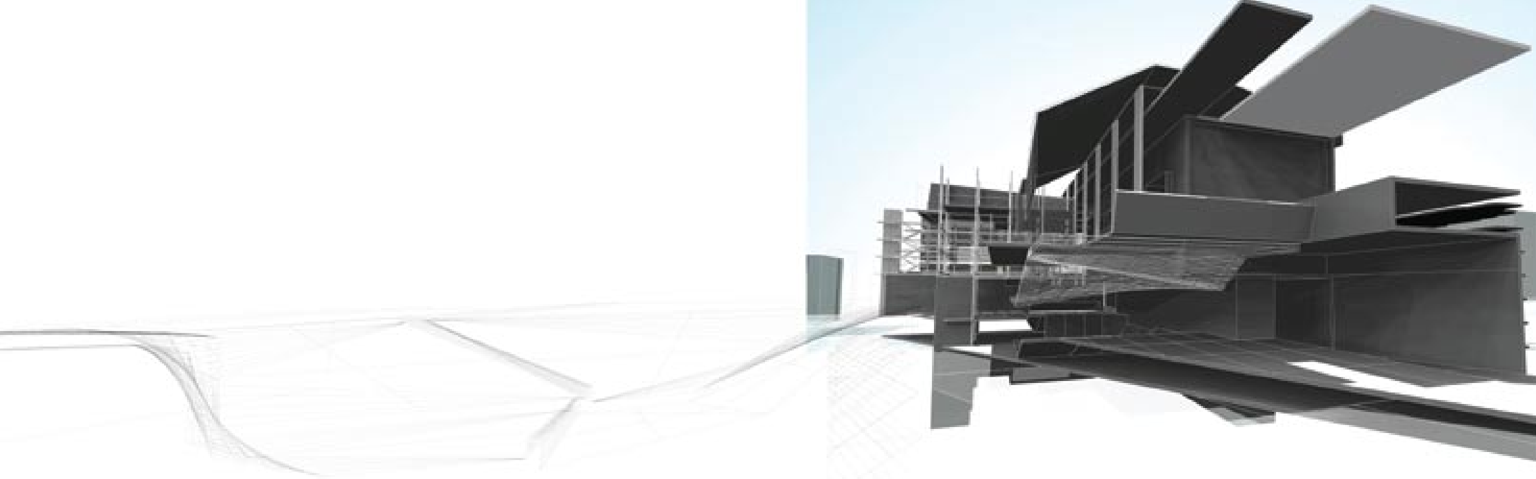
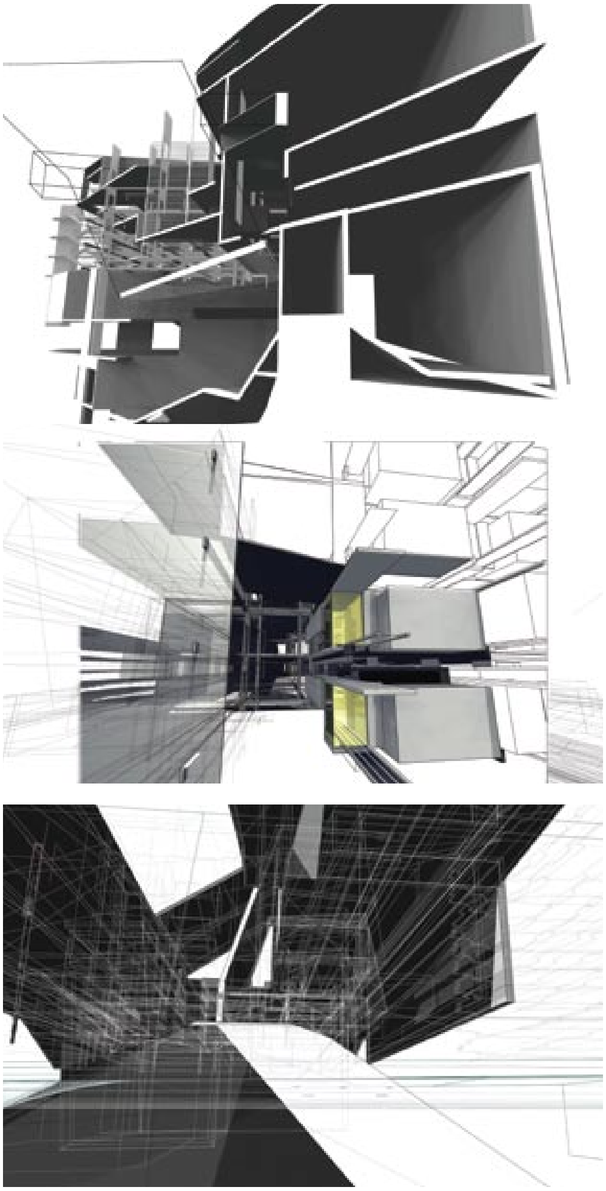


***Figure 4:*** Site posture of PRI Headquarters, Studio – Carl Lostritto.



***Figures 5a-c:*** Animate conditions in static proposal for PRI Headquarters, Studio – Carl Lostritto.

## Animation as Qualitative Design

This research seeks to distinguish between processes that produce a compelling outcome and processes that can be completely designed at all levels of implementation. Qualitative design, like qualitative scientific research, mandates a measurable outcome with a controlled and documented process. In an architectural context, this attitude promises extendibility as the focus is on cause-effect relationships rather than the achievement of a goal. This requires that the experimentation be open-ended; there must not be an assumed, projected or mandated outcome. There is no expectation that animate design will lead to a solution, rather that animation can be a means to translate parameters into relationships.

**form•Z**'s unique ability to model complex, detailed parametric architectural forms as well as the paralleled functionality allowing creation of non-linear animations is essential in infusing architecture with animation, and vise versa and more importantly, both simultaneously. This allows for the transition and overlap of virtual building model and a physical, abstract topological study. Animations created in **form•Z** can reveal nested, interactive, parametric relationships that would otherwise be obscured by the sometimes distractingly formal product. As a design medium, **form•Z** animation can be used to arrive at sets of solutions rather than a single solution. Animation is a medium by which to explore cause and effect relationships also, especially using the powerful Animation Editor palette.

## Animation toward Architecture

Figure 2 represents an investigation demonstrating the application of animation craft gleaned from the seminar. Here, speculation on the potential programmatic requirements for a National Public Radio Headquarters takes place through the language of animation. By modeling opposing extremes of proportion and adjacency and the automatically tweened instances represent plausible programmatic arrangement. Additional key frames were added to adjust and restrict overlap.

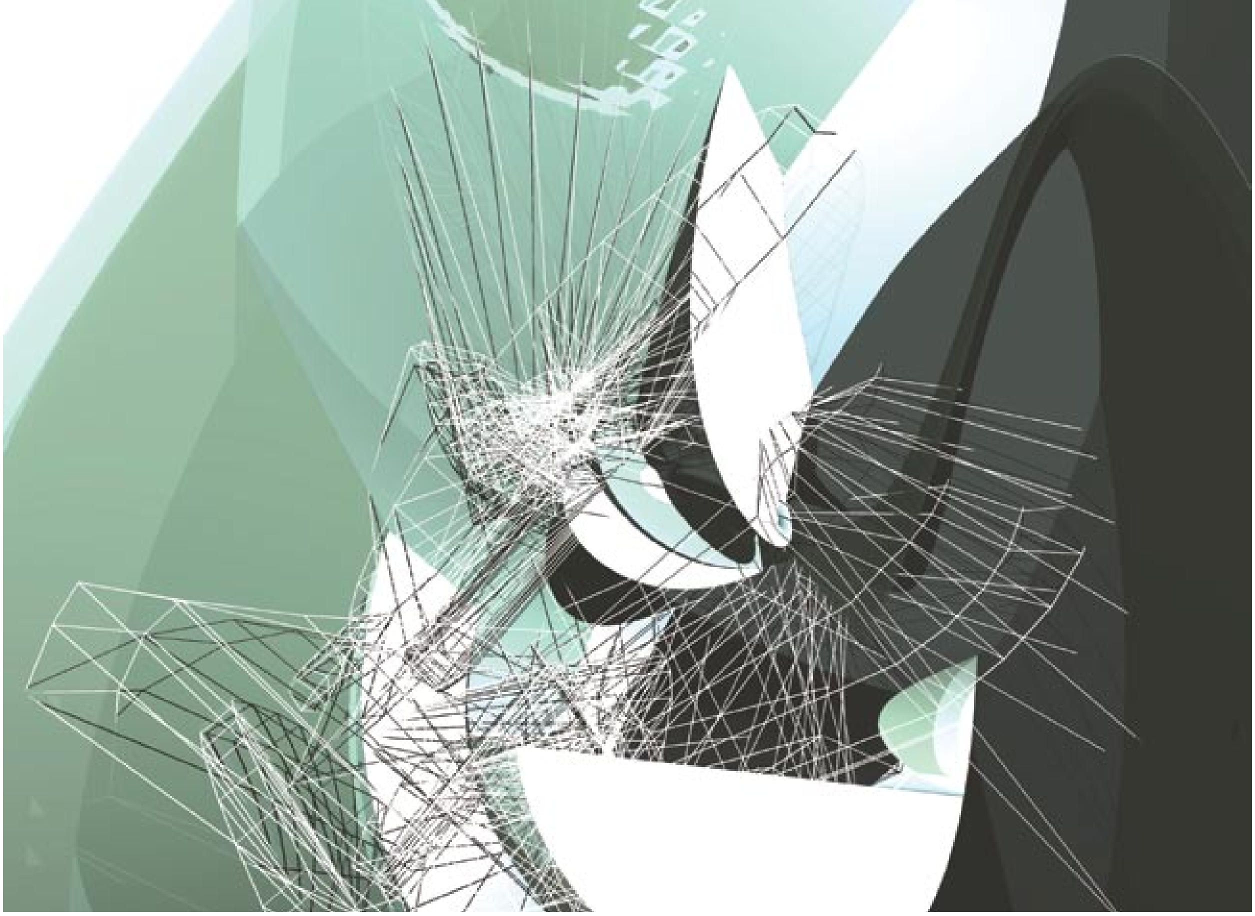


***Figure 6:*** Growth by exaggeration of motion, seminar – Carl Lostritto.

A single, static program diagram would not only be nearly impossible to achieve but would, in its nature, contribute to a failure of a recursive design strategy. Any "solution" to this complicated program of radio, library, exhibit and building administration must address evolving, nuanced parameters of overlap, adjacency, connection (physical as well as visual), sound isolation, levels of restricted access, frequency of use by various groups, varying density requirements over the course of a day/week/month/year, floor area, wall area, height, volume, light and air. A subtle adjustment to any one of these parameters might affect any or all of the others, potentially drastically.

This investigation makes use of the language of animation to speak about many potential programmatic as well as site (Figure 3) arrangements given aforementioned and additional parameters. While it is acknowledged that there may not be one singular working, perfect solution to this demanding program, it is possible to consider dozens of arrangements made plausible by relinquishing temporal control over some of the variables while monitoring and adjusting others. This type of analysis is made possible given the investigation of program, site and concept in isolation from one another.

In this analysis, geometry of programmatic elements is controlled by tweening. Extremes of proportion are keyframed. The resultant animation generated by the computer is made up of plausible volumes for that programmatic element at each frame while no frame shows the same volume. Take, for example, the programmatic element of the stacks within the library. At the one keyframe it is modeled as long and narrow as it could possibly be—it is at this point at its extreme limit of reasonability—any narrower and it would be non-functional as storage for media with enough room for people to move freely through. At the other keyframe it is modeled as tall and skinny as stacks could possibly exist. The computer generates the frames and the result is many volumes representing the stacks, each with working volumes. The middle frame generated in this case would be a cube.

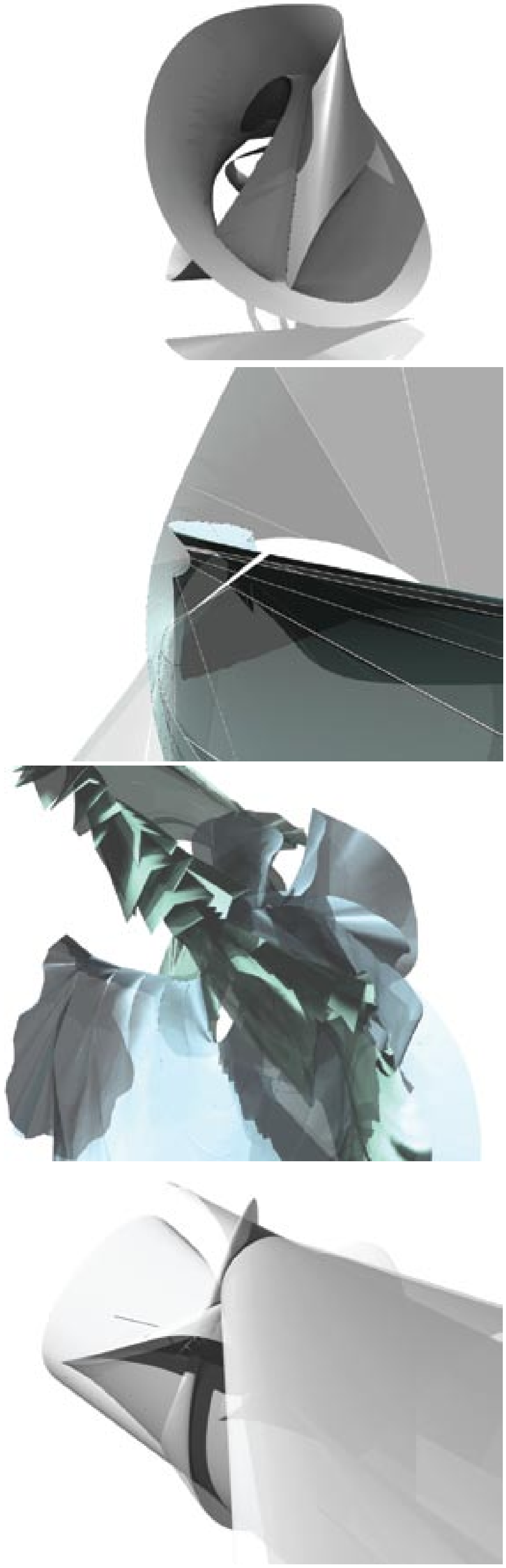
As tracked parameters begin to influence each other, the research potential extends exponentially. At this point a control variable becomes essential. Certain key elements of the program is cycled through extremes and offset slightly as to reduce the propensity for temporal overlap of resting states. Then, gradually, more keyframes are added within the animation as other parameters relating to position, orientation and proximity are introduced. Some elements tend to attract others because of a programmatic relationship. Elements must shift laterally or vertically to avoid unacceptable or undesirable overlap or adjacency. The ultimate, ten-second animation that results represents the many complicated resolutions to the program. Many layered, overlapping chains of events resonate over time as the individual elements all simultaneously cause and respond to programmatic forces. The result embodies interconnectedness of a complicated machine as well as the smooth, evolutionary aspects of an organism. This new tool-artifact in its complete state wholly discovered, its complexity too rich to be particularly foreseen although the program's initial, perceived complexity and simultaneity is manifest exactly.

The animation is then dissected. While each frame represents a valid complete solution to the set of problems, a search for "found frames of interest" begins. Reasonable success in terms of program is a given at each and every frame. Conditions, forms, spaces, patterns relationships based on emergent parameters or established barometers of success can be discovered. Each program instance can be looked at with a fresh eye. These discoveries lie not only in the image, the frame, but in the particular programmatic arrangement communicated by that frame. Evocative, poetic, serendipitous discoveries arise because of this layered approach—some conditions were not even visible in the original found frame of interest but only revealed by framing a different view at the same moment.

## Architecture in Animation

The structure of the studio has embedded a clear overall expectation: a coherent, singular, physical architectural proposal, with an open-ended process. The parallel seminar allows for a complimentary opportunity: using a rigorously controlled process without any pre-determined resultant outcome. Expectations and agendas dominated any artful whims however. Specifically these pertain to the clarity of process and intention as represented by the output. In an effort to explore meaning in media, source-material is recorded into tangible, literal bits of information within **form•Z** (often employing physical methods of measuring or marking has necessary to obtain precise, although not necessarily accurate, information). The source material is not irrelevant as two instances of events rooted in motion-space were carefully selected for their complexity and irregular order. However, the translation of content into data purposely strips the motion and space from meaning and context. The data become the control variable by which media can be exposed and meaningfully and directly presented.

A dominant theme of this research was that of growth as means of communicating patters embedded in data. **form•Z** tools were used, for example, to extend a NURBS surface (itself a direct manifestation of recorded information from a dancer) from the exterior continuous based on completely preexisting geometries. As exaggeration continues, so does an exponential change



a

b

c

d

***Figures 7a-d:*** Grown artifacts, Seminar – Carl Lostritto.

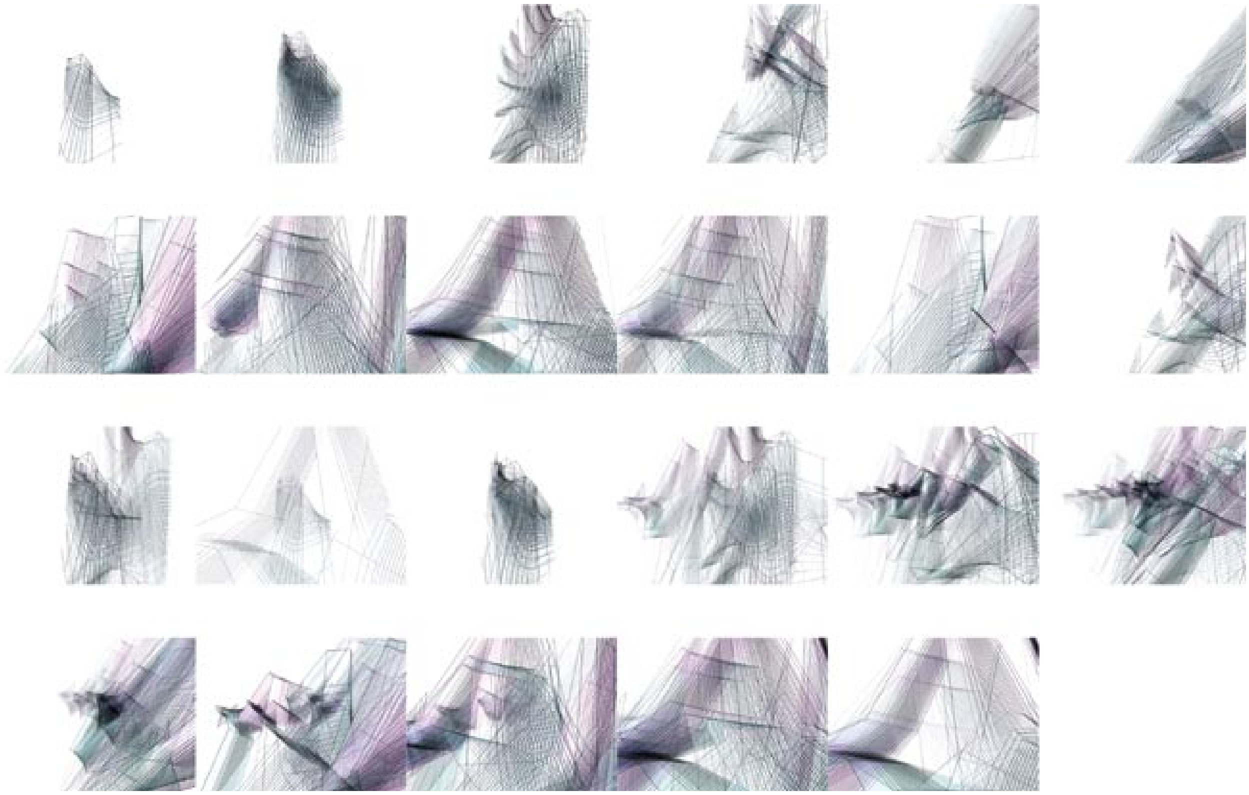


***Figure 8:*** Integrated Animation: linking geometric and temporal tracks, Seminar – Carl Lostritto.

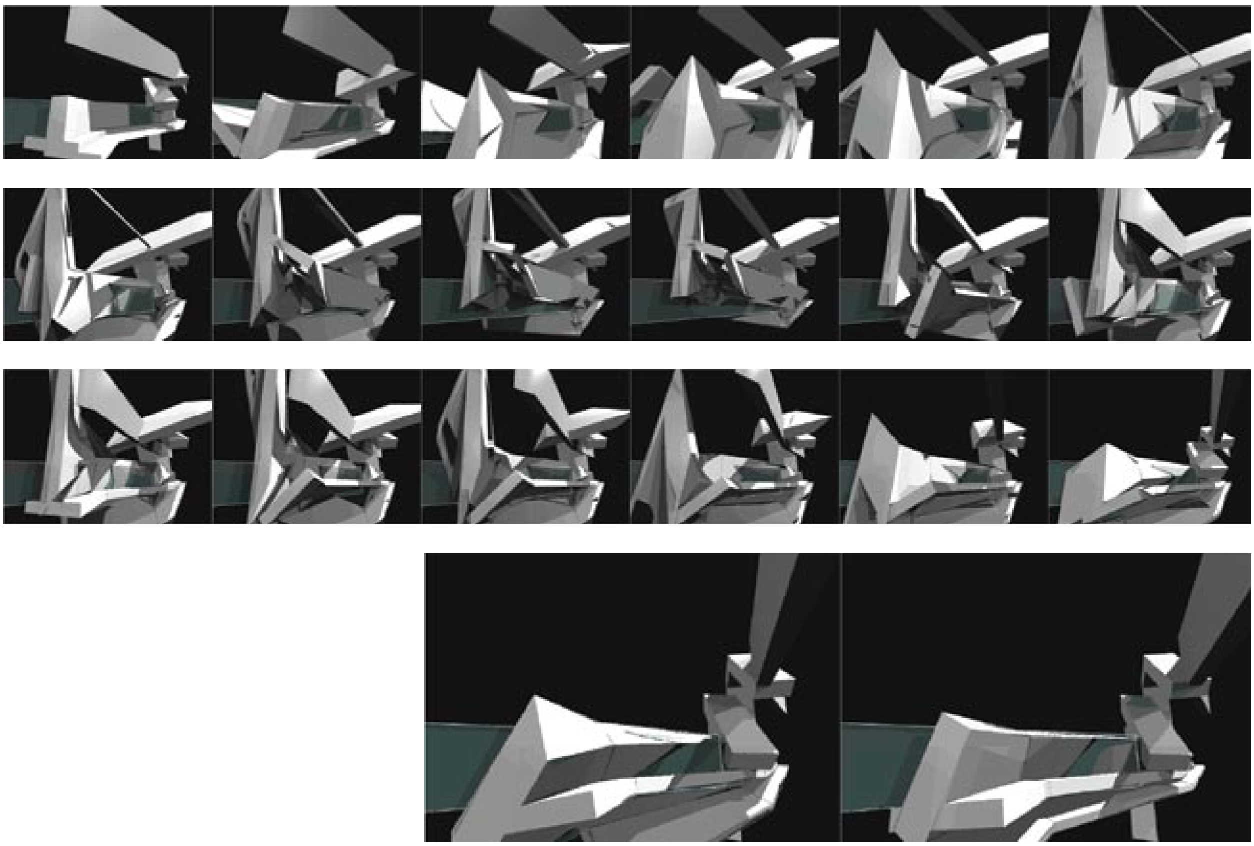


***Figure 9:*** Documenting Spatial Inversion, Studio – Carl Lostritto.

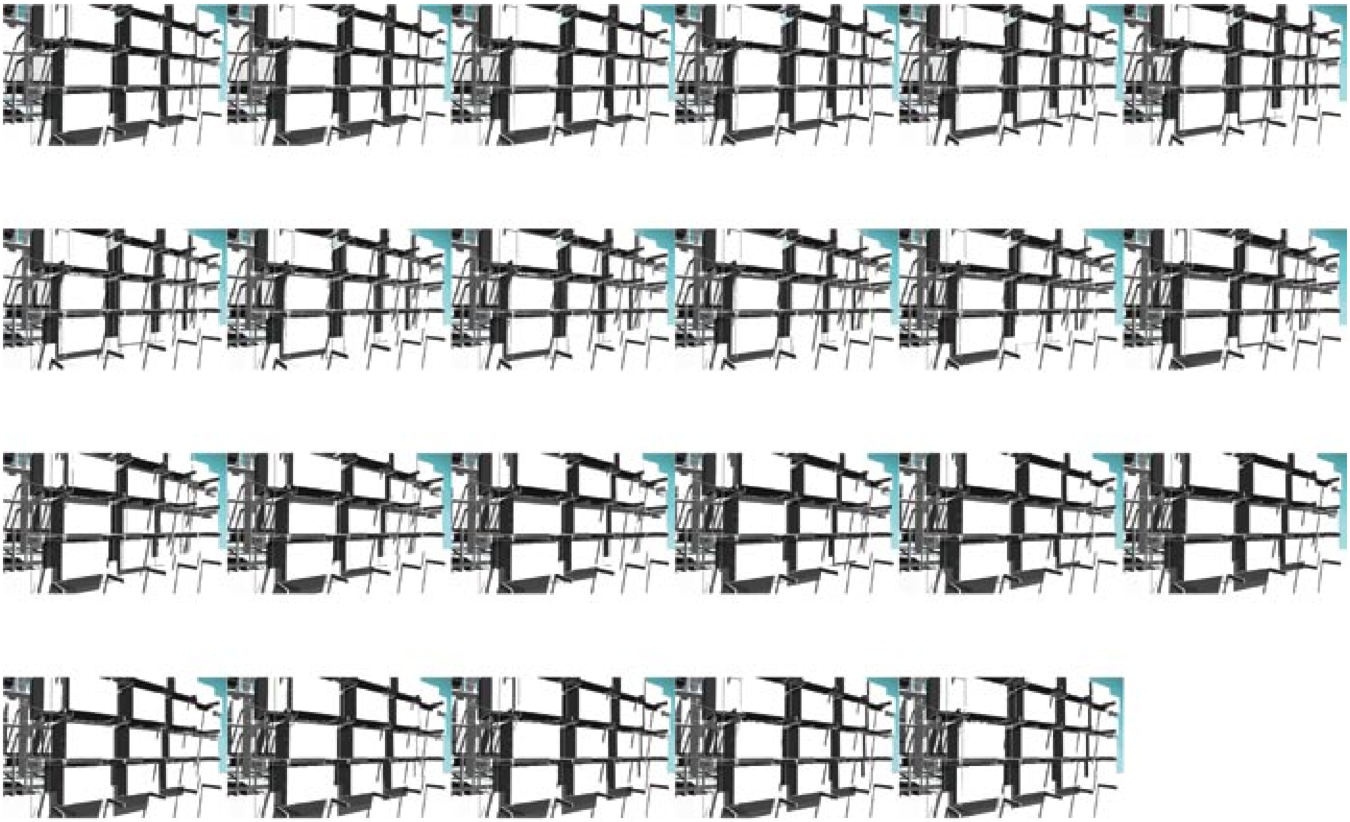


***Figure 10:*** Variable conditions in PRI Headquarters building proposal, Studio – Carl Lostritto.

in surface variation from slight and nearly imperceptible to extreme to the point of constantly inverting characteristics (Figure 7(c)). In the other experiment, growth manifests as the integration of largely linear data into surface and subsequently volume (Figure 8). **form•Z**'s generative toolset allowed for this translation to be controlled and meaningful. Since a number of **form•Z**'s generative functions have trackable parameters, these processes of transformation and distortion can be expressed through animation thus allowing for an expression-by-manipulation to occur.

When the linear information from the above mentioned experiment is applied by to the rate of change by manipulating the change graph (**form•Z**'s animation editor palette). This cyclical process is the temporal (as opposed to geometric) integration of the data, literally translating form into time then allowing that time to frame the adjustment of geometric parameters of the original linear condition. The resulting echo reveals as much about the spatial potential of motion graphics as the patterns embedded in the original, recorded data.

## Intersection of Design Process and Media Research

Processes began to overlap and merge in the later portion of the semester as animations from the seminar tended to evolve toward the physical and as the animate diagrams from the studio began themselves to be translated into static manifestations of the numerous temporal conditions. Figures 11(a) and (b) represent one of these critical in-between states. Some animate conditions from the seminar were recreated using architectural elements, as is demonstrated in Figure 10. The final architectural proposal (Figures 4 and 5), and the two constructed animations from the seminar (Figures 6 and 8) are as much varying in their medium as they are conceptually dependant.

Parametric design used to generate a single solution is only as valid as parameters used. An animate design process allows for the exploration of the nature of the impact of parameters in design. In addition to giving an exigency to eventual solutions, this process allows a meta-analysis of the meaning of all solutions and a control of design media. In a process in which computational design is integral, such a freedom is critical if intuition, discovery, and serendipity are allowed to remain as the a

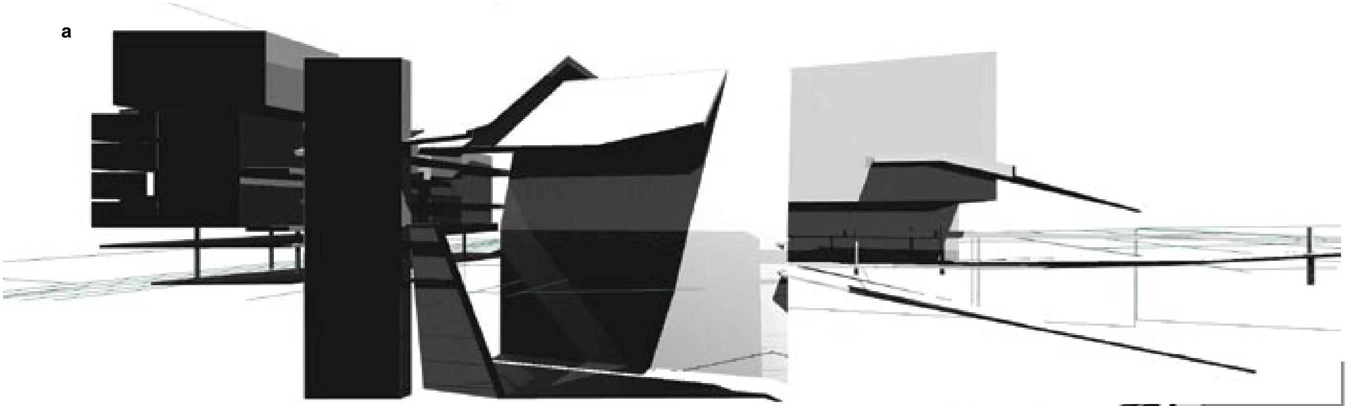
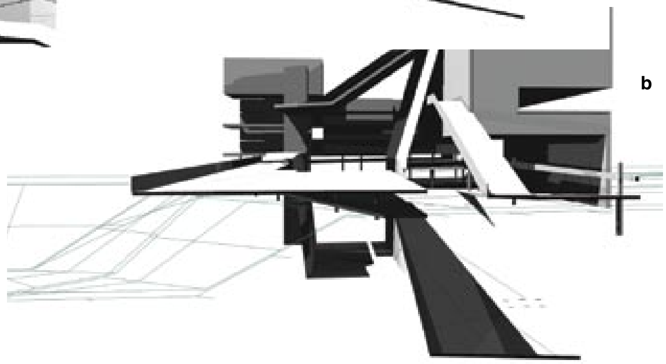


*Figure 11:* Early translations from animate condition to dimensioned spatial relationships, Studio – Carl Lostritto.

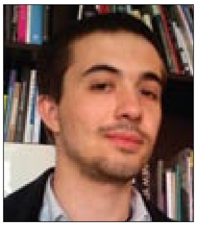
b



human element of design. A process-driven approach to design is only valid if the process itself is designed, rather than selected and executed. Animate design necessitates this output is never a direct architectural product.

## Conclusion

As animation capabilities begin to permeate the core of software, moving from where they once resided under the umbrella of virtual movable cameras, this medium becomes viable as a design environment. Animation in and as design can focus digital media toward a reflection of intent and agenda. Digital models become simultaneously physically inexact and acutely spatial. Modeling craft has always been an acutely intellectual proposition. Now animate architecture can merge process with product to enhance both.

**Carl Lostritto** is a lecturer at the University of Maryland School of Architecture, Planning and Preservation. He teaches an introductory digital media seminar and collaborates in the execution of courses at multiple levels including introductory undergraduate and graduate elective studios. With a methodology influenced by programming cultures, his research investigates animation and computation as mutually informative media. He was awarded the Alpha Rho Chi Medal, thesis prize and distinguished teaching assistant award upon his recent completion of a Master of Architecture Degree in 2008. In addition to teaching, Lostritto practices print, web and architectural design.

**Michael Ambrose** holds a Bachelor of Architecture degree from Temple University where he studied in Philadelphia and Rome on a Temple University Study Grant. He completed his graduate studies in Italy, working in Florence, earning a Master of Architecture degree from Syracuse University through their MArch history/theory program. He teaches architectural design studios at both the graduate and undergraduate levels and an advanced digital media seminar course focused on digital modeling and animation as well as digital design methods and processes. His areas of teaching and professional expertise reside in the design studio and digital media. His research and scholarship examine the value and impact of digital media and computational tools on architectural education and the design process. His teaching crosses many topical areas in architecture, from his digital design media courses, select topic graduate design studios, to his study abroad course titled Visual Analysis: The Building and the City conducted in Rome, Italy. Professionally, Ambrose works in collaboration with Caprioglio Associati of Mestre, Italy. Michael's current speculative design work focuses on issues of media and politics related to individual and collective identity in architecture and the city. Currently he is a Lilly Fellow at the Center for Teaching Excellence at the University of Maryland and design discipline coordinator for the Architecture Program at the University of Maryland.

# Deformable & Performative Space

**by George Katodrytis**

The proliferation of information technologies and their global trajectory have created new approaches to architectural design and production. Emergent practices of genetic algorithms, parametric design and topological modeling are now incorporating mimetic and behavior techniques as well as "performative" models. The generation of form follows a morphological process in which geometry coded with behavioral intelligence becomes responsive to fields of influence. The parametric model developed in such project utilizes scripts to trigger and define its deformation, developing a certain level of cognitive response within the geometry. This creates a new immersive experience, as porous and sponge-like spaces.

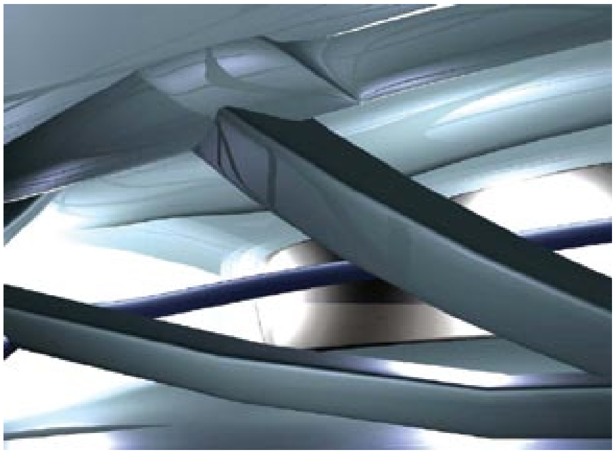
From its inception, digital media were considered as a discipline external to architecture. By definition the digital in architecture does not exist. Despite this, architecture would seem to be the medium that truly lends itself to digital exploration, both in physical and psychical structures. It manifests itself in the most ambiguous element—space—within which any projection moves freely and without fixed boundaries. What the new technology of the digital media has managed to achieve is to unravel the repressed condition and abandoned projects of 20$^{th}$ century architecture. In the space of digital media, the boundaries between organic and inorganic are blurred; the body itself, invaded and reshaped by technology, in turn invades, permeates the space outside, even as this space takes on dimensions that themselves confuse the inner and the outer, visually and physically. Digital technology attempts to reincarnate this "mythological configurations", repressed by modernism, with the monstrous and anamorphic merging of animal and house as an oneiric machine, a machine for dreaming. After all, there is no architecture without dream, myth and fantasy.

***Figure 1:*** Project by author.

***Figure 2:*** The act of mimesis.

When the fusion between the organic and the inorganic takes form a mimesis takes place. Digital technology mimicking architectural space, so much that it becomes believable so that organic and inorganic matter, animate and inanimate forms becoming indistinguishable. Form becomes malleable and changeable and interactive, as though it imitates its occupants. The body fuses with its surroundings. Through physical and bodily acts of mimesis (i.e. the chameleon blending in with its environment), the distinction between the self and other becomes porous and flexible. Rather than dominating nature, mimesis as mimicry opens up a tactile experience of the world in which the Cartesian coordinates of subject and object are not firm, but rather malleable.

Any discussion of mimesis originates in a biological context in which mimicry (a mediator between life and death) is a zoological predecessor to mimesis. Animals are seen as genealogically perfecting mimicry (adaptation to their surroundings with the intent to deceive or delude their pursuer) as a means of survival. Survival, the attempt to guarantee life, is thus dependant upon the identification

***Figures 3, 4, and 5:*** Project by author.

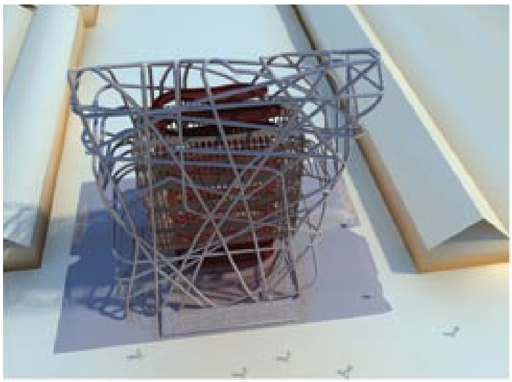
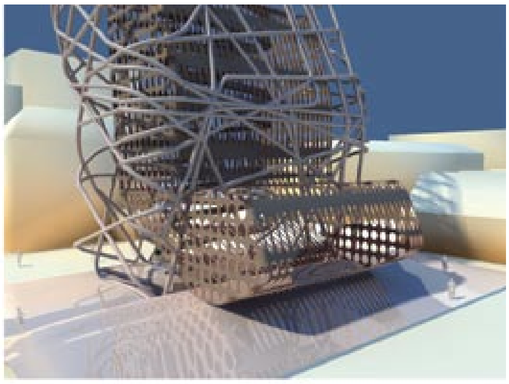
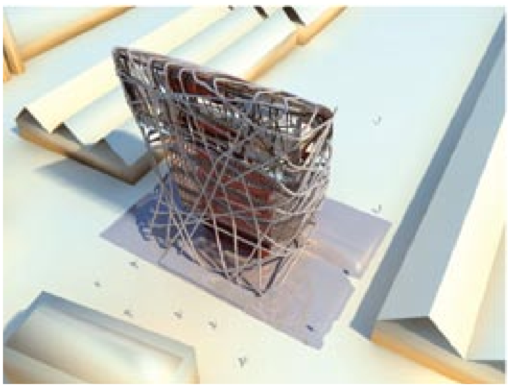
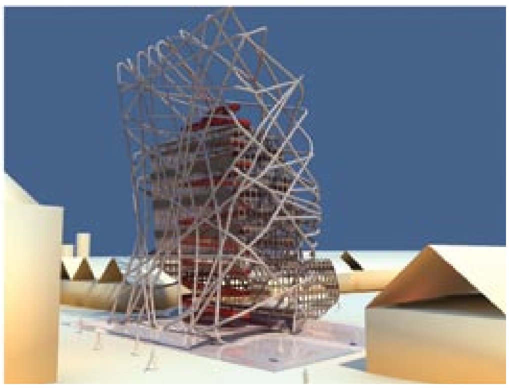





***Figure 6:*** Project by author.

with something external. The manner in which mimesis is viewed, as a correlative behavior in which a subject actively engages in "making oneself similar to another", dissociates it from its definition as merely imitation.

To understand the meaning of mimesis we must recognize its origin in the process of modeling, of "making a copy of." In essence it refers to an interpretative process that relates not just to the creation of a model, but also to the engagement with that model. In mimesis, imagination is at work and serves to reconcile the subject with the object. This imagination operates at the level of fantasy, which mediates between the unconscious and the conscious, dream and reality.

Architecture along with the other visual arts can therefore be viewed as a potential reservoir for the operation of mimesis. In the very design of buildings the architect may articulate the relational correspondence with the world that is embodied in the concept of mimesis. These forms may be interpreted in a similar fashion by those who experience the building, in that the mechanism by which human beings begin to feel at home in the built environment can also be seen as a mimetic one.

The new digital approach to architectural design is based on computational concepts such as topological space, isomorphic surfaces, parametric design, and genetic algorithms. Architecture is recasting itself, becoming—in part—an experimental investigation of topological geometries. Digital media is employed not as a representational tool for visualization, but as a generative tool for the derivation of form and its transformation—the digital morphogenesis. It explores the possibilities of the "finding form", that the emergence of various digitally based generative techniques seem to bring about. Topological space opens up a universe where essentially curvilinear forms are not stable but may undergo variations, giving rise to new possibilities, i.e., the emergent form.

The computer simulation of evolutionary processes is already a well-established technique for the study of biological dynamics. This is based on mimesis and on evolutionary simulations to breed new forms rather than specifically design them. This algorithm searches needs to be sufficiently rich for the evolutionary results to be truly surprising and for exploration of space rich enough so that all the possibilities cannot be considered in advance. This unpredictability of the new, like an outcome of a design process, makes genetic algorithms useful visualization tools.

The employment of generic design strategies develops autonomous architectural concepts, which replace the traditional hierarchical processes of production known as "cause and effect," with generative systems of reciprocal and interdependent relationships: new organizational patterns and weavings and performative morphologies that can modulate and differentiate the environment. In doing so, we have suggested alternative forms of habitation: interlacing and networking lines into complex configurations. This morphogenetic process includes pattern, repetition and permutations.

Current experimental work focuses on issues of organizational complexity (layering, interpenetration of domains), the production of diversity (iteration vs. repetition), the spatial recognition of fuzzy social logics (smooth vs. striated space), and ways of coping with uncertainty (virtuality vs. actuality), and engagement with new production technologies.

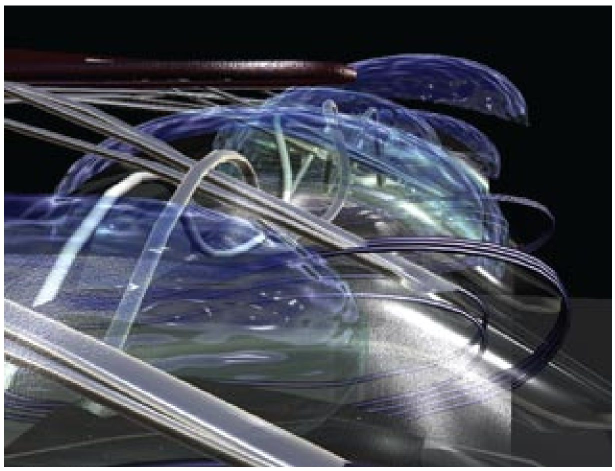


***Figure 7:*** Project by author.

It is time to move from theorizing forms to structuring them. The new apace is the outcome of the synthesis between space-oriented and structure-oriented models, developing self-regulatory patterns in which potentialities are regulated by the developing structure itself. These techniques result in the simulation of evolutionary and environment based three-dimensional structures and surfaces. This results in high-speed generation of formal systems. The new research in architecture involves structural morphology, generative modeling of architectural form. The design process now has turned from mimetic into one of growth, based on given data (directions or restrictions). Algorithmic structure represents abstract patterns that are not necessarily associated with experience or perception. Algorithmic processes result from events that are often neither observable nor predictable and seem to be highly intuitive. In this sense, algorithmic processes become a vehicle for exploration that extends beyond the limits of perception.

One example of fusing surface and structure is the production of weaves, a tool that generates woven meshes. This script uses a grammar capable of describing and generating woven strands to a user-defined surface. It allows the user to explore patterns that can be either used to generate the building morphology or be applied to a shape established by other parameters.

The architectural process is now evolutionary, intuitive and performative.

***Figure 8:*** Project by author.

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# Outside THE Blocks

Figure 1: Documentation of the existing Pittsburgh Corning glass block product.

## by Keith Labutta and Drew Weinheimer

Presented with the course objective of rethinking and eventually fabricating a new glass block for Pittsburgh Corning Glass Block Corporation, our mindset was to thoroughly investigate all states of the existing product, from manufacturing to marketing and finally installation. It was from this process that we hoped to design a product that could reinvigorate the use of glass block within contemporary architecture.

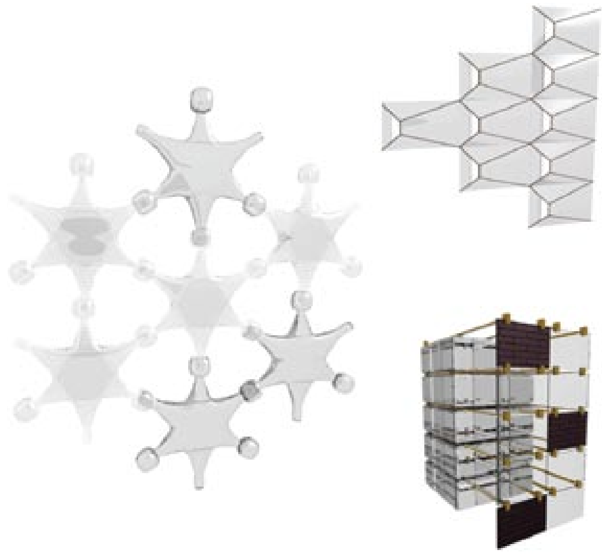


*Figure 2:* Preliminary schematic designs not based on final fabricated model.

Before we were able to take any steps toward design, we sought to answer the question, “What is glass block?” After researching the product and the manufacturing process, we began to understand that glass block was not only a unit of an installed system, but it was also a product of a highly efficient manufacturing system. While the product added value through efficiency, both the modularity and efficiency of these systems limited the visual and physical flexibility of glass block. This understanding informed us that our design would need to be driven by existing construction and manufacturing systems, while discovering new possibilities for the designer and product.

Conceptually, we set out to create a design that obscured the visual modularity, yet understood the systematic presence of the existing glass block. We also set out to maximize design changes by establishing simple design guidelines. The existing system of glass block led to our thoughts concerning profile conditions, orientation, and density. It was thought this would allow strengths to lie in design and aggregation. The following ideas surfaced from these guidelines:

*Figure 3:* Schematic design with nine identical interlocking modules using developed design concept.

**Variable Orientation** – The form within a modular grid can be rotated to give different appearances while maintaining continuity of the overall form. Each unit can be rotated 270, 180, 90, or zero degrees. The units also have a depth so that a front facing block will protrude from the wall while a rear facing block will recess into the wall.

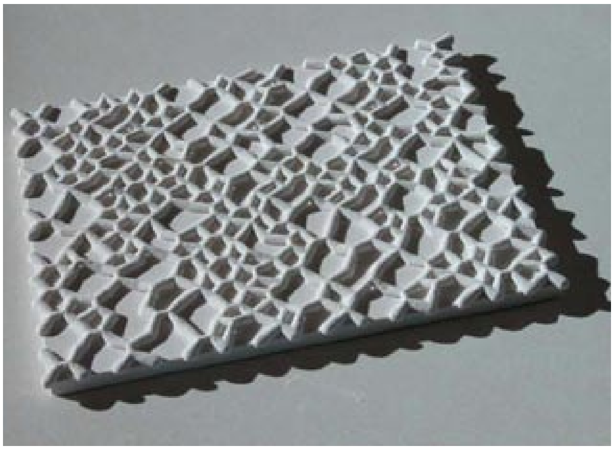


***Figure 4:*** 3D print of two different interlocking geometries, placed randomly.

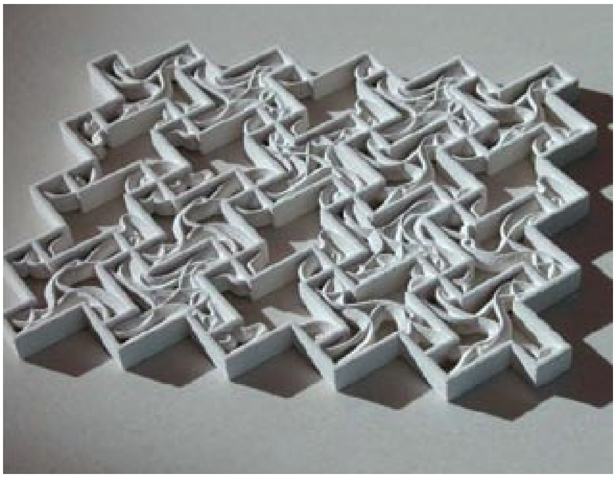


***Figure 6:*** 3D print of inset interlocking geometry.

**Variable Density** – Each unit has a different volume to fill the grid. There are three different units based upon the 8" square and has a high density. One is 16" by 8" and has a medium density. The last unit resolves variable end conditions, and merely caps other units entering into its boundaries, giving the lowest density.

**Consistent Coincidental Profile Pattern** – Within the boundary of each form, there are no real parameters to design. However, flow must be maintained when all the forms are aggregated so each edge condition must be consistent. The form flows into a forgiving central point from which it can flow tangentially into any other condition within the kit of parts.

Our selection of **form•Z** for design software fit seamlessly into understanding and visualizing these schemes.

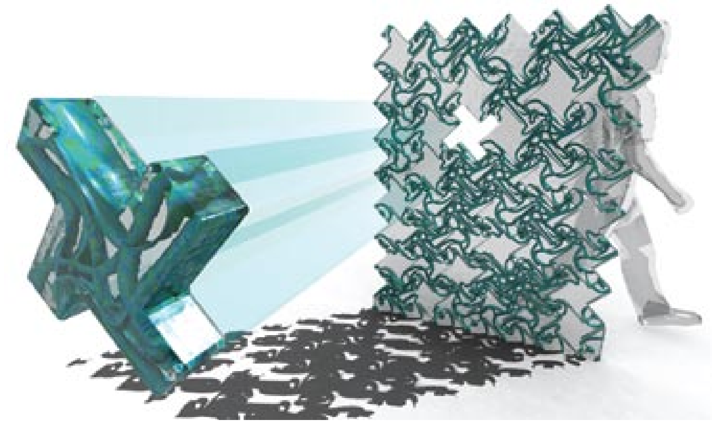


***Figure 5:*** Exploration of wall mockup with design pattern inset within a simplified glass block form.

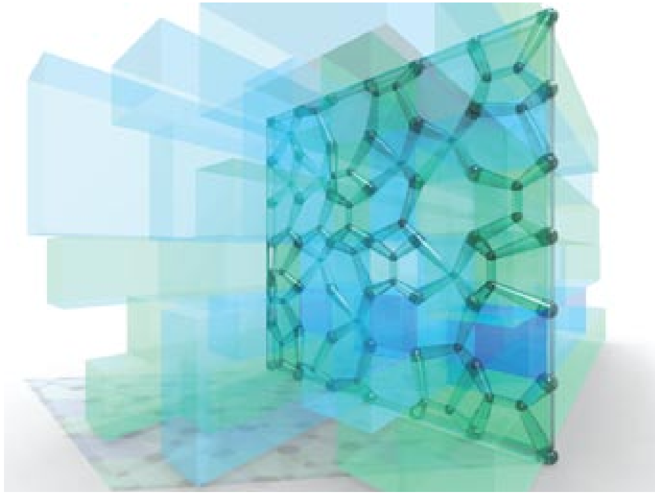


***Figure 7:*** Visualization of three modules within one wall configuration.

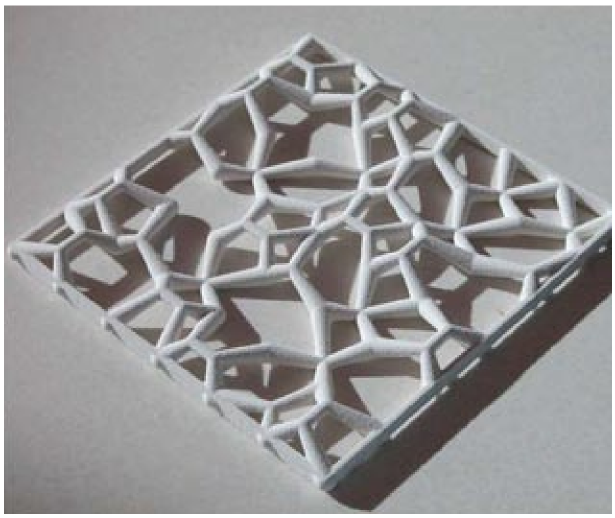


***Figure 8:*** 3D print of visualization from previous image.

***Figure 9:*** Understanding mold making utilizing two small units and one large.

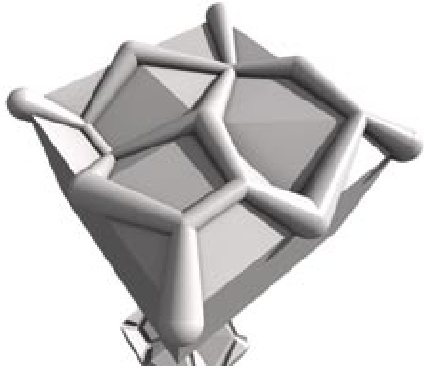


***Figure 10:*** Modeling the positive form.

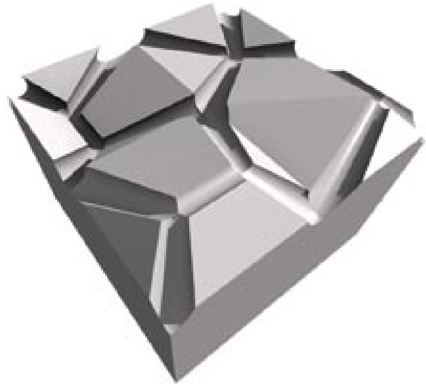


***Figure 11:*** Boolean difference to create the fabrication mold.

While our initial design responses utilized both **form•Z** and the more traditional pen and paper, fabrication favored the digital realm. Our developing understanding of workflow between machining and software played critical roles in the design. We were discovering that **form•Z** was capable of creating files that were formatted for 3D Zcorp printing as well as CNC milling. From this point forward, we worked entirely in **form•Z** to develop everything from conceptual images to presentation images to molds for milling. As the design was set, importance was placed upon dimensional accuracy of **form•Z** models to produce the casting molds for the new glass block.

Molds were first fabricated out of high-density foam to ensure the **form•Z** designed molds were tooled correctly using Visual Mill, milling software used for tool and path selection. With our first routed molds in hand, we were confident that the milling stock that was created from layering poplar would have a similar success. The six-piece mold was cut from the 3 axis router, sanded, and shellacked to promote the release of the cast. Ultimately, this process led to the successful fabrication of four prototype urethane resin blocks.

Although the design objective was to produce a glass block wall system, perhaps this design lends itself more to plastics or metals. Glass would have a tendency to fracture at weak locations and also would not be suited for a butt-jointed socket. Synthetic materials allow more flexibility and are better suited for this type of design application.

While only one final version of glass block was fabricated, the system is very flexible. Countless versions of walls can be generated under the same design principles. The ultimate strength of the designs rests within the flexibility of form and application.

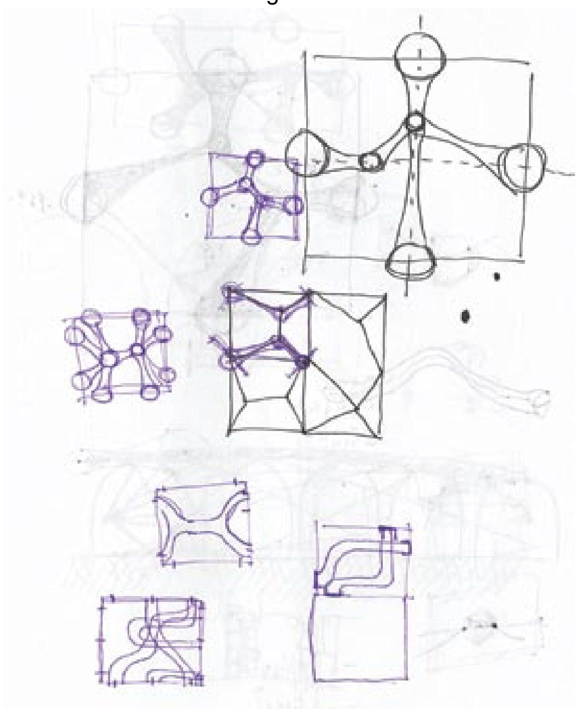


***Figure 12:*** Sketch to change difficult corner connection to midpoint of module.

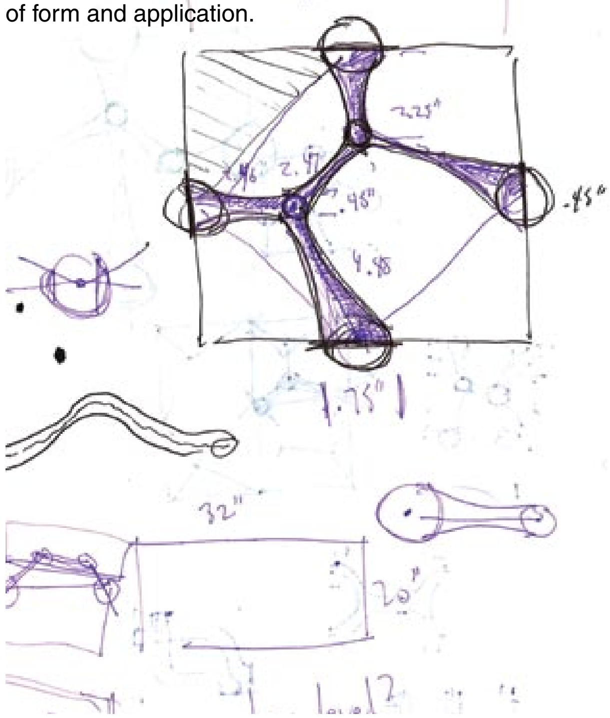


***Figure 13:*** Sketch to determine final dimensions for fabricated product.

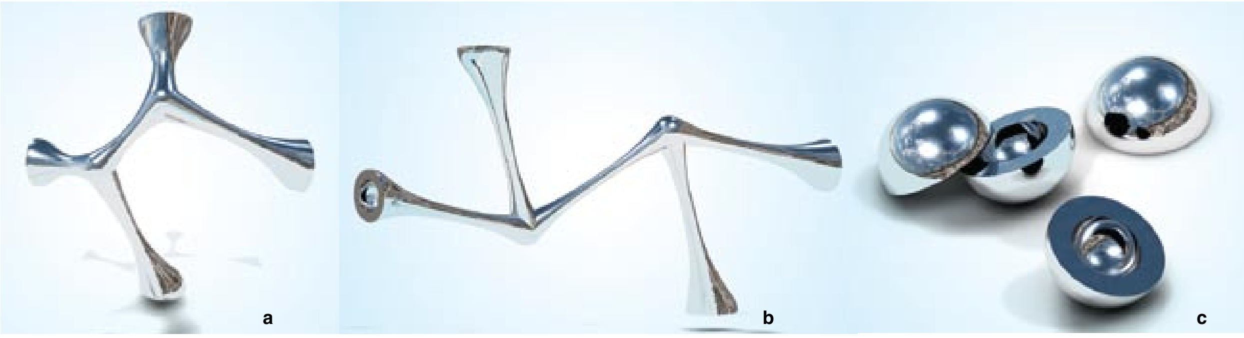



***Figure 14:*** Final designs: **(a)** unit of new fabricated block system; **(b)** double unit for new fabricated block system; and **(c)** cap condition unit.

While we believe that we have created a successful new building product and developed it both digitally and physically, it is a new struggle to reach the market. Pittsburgh Corning was fascinated by the many designs produced by the students of our class. They were also eager to support the development of the designs through the various modeling tools, rapid prototyping and CNC milling most explicitly. However, there was a certain understandable hesitation encountered when we questioned the actual production of our product. Ultimately, the manufacturing process can be driven by forces outside of good design. There must be a foreseeable profit for the company. In retooling machines for the fabrication of custom blocks, a significant overhead must be used to mill aluminum casts, reconfigure pouring and drying procedures, and develop new packaging. Many custom designs are simply not able to offset the necessary production costs through sales to make the product manufacturable. While Pittsburgh Corning may have loved the insight provided to them as to how to reinvent their product, the manufacturing process may be better suited for mass production.

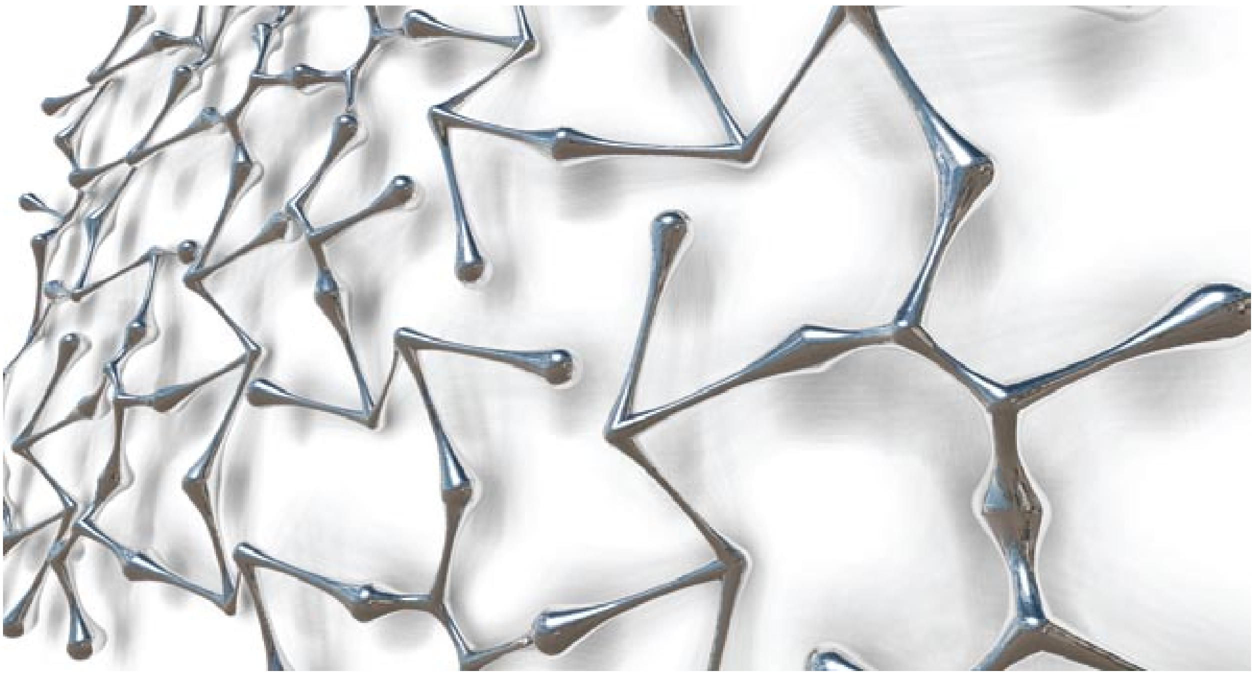


***Figure 15:*** Final design mockup utilizing all three units of the new design.

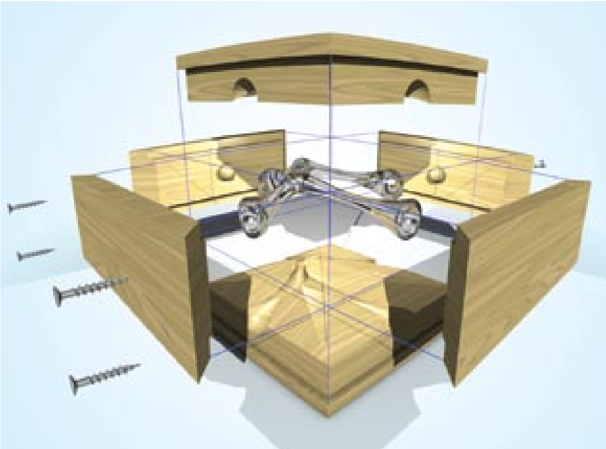


***Figure 16:*** Exploded axonometric of mold assembly and final product.

***Figure 18:*** Final machined poplar mold with lacquer finish for mold removal.

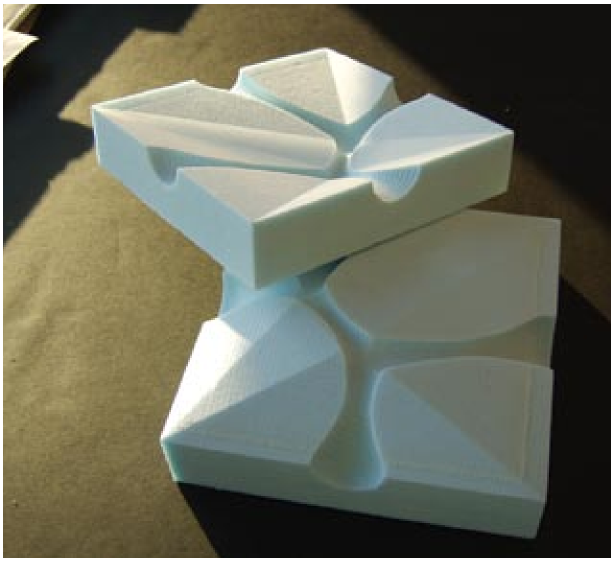
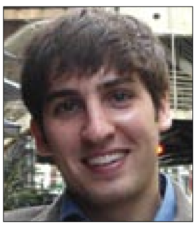
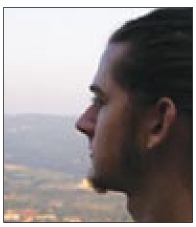


***Figure 17:*** Trial fabrication of mold in high density foam.

***Figure 19:*** Final casting is opened after curing process.



**Keith Labutta** holds a Bachelor of Architecture degree (2008) from the Pennsylvania State University. He currently resides in Chicago, where he has contributed to a variety of residential and commercial projects since graduation. His interests include utilizing and developing emergent digital fabrication techniques in practice, as well as expanding upon undergraduate research pertaining to the role and ability of the public building to foster beneficial societal change. In collaboration with Drew Weinheimer, they were the recipients of the 2008 **form•Z** Joint Study Award of Distinction in Fabrication.



**Drew Weinheimer** received his Bachelor of Architecture degree from the Pennsylvania State University in 2008. After graduation, he worked on several large commercial, residential, educational, and hospitality projects in Dubai, UAE while working at Burt Hill's International Studio. He is currently working on several higher education projects in Pennsylvania while working at Celli-Flynn Brennan in Pittsburgh. His interests include emergent digital design technology, phenomenology, and the human perception of architecture, design through exploration, and technical research.

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# Typologies:

## Architectural Associations, Dynamic Processes, Digital Tectonics

**by Thomas Rusher**

The notion of existing historical typologies in architecture from component and assemblies to program and space, and how designers approach this knowledge base relative to nascent associations with emerging technologies calls into question techniques, relationships, and preconceptions of historical design canons. In addition, how digital techniques might enhance or redefine existing analog design methods is a contemporary topic and interst of mine. Algorithmic Operatives, Scripted Surfaces, Digital Fabrication, and Animated Conveyance Techniques are just a few emerging Digital Design Typologies that I research. We are in the midst of a developmental technological era of rapidly changing digital devices, fabrication/proto-typing equipment, and experiential virtual spaces.

How can digital media be used in both an inventive and generative fashion without complete loss of authorship and humanity to the computer? What is the architect's role both in and out of digital space? What are the approaches to digital media and analog links to architectural principles of design? In all three of my Digital Design classes, these topics are studied and explored through varying investigations depending on the level of the student. Investigations of historical known types, running empirical studies to understand digital constructs, developing of dynamic digital operatives as a generative device, and, (in my advanced digital design classes), examining of animated temporal organizational structures are researched as a means of establishing "generative digital techniques." The development of rhythmic tectonic structures, through dynamic means while creating analogous conceptual relationships to known architectural types and cross pollinating with allied design fields is leveraged as an initial point of departure. This runs in tandem with my own independent theoretical studies related to algorithmic structures, component development through dynamic means, and frozen animate conditions as the establishment of digital typologies (Figure 1). While a student at Columbia University in the mid-1990s in Greg Lynn's Design Studio, I began a line

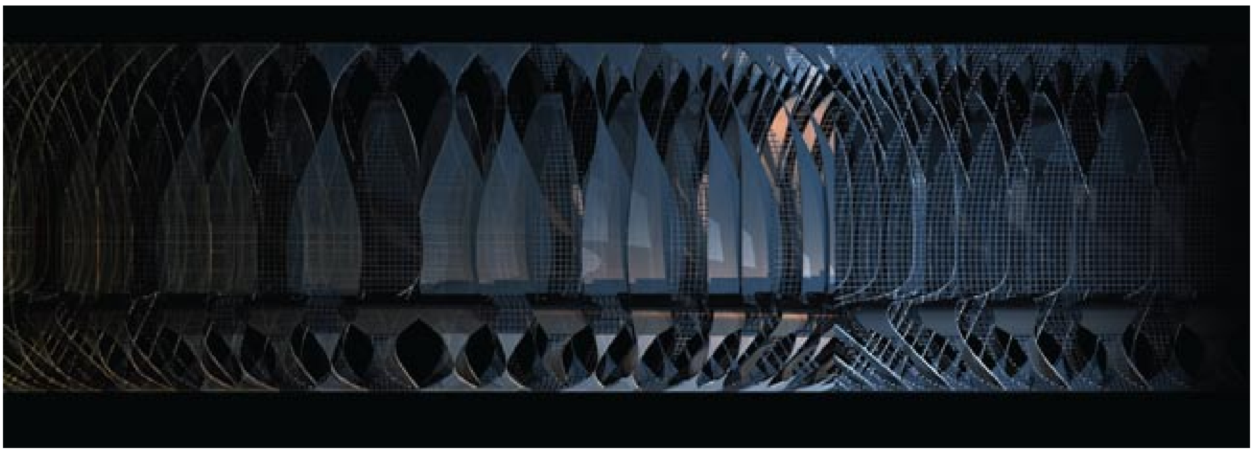


***Figure 1:*** Tom Rusher: Dynamic Algorithmic Assembly Process.

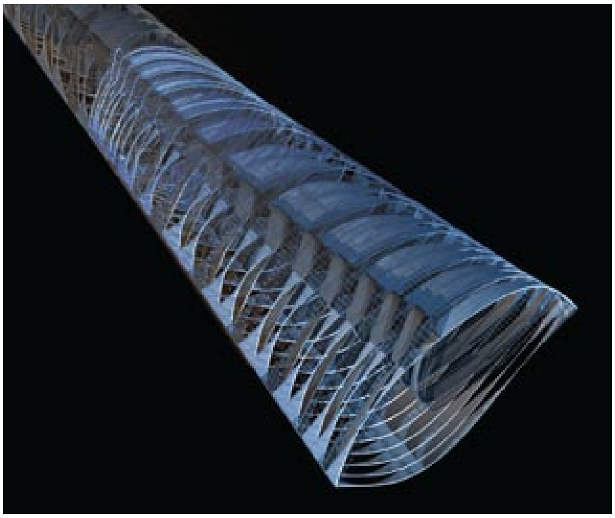


***Figure 2:*** Tom Rusher: Variable Spatial Porosity/Digital Tectonic.

of study that incorporated animation as an analytical and generative apparatus. "Through experimentation with non-architectural regimens, architects may discover how to engage time and motion in design."[1]

My interests lay in the immersion of topics that range from synthetic structures, digital skins, material amalgamation, digital/analog tectonics, stochastic structures, digital relationships of component to assembly, links to allied design disciplines, atmospheres and environments, material studies, cause/effect spatial relationships to program and finally, the cinematic aspect of dynamic performative communication using sound and animation in the conveyance of concepts (Figure 2). In order to understand the development of these Emergent Digital Design Typologies and how they may inform, add value to, and/or redefine physical architectural types, an understanding of the psychology of known typologies and how we tend to recognize, embrace, and intuitively understand "known" categories need to be investigated. Digital Constructs both environmentally and behaviorally need to be understood in order to create conceptual bridges to the physical. Finally, looking to allied design fields that have had much more experience with technology to generate designs such as the aerospace and the car industry are of great analytical and conceptual value to the architectural profession in understanding how digital tools may inform designs.

Typologies are not constructed over night but rather tend to happen in movements over time and with a grown consensus in the particular industry for accepted practices. "Typology plays a significant role within material practice. It allows for a clear selection of architectural organization from among the almost limitless possibilities available today."[2] A good example comes from the car industry and with the concept of Uni-body Construction. The main tenant of the Uni-Body construction type is the merging of components into a unified whole where structural chassis and skin components of body panels, windshields, and the like work in conjunction with each other to create structural, fuel, surface, performance, economic, and safety efficiencies. This involves innumerable components from rear light configurations, air intake grills, and windshields, to doors, thin metal skins, merged bumpers and naturally, the main structural steel chassis. All of these components are tied to the logic of aerodynamics, ergonomics, and design aesthetics which establish a symbiosis of efficiency, systems logic, and styling. The first two categories, (aerodynamics and ergonomics) are beholden to "function" the latter, (aesthetics) to "distinction." Yet, in distinction all are linked through the overarching typology and logic of Uni-Body construction. It is also known as Monocoque Vehicle Construction which is Greek for single (mono), and French for shell (coque).

Distinctions are made through material and surface fluctuations. Although all components have a sense of being different, they are in fact all the same by virtue of being part of the same "family" of components and industry accord. Looking at front fenders, grills, and headlight configurations, the current design trend is to construct head lights in crystalline chambers, emphasize the mimetic expressions of air intake grills for aggressive styling, and seamlessly connect front to side to top establishing a morphological sequence from X to Y to Z coordinates. The car industry is a good model to analyze as an allied design field that has incorporated sophisticated design and simulation software decades prior to architects to aid in the understanding and development of their products and establish efficiencies in cost and life cycle. The main advantages of Uni-Body construction are lighter weight construction, integrated surface as support skin, safety, and fuel efficiency. Despite the advanced use of sophisticated software, this industry still runs physical empirical studies to understand the ramifications of their design before it goes to market. Prototypes of new models are taken on to closed tracks to test breaks, speed, and acceleration, or the "performance" of the vehicle, as a completed system. They are crash tested for safety studies to gather empirical data and refine designs accordingly and are taken through wind tunnel tests to understand how function and distinction can work in tandem.

Architecture also has its accepted typologies from structural and mechanical systems integration, to surface, space, form, materials and programmatic requirements. Having worked for several large architectural design firms including Polshek and Partners and SOM NYC in the late 1990s to early 2000s, I had the opportunity to work on a variety of large scale building types from museums and cultural centers to airports, retail, mixed use, hospitality, office and transportation centers. This experience has given me an insight into many different building typologies and a curiosity about their relationships to each other, design, history, and the notion of how technology feeds new conceptions. In understanding complex existing building typologies, one needs to be able to extract the "characteristics" of the type that the computer might be able to expand on, establish efficiencies to, or entirely reinvent. This establishes a historical grounding to the research with a well-established knowledge base that becomes relevant in designing a bridge from the virtual to the physical. Given a perusal of the Time Saver Standards Book, one might develop a sense that each building type has been distilled into its function and programmatic relationships but the third dimension of "distinction" is not brought to bear.

The relationship to the digital era that we are in the midst of is certainly not discussed at any length and how it might allow for a rethinking of and perhaps produce a dividend of further time savings by establishing virtual connections analogous to the known "architectural associations." Here is where architects are called upon to not simply problem solve, program, and be cost-effective but to inspire, create, reinterpret, and orchestrate a built environment with connections to dynamic virtual processes. In other words, to create its "distinction" through the understanding of its key typological characteristics while exploiting the new technologies as a way of informing, enhancing or perhaps, establishing a new series of design typologies linked to dynamic digital techniques. Analyzing building typologies closely reveals accepted norms and working models for the types developed through pre-digital means. Each building type is beholden to its function, programmatic scope, the laws of physics, and economics, but once again, distinction is beholden to techniques, analog organizational matrices and accepted forms of the historical types. Here is where the role of the computer becomes interesting. Is it simply a way of expediting and visualizing pre-computing methods or should the computer allow for new methods and models to expand on analog techniques and establish a language for the zeitgeist of the 21st century?

There are several Digital Typologies in developmental stages having a direct link to architecture that range from scripting, algorithmic architectures, animated techniques, dynamic digital operatives, and computer aided manufacturing (CAM), to virtual social networking sites such as Linked In, My Space, and Face Book. One approach I have explored is to leverage the emerging toolset of software and development of "dynamic digital operatives" as a means of designing novel organizational structures and "digital tectonics." Through this process the creation of "traces" of the dynamic process as "frozen moments" emerge as new digital constructs with physical potentials. I've been refining and evolving these techniques over several years using the new functions in **form•Z RenderZone** and other 3D modeling and time based software packages. Examining the 2002 Serpentine Pavilion by Toyo Ito and Arup as an example of digital operations being utilized as a design generative, they set up a simple problem for the pavilion by asking a question. How do you float a slab and transform the box?[3] Their technique was to establish a control for the boundary, (the box) and dynamically arraying a frame in plan to establish a stochastic reading that was then mapped onto the control element. Members became continuous and bent

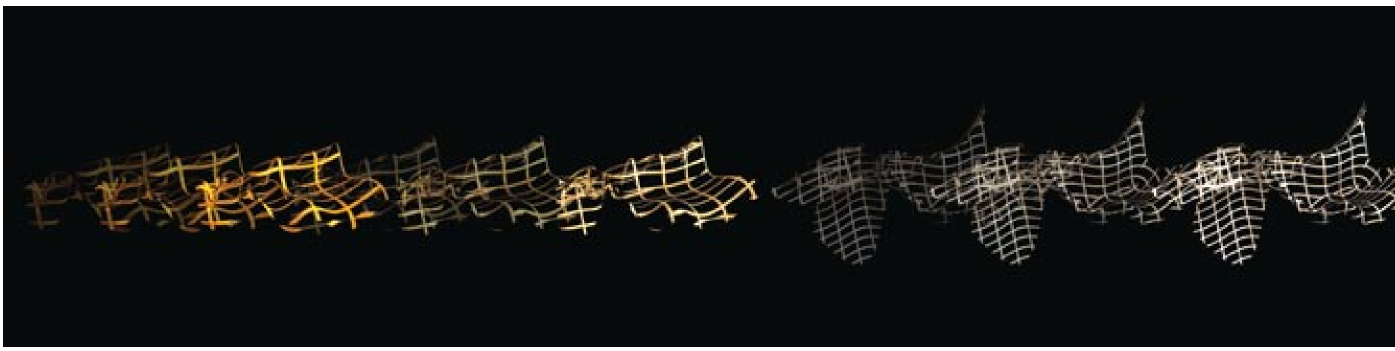
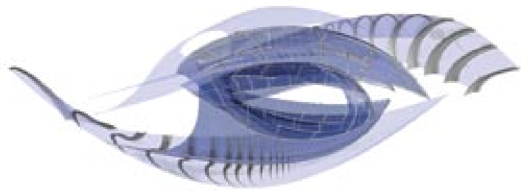


***Figure 4:*** Tom Rusher: NURBS Surface Morphology: Trait Inheritance.

along edges to create ground connections. A coded matrix was used to define the placement of opaque, transparent, and open zones in the pavilion working with in the logic of the dynamic organizational system. The final product was an integrated stochastic armature with variable of glass and painted metal panels that leveraged the ability of the new fabrication techniques to produce "mass customized" elements.

In my advanced computer and design class at the University of Texas at Arlington's School of Architecture, students explored with the development of digital operatives and the establishing of dynamic organizational structures, through a series of abstract animated empirical and analytical models. One of the major tenants of the study was to have the students discover and categorize "digital typologies, dynamic operatives, and animated conveyance methods" while establishing conceptual analog links to architectural typologies from component, to assembly, to systems (Figure 3). Behavioral characteristics of digital objects were analyzed in order to understand its intrinsic value, logic and limitations. For instance, there are NURBS, (Non-Uniform Rational B-Splines), typologies based on initial spline construction and line typologies, orientation of lines, open or closed sections, and so on. Each variable of construction adds to the performance of the structure. This coded information affects the flexibility of the NURBS and once created inherits these traits (Figure 4). Additional control points may be added or subtracted but the inherent behavior of the structure vis-à-vis its initial line type does not change.

Conceptual links to architectural structure, skin, space, digital tectonics, and ultimately program were generated and leveraged for a final conceptual proposal for a transportation building type. Beginning with base elements of parametric primitives, known steel typologies, non-Euclidean forms, lines, preprogrammed formula surfaces and splines, students learned how to parametrically



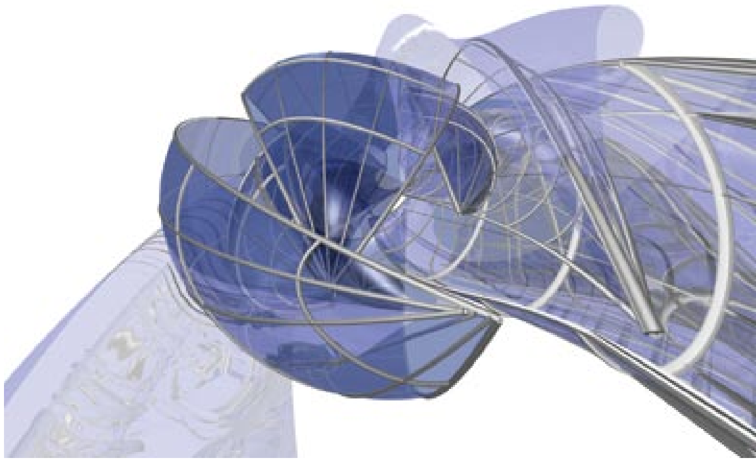


***Figure 3:*** Student: Sergejs Aleksjevs: Tectonic Assembly.

control digital materials. Derivative elements such as NURBS, Lofts and Sweeps were also utilized as generative control structures. Dynamic operatives with the ability to embed new parametric controls through the application of the deformative operations in **form•Z** allowed for the development of the empirical studies. The idea was to create a "family" of components that exhibited variable characteristics while inheriting traits of previous iterations over to the next through an animated morphology of interrelated operations as a technique for component development. Another method was to analyze the "tween" or interpolated sections generated by the computer by moving from one state to another as a way of generating variable components with incremental

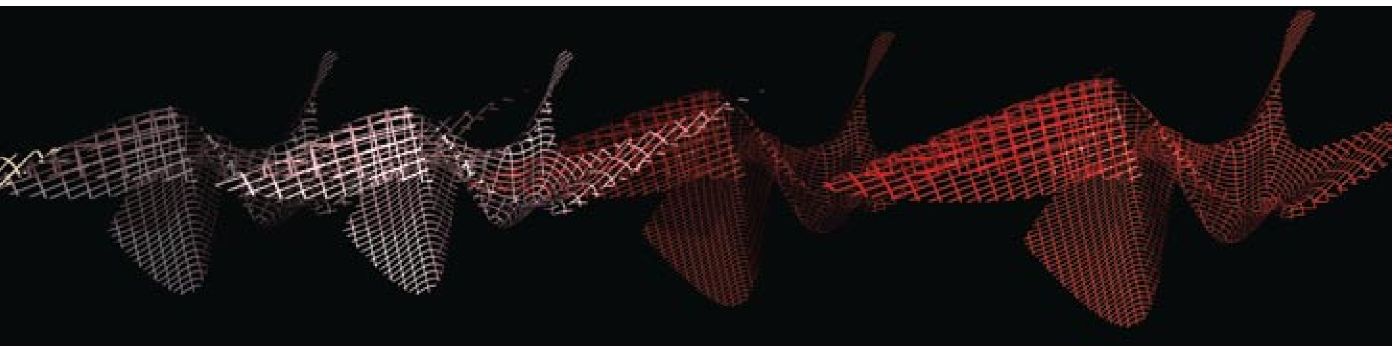


***Figure 4:*** (continued):

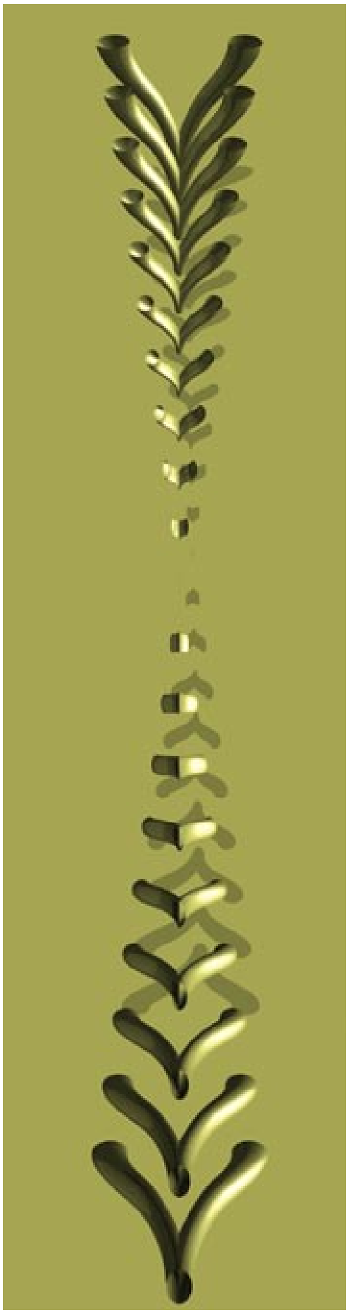


***Figure 5:*** Alexander Kwong:
Tween Morphology: Animated Component Development.

temporal links (Figure 5). Dynamic Methods and were expanded on for the development of a "stochastic steel chassis" (Figure 6). The bend, twist, bulge, and other tools in software packages such as **form•Z**, 3DS, Cinema 4D, and Maya, allow for real time control over the creation of digital components and animated phenomena while affording the ability to "nest" operations. Nesting

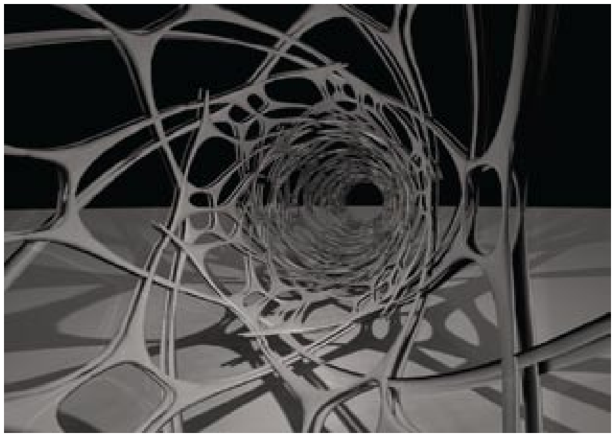


***Figure 6:*** Michael Peguero: Stochastic Steel Structure.

operations allows the user to apply multiple characteristics to an object giving rise to new possibilities of component development. Control mechanisms were established and the development of a dynamic stochastic steel chassis, reactive surface studies, animated material explorations and temporal extractions with distinctive spatial and surface characteristics were designed and analog links to specific transportations typologies were engaged as new digital tectonic typologies (Figure7).

In my introductory level digital design class, digital operatives were leveraged to develop a digital design methodology that established a "digital logic" of manipulation and construction. In the curriculum, this is the first formal class where students are exposed to 2D vector, 2D raster and 3D modeling. As such, the students have had limited exposure to graphic computer software at this level and robust yet easy to use 3D modeling software like **form•Z** affords the students the ability to tool up quickly

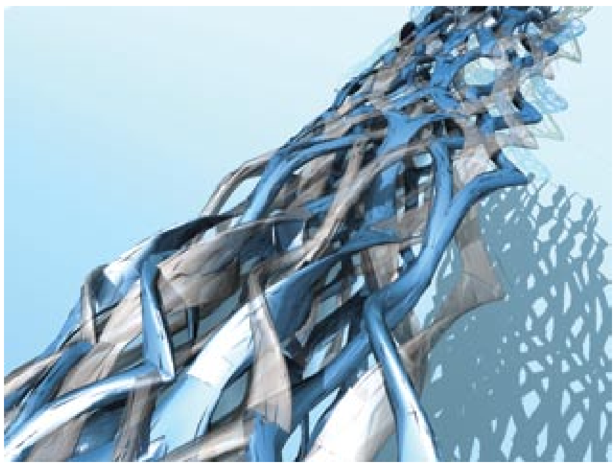


***Figure 7:*** Alexander Kwong: Reactive Surface: Woven Assembly.

and still produce sophisticated digital works. Students were grouped into pairs to enter a design competition for a small transit stop in Milwaukee during the last two weeks of the semester. This was an opportunity for the students to collaborate, and synthesis digital design concepts and skills introduced earlier in the semester. Two groups of students in this intro to digital design class placed in the competition. The first group received one of three merit awards for their Village Green submission. The concept was to develop a synthetic bunker with light sensors that established a signaling system for approaching busses while incorporating sustainable technologies to power the station and recycle materials (Figure 8). The second group received an award for pushing the "programmatic boundaries of the design" for their Mobius Motion Scheme. This group developed both digital and analog methods for the development of their "continuous strip" concept. This "animated strip" would respond to programmatic and site situations. Differing strip typologies were established to incorporate signage, public digital communication devices, seating, and shelter (Figure 9). In each instance the software aided in the development of dynamic techniques, visualizing tectonic possibilities and in the rapid deployment of the concepts of the projects.

The use of empirical studies as a teaching aid for students to "discover" digital potentials, analyzing of existing architectural typologies, the extraction of base characteristics, and the development of an approach to synthesis the virtual and the physical has been an invaluable teaching instrument for me. Making conceptual links between known typologies and emergent digital ones becomes a higher order thinking skill which allows students to synthesize complex processes and speculate as to new possibilities based on an understanding of existing architectural typologies as a control. Animation as a means of understanding "real time" processes and designing dynamic organizational structures that leverage the processing capabilities of the computer is still in its nascent stages and deserves attention by the

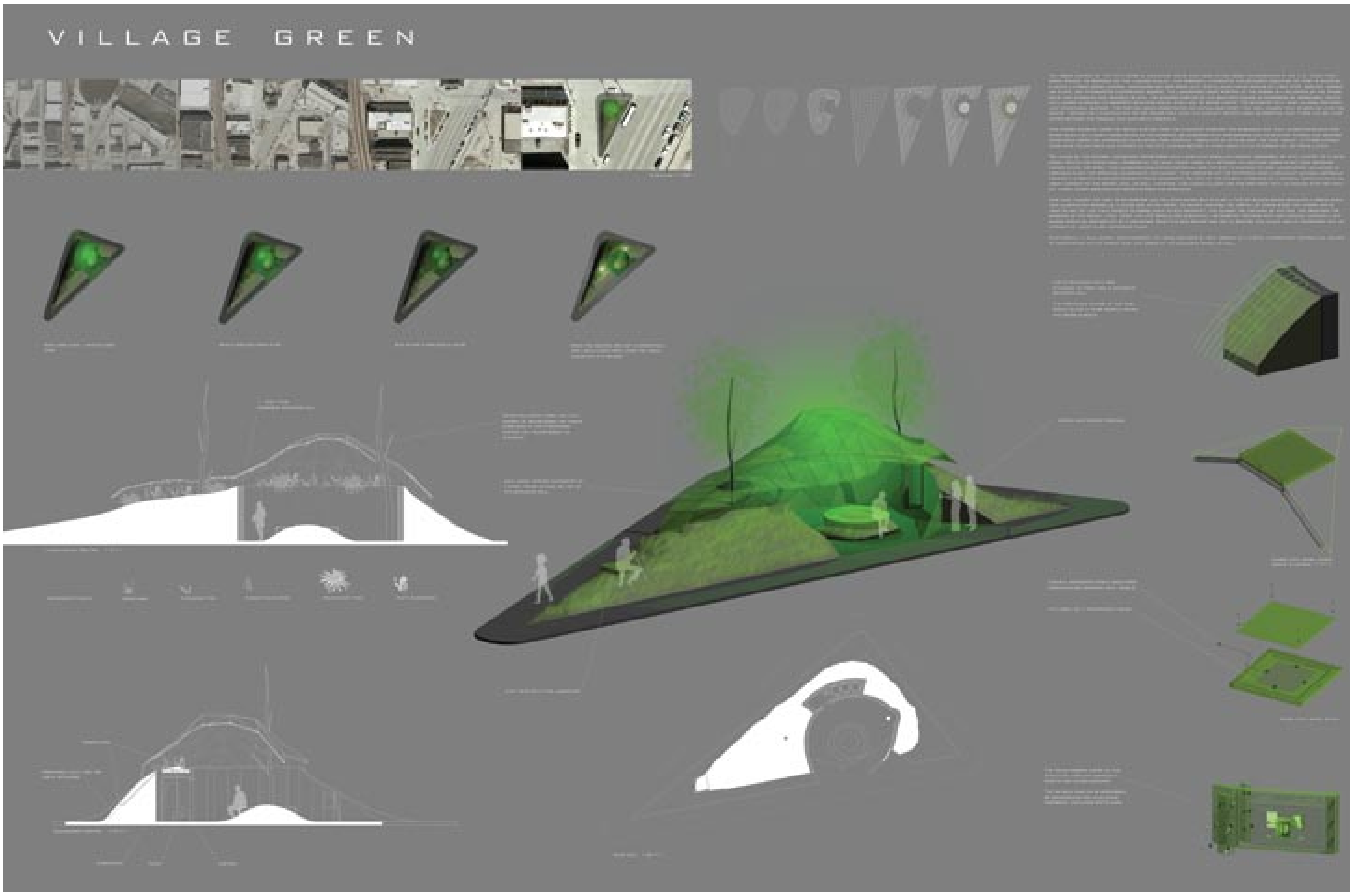



***Figure 8:*** Frederick Thomas and Toan Nguyen: Milwaukee Transit Stop Competition: "Village Green." Award for Pushing the Programmatic Boundaries of the Design. Faculty Sponsor: Tom Rusher.

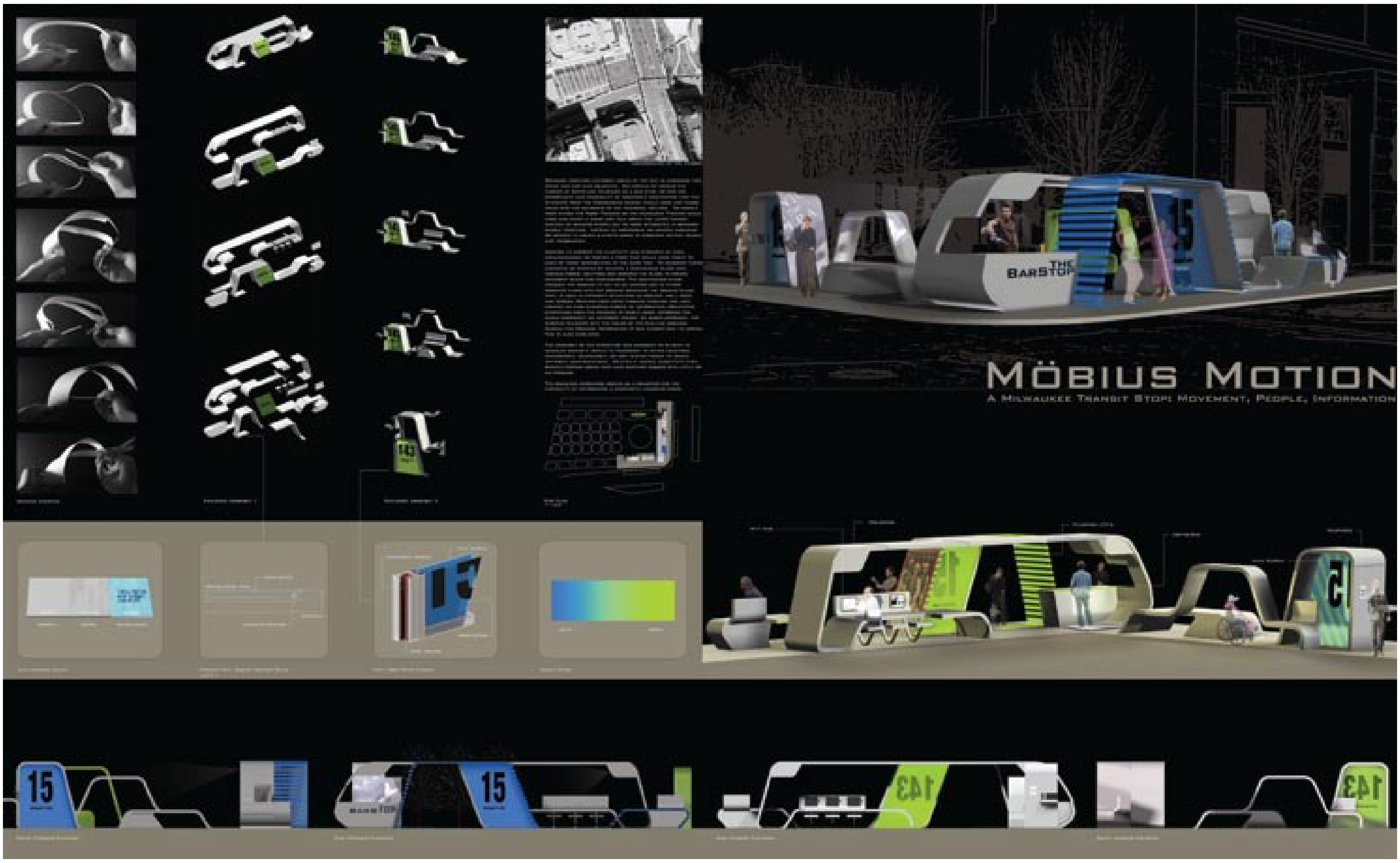



***Figure 9:*** Michael Peguero & Bobak Firoozbakht: Milwaukee Transit Stop Competition: "Mobius Motion." Award for Pushing the Programmatic Boundaries of the Design. Faculty Sponsor: Tom Rusher.

profession as a way of incorporating the new technologies and expanding the design vocabulary. The techniques of digital fabrication that now allow greater precision in constructed components opens the design field up to new potentials that embrace the notion of "mass customization" that is proving to be cost effective, efficient, and inspiring. These digital approaches have the potential to expand on architectural typologies, develop virtual techniques, and establish novel 21st century approaches to design through digital means.

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Miami University
Oxford, Ohio

# Rapid Visualization: Purpose Driven 3D Modeling and Rendering

by Murali Paranandi

*“If a picture is not worth a thousand words, the hell with it…”*—***Tufte***[1]

One of the virtues of digital computing ought to be the speed – allowing us to accomplish more within less time. While this is largely true, and experienced designers take full advantage, novice student designers often are disadvantaged because they are less discerning about when and how to engage digital media. One of their struggles is coming up with effectual digital model that best supports design process. The best model should help to define, analyze, understand, and express a design solution. More importantly it should be something that is rapidly built, imaged, and revised. Most of the literature in our discipline celebrates the explorative possibilities opened up by the microprocessor (as it should), and very little attention paid studying its meaningfulness the side effects[2, 3, 4]. Our experience shows that most novice students see the sole purpose of building a 3D model to be for generating perspectives of their buildings for final presentation. They lack an understanding of process of modeling and level of detail necessary to represent their ideas. Consequently, they spend an inordinate amount of time building and rendering them, and rarely study iterative variations of their solutions.

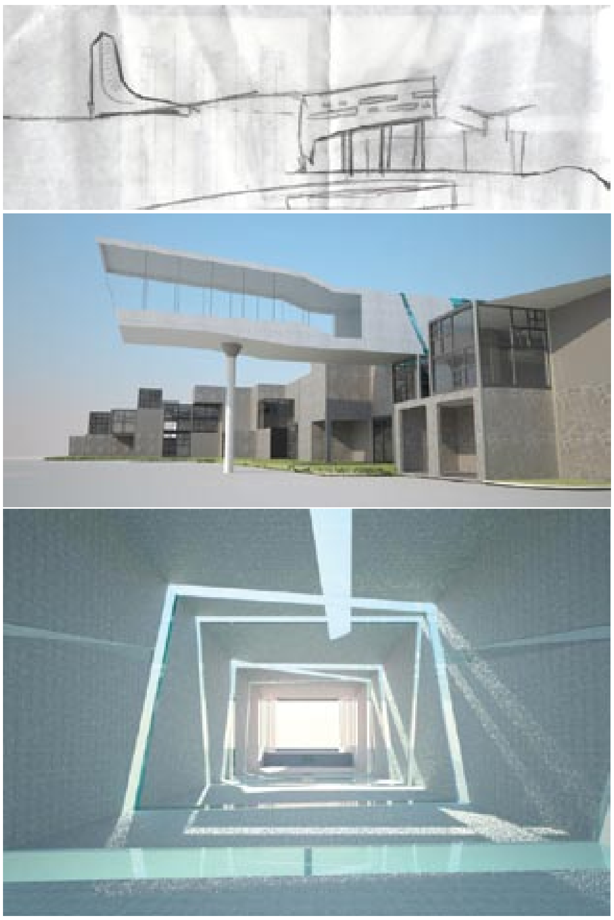
Typically students study their ideas with sketching on paper, refine it further in a CAD package by drafting plans/sections, and then incorporate 3D packages to build a model of their proposed buildings by assembling component geometries; preparing scenes with proper props, textures, lights; rendering to generate photorealistic images. This process increases the time investment in translating the idea into a 3D digital form. Restrictive assumptions made by the underlying modeling algorithms, and excessive render times to generate photorealistic imagery act as two primary obstacles. This slows the pace of design overall, inhibits study of ideas by progressive refinement, and discourages iterative exploration. Consequently, student designers often become less receptive to design feedback because of the effort it takes to revise their models, and the time it takes to re-render their images.

To illustrate this point, I will use the experience of one of my very talented, bright students as an example. Their design solution involved an art gallery space extending out of a subterranean structure, serving as the culmination point for visitors touring the proposed recycling facility. This gallery’s purpose was to stage exhibits related to environmental impact of recycling. High concept for this facility was an intervention into a brown field site to heal from years of industrial abuse. The main attraction of the gallery was the experience of this healing of the site. This idea was conceived rather quickly in a sketch form (Figure 1(a)). In the pre final presentation, ten days before the final deadline, they presented images of this modeled in **form•Z** and rendered in Maxwell Render (images not shown in this article). Critics loved the basic idea, but made a suggestion to strengthen it further by unifying the openings into a continuous coil that progressively gets wider as it reaches out such that it provided for more predictable wall display space and also a better forced perspective. The student agreed, and to their credit, invested several hours of modeling and rendering time (14 hours of processing time) to generate one image to study the coiled openings (Figures 1(b) and (c)). At this point, they were reluctant to study its variations any further and abandoned any further development, due to the time it takes to render, which is a perfectly understandable predicament at the end of the semester. Had they made a different choice that allowed generation of images quickly (such as not using glass as a material, or non-photorealistic imagery etc.), they would have been able to refine the idea to their fullest satisfaction.

Studies show that targeted control of detail supports enhanced understanding of an image[5]. Modeling meaningful elements of the structure/space, rather than all of the building’s components should be the priority during the early stages of design. This allows you to focus on things that matter. Such abstract approaches permit the designer to consider the ridiculous and impossible (in real world or within the computer program). An artist must be selective and invest his work with attributes that are essential, discarding much that is superfluous[6], typical computer rendering must come up with an outcome by a process of optimization. The process of optimization can be either driven by realistic or stylistic goals. However, it does not account for awareness of purpose or meaning of the context. Also, there is growing interest even in the scientific community for perceptually motivated stylistic graphics over photorealistic. Hubble's images are touched by Zoltan G. Levay, NASA's artist using Photoshop, to bring out their essential qualities for enhanced understanding[7]. A recent Ph. D. dissertation at Northwestern University is an excellent resource for the interested reader[8].

This essay presents a few projects from my classes that have adapted these strategies successfully.

"*The only way to get good ideas is to get a lot of good ideas.*" ***—Linus Pauling***



a

b

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***Figure 1:*** Joe Puchala. ARC 302. Spring 2008.
A proposal for a Recycling Center as part of a solution for Mill Creek Restoration Project, Cincinnati, Ohio, by Case Blum, Joe Puchala, and Myles Suer. ARC 302, Spring 2008. Instructor: Murali Paranandi.

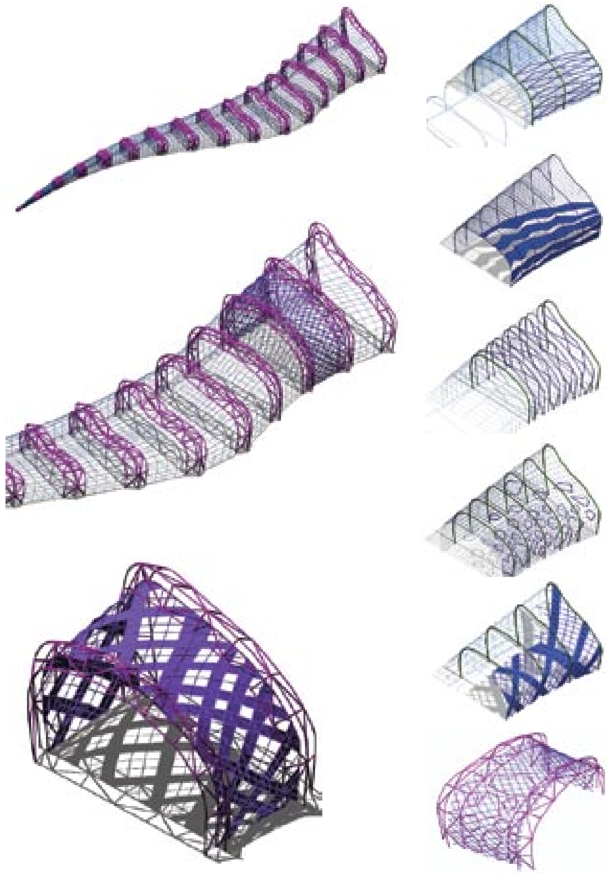

***Figure 2:*** Building exterior envelope studies for Maritime Museum in Chicago, by Adeleh Nejati. ARC 601. Fall 2008. Instructor: Paranandi.

## Tectonics/Design Development: Surface Rationalization

In this project, the student wanted to explore solutions for the exterior envelope using a double façade principle and with organic expressiveness. She had neither time to learn scripting, nor access to a sophisticated parametric modeler that would automate the study of such forms. However, that did not stop her. She modeled the interior volume as a swept surface. Once the student grasped techniques of using trim with line (to isolate a portion of the exterior skin to study), contouring (to generate structural grids), drawing using snaps (to develop patterns), layer organization (to see options simultaneously, and to set rendering attributes by layer to render wires with thickness, with or without surface to quickly simulate thicknesses for structural members without actually generating geometry), in a desk critique—six variations of cladding the skin of this complex form were explored and constructed within a single studio session. One of these alternatives was integrated into the exterior envelope of her project and the geometry was used for making large-scale physical models using rapid prototyping/laser cutting, to develop drawings for sophisticated double façade section in AutoCAD, and diagrams showing sustainable aspects in illustrator.

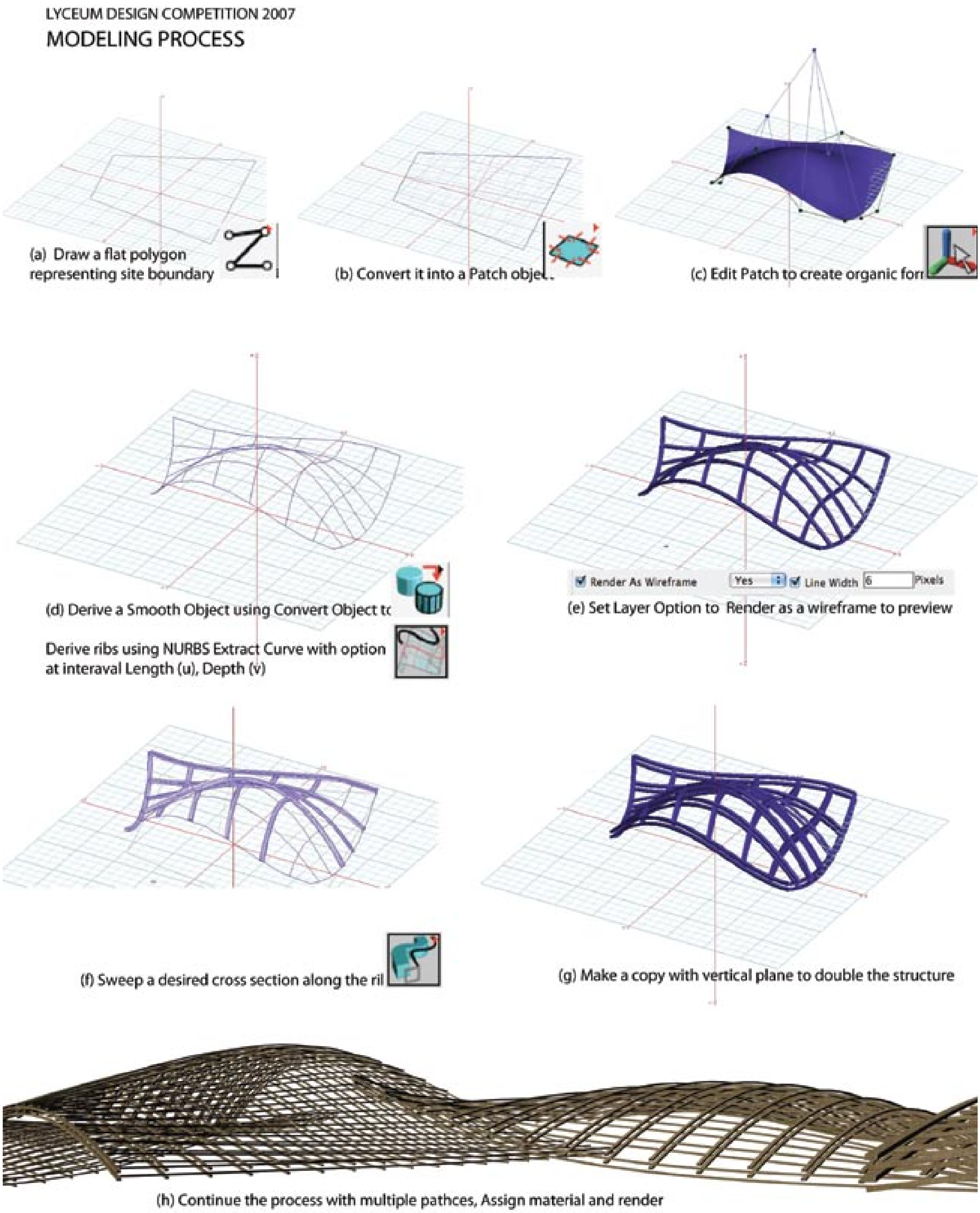


***Figure 3:*** Modeling Process Study by Kyle Coburn. Spring 2007. ARC 404.P. Instructor: Paranandi.

## Roof Studies Using Patches/Nurbs

In this project by Kyle Coburn, the design responds to the dynamic beauty of the traditional marketplace through the materialization of the ritualistic life of the market in kinetic movement. As vendors come and go, the roof undulates, never being the same as the day before, yet still married to the day to day cycle of what it holds. He had to represent the roof in many configurations to illustrate this intent. Roof form was modeled as a NURBS surface by defining four boundaries (Figures 3(a) through (c)). The Reconstruct NURBS tool was used to regulate and extract gridlines along the surface (Figure 3(d)). Rendering these placed on a separate layer with the option to render "as wireframe with thickness, no shadows" allowed for quick and clearer grasp of the tectonic qualities (Figure 3(e)). Since all of this happens with a single mouse click on the NURBS surface, it was easy to visually study various options. Once a decision was made they simple sweep gave them sectional qualities (Figures 3(f) and (g)). The student was able to generate and study five iterative variations of roof structures before arriving at the final solution presented.

Also notable is the way in which individual vendor stalls (seen in Figure 4) were modeled as symbols with three levels of detail. Given that there are a large number of vendor stalls, those closest to the viewer received highest detail, and those farthest the least. All this combined with the combination of hidden line, and wire frame image exports paired with **RenderZone** images allowed for the generation of non-photorealistic diagrams displaying the operation details of the roof. Notably, in awarding second place in the Lyceum competition, all the jurors agreed that this entry addressed the program in a complete way that demonstrated an understanding of the most important elements. One said that this student had "a fine grasp" of the work[9].

***Figure 4:*** Hybrid marketplace in Mexico City by Kyle Coburn. Spring 2007. ARC 302 and ARC 404.P.
Critics: Manoli. Digital strategy: Paranandi.

## Site Design/Land Manipulation

Extruding a land form from a set of point data or contour lines works well for modeling existing conditions of the site, but developing it further by sculpting the topography and studying circulation (roads, pathways etc.) in a fluid form is not easily supported by such approaches. The project presented here serves as an example where such investigation took place with ease and success at a rapid pace. The students dealt with a building that was to be located on a man-made 99-acre peninsula along Chicago's lakeshore, which is being developed into an expansive nature habitat for prairie grasses. The design concept called for the building to be weaved into the site such that its rooftop can be occupied to act as amphitheatre-like setting to get the best views of the site. The students started from a given AutoCAD site map and traced the site zones he wanted to develop. Once a simple extrusion of this site outline was made, it was further subdivided into manageable gridded chunks by using trim/stitch with line tool. Meshes of varying densities were applied to each area. Mesh densities were chosen to be fine where land manipulation had to be carefully sculpted, and coarse where it just needed gentle slope. Roads were inscribed into this volume by using trim/stitch with line on double lines drawn in Plan. These were assigned a different color at the face level to read distinctly from the site. Most of this was learned in one studio class session, and by next class the students already made most critical decisions. This crude model was used to refine the design progressively. It was also used in conjunction AutoCAD/Illustrator to generate drawings, and Photoshop to generate perspective imagery.

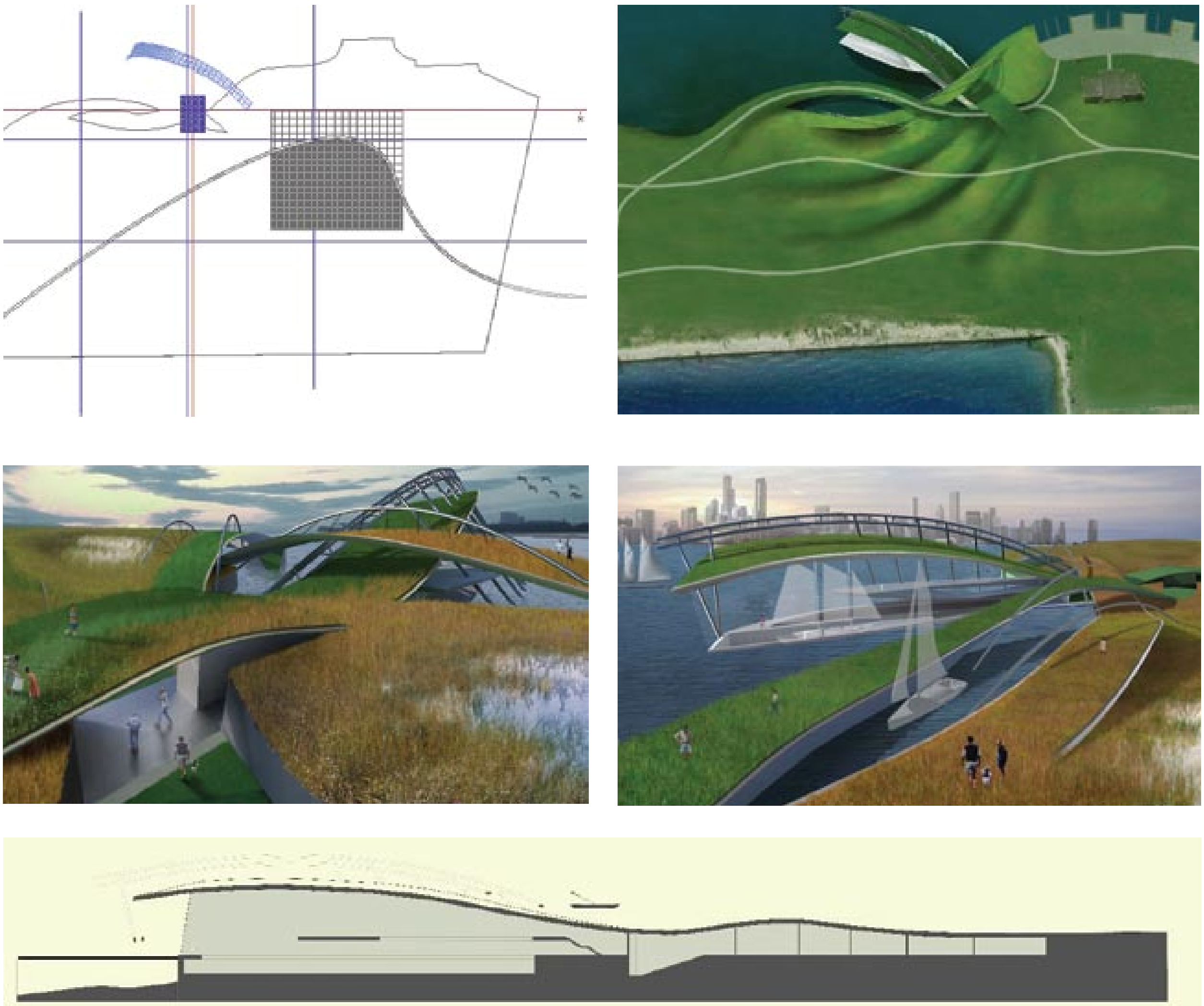

***Figure 5:*** Maritime Museum and History Center at Northerly Island, Chicago, by MatiAlex Hogrefe and Jeff Kruth. ARC 601. Instructor: Paranandi.

## Expressive Rendering

Modeling an idea: This student's (Todd Spangler) concept was to express the forging activity (in the design of the school for metals on a college campus) using photo chromatic materials and nano-technologies. Modeling strategy was setup accordingly. Only essential elements were chosen purposefully for modeling to study their organization and integration. Images were constructed by rendering in layers. This was accomplished quickly. This process demonstrates the effectiveness of non-photo-realistic rendering in facilitating iterative design development. The student was very receptive to the critical feedback provided at reviews, and was able to revise his models, images, and drawings with great agility.

## Stylistic/Caricature Approach

This student (Augustine Fernando), although had a good design solution, built an accurate model that was used to generate drawings (plans, sections, elevations). However, he was having a hard time with rendering imagery that conveyed his design intentions. Consequently, his design reviews did not go well. He was encouraged to shift his investigation into non-photorealistic caricature realm. This allowed him not only to enjoy the process, but also to produce images of his ideas fluently.

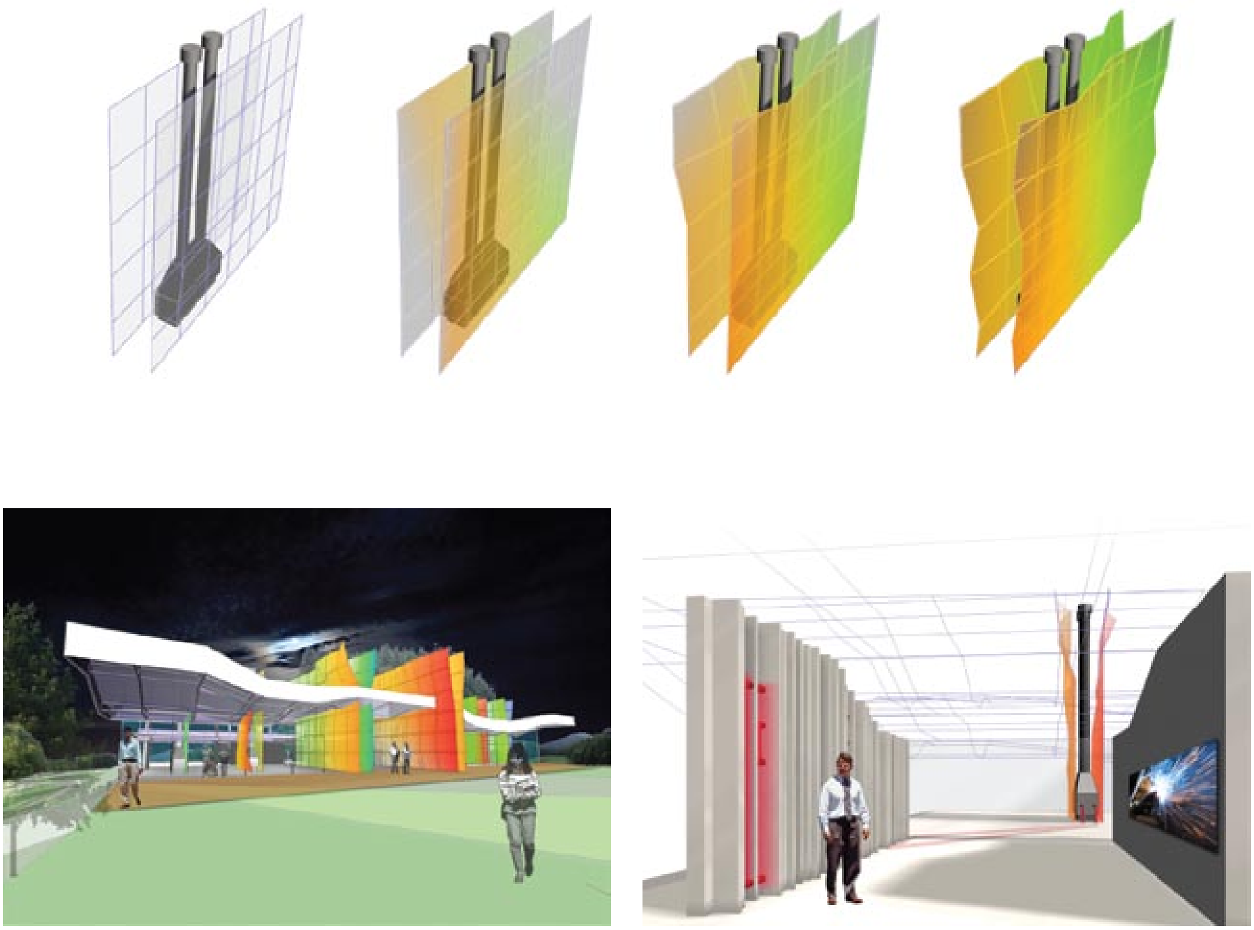

***Figure 6:*** Todd Spangler. Arc 401. Fall 2008. Critics: Elliot, Paranandi.

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***Figure 7:*** A proposal for a Recycling Center as part of Mill Creek Restoration Project next to I-75 in Cincinnati. Augustine Fernando. ARC 402. Spring 2008. Instructor: Paranandi.


**Murali Paranandi** is an associate professor at the Department of Architecture and Interior Design at Miami University in Oxford, Ohio. He holds a B. Arch. from Jawaharlal Technological University, M. Arch. from Kent State University, and M. Arch and postgraduate certificate in CAAD from the Ohio State University. His research and teaching explore engaging digital media to enhance architectural design process. He guest edited Digital Pedagogies, the 2005-06 joint studies journal published by AutoDesSys, Inc. Professor Paranandi’s students from Miami University have won numerous awards for design at national and international levels. His work received over $300K funding support from National Science Foundation, Ohio Board of Regents, Miami University, and others. Photo by Vishnu Paranandi.

**Texas Tech University**
**Lubbock, Texas**

# Four Poetic Statements

**by Bennett Neiman**

*The fiction is already there, the [designer's] task is to invent the reality. —**J.G. Ballard***

This media workshop offers new ways to see, think, model, study and understand architecture. The methodology explores the tactics and techniques of how digital media and physical material are used interchangeably as instruments in a design environment.

The workshop promotes the act of making as a discourse, where execution precedes conception. Pragmatic concerns are superseded. The computer is introduced as an interpretive playground for design experimentation, exploiting the representational elements of form, space, light, shade, shadow, color, transparency, translucency, reflectivity, texture and implied motion.

The workshop uses a systematic approach inspired by Bauhaus principles of craftsmanship and visual perception. A series of weekly exercises stimulate intuition, experimentation and analytic observation. Various sources are transcoded, rearranged, manipulated and transformed into space visualization fantasies. Out of the many possibilities captured, something is made literally out of nothing. A pure creation of the mind is made possible with digital media. These poetic statements investigate space-making with a particular emphasis on mythical, experiential and sensorial factors.


## Poetic Statement One

The Transformer box is an idea that fosters a process of design playfulness. This game of 'Transformers' promotes the creation of something new and unknown through the alternation of design decisions between two individuals. Each move inspires the next. Each decision poses a question. Design conversation is established. Through the reassembly of formal elements, based on fictitious means, spacial reality is created. This play between what was and what can be, is carried throughout the design process. With each decision comes new rules, inspiration, and reality. A move is made and a space is created. A space that is as permanent as its ability to inspire. The kinetic character of such space is the nature of transformers. With each decision, a question. With each question, a new space. Let's play. —Lauren Segapeli

## Poetic Statement One

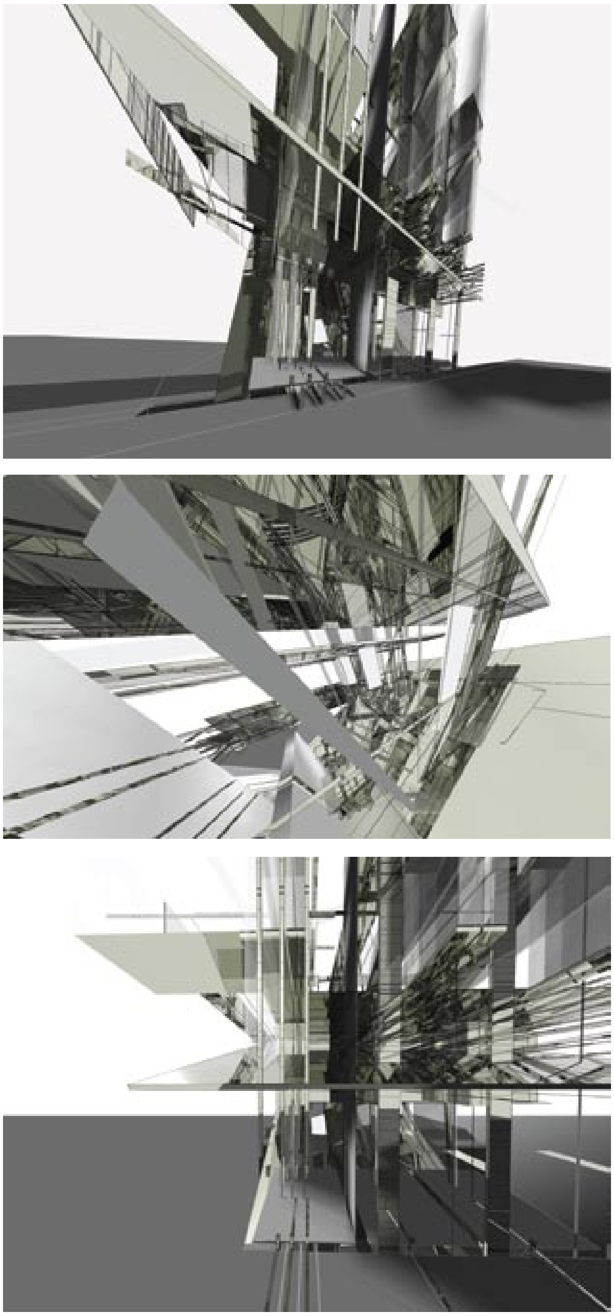

*Figure 1:* Transformer Box. Lauren Segapeli (**form•Z** award of distinction for Visualization and Illustration).

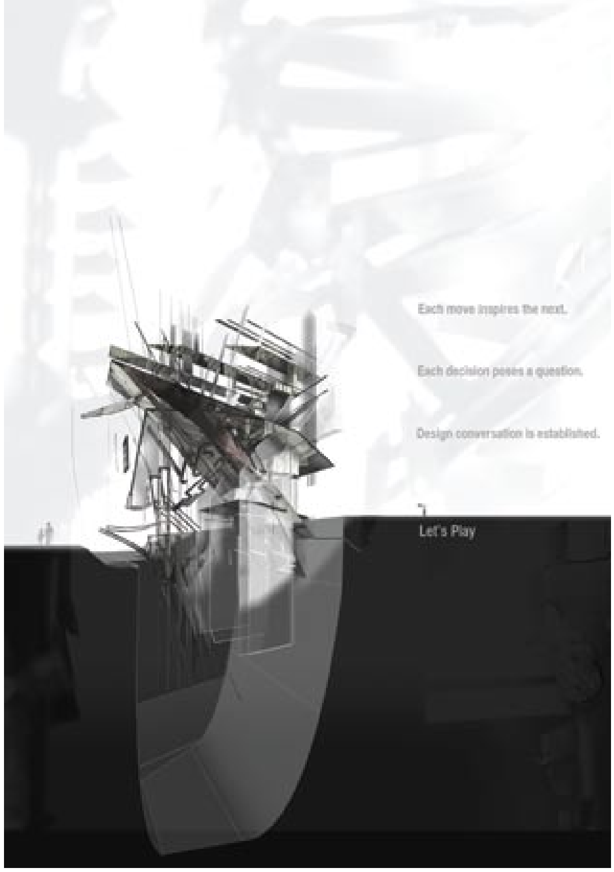


*Figure 2:* Transformer Box. Lauren Segapeli.

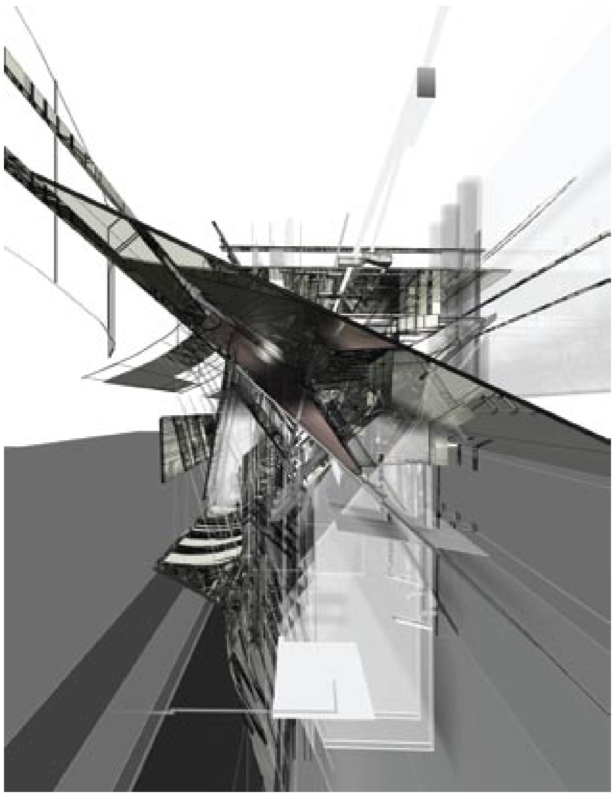

*Figure 3:* Transformer Box. Lauren Segapeli.

## Poetic Statement Two

***A Long Scan.*** A fish tank is designed by means of an algorithmic process involving observation, numeric association, documentation, and parametric structuring. During analog conception, characteristics of resolution, time, frequency, and length are measured and recorded. As the project progresses, continuity in design and a relationship to the original model is achieved by transferring values across evolving mediums in a process that recognizes quality as quantifiable. Once considered limitations, these values are utilized to structure output, so that visual qualities are reinstated as traces of their original states from quantitative recordings. Hence, what was surplus resolution becomes length, governing circumference, and rotational frequency becomes tempo, in turn forming an undulating digital element. As the fish tank turns, the designer divides time between intuitions and the rational, eventually rediscovering beginning as end. —Justin Smith

**Top to bottom:** fish tank setup on potters wheel; scanner apparatus; fish swimming in tank; scan moment.

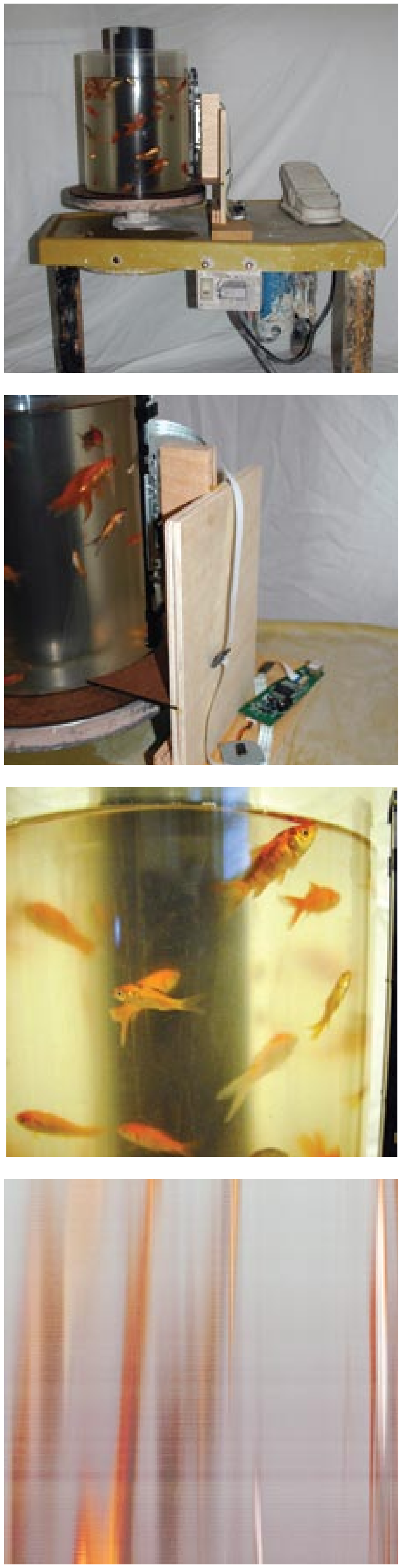

***Figure 4:*** Fish Tank Scanner. Justin Smith.

## Poetic Statement Two

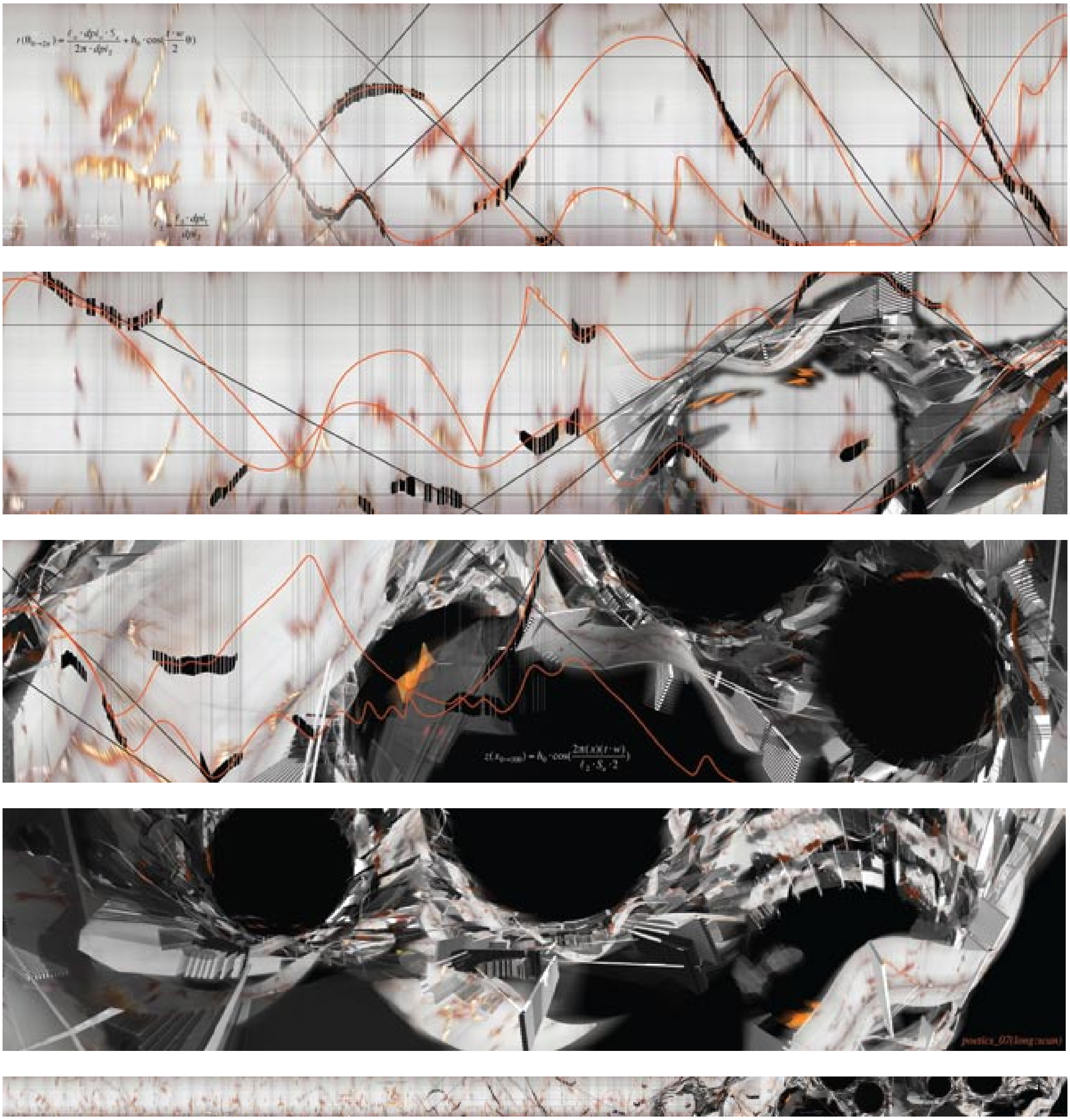

***Figure 5:*** The Long Scan. Justin Smith.

## Poetic Statement Three

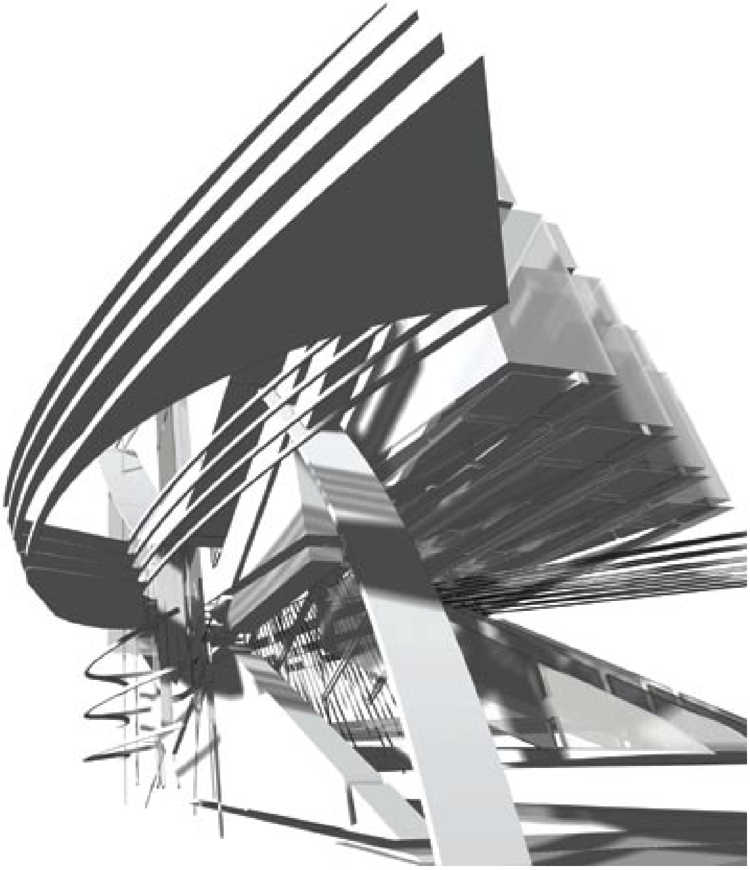

***Figure 6a:*** Inspiring architectural possibility. Garrett Jones.

## Poetic Statement Three

***Inspiring Architectural Possibility.*** This is an architectural exploration of spatial intrigues and formal gestures. It is not confined by a traditional sense of physical structure, but rather controlled by virtual structure and order of space, form and light. It is a creative act of integration; of reflection, illumination, transparency, mood, spontaneity, and intricacy. The object created is an imitation of the imagination with architectural aspirations. The product is a virtual fantasy that draws upon and inspires architectural possibility. The gestures of the virtual forms created respond to the photograph. It embodies a dynamic harmony between the stationary and rotational; between the physical and virtual; between the reflective and translucent; and between the interior and exterior. The purpose is to freely express spatial concept through development, practice and experience. — Garrett Jones

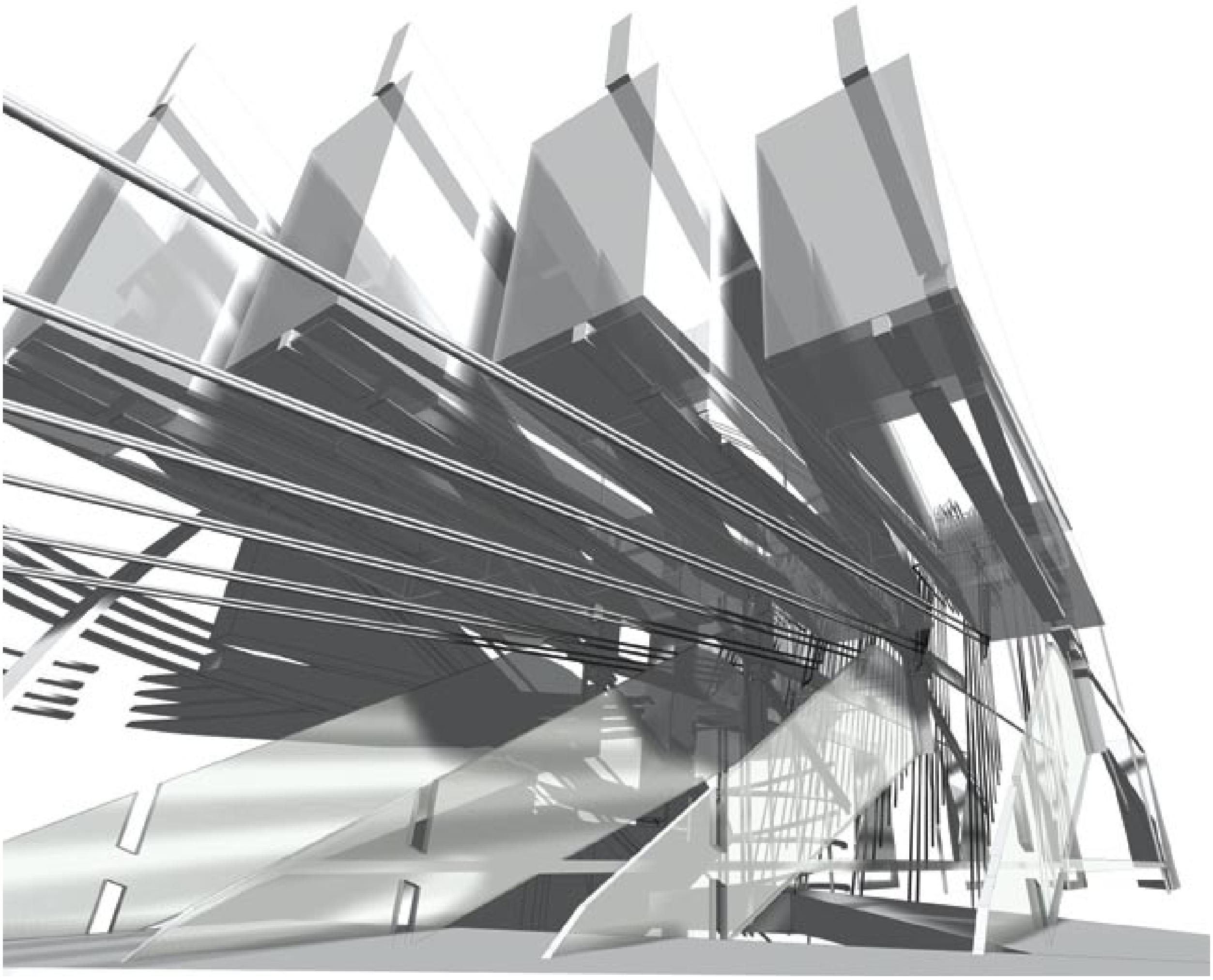

***Figure 6b:*** Inspiring architectural possibility. Garrett Jones.

## Poetic Statement Four

***Techno-tumescence.*** Two beings identified by their serial partaking in sexual activity on the bed of a scanner. A male and female machine court, using cellophane to scan each other. They probe their counterpart's being and submit a vision of radical illumination. The relationship is contrasted by their interpretations of the scene. One sees the monochrome and the reflection. It sees the promiscuity of the curvilinear lines which it probes. The other uses those undulations to split the illuminated light into a prism of vacillating colors. The images of each other lay side by side; they are interpreted by each other and make a performance not knowing their own cogs and parts. Their experience is exploited in the technotumescent, for that is what they're made for. Alone, the machines give light; however, together they give light to experience and make a new self in the other. — Jonathan Creel and Mary Stuckert

**top to bottom:** scanner box; materials cellophane & scanner mechanisms; two sided overlay scan with motion manipulation; where color and light decide.

***Figure 8:*** Techno-tumescence: Female. Mary Stuckert.

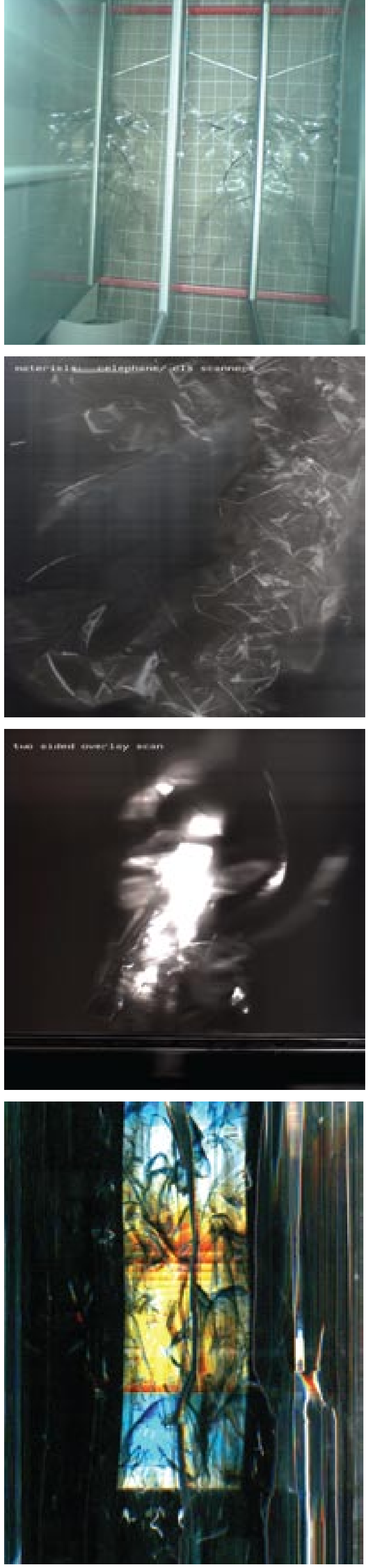


***Figure 7:*** scanner box experimentations. Jonathan Creel and Mary Stuckert.

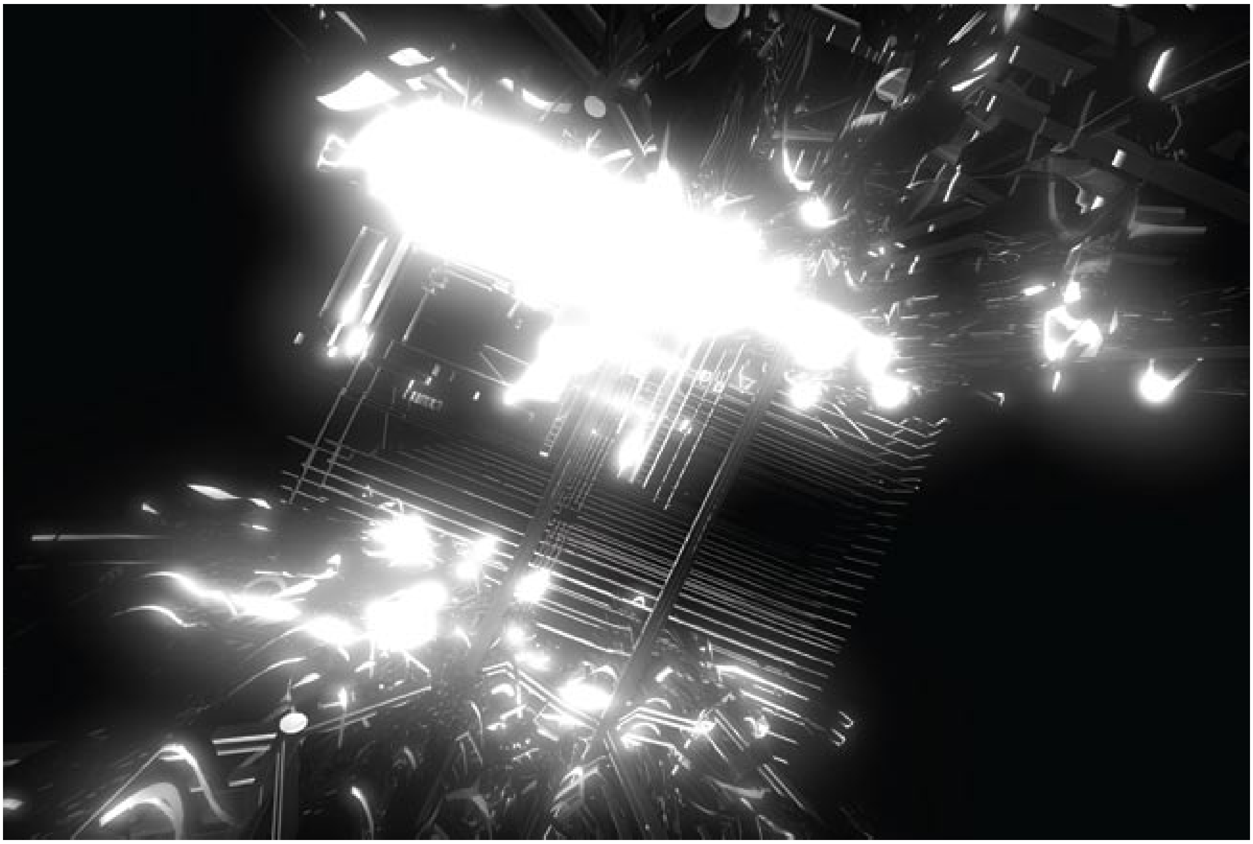

***Figure 9:*** Techno-tumescence: Male. Jonathan Creel.

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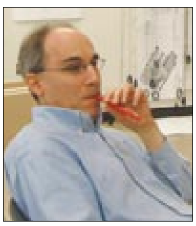


**Bennett Neiman** holds a two-year Master of Architecture from Yale and a six-year Bachelor of Architecture from the University of Cincinnati. He taught architectural design at University of Colorado at Denver/Boulder from 1987-2004, earning tenure in 1995. He is currently a tenured Associate Professor at Texas Tech University College of Architecture. Since 1983, Professor Neiman has received several honors for a series of self-generated architectural design projects, competitions, and teaching involving improvisation, order, and variation on a theme. His design workshops, seminars, and studios exploit the strengths of both traditional media and digital technology in design. He received the American Institute of Architects AIA Education Honors Award in 1994 and 1998 for this work. He received the Association of Collegiate Schools of Architecture Faculty Design Award, in 1990 for Surrealistic Landscapes and in 2005-2006 for bebop SPACES. Photo by Lahib Jaddo.

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# Modular ConstructS

by Asterios Agkathidis

The notion of modularity has been known to European architecture and construction since the classical period. It can be described as a system which allows economy and efficiency in the design and realization of architectural projects. Nevertheless, modularity is not a static term, but a constantly shifting notion, which readjusts its meaning in relation to contemporary manufacturing and production technology, taking its lead from significant technological innovations.

Today, in the midst of the digital and information revolutions, modularity seems to be undergoing a drastic realignment. CAD/CAM technologies have revolutionized the production of constructional elements, as design and form-defining mechanisms.

***Figure 1:*** The Parthenon.

## Conceptual Definition

Modularity was first brought to our attention by Vitruvius. By analyzing the "Doric order" present in the ancient Greek temples, he introduces the "module" (modulus)[1] as a minimum unit by which any other component of the temple may be measured. By applying the rule to the Parthenon (see Figure 1), he explores further the 4 : 6 : 9 module to the other dimensions of the building, which he defines by the size of the "triglyph" ( = 875.9mm). Thus, each structural element of the temple has a precisely defined relation to other elements and the rest of the building as a whole.

By examining the Parthenon in terms of manufacturing, we can see that the temple shows many characteristics of contemporary building. It is constructed of standardised, modular pieces, which were manufactured to a high degree of precision under quasi-industrial conditions. Considering this, modularity as defined in the classical period becomes a determination technique for design, organization and efficiency in construction. The "rhythm" of the ratio 4:6:9 functions as a design tool and detailing principle at the same time. The module is not a physical element but a theoretical definition of a measurement, which operates as a form defining and problem-solving mechanism.

## Identical Units

Modular constructions appear again in abundance as a consequence of colonial expansion and the industrial revolution. The lack of skilled craftsmen in the new world forced engineers to develop light, modular constructions that would allow standardised mass production on an industrial scale and facilitate the easy assembly of the components on site.

Thus, the first industrially produced construction system came into being: the balloon frame. Its name reflects its lightness and its "high-tech" construction, which was similar to the balloons, or the woven baskets. The "balloon frame"[2] could be described as a technique based on structural units, called "studs", which provide a stable frame to which interior and exterior wall coverings were attached and covered by a roof comprising horizontal joists or sloping rafters covered by various sheathing materials.

The wooden frames become identical modules, which are being repeatedly added, generating a regular three-dimensional grid. Their width and height determined the dimensions of doors and windows, the stairs and roof. Thus a regular system of order arises, which in later stages expands even to an urban scale, through mass replication in the construction of housing units. The "balloon frame construction" and the later optimized version, the "general panel system", describes a module as a physically identical unit, which is multiplied and repeated. The module is characterized by the greatest possible simplicity and its suitability for economical mass production (Figure 2). The building itself can also be seen as a unit, or a spatial module. This definition of modularity dominated architecture for many decades, with several variations in the modern, late and post modern period, always linked to the emergence of new manufacturing techniques and materials. Here, I could make reference to the modern movement with Walter Gropius´ "Baukastensystem" and the Metabolists.

***Figure 2:*** Modular housing: Bird Fair, Porto, Portugal.

***Figure 3:*** Parametric modules.
Rapid prototype by Bernhardt Bangert.

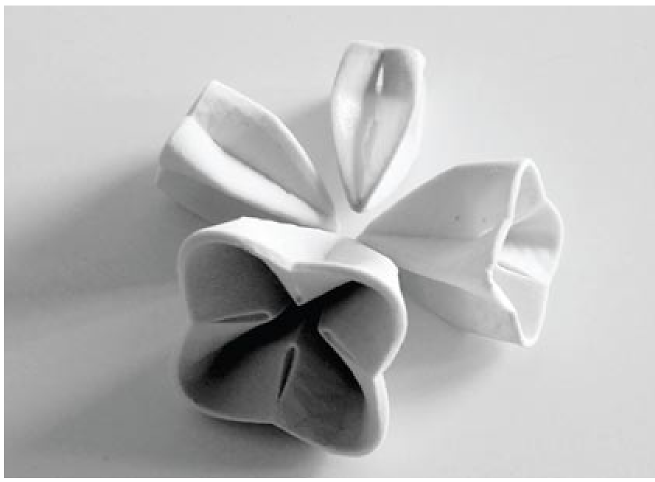


***Figure 4:*** Parametric modules.
Rapid prototype by Olivia Haym, Constanze Joppen, and Sandra Renner.

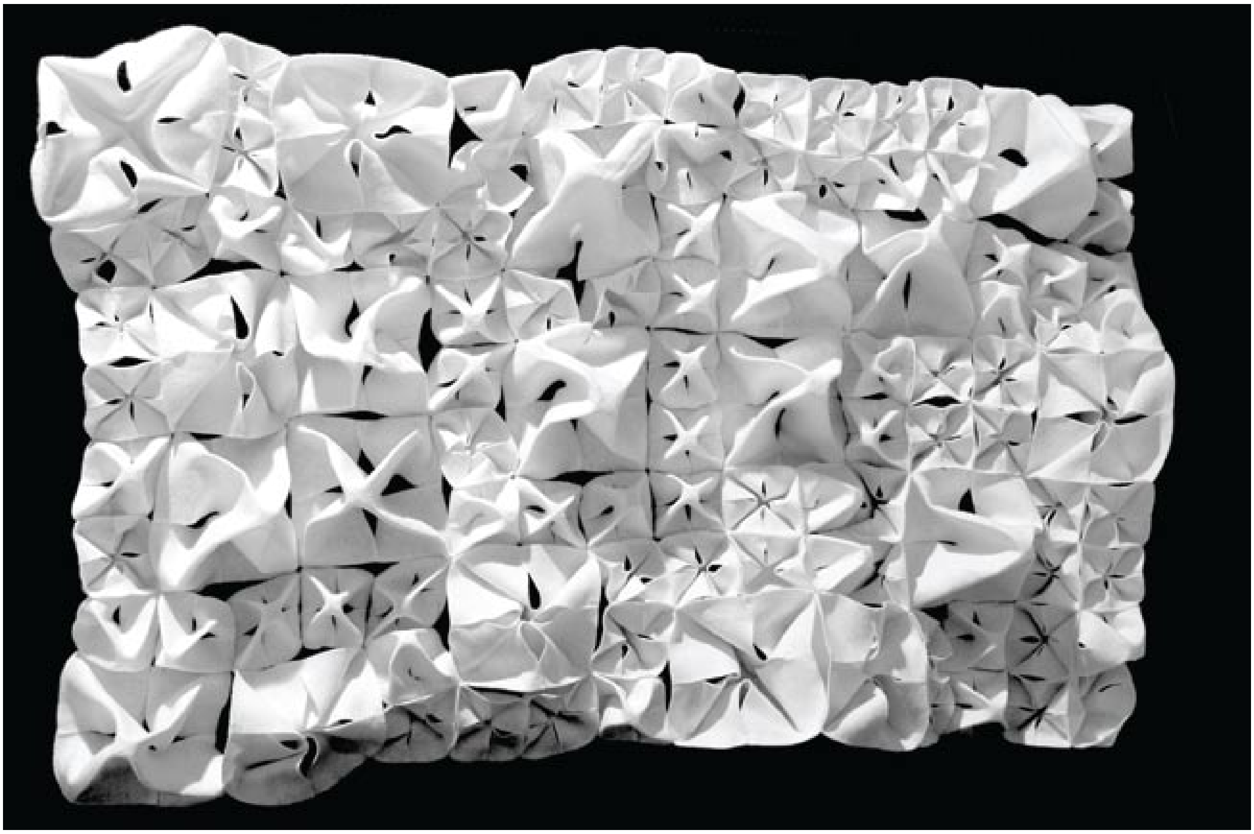


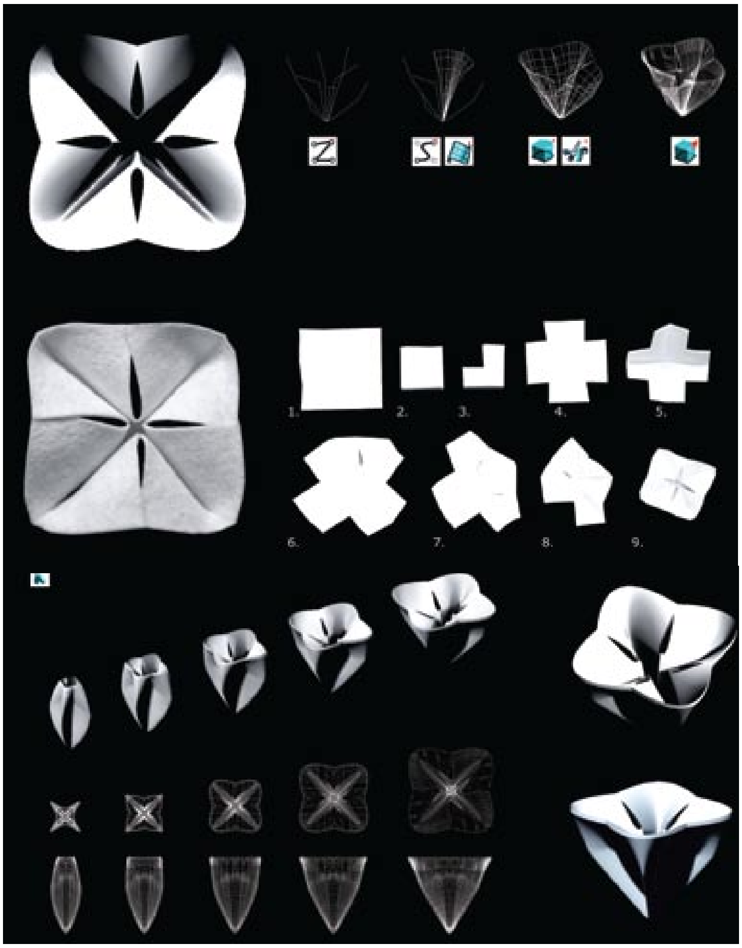
***Figure 5:*** Carpet by Olivia Haym, Constanze Joppen, and Sandra Renner.

## Parametric Set

Today, the cultural and social revolution brought on by telecommunication and information technologies is rapidly transforming the field of architecture. We live in an era of accelerated change, in which data speeds invisibly around us, the flow of information superseding the importance of material exchange. Complex digital infrastructures have inscribed themselves within our well-established mechanical and urban patterns. Today the unique character of handicraft and the industrial sameness of systematic mass production can coexist thanks to CAD/CAM, which assists the production of series-manufactured, mathematically coherent but differentiated objects, as well as elaborate and relatively cheap components.

Today's algorithmic and parametric tools in 3D modelling software allow the associative behavior of the unit. Computerised manufacturing allows fast individual production of the different components. The "new module" seems to dematerialise, becoming more of a set of rules and mechanisms defined in a virtual environment (Figure 3). The parameters defining the "new module" expand until present manufacturing, materiality, transportation and cost limitations can reach. Today's modular constructs define an era of neo structuralism, combining technology, complex geometry and ornamental aesthetics in one singular entity.

Architecture is mutating into "firmware,"[3] the digital building of software space inscribed in the hardwares of construction. Soft, complex curved surfaces modelled in data-space will be transmuted to real space as bent or tongued variable panels, as sheets in steel, copper or plastics, or as Kevlar or glass fiber skins; massive involuted elements designed in data-space become milled, routed or turned elements in wood or aluminum, or cut as moulds for quick-setting resins, rubbers or metals. Bridging the boundaries between the real-technical and the virtual-technical, firmware will favour a far more malleable relationship between bits, space and matter.




**Analogue tooling:** A flower is generated by folding felt. Four variations of the module are put together in a flexible blanket.

**Digital tooling:** The flower is transformed into a parametric object that can be modified with the Morph tool. Several variations between open and closed conditions are created. The final object is exported as a rapid prototype model.

***Figure 6:*** FlowerZ: parametric modules created with **form•Z**'s Morph tool by Olivia Haym, Costanze Joppen, and Sandra Renner.

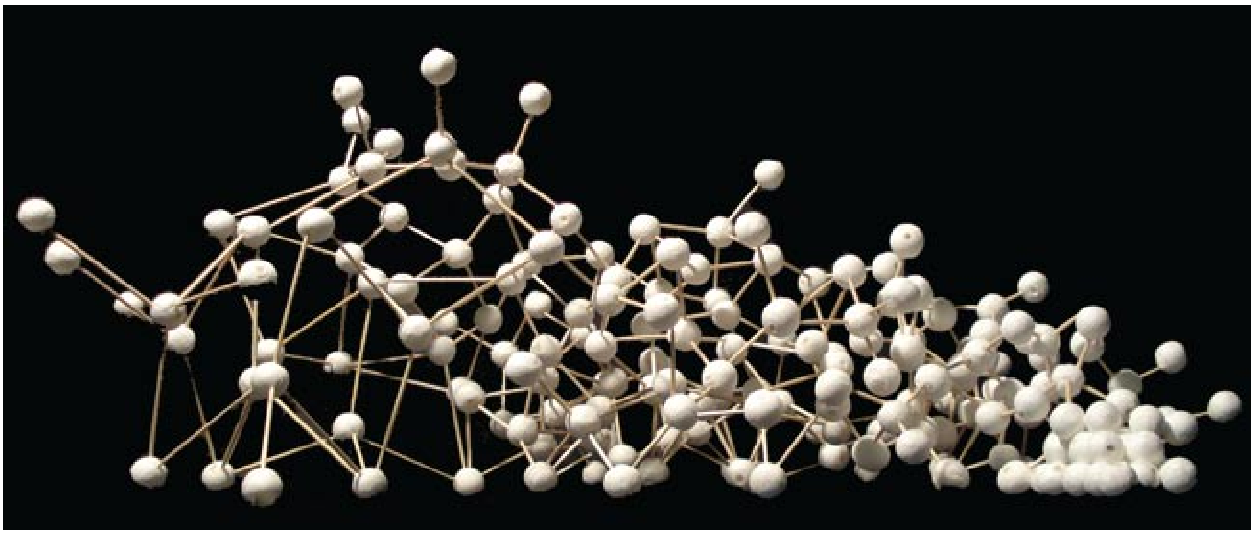


***Figure 7:*** Particle cloud by Egon Hedrich and Rainer Schmidt.

**Analogue tooling:** A complex geometrical construct is constructed as a cluster by varying modular particle entities.

**Digital tooling:** One geometrical segment is digitised and its spatial and surface conditions are explored. The final object is a 3D plot.

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***Figure 8:*** Modular construct by Mareike Ahl, Bettina Dobschal, and Miao Miao Ma.

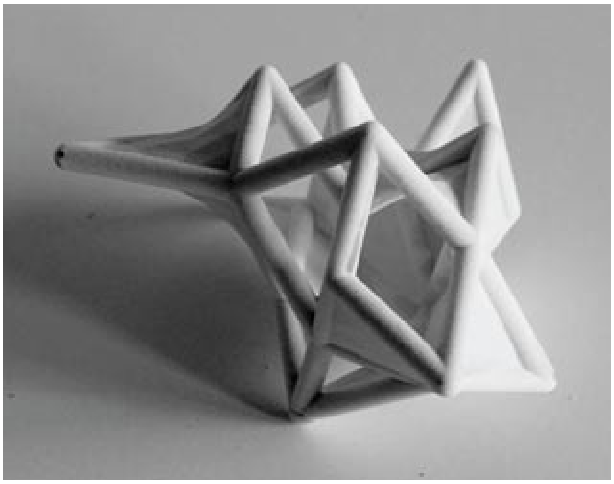

***Figure 9:*** Rapid prototype model.

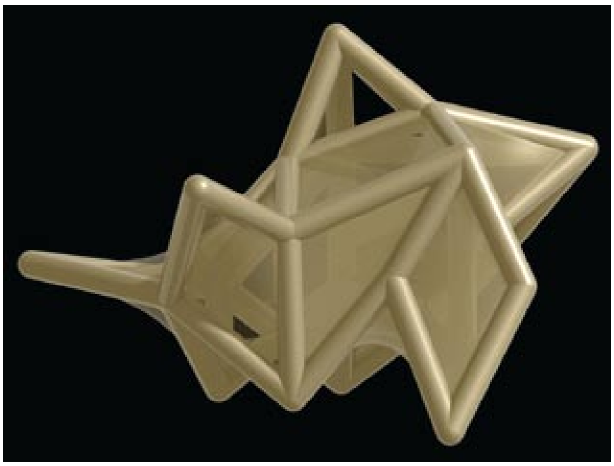

***Figure 10:*** Rendered 3D model.

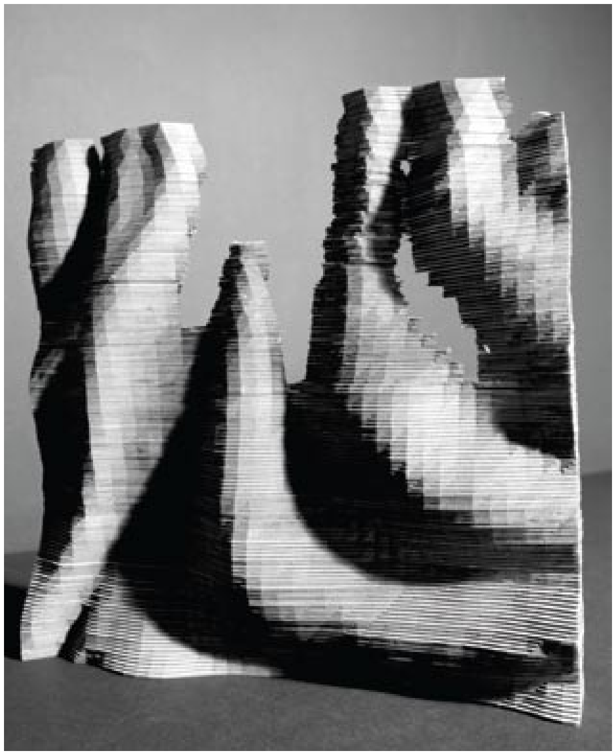

***Figure 11:*** Laser cut prototype by Nina Linde and Johen Vollmer.

**Asterios Agkathidis** was born in 1974 in Thessaloniki, Greece. He studied architecture in Thessaloniki and completed postgraduate studies in Advanced Architectural Design at the Staedelschule in Frankfurt in 2001, with Ben van Berkel and Peter Cook. He became a partner in the architectural practice b&k+ in Cologne until 2004, then at VMX architects in Amsterdam, until 2005. He later founded the architecture and research platform www.a3lab.org (Frankfurt-Thessaloniki). Teaching and lecturing experiences include AdBK Nuremberg, FH Frankfurt, FH Cologne, FH Bielefeld, Univ. of Thessaloniki, Staedelschule Frankfurt, and Van Alen Institute in NY. Today he teaches at the Technical University of Darmstadt and the Boston Architectural College. His recently published book “modular structures” follows the success of “form defining strategies” in Europe and America.

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# Giving Our Ideas a Playground, not a Contained Shoebox

## numerous thoughts on the digital design process and the reasons why it is a creative step forward

**by Andrzej Zarzycki**

The term "design process" might be seen as an oxymoron, however it is an interesting combination of contrasting words. The word "design" suggests a creative endeavor with unlimited possibilities, not tempered by predictable or predetermined patterns. It also suggests something new and out of the ordinary. From a different perspective, the word "process" implies a systematic course of action that brings about a result. It implies a course of action that is both deterministic and goal oriented.

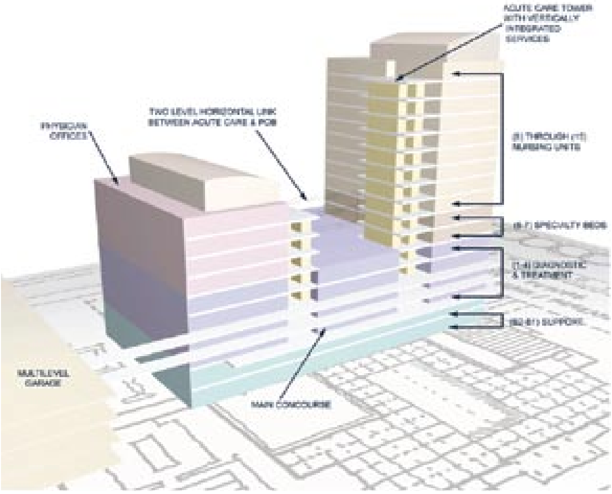
Indeed, the phrase "design process" captures effectively the dialectic tension and meaning of a creative struggle. This apparent contradiction underlines two formative components of a successful design process: generative and implementive. The first component 'wants' to be creative, unrestrained by the current state of knowledge and is occasionally provocative. The other component is systematic and hierarchical with reasoning based on critical thinking. However, these two distinct and polarized ways of thinking: hierarchical or generative, didactic or inductive, have to occur together since neither one alone is sufficient in facilitating the creative process. Thus, the "design process" is a fused dichotomy of design generation and the process of its implementation.

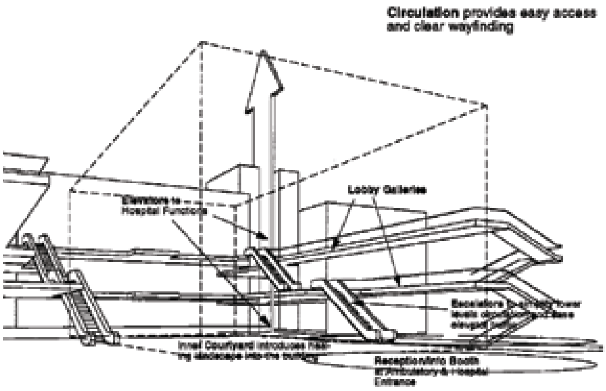
The distinction I made earlier between generative and implementive (design and process) is critical. The concern with design process based architecture is that it often has too much process and not enough design. By process in this particular context, I mean a highly didactic form of reasoning, while self-consistent and self-integrated, relies heavily on arbitrary propositions. This reliance is not in question, but rather its unapologetic confidence and presumed righteousness. This methodology often confuses intellectual beauty for visual beauty; intellectual construct for visual and emotional experience. There seems to be a conviction in the architectural profession that good process can justify the final design on the merit of its process alone. While this is often an effective way to convince a client or justify our actions to colleagues, it does not guarantee design or creative excellence. Not choosing one way of thinking—simply hierarchical alone, but benefiting from both—hierarchical and generative—is necessary for a successful creative thinking/process resulting in a creative end-design.

While touching on several aspects of the design process, this article focuses primarily on the generative aspects of design with an emphasis on the new and renewed role of digital tools within its spectrum. Specifically, it discusses how digital tools continue and reuse traditional (analog) modes of creative thinking, as well as emerging possibilities specifically connected to the digital interface.

This article's argument points to specific modes of creativity that facilitate in breaking established mental patterns within creative thinking. The design goal should be to increase flexibility so that the design can evolve with project constraints and sensitivities, not just according to our own internal reality, or as controlled by our initial propositions. Rather than to force the design to become a simple consequence of our initial assumption, it is important to set up a framework that allows the design to flourish and in turn optimize our initial assumptions.

The question about how one goes about reframing her own frame of reference or restructuring his thinking patterns, is central to any creative endeavors. How do we develop innovative ideas based on past experience? How do we learn from the past, without becoming predestined to replay it? This article does not aspire to answer all these questions, but rather attempts to position various current creative developments within the digital design scene; which in effect connects emerging design strategies. The examples discussed in this paper are narrowed to tectonic expressions—otherwise known as model based modes of




***Figures 1-3:*** Commonly, the design process is associated with hierarchical and sequential refinements as shown above. A linear design process is concerned with idea development and delivery. A process with a predetermined direction and a predictable class of solutions.

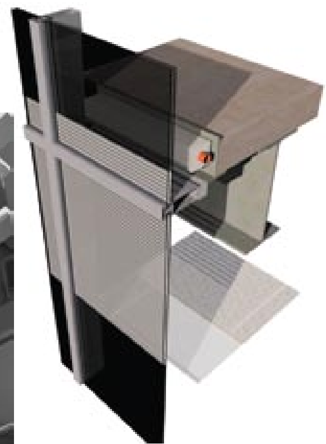
creativity. However, the discussed ideas and posed questions are relevant to broader aspects of creativity.

## Limitations of Purely Hierarchical Thinking

The design process involves the progression and successive resolution of an idea through a series of phases--from general to specific. Architecturally, these would be schematic design, design development, and construction documentation (Figures 1-5). Design starts with a set of assumptions and progresses through a series of deducible events or propositions preserving the underlying initial logic. At each stage, the initial idea does not change, but is further refined to address the evolving constraints and sensitivities relevant to this particular phase. The design methodology, in the traditional (deductive) approach is highly scripted resulting in more refined ideas, but at the expense of the reduced flexibility. While this is acceptable for the final design product, it is not desired for the intermediate design stages, because this obscures alternatives that may be more suitable for the final resolution.

The didactic process can be scripted into discreet steps, each step testing or resolving a particular design aspect. This hierarchical and linear methodology narrows a number of paths the design can follow. Additionally, the sequential logic associated with the didactic process obscures the solutions (events) that lay outside the immediate logical horizon, making it difficult to move laterally and develop alternatives. Furthermore, the traditional step-by-step thinking builds an inertia of predictable conjectures leading to deterministic outcomes, or in order to move beyond it requires an imaginative leap of causal thinking that would not be consistent with a purely didactic methodology. Some might argue that struggle is necessary in order to find greatness or success in the end-result. In pop culture, people refer to this as the all-important “ah-hah” moment.

***Figures 4-5:*** Digital models of construction details.



## Points for Generative Thinking

A didactic, overly controlled (scripted) design process depreciates the value of the intuition and marginalizes the value of a local condition, by imposing an 'a priori' idea or philosophy. While useful in the design delivery, didactic thinking can be derailed by an inability to deal with unexpected incompatibilities. The didactic process alone comes short of creative possibilities because of the inexpressiveness of certain architectural ideas. Also, the true nature of the design process is not deterministic but rather stochastic defined by tendencies and gravitational pulls, not intellectual absolutes.

Any design process needs to have a strong inductive component. This inductive component is responsible for the site response, human experience considerations, as well as formal sculptural expressions that test their appropriateness against human's visual judgment and perception. However, for the inductive design process to thrive successfully, we need to build into it an accident, chance or the unexpected. In the traditional/analog design process we would call it an inspiration. It would usually involve a metaphor, analogy or a set of substitutions, both visual and semantic to facilitate a lateral movement from one idea into another.

## Traditional Generative Design Process

This speaks about the continuum between analog creative means and the new digital paradigm. Conceptual design in the traditional design process uses metaphor, analogy, substitutions, and found objects. Found objects can be three-dimensional elements such as ordinary objects, but also a painting or a photograph, sometimes altered in scale or in composition. Oftentimes, designers use destructive or deforming procedures to arrive at new design ideas.

In the design process, a creator is constantly presented with a challenge—how to step outside the familiar and explore possibilities that are not immediately obvious or reachable based on the past experience. This challenge was and is present in design, predating the use of digital technology. However, it is useful to look briefly into the past to see how designers and artists dealt with this predicament to better realize digital tools' impact on the design process. Designers in the past used metaphor, a found object—involuntary sculptures, etc. Dada, Cubism and Surrealism, were good examples of artistic thinking and subsequently were translated into other design disciplines such as architecture.

Found objects, random photographic captures, elements of decay, they all can serve as a diversion and a starting point for design—a seed—that will evolve through a new set of events and follow a new trajectory. While we could discuss more traditional modes of designing; it is important to underline the correspondence of these techniques with digital modes of creativity.

## Digital Equivalents and Supersedures

The introduction of digital tools into the design process does not change the rules of the creative game used currently in analog design. Analog tools and methods are easily mapped into new, digital equivalents with little or no translation lost. With the digital design process, analog methods are further expanded by a new set of instructions such as transforms, morphs and substitutions, as well as dynamically changing constraints and sensitivities. These new instructions allow for qualitative change in design thinking and help designers to see their work in new ways.

By deforming, morphing or substituting elements, designers can experiment with models and generate a number of variations that display new spatial and tectonic characteristics. This way of working brings generative qualities into often overly systematic and hierarchical design process by allowing for imaginative design leaps. These generative processes manifest exploratory behaviors and help in pattern breaking out of the current conceptual paradigm—changing a frame of reference. They facilitate idea searching by asking "what if?" questions, not narrowing design possibilities to focus on a final solution as hierarchical processes do. The tectonic products of the generative explorations become the digital equivalents of "found objects," similar in meaning and use as those used by Duchamp in his art[1]. However, it is important to remember that these generative strategies are not means in itself, at least architecturally, but are meant to complement a hierarchical, step-by-step design process.

In the transformation-based approach, the design is executed by applying simple rules and behaviors to the original form. Each of these rules represents a limited vocabulary and produces very recognizable effects, such as the 'bend' or 'twist' transformation. However, by compounding even a small number of simple transformations, the forms' complexity and design possibilities grow exponentially and escape predictable visual patterns (Figures 6,7).

Furthermore, the way a transformation is applied—the relationship between a transformational "gizmo" and the object's axes of symmetry—would result in visually different outcomes. Although, all outcomes would be consistent with a mathematical definition of a particular transformation, they may not be obvious and would be seen as a distinct form (Figure 8).

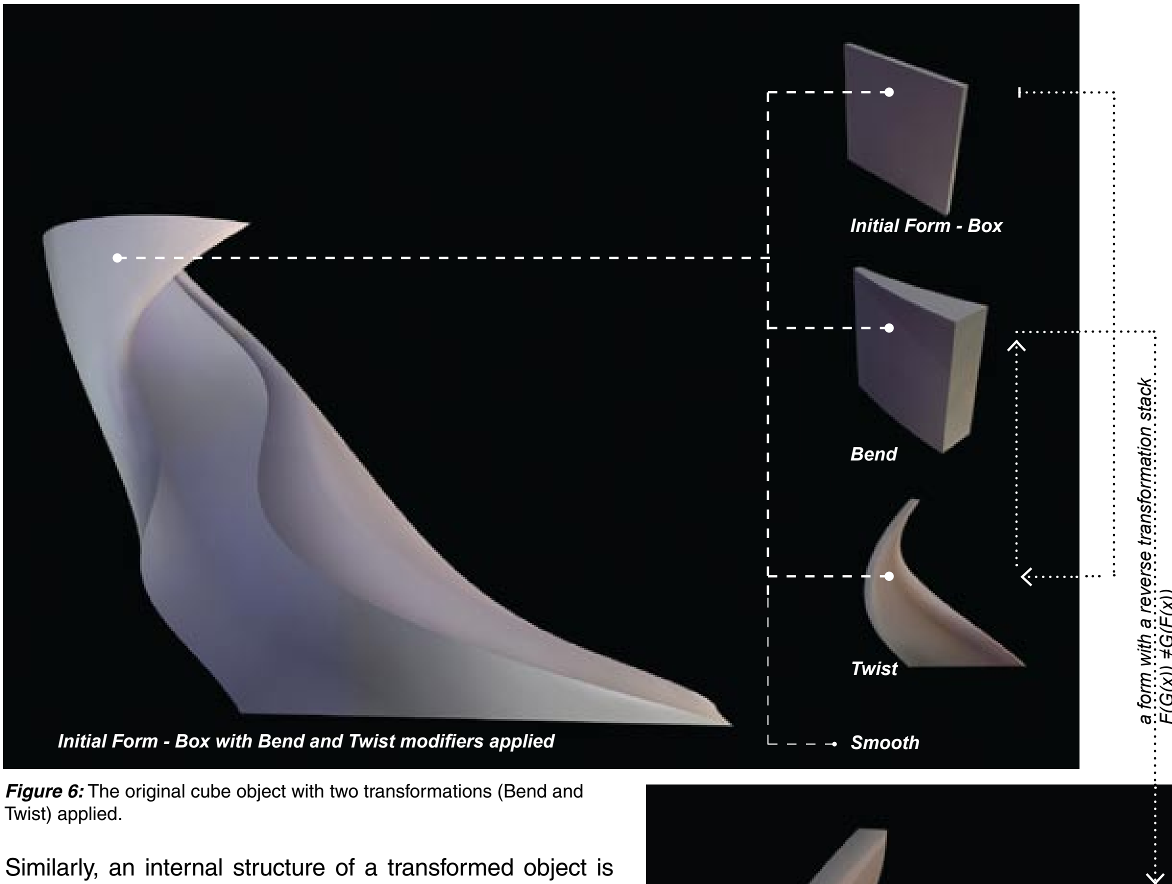



***Figure 6:*** The original cube object with two transformations (Bend and Twist) applied.

***Figure 7:*** The same object transformations applied in a reverse order result in a different form.

Similarly, an internal structure of a transformed object is critical in expressing its resultant form. For example, the bending of a meshed object is dictated by its segmentation. Since individual faces do not bend and are the smallest building blocks of a meshed form, the size and number of segments may drastically change the result of applied transformation. The difference between shapes like a letter “V” and “U” lies in an internal segmentation of an object, not necessarily in the difference of a transformation applied to the letter “I” or a character “-.” In these situations, segmentation can be seen as an object’s transformational degree of freedom, which defines a number of pivotal points controlling facets and curvatures (Figure 9).

Not only may a transformation result in a new form, but also a change in the internal definition of a form. These changes, when continuous, result in the texturizing of an object, creating an interesting relationship between a form and its texture (faktura). Figure 10 shows form fragmentation resulting in unique material expressions. While animating elements’ fragmentations, textual qualities emerge from smooth forms. This also introduces an interesting ability of fragmenting transformations to populate design with newly emerged geometries.

The transformational tectonic strategies show a potential to be dynamic tools in form emergence. Often within a couple of design steps, a form can progress from a seed object to a new, independent creation that does not bear any visual resemblance of the original design.

Script-based or algorithmic design brings this design approach into the next level where a designer sets transformations in a continuous process executed by a script or an algorithm. This algorithm can be completely predefined,

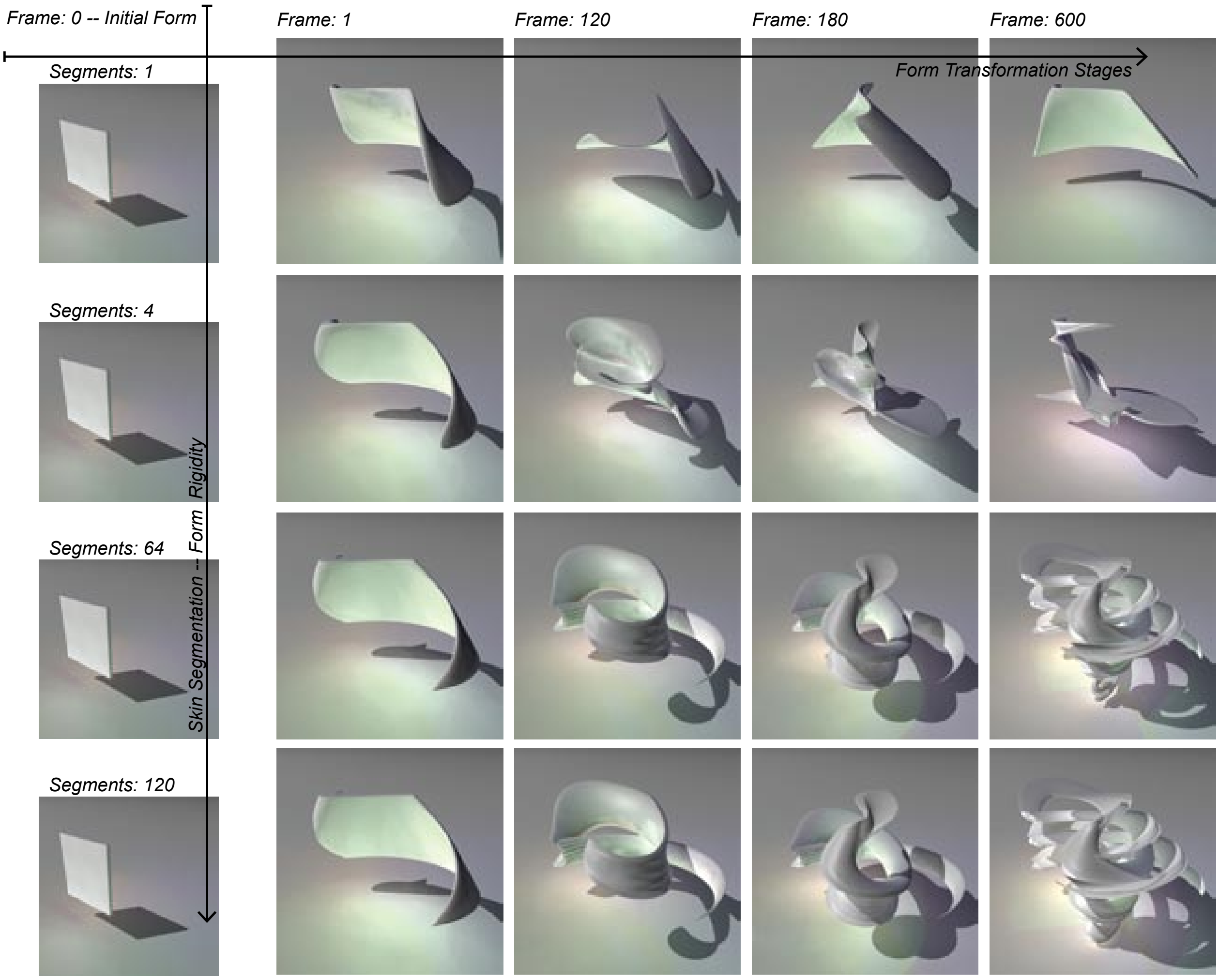



***Figure 9:*** Segmentation as an object's transformational degree of freedom.

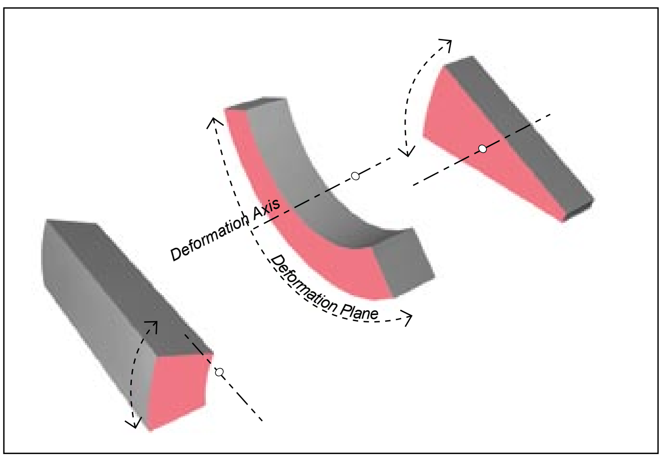



***Figure 8:*** The 'bend' deformation applied along three different axis.

controlled by input parameters, or can have some autonomous behavior based on random variable inputs. These random inputs, further extend the transformation-based or algorithmic design into evolutionary strategies where the design process can acquire some level of self-directing behavior. In this case, the role of a designer would shift from being clearly interactive into a system manager that controls naturally evolving processes through arranging various starting conditions (Figure 11).

For the evolutionary design approach to be successful in creating new ideas and forms, it has to rely heavily on the generative, lateral thinking[2] based design strategies. Since an evolutionary approach uses an existing form as a starting point, the natural tendency would be to continue within its cone default variations arranged within the same family tree. However, a creative process requires transcending its initial state and realization of a qualitatively new form.

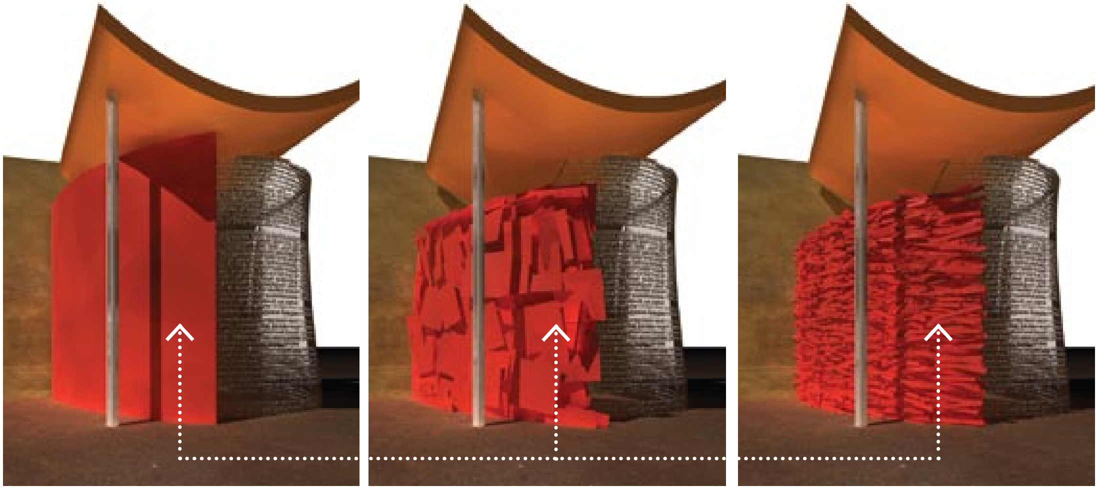


***Figure 10:*** The destructive deformation applied to an object creates an impression of texture. A texture emerges from a surface transformation.

## The Design Equation

As one goes through the design process and comes across a difficulty of finding a satisfactory solution, s/he often realizes that the initial assumptions used for design are not compatible with the desired goal. To resolve this situation, one would have to re-address the initial design assumptions. In many cases, it is difficult to evaluate an initial assumption from the perspective of the final design because of the complexity and non-linear nature of the design process. The cause and effect sequence may be obscured, particularly in the analog design process, since there is less opportunities for the common thread connecting various design events.

However, the re-evaluation of initial design assumptions could be achieved by considering design as a formula based equation with parametrically driven definitions and not as a collage of unrelated tectonic gestures. Consequently, if we were to reverse the design direction[3], we could use the final design goal as a driving agent to define what conditions or assumptions are necessary to achieve this specific goal.

Digital based speculations allow for thought-provoking investigations that consequently facilitate looking at the problem in new or less dogmatic ways. Examples of this are tectonic animations used not as generative tools, but as analytical ones to study form potentiality. They help to scrutinize design formula and deriving often-unexamined aspects of architecture.

Since generative digital design can be a product of a parametric formula, we are able to derive any value used in a formula that went into defining this particular form. This is achieved by reversing the design equation and treating the parameter in question as the unknown, while the final design is treated as a variable that informs design assumptions. Consequently, we can ask: "what parameters are necessary to achieve a particular form or performance criteria?" This ability is critical in design evalu-

***Figure 11:*** Generative variation of an initial object.

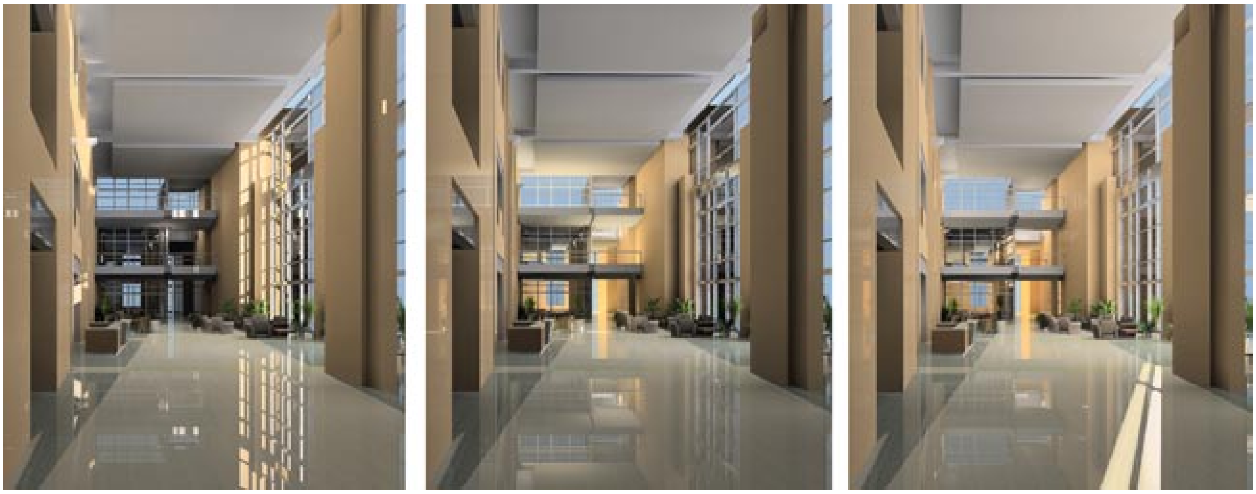


***Figure 12:*** Sunlight study of an interior space.

ation and analysis, since it provides feedback based on final delivery criteria. For example, instead of studying sunlight within a space throughout a day (Figure12), one could study the form as a morphing continuum and pose the question: what a space or form wants to be to allow for optimal illumination, or perhaps more evocative reading of an interior space (Figure13)? This effectively repositions the question from what is the best lighting scenario for a particular design, to what is the design that uses existing lighting possibilities most effectively.

The ability to reverse a design equation and derive a component that is usually considered as unchangeable or constant allows for imaginative leaps. This brings a feedback mechanism into design simulation and allows for a two-directional design process, where the final design can be tested against initial assumptions. Vice versa, a class of possible final designs can be used to verify the integrity of the initial assumptions. Furthermore, this approach promotes creative, non-hierarchical thinking by questioning and testing initial assumptions, which consequently help in overcoming design stereotypes and the inertia of past ideas.

## "Why Shouldn't We Undervalue the Digital Design Process?"

As mentioned earlier, the traditional (analog) design process often relies on metaphors or analogies to break away from an established way of design thinking. While this approach is useful in generating new parallel ideas, the product of this analog, generative thinking often does not flow naturally into the next level of design development. While it is very effective in art—the place of its origin, it is more difficult to realize it in design.

An artistically deformed piece of burned plastic may, or may not, easily translate into an architectural form. Its material and texture at the scale of a small, hand-size model may work very well as a design metaphor, but struggles to translate poetically into a full-scale building.[4] This may result in a schism between the conceptual and implemented design manifestations, where poetic visuals cannot be easily translated into architectural forms and propositions.

We often see students creating highly evocative and effective physical study models that later fail to evolve into a more resolved stage. In these moments, evocative conceptual ideas created in early design stages are lost when passed into design development.

The reason for this situation usually does not lie with a student's design abilities, but rather with the non-portability of the design expressions used in this particular model from a perspective of various dimensional scales and detail levels. This lack of portability results from the dependence of their key design expressions on these particular materials, scales or levels of textures. While a cardboard model with partially removed layer of paper looks evocative, this quality may be difficult to express in a full-scale version of the same design.

While both analog and digital design processes are prone to fall into this "lost in translation" condition, I feel that digital generative explorations have a greater ability to transfer the initial intent into subsequent design stages. The reason for the digital design's greater interoperability lies not only in the continuity of digital data sets[5], but also in an ability to go-back-and-forth between the generative and design development model; a stronger interconnection between the design cause and effect. This is particu-

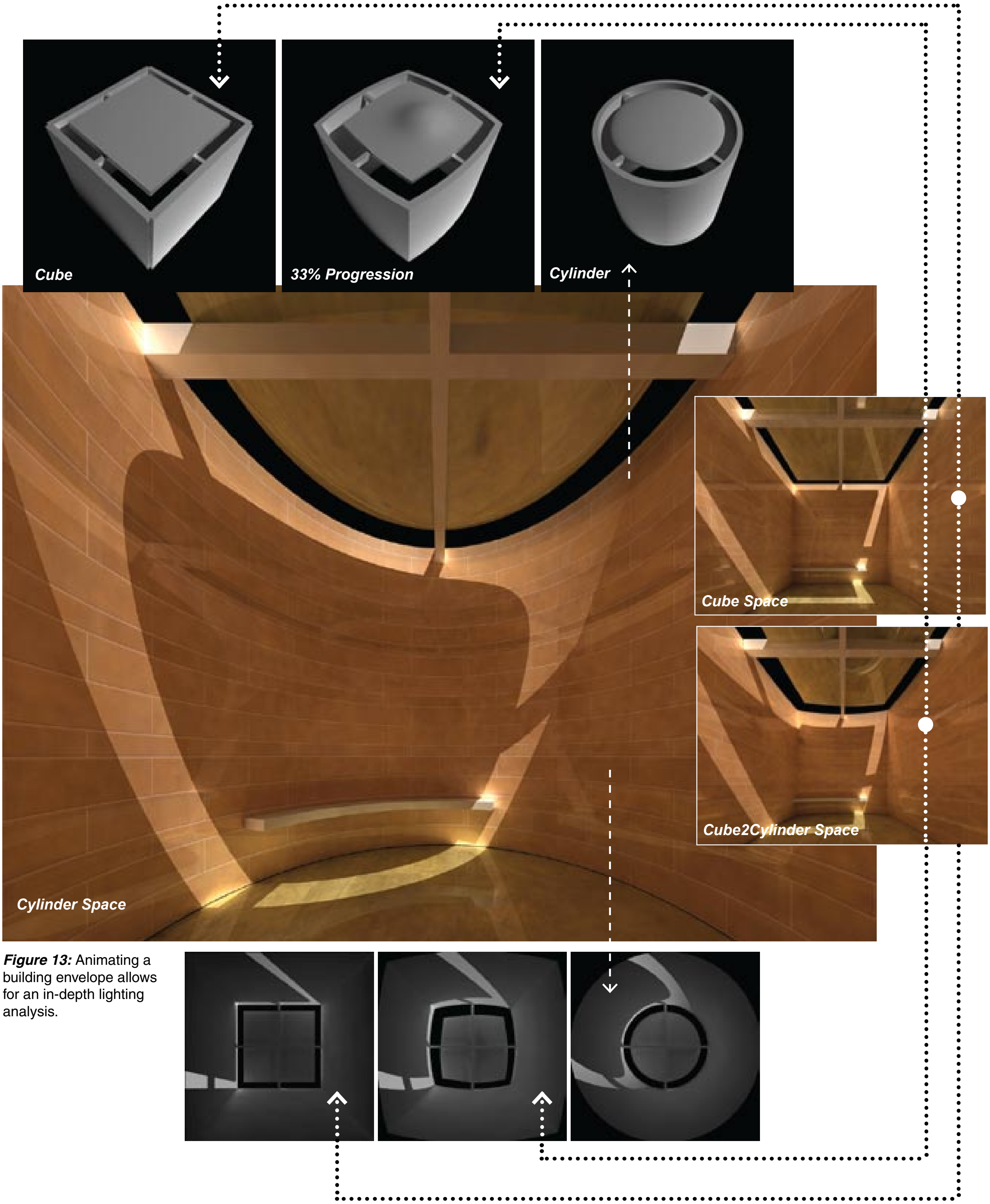



***Figure 13:*** Animating a building envelope allows for an in-depth lighting analysis.

*Sun light Shadow Simulation, RCP view*

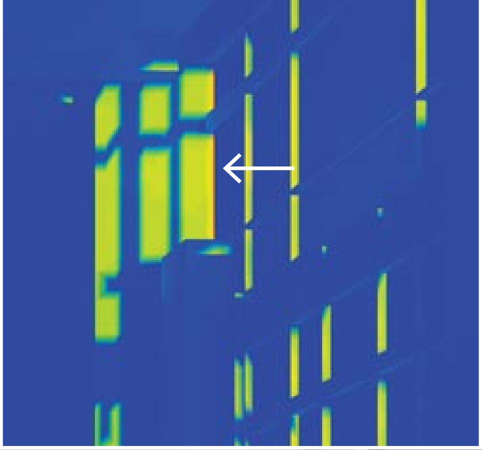


***Figure 15:*** A detail of the illumination analysis showing the change in sunlight intensity when passing through the curtain wall glass.

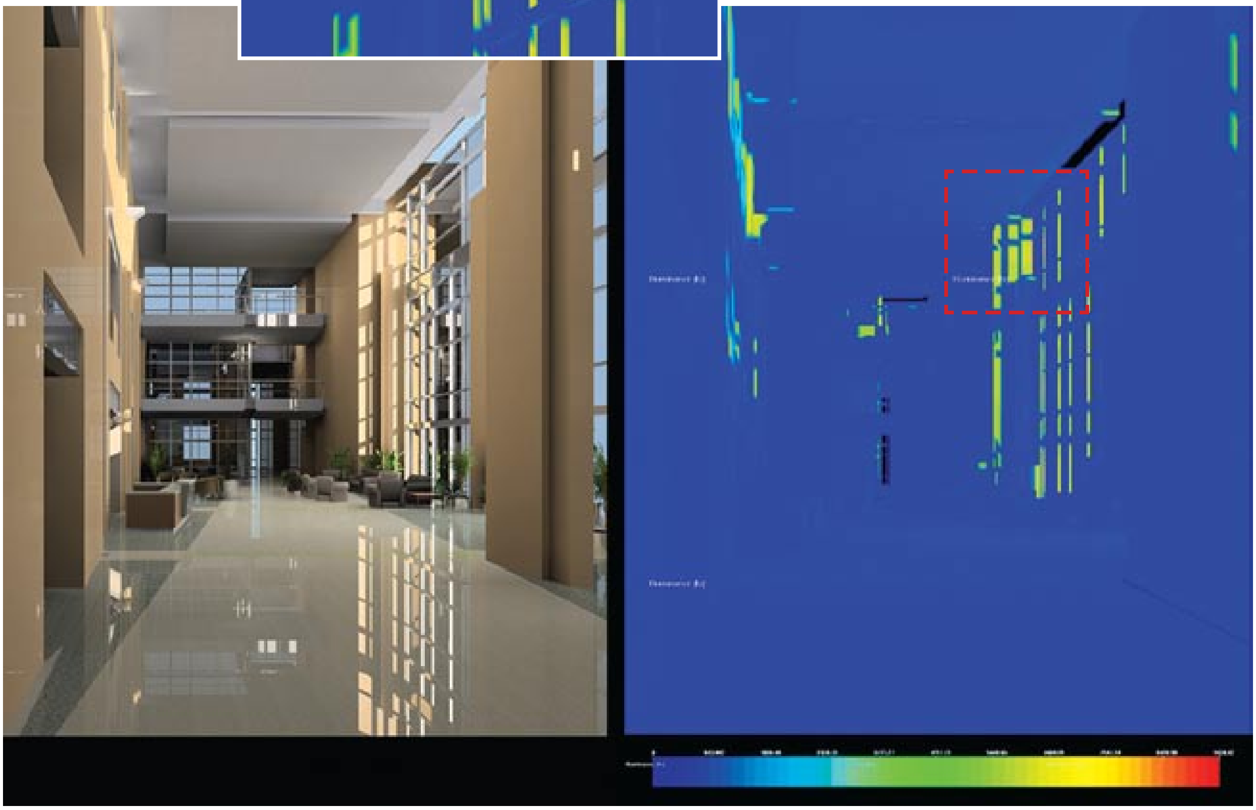


***Figure 14:*** Sunlight illumination analysis module.

larly true in the situations discussed earlier ("reversal of the design equation,") when a causal relationship can be transposed as part of the design evaluation phase.

This continuity of creative expressions compounded through subsequent design phases is more easily achieved within the digital environment than an analog one. The interoperability of digital content goes beyond the ability of various software packages to interact between each other. It is directly connected to design data's spatially and tectonically resolvability as well as digital "lingua franca."

Digital visuals and models have some of the same impediments. However, they can usually be more easily controlled because of the multiplicity of design scales afforded in virtual media. This does not mean that these traditional, highly evocative approaches should not be used in the design process. On the contrary, they should be used as strategic generative devises that help to break away from preconceived patterns, but not as miniatures of a final design.

A critical step in this direction is the development of the Building Information Modeling (BIM)[6], which aims to connect all architectural design stages into one informational continuum spine. This approach has a number of benefits such as error reduction or measures to prevent knowledge loss associated with handing a project from one design team to another. However, it presently operates almost exclusively within hierarchical and sequential paradigms with focus on continuous refinement of design without an idea/design generating component.

While BIM technology starts to address lateral/generative thinking[2] by allowing easy component substitutions such as window or door blocks, the extent BIM is presently implemented facilitates design refinement more than design explorations. The greatest challenge for the BIM technology is to reconnect its hierarchical and methodological structure with the generative tools like **form•Z**, in order to broaden the tectonic class of solutions, making it relevant with the present state of architectural and product design.

The interoperability between project delivery software (BIM) and design generative software will be critical in achieving a fully integrated digital design process. This would bridge both modes of design thinking—hierarchical and generative—preventing information loss associated with moving between different stages of the project.

More importantly, it would allow instant and interactive design feedback in the conceptual (generative) stages based on the contractibility or building performance criteria. This could be achieved with single or multiple software packages. If done with multiple software applications, it would be important to establish a set of standards or procedures that would facilitate the data portability and interactive building information modeling.

A critical component of this interactivity would be a performance simulation and analysis module (Figures 14,15) that could be used as evaluations criteria for generative designs. With the use of this module, a designer would receive instant feedback on the building's performance, not unlike a player would experience in the game "Jenga," when removing a block from underneath a set of stacked blocks.

## Closing Thoughts

With my interest in the geometry of three-dimensional forms, I find tools like **form•Z** very helpful in exploring relationships between various forms and designs. What is most intriguing for me, is not what a particular form with its descriptive qualifications is, but rather how this form can emerge out of another form. With this in mind, the geometry and parametric definitions bring clarity and elegance to the design process. They also allow for greater flexibility in experimentation, which often leads to new qualitative solutions.

This article highlights the often under-appreciated quality of the digital design process; that even though it can be arbitrary and abstract, it also creates opportunities for new modes of thinking and inventing. This quality is directly connected to the digital world's ability to shift scales, substitute elements and to cross tectonic (topological) boundaries. The digital environment is a rich, prolific, generative medium to pursue unintended consequence and achieve unexpected goals. These unintended and unexpected outcomes often fall in a highly desirable class of solutions.

While this article proposes ways to address generative design thinking, it hopefully raises more questions about the nature and structure of the design process. Questions in pursuit of which, will certainly advance our ability to design and create.

## Notes

[1] this refers to Duchamp's readymade objects

[2] as defined by Edward de Bono in "Lateral Thinking; creativity step by step"

[3] also called the reverse the design equation

[4] While digital modes of designing are often criticized by its lack of scale and instant zooming capabilities that may confuse designers—there is some weight in this argument; it is often omitted or not realized that the scale relevance of physical models make them often less than ideal study partners since the material, proportional and structural qualities usually do not translate between various scales.

[5] relates to Greg Lynn's "Integration of differences within a continuous yet heterogeneous system"

[6] Although the concept of BIM and similar processes are being currently explored, the term BIM itself is still being debated. Other alternative nomenclatures include: integrated practice/design, integrated project delivery, and more.

**Andrzej Zarzycki** is Boston based architect and educator who employs building information and generative tools as a common platform for both studio and non-studio courses. His current research focuses on validation methodologies of generative designs through building performance, analysis, and simulation tools. He brings over 10 years of design practice combined with design and technology teaching into the New Jersey School of Architecture, at NJIT. He earned his Master of Architecture from the Technical University of Gdansk, Poland, and Master of Science in Architecture Studies from Massachusetts Institute of Technology, Cambridge, MA.

University of Maryland
College Park, Maryland

# Introductory Digital Design Seminar:
# Thinking and Making

**by Mark Ramirez and Carl Lostritto**

*"The purpose of architectural education – as of all education – is not alone to train a student for professional occupation, but is above all to stimulate his [or her] spiritual growth, to develop his intellectual faculties and to enable him [or her] to grasp the nature and meaning of architecture. Any educational program of a school of architecture cannot be based on the mechanics of the professional occupation but only on the intellectual content of architecture. Our obligations to our students are two: 1. To enable him [or her] through education to develop his [or her] powers of selection by the exercise of judgment. 2. To Equip him [or her] with the skills and knowledge necessary for the practice of his [or her] profession.*
*—**Colin Rowe***

## Introduction

In an attempt to counter the training oriented model of digital media instruction and fuse into it aspects of craft and critical thinking, an introductory course in Digital Media can apply a Design Seminar methodology. This pedagogy allows for the exploration of a multitude of different software, both 2D and 3D, all within the context and use in the design process. The goal of an exercise is not to design an object or layout and then ask students simply reproduce the object digitally but to let the software inform—yet not control—the design process. In this approach the software is agnostic, not significantly influencing or biasing the student in any particular way. By disconnecting the course exercises from typical building programs the students are free to experiment with ideas and concepts that might not normally be available to them due to architectural biases inherent to the studio environment.

Within the context of any design education environment, introductory courses associated with digital media often experience a particular challenge. As a survey course they tend to focus exclusively on the training of a specific piece of software, structured around a series of assignments that ask the students to create a specific given model or three dimensional form. The success of the student is measured by how accurately the task is accomplished. Each successive exercise builds on the previous exercise, introducing a new skill or software functionality along the way. After this linear process and at the end of the term, the student theoretically acquired enough of an understanding of the software so that they can apply it in their next studio or design project.

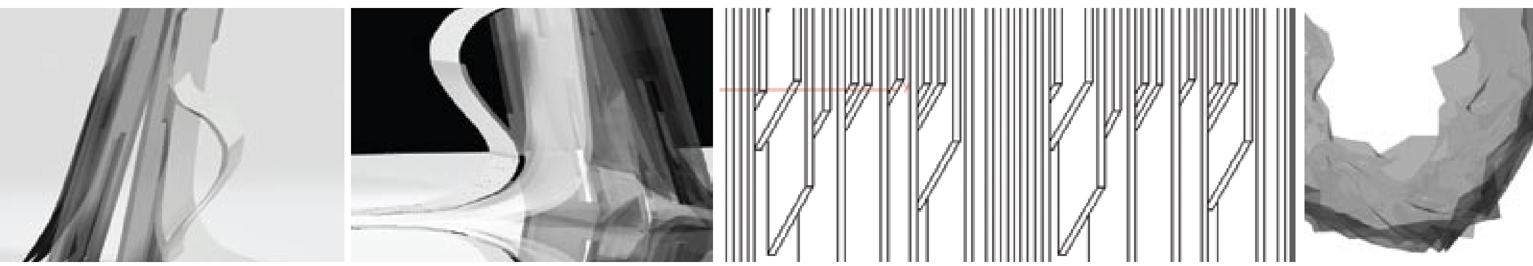


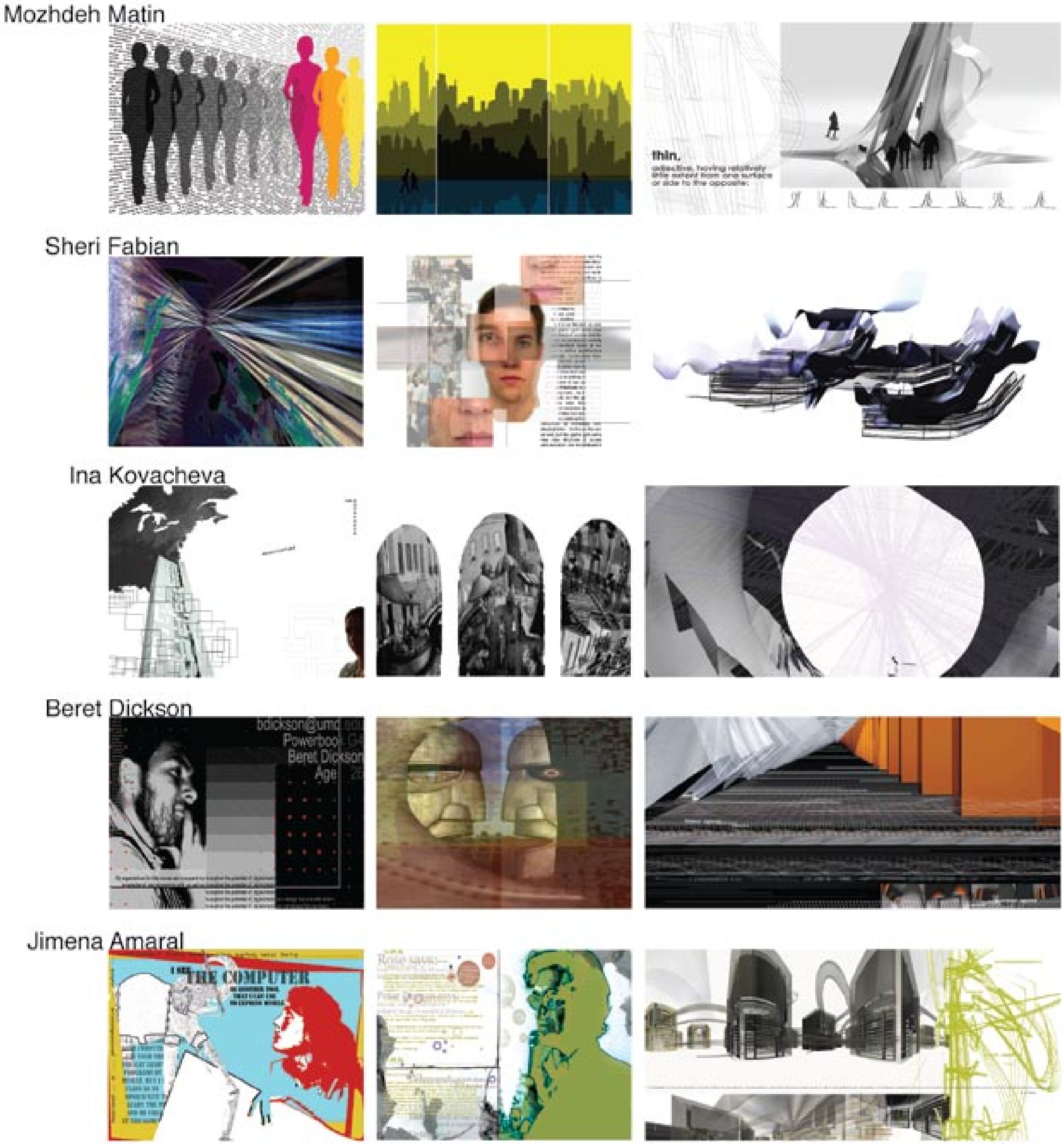
***Figure 1:*** Mozhdeh Matin. Midterm Project Process.

week 7

week 9
week 10

week 15

# midterm project



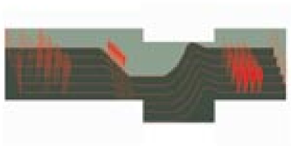

Provide a visual catalog or matrix of the given personal information.

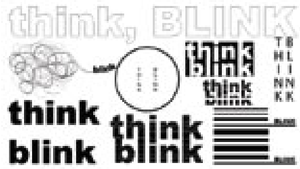
Reinterpret the idea of a Triptych. Each "pane" of the triptych must express a concept or an idea from the readings.

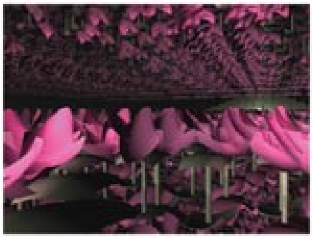
Based upon interpretation of the assigned reading, generate a series of conceptual and architectural models of the space.

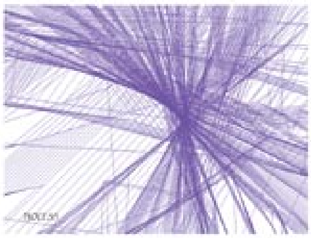
***Figure 2:*** Student-Project Matrix.

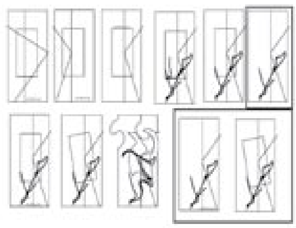
# final project

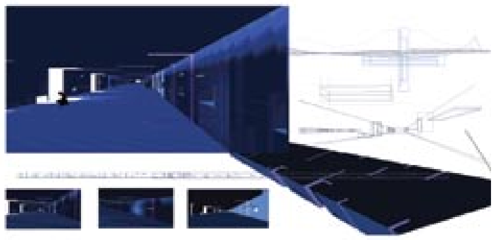


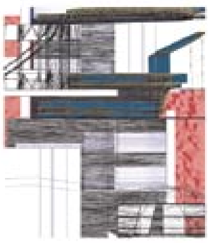


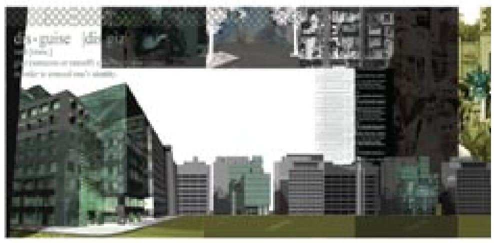













Create a series of 3D diagrams that document the process of a recent modeling or design endeavor.

Create a series of logos that represent this set of ideas.Or, maniplate the enviornemntal or perceptual context of a model to communicte a new concept or narative.

Question how a constructed process can enliven design given explicitly architectural parameters.

Unfortunately, this linear or training methodology for learning is more akin to the standard tutorial found with "off the shelf" software. No matter how energetic the instructor, the student body generally is passive and not engaged fully in their own education. Retention of the learned skills also comes into question, particularly since the students do not have any personal associations with the software when they try to use at a later date.

While software tutorials certainly have their place and they can be useful for individuals, this model applied in a design curriculum does a disservice to the student. Lost is an opportunity to discover how digital media can be used in a normal design process as well as an understanding of the benefits/pitfalls of digital tools as compared to a traditional analog or a hand drawing process. While the traditional methodology may be acceptable for a student simply interested in the production value of a particular piece of software it falls short for those where design education is the primary goal.

By contrast the focus of design studio is on craft/making, where exploration and discovery is at the root of the course pedagogy. While training on how best to draw a line or the proper way to make a plaster model may be a topic of discussion it is not of primary importance in the greater studio education. By the same token, rigorous intellectual debate and critical thinking often become prey to the time constraints of a project and when production of a model or drawing takes precedence over discovery.

## Course Description

The intent of the course is to introduce students to the design potential of digital media within the discipline of architecture. The course exposes the student to the principles and fundamentals of computer aided design through inquiries into digital modeling and visualization. The core of the class is structured around weekly design exercises as well as two larger scale projects. Following each exercise, or at critical points in the project, the students present their work in the form of pin-ups or digital presentations. The majority of the critique comes from the other students in the class with the faculty only guiding the discussion. The purpose is to help the student develop a critical eye toward digital design, whether it in their work or their fellow students. Short lectures, demonstrations, and in class presentations supplement the design discussions giving exposure to technical and theoretical issues.

Fundamental to the course methodology is the premise that the students will learn the software themselves. The aforementioned demonstrations are both short in duration (15-20 minutes) and broad in scope. It is expected of the students that they will then go back, after class hours, and explore additional or more complex functionality on their own.

As this methodology is at times in conflict with their previous scholastic experience or current expectations, many times students ask (or complain) that not enough class time is given to demonstrations of the software and that the time required for the design components prohibit the full exploration of the software. This gives opportunity to discuss the greater issue about the nature of software in the context of a student's education.

Software is ever changing, sometimes through slow evolutionary growth in functionality/capabilities or at other times through revolutionary change where new paradigm for working with digital media is uncovered. Depending on a student's career path, they may find that their chosen discipline may favor a particular 3D software over another. Software is often a victim of fashions or trends, where one is in favor now, while in a few years another becomes the preferred choice. In the context of this constant change, it can be counter-productive for design students to learn all the complexities of a specific piece of software as it may not be what they will need in their future careers. To counter this approach, the students are asked to develop a process by which, at any time, they can learn how to


***Figure 3:*** Beret Dickson. Exercise 7.

use and manipulate a new piece of software, on their own and with minimal exposure. In a sense, they learn how to learn.

It is important to note that the typical composition of the course consists of students in the second semester of their junior year or above. As a digital survey course there is no other technical or course prerequisite. Most of the students start the class with either limited or no experience with digital media. A typical class consists of a mix of juniors, seniors and second year graduate students.

The challenge for this course is to provide an environment rich in design opportunities and discussion yet one that did not compete with their typical design studios. As typical studios include two projects over the course of an entire semester and tend to focus on strictly architectural programs, the design exercises are much shorter in duration and generally independent of each other. They are conceived as short "design bombs" that run the course of the week, and allow for immediate feedback to the student. Each exercise is purposely disconnected from each subsequent exercise, so that if a student failed to generate a successful result with one assignment, their frustration does not necessarily carry on to the next. In short, they have a fresh start every week. The primary goal is to give the students as many independent design opportunities as possible. To supplement this and at critical points within the course of the semester, even shorter "Quickfire" design challenges are given. They last anywhere from five to 20 minutes and ask the student to interpret an idea from a particular topic or discussion from the week and then present it with one of the newly acquired software skills.

Also as a supplement to the software demonstrations, the students are often presented with a series of images and asked to evaluate them. This might take the form of 20 images of Picasso paintings. The paintings selected include both successful and unsuccessful studies. Another example is to present the students with a series of images from projects from the previous semester. In all cases, the goal is the same, to test the student's ability to see and make judgments about the quality or success of the image presented.

## Student Examples

The work of two students, Jimena Amaral (Bachelor of Science in Architecture, 2007) and Beret Dickson (Master of Architecture, 2008) is featured here as two representative examples of successful execution of exercises and projects throughout the course. The work of these and other students is presented sequentially with exercises conducted in the first two weeks of the course through and including the final project, completed in week 14 in Figure 2.

Amaral entered the course at one of two typical curricular levels. As an experienced design student in her final year of undergraduate education she began the course

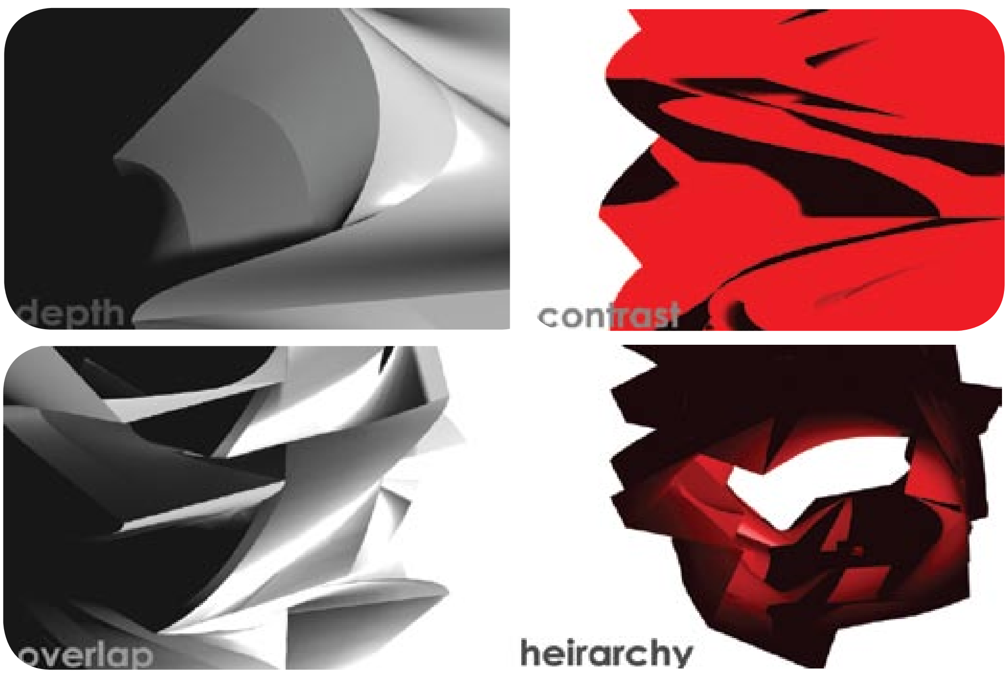



***Figure 4:*** Mozdeh Matin. Exercise 8.


***Figure 5:*** Jimena Amaral. Exercise 1.


***Figure 6:*** Jimena Amaral. Exercise 2.

with a high level of design knowledge and skill compared relatively to her facility with digital media. The early exercises allowed her and other students with similar backgrounds to leverage compositional instincts in an environment that contrasts pragmatically driven architectural projects. Few students make the transition as immediately. Some intellectually advanced students struggle with strictly graphic parameters. Even then, a common architectural vocabulary at least allows for a level of communication during discussions. The evolution from narrow understanding of architectural issues into a broad and fundamental ability to manipulate, explore, distort and communicate those same issues in varied contexts is the eventual goal.

In these early exercises (the first two columns of the student work matrix, Figures 5 and 6) are explorations in 2D media. As such, the procedural instruction is minimal, allowing weight to be placed on craft, vocabulary and technique. During its presentation, discussions regarding the work set the tone for the course with an emphasis on experimentations with media rather than usability of software. Besides their function pedagogically, these exercises lay the necessary foundation for a later in-depth series of course-wide conversations on modeling craft. A command of graphic methods is essential to an implementation of descriptive geometry. In addition, manipulation of the printed image is a necessary step in moving from digital to physical models in a cyclical digital-physical design process.

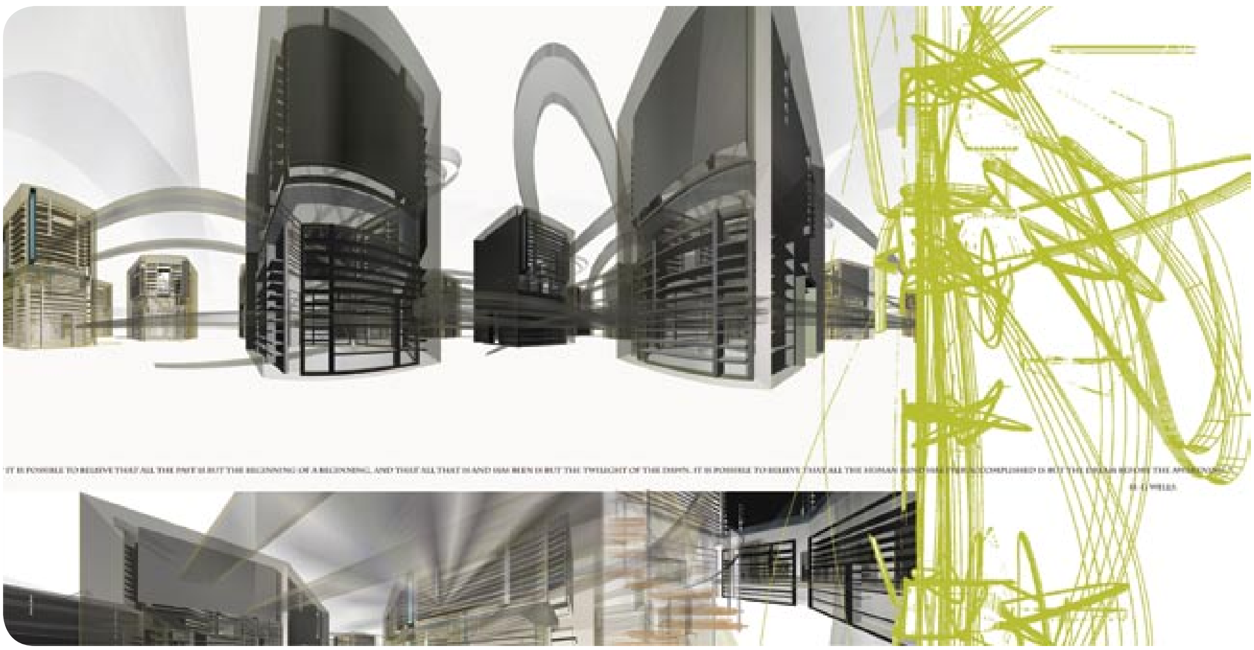


***Figure 7:*** Jimena Amaral. Midterm Project.

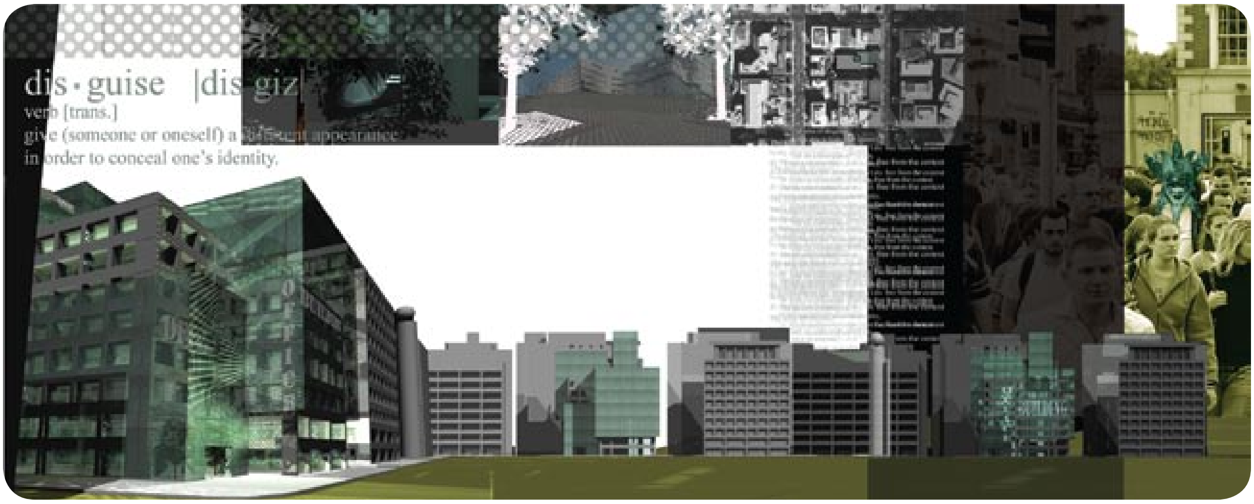



***Figure 8:*** Jimena Amaral. Final Project.

***Figure 9:*** Beret Dickson. Midterm Project.

In the 2D exercises Amaral revealed a comfort with layering, color and patterning as compositional devices. The parameters given to the students mandate little more than an explicit clarity of information. The agenda is the expectation of a reasoned intent by the designer, clarified in and by the product. This agenda persists throughout the course and is evident in that there is as much, if not more, similarity across rows (corresponding to the students) of the student-work matrix as there is along the columns (corresponding to the projects). The success of the two compositions cannot be labeled as such because the parameters were achieved to a high degree. In fact, in these exercises, the binary parameters leave so little to subjective interpretation as to negate the value of subsequent "successful" responses. The requirements are as

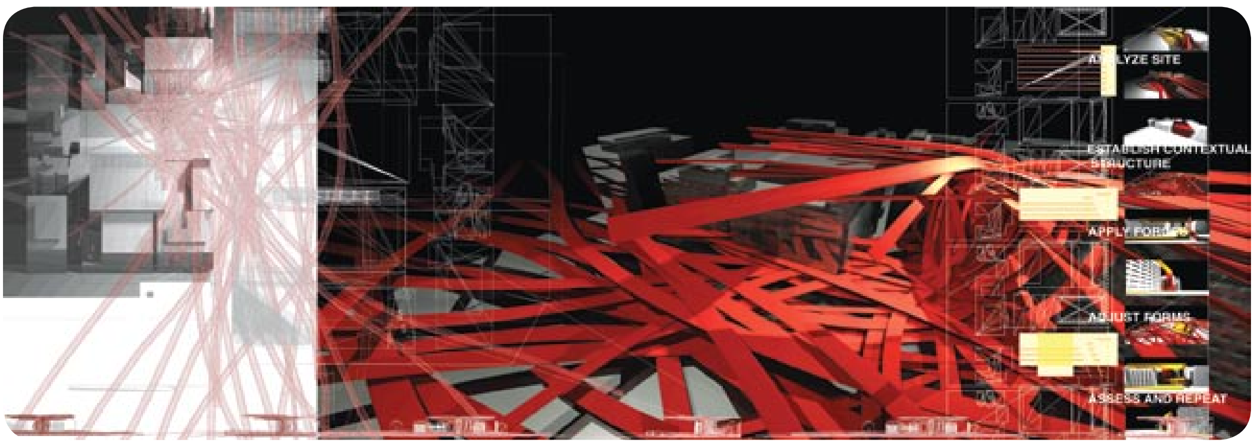



***Figure 10:*** Beret Dickson. Final Project.

basic as including information within the composition. Information cannot be more or less included. Amaral's work is successful because her intent, to create ambiguity of depth using highly contrasting figures amongst shifting frames. These two digital collages strike a balance between a flat composition and perceived space projected into that composition. These conditions and others would continue—sometimes persistently, other times dropping off and reappearing—throughout the course.

In her first project (Figure 7) Amaral translates some intent and aesthetics to an extended endeavor, the midterm project. At this point in the course digital modeling has become the primary focus. This project tasks the student with spatially conceiving a work of fiction (the specific work varied from semester to semester but included authors such as Jorge Luis Borges and Italo Calvino). In this case the intent is the realm left open to the student by nature of using subjective poetic language as the primary content generator. It is not important for the student to romanticize the selection process of the work itself, but rather rigorously articulate and execute her defined process for translating between media. In this case prose referencing dancing corridors and infinitely weaving connections to and from simultaneously central and peripheral nodes—an almost paradoxical point of departure—was translated first to a series of gestural sketches to best capture the loosely repetitive web. These lines and forms are re-digitized and manifest as forms and lines in space. Pulling from her early exercises, Amaral translated ambiguity of frame and figure into ambiguity of line and form in the construction of a spatial experience. The seemingly boundless environment is revealed by the position of the camera and extreme field of view in the primary graphic. Somewhat dimensionally apparent conditions are juxtaposed against fantastically impossible forms and the abstraction of void that is the white page. At the periphery, objective representations blend with the experiential to collage into the final product. As in her early exercises, contrasting aesthetics blur with each other to achieve compositional and spatial effects. The fundamental 2D exercises allowed for a situation in which digital modeling could be in service to the designed image rather than the converse: a static image capturing, as a simulated photograph or other conventional representation, the model. Amaral took advantage of the ability for this project to become a culmination of architectural issues while still maintaining aphysical formal and geometric gestures.

At the midterm, the mandate for the use of a digital model to achieve the end product is explicit in its existence but is open in terms of how it is used. This gives some room for students to experiment with the software with little risk as their graphic manipulation skills can provide leverage, if necessary. The exercises after the midterm set the table for a final project that demands the issues students have explored be placed within an architectural context. Students are exposed to surface, solid, additive and subtractive modeling techniques in some depth. Discussions and lectures center around the meaning and value of each. Amaral explored texture, patterning and materiality as a digital surface while modeling for these exercises. Her final project (Figure 8) successfully maintains the primacy of concept as the focus given more traditionally architectural requirements of a site and program.

A parallel final project, completed with the same given site and program with the same level of architectural implication is designed by Beret Dickson (Figure 9), a first year graduate student in his second semester of architectural education. More physical in its representation than Amaral's project, this work is less plausible as a constructible proposal. This work expresses an issue that arises in various ways throughout the course: to what extent can digital modeling promote a non-linear design process? How can media and software help reject a singular notion of architectural development

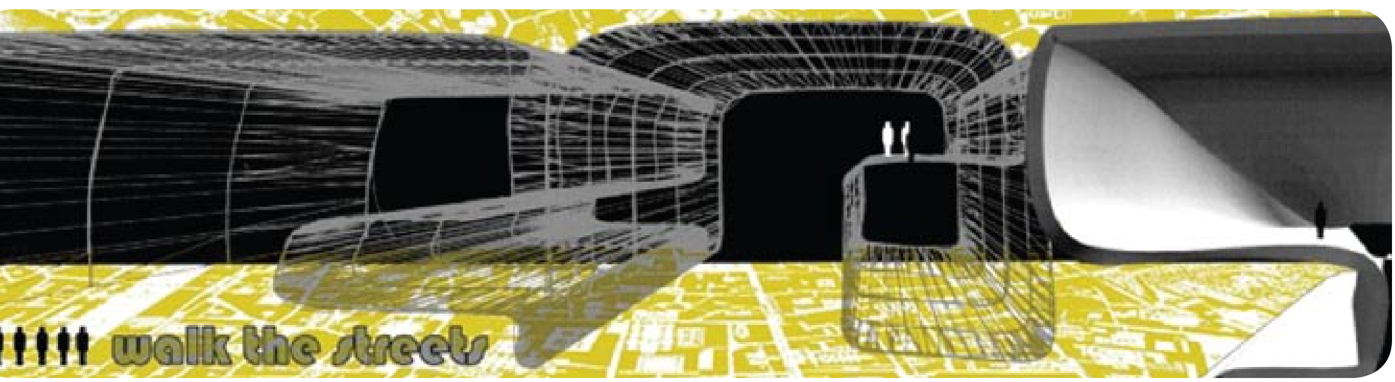



***Figure 11:*** Kevin Blusewicz. Hybrid.

from preconceived, predefined formal abstraction into articulated architectural form (with increasing and gradual focus on the more detailed scale)? Dickson began exploring this issue from the early exercises through his focus on the relationship between a user controlled part to a digitally distorted whole. His work throughout the semester regularly represents an articulation of a process rather than a product. In the early exercises it was the conglomeration of non-hierarchal content, patterned or overlapped to create a coherent whole. Later, Dickson began to explore and control emergent effects grown out of parametric variation. His two projects (Figures 9 and 10) document an algorithmic manipulation of form and space in a way that is ironic in its absurdly physical representation as it proposes not a single formal structure but a reasoned approach for distorting conventional form.

## Conclusion

This work is proof that digital media is not a tool, but rather a means to explore architectural issues from the most abstract topological concepts to the literal building. As a design seminar, this course seeks to initiate a series of experiments, with concepts proposed and tested. Never do these experiment result in anything close to a building proposal, as might occur in a studio setting. The projects however, directly propose a physical, spatial attitude about a site and program with digital media.

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## Course Software

AutoDesSys **form•Z**, Adobe Photoshop, Adobe InDesign, Adobe Illustrator, Google SketchUp.

**Mark Ramirez** is a founding principal of Square 134 Architects, a Washington DC based firm specializing in mixed-use, office, and multi-family residential design. For the past three years he has been a Lecturer at the University of Maryland School of Architecture, where he has taught several courses including Architectural Design Studio and a seminar focused Introduction to Digital Media and Architectural Representation. He is a graduate of Virginia Tech where he holds both a Bachelor of Architecture and a Master of Architecture degree. While working on his Masters, Mark spent nearly two years living and studying in Virginia Tech's European Studies Center, located in the Ticino region of Switzerland. During this time, he traveled extensively throughout Europe studying construction techniques and the effect new technological models of thought have on Architectural design. He is recognized by clients, engineers and contractors in the industry for his design portfolio, project management skills and strong technical background. He is devoted to striking the balance between design, technical detailing, and the construction process.

For **Carl Lostritto**'s biographical note see page 26.

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# Razor Design:
## Integrating Individual Design Skills into the Project Process

by Robert Brainard, IDSA

The greatest thrill in teaching the creative discipline of industrial design is to see student designers put it all together and integrate their skills with the outcome of a great product. This particular article tracks just such an experience—a design project in collaboration with Schick Corporation.

While teaching at the University of Bridgeport, my focus was teaching computer modeling and integrating it with the junior level Industrial Design Studios. The personal measure of success was the integration of all the design skills into the design process. This involved not just teaching the fundamental modeling tools, but getting the students to use it regularly just as they would their sketching skills and model making skills. This was typically done in a number of stages—(1) teaching **form•Z** as a series of tutorials, (2) teaching advanced modeling skills, (3) requiring the use of computer models to illustrate the proposed designs of the various design studio courses – basically to integrate computer modeling with the design process as you would with any other design skill or tool. This integration is what is necessary in the professional world in order to efficiently move the design forward.

This advanced integration of design skills with the design process is what I see as the goal of the junior year Industrial Design program. The first two years of undergraduate education are developmental in nature giving the students the initial and necessary skills to start designing products. The junior year is the integration of these skills into the design process to develop unique and usable products that solve real user needs. Typically we would have a series of short problems in the fall semester to make sure that students are up to speed and to advance their skills. Then we would tackle a larger scale design problem in the spring semester that would encompass multiple facets and all the design skills the students had developed to that point.

In this project students had the opportunity to choose to focus their design on a men's or women's razor and either a refillable or disposable razor. The goal was to not just design a razor, but to develop concepts through sketches, prove them through foam study models, refine the concept through computer models, and finally generate SLA models which was done through the generous assistance of Model Vision in New Milford, CT.

In this project the process involved analyzing the user needs through observation and photography and therefore drawing ergonomic conclusions. Developing concept directions through sketch development and modeling those in both foam models and in 3D computer models. This development ultimately resulted in SLA models that

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b

***Figures 1a-b:*** Ergonomic analysis of existing razors by Joel Miller.

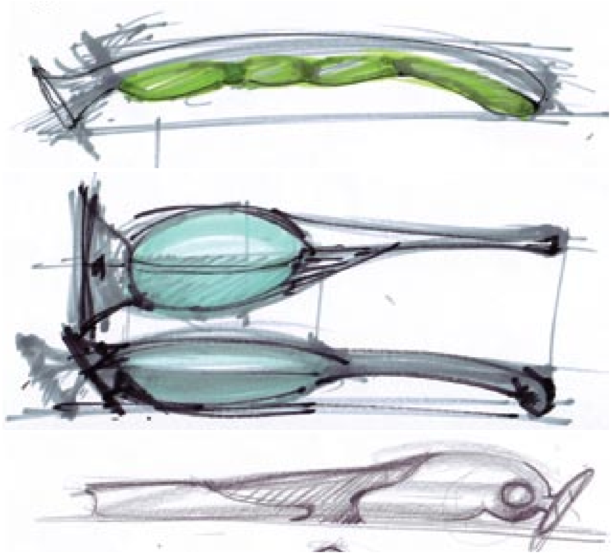


***Figure 2:*** Sketch concepts by Joel Miller.

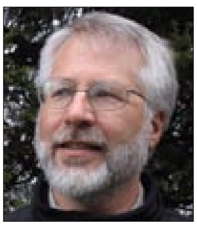
***Figure 3:*** Foam study models by William Gaston — showing the progression for economizing materials and improving the grip.

***Figure 4:*** Final image series of computer models by William Gaston.

were used for the final evaluation. While the students had a variety of programs at their disposal (**form•Z**, SolidWorks, Maya, Google SketchUp)—and some students used SolidWorks for the refinement stages because of the feature history—there were many distinct advantages that were discovered for using **form•Z**. They were: better 3D paths, great 3D sketching, ability to quickly develop concept variations, and superior rendering of images.

The process that we used was to define the design before finalizing the computer model so that the model was defined by the desired user configuration rather than the design being defined by the students' limited ability to create a computer model that is reflective of solving the user needs.

The goal is to have the students design a razor and create a computer model to reflect that design. The computer model must be driven by the desired design, rather than the design being a result of the student's computer modeling limitations. This makes for a great exercise to fine tune the computer modeling skills—rather than have the design driven by the student's limitations of computer modeling. It is a great intermediate / advanced exercise. The students enjoy it because it helps to further progress their computer modeling skills and also helps them to understand how computer modeling fits into the design process.



**Robert Brainard** taught in the design department of the University of Bridgeport from 1997 to 2008. His students won the **form•Z** Joint Study Award of Distinction in 1999, 2003, and 2005 as well as honorable mentions in 1999, and 2005. His students have also won national and international competitions by IDSA, Lightolier, The Library of Congress, Samsung, National Housewares, and LG Electronics among others. He was educated at the University of Cincinnati in industrial design and has a career involved in consulting with start-up companies on up to multinational corporations. His work has involved groundbreaking research and resulted in numerous US and international patents. He has run his own consulting firm since 1992 having previously worked for consulting firms and corporate offices.

# AutoPLAN: a stochastic generator of architectural plans from a building program

by Kostas Terzidis

In the world of design, computer programs have taken over many traditionally human intellectual tasks leaving fewer tasks for traditional designers. From Photoshop filters to modeling applications and from simulation programs to virtual reality animation and even more mundane tasks that used to need a certain talent to take on such as rendering, paper cutting, or 3D sculpting the list of tasks diminishes day by day only to be replaced by their computational counterparts. What used to be a basis to judge somebody as a talent or a genius is no more applicable. No longer are dexterity, adeptness, memorization, fast calculation, and aptitude sought after in a designer's skills set, nor do they elicit admiration and genius-level praise. The focus has shifted far away from what it used to be toward new territories. In the process many take advantage of the ephemeral awe that the new computational tools bring to design by using them as means to establish a new concept or form only to be revealed later that their power was based on the tool they used and not on their own intellectual ability. After all, the tool was developed by somebody else, the programmer who discovered the tool's mechanism, and should, perhaps, be considered the innovator instead.

As a result of the use and abuse of design tools, many have started to worry about the direction that design will take in the coming years. As one-by-one all design tasks are becoming computational, some regard this as a danger, misfortune, or an appropriation of what design should be and others as a liberation, freedom, and power toward what design should be: i.e. conceptualization. According to the latter, the designer does not need to worry anymore about the construction documents, schedules, databases, modeling, rendering, animation, etc. and can now concentrate on what is most important: the concept. But what if that is also replaced? What if one day a new piece of software appears that allows one to input the building program and then produces valid designs, i.e. plan, elevation, and sections that work. And, worse, what if they are better than the designer would have ever done by himself or herself? (Even though most designers would never admit publicly that something is better than what

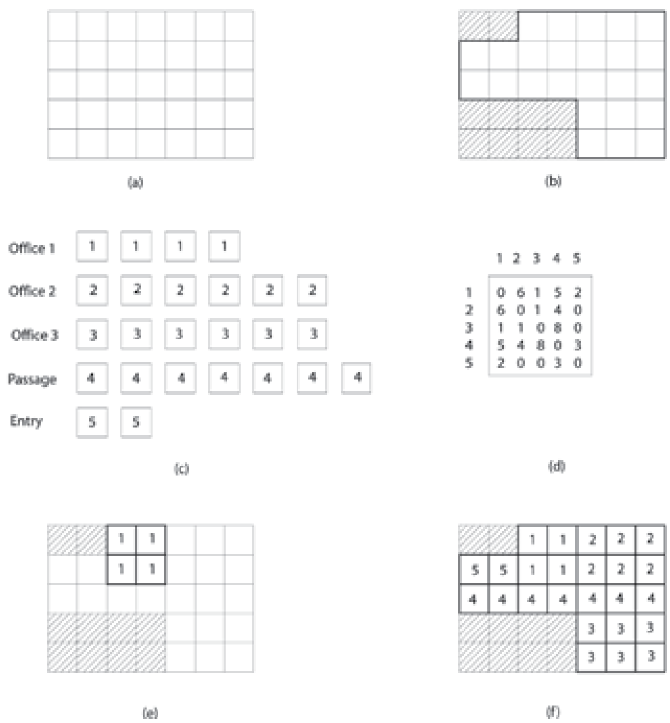



***Figure 1:*** **(a)** A grid, **(b)** the site, **(c)** the spaces, **(d)** the adjacency matrix, **(e)** placing a space, and **(f)** one possible solution.

they would have designed, yet what if deep inside them they would admit the opposite). What then? Are we still going to continue demonizing the computer and seeking to promote geniuses when they really don't exist?

During the peak of enthusiasm for possibilities that opened up for computational design in the early 1970s, a series of innovative projects were set as potential targets. One of them was the automatic generation of plans from building programs that was proposed by Dietz (1974). It involved a unit system, a site, a program, and an adjacency matrix and then the computer system would produce multiple solutions by trying various combinations of space allocation based on the neighborhood rules (see image below). This possibility apart from clever, innovative, productive, and effective, it also introduced indirectly a radical view on the role of the designer and the process of design itself. In its simplest manifestation it calls for the production of an architectural plan without human guidance. In its so-called "automatic" nature, it negates the very premise upon which architecture, and design by extension, has established its existence, identity and authority throughout the ages. It poses a strange paradox where design is redefined not as an intentional articulation of form in pursuit of an objective, but as a random reshuffling of information under constraining rules until a possibility is met that satisfies a function. Despite its promising potential, automated design did not take off as one would perhaps expect. Instead, computers simply became tools that enhanced the productivity, efficiency, and presentation of design that led eventually to enhancing the ego of the designer instead of challenging it.

In an attempt to shed light on this missing opportunity, the author of this paper developed a computer program called autoPLAN in 2008 that generates architectural plans out of a building program and a site. The program was written in the Processing computer language and can export multiple CAD files, one for each plan that was then further enhanced using **form•Z**. A series of plans generated under autoPLAN can be seen in the figures below. AutoPLAN uses a stochastic search algorithm that searches for available space to distribute the program's rooms given the site's boundary and the adjacency matrix.

The program and its algorithm demonstrate an alternative approach to the potential of computation as a design methodology. Is it possible that a design can be accomplished through the exhaustive search of possible solutions? Consider the case of all possible combinations of black or white for nine squares in a 3x3 arrangement. They are 512. If we constrain the choice to only symmetrical configurations, those are only 32. Or perhaps all possible combinations of three continuous sets of three block of three colors in a 3x3 arrangement. Those are only 60. In that sense, the notion of randomness can

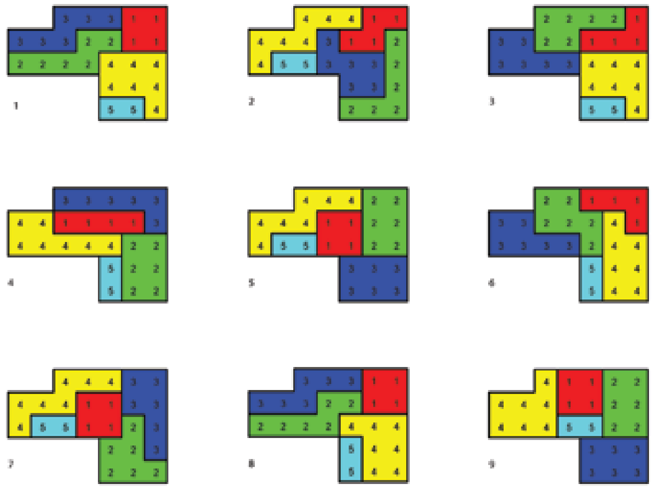


***Figure 2:*** A series of possible solutions.

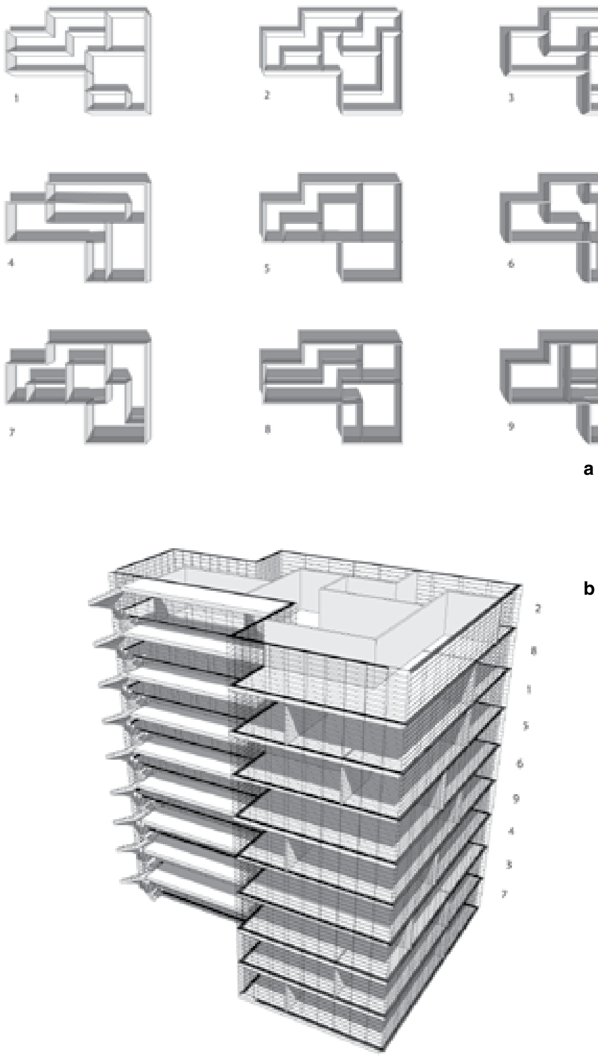



***Figure 3:*** **(a)** A series of possible plans and **(b)** a high rise.

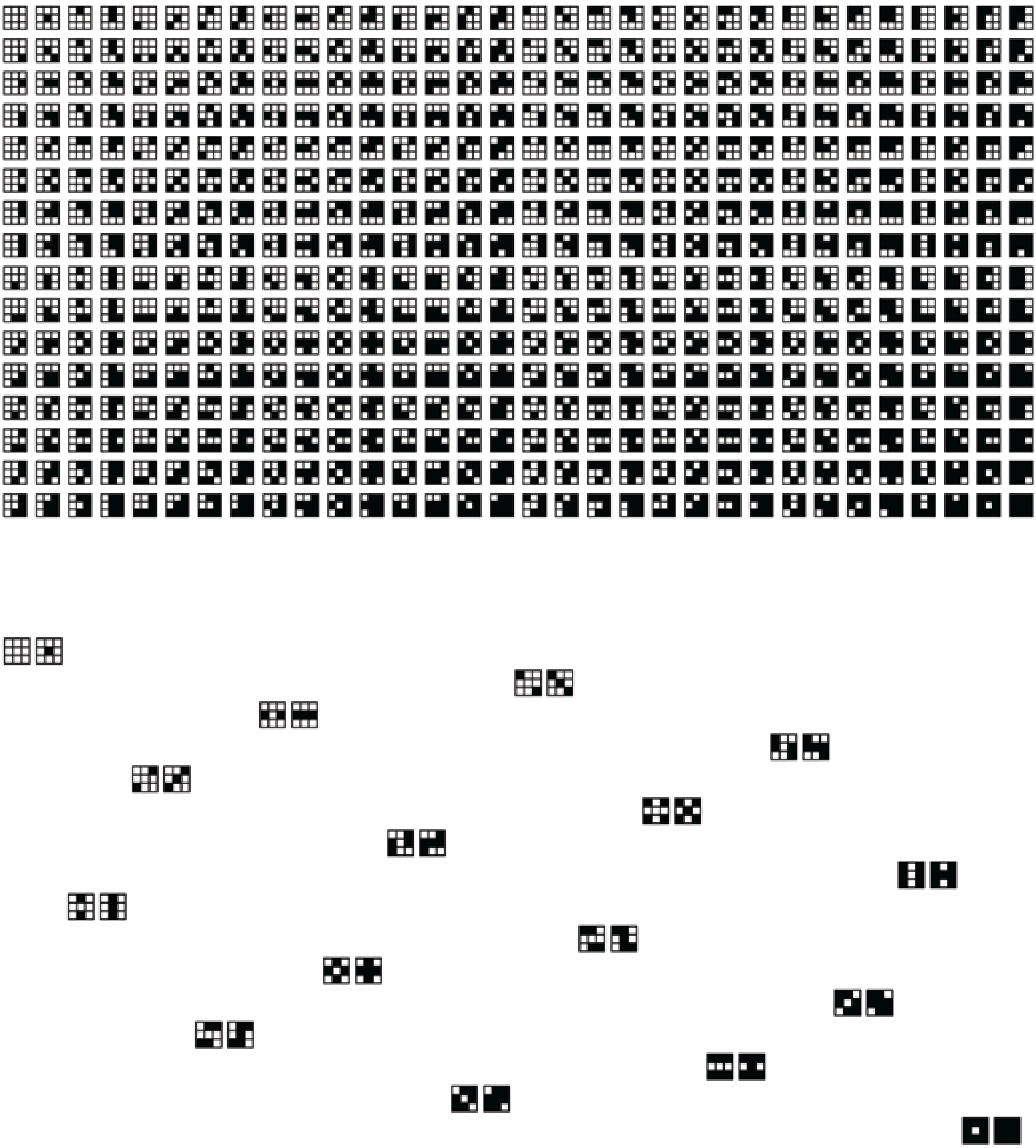


***Figure 4:*** All possible combinations of black or white for nine squares in a 3x3 arrangement (top) and those that are symmetrical (bottom).

be seen not as a chaotic disorganizing principle that is often portrayed, but rather as an ordering mechanism. Perhaps, the term randomness should be redefined here to clarify its connection with order. Random presupposes an exhaustive search of all possible combinations and therefore can be seen as unexpected sampling. In the cases shown earlier, such combinations are computable within a reasonable amount of time. Yet, in other cases, the combinations are so many that it is not possible to be computed in a desirable amount of time. In such a case, randomness functions as a sampling mechanism that provides possible choices for the designer, occasionally surprising. Nevertheless, such an ordering device is based not on a careful premeditated intuitive process but rather on simple, almost naïve, attempts under extreme repetition. The process, albeit antithetical to that of traditional design, sets out a new paradigm where design is laid out, not in the mind of the user, but rather in the computer program that addresses the issue. The focus of design is not even in the process itself since that can be replaced, but rather in the replacement operation itself. In that realm the new designer constructs the tool that will enable one to design in an indirect meta-design fashion.

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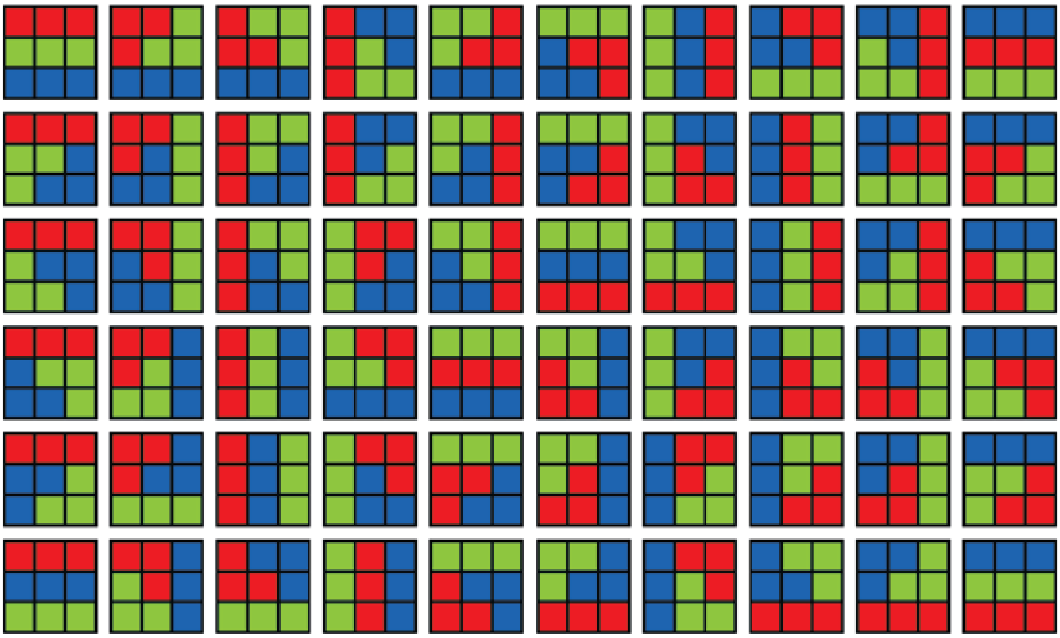

***Figure 5:*** All possible combinations of three continuous sets of three block of three colors in a 3x3 arangement.


**Kostas Terzidis** is an Associate Professor at the Harvard Graduate School of Design. His current GSD courses are Kinetic Architecture, Algorithmic Architecture, Digital Media I & II, Cinematic Architecture, and Design Research Methods. He holds a PhD in Architecture from the University of Michigan (1994), a Master's of Architecture from The Ohio State University (1989), and a Diploma of Engineering from the Aristotelion University in Thessaloniki, Greece (1986). He is a registered architect in Europe where he has designed and built several commercial and residential buildings. His research work focuses on creative experimentation within the threshold between arts, architecture, and computer science. As a professional computer programmer he is the author of many computer applications on form-making, morphing, virtual reality, and self-organization. His most recent work is in the development of theories and techniques for algorithmic architecture. His book Expressive Form: A Conceptual Approach to Computational Design published by London-based Spon Press (2003) offers a unique perspective on the use of computation as it relates to aesthetics, specifically in architecture and design. His book Algorithmic Architecture, (Architectural Press/Elsevier, 2006), provides an ontological investigation into the terms, concepts, and processes of algorithmic architecture and provides a theoretical framework for design implementations. His latest book Algorithms for Visual Design by Wiley (2009) provides students, programmers, and researchers the technical, theoretical, and design means to develop computer code that will allow them to experiment with design problems.

Tamkang University
Tanshui, Taiwan

# Designing and Fabricating a Chair as a Conceptual Model for Architectural Design

by Chen-Cheng Chen

Design Studio EA408 is one out of nine studios in the Department of Architecture at Tamkang University. These nine studios work individually and each studio, with approximately seven or eight senior students, has its own assignment to complete. The objective of the EA408 studio is to enable each student to create his/her own designs using 3D computer tools. In addition, our aim is that EA408 students learn to use CAD/CAM software to effectively transform their thoughts into actual designs. The studio mainly uses **form•Z** as its software. Most of the students already know how to use AutoCAD and fundamental 3D computer graphic functions before they enter the program. This article is a presentation of design work completed in the EA408 studio in the spring of 2008.

## First Stage Design Description

The studio's program began in the spring. Drawing inspiration from Taiwan's Arbor Day, we suggested that students choose one kind of plant to raise, and we were hoping that the plant would grow with them and their design projects. Perhaps they could even find similarities between their plants and their projects.

The first assignment was to design a "transformable" chair in eight weeks. We were looking for a design that might reflect the plant that each student was raising and we also required that the "transformable" chair could actually be manufactured. They had to use plywood as material. The "transformable" chair was originally virtual, designed on the computer, but we expected the chair to be made real and stand on its own ground.

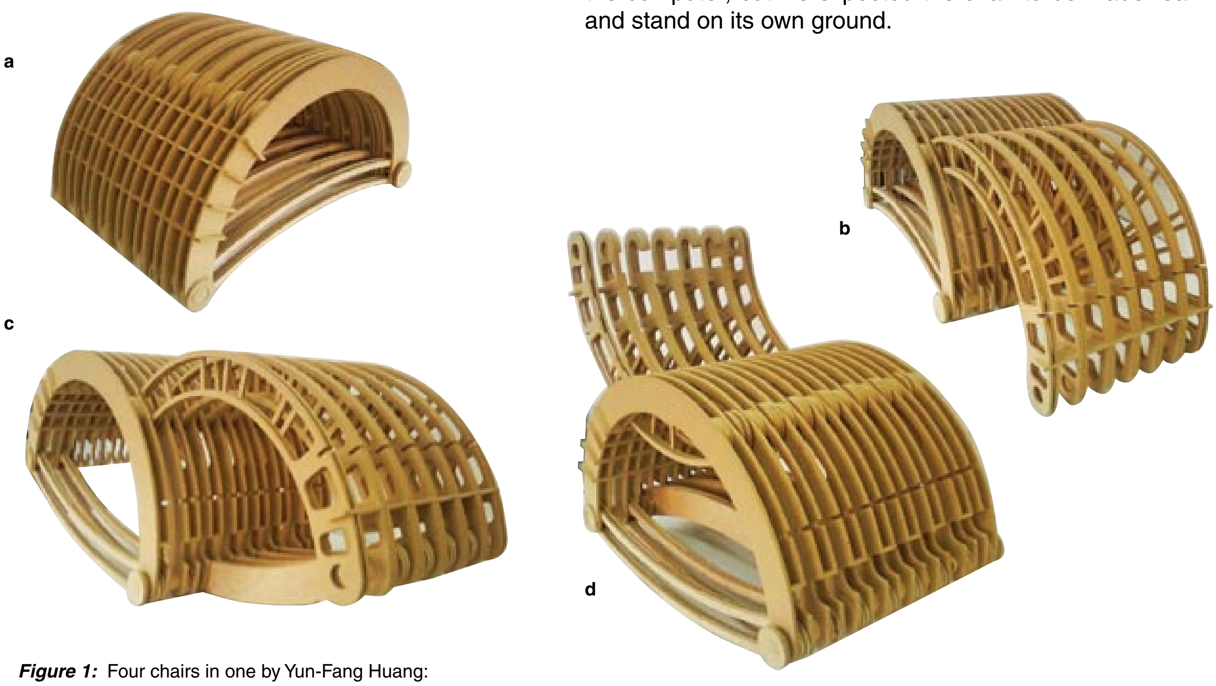


***Figure 1:*** Four chairs in one by Yun-Fang Huang:
**(a)** chair for one, **(b)** chair for two, **(c)** rocking chair for two, **(d)** rocking chair for one with a back rest.

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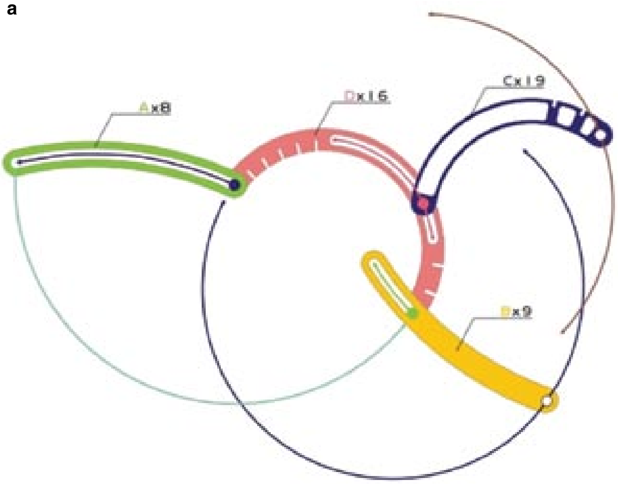


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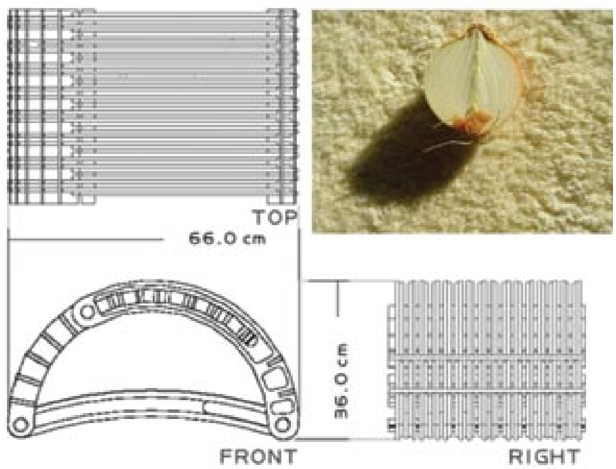


## Four Chairs in One

From the beginning, Ms. Yun-Fang Huang, the designer of "Four Chairs in One", planned to make a long folding chair, but the plant she had chosen to grow, an onion (Figure 2b), influenced the design in a different direction. She changed the shape of the chair, using characteristics of the onion, specifically its round shape and the shape of its slices. The design began as a chair for one (Figure 1a), but gradually additional folding possibilities were developed, which led to additional types of chairs, namely, a chair for two (Figure 1b), a rocking chair for two (Figure 1c), and a rocking chair for one with a back rest (Figure 1d). So, altogether, there were four distinct possibilities. Because of this, each section of the chair became crucial to the overall design. The designer spent many hours graphically exploring the chair, as seen in Figure 2a. She then changed the size of the chair many times until the final design was completed, as shown in elevation in Figure 2b.

In order to produce the layout seen in Figure 2c, we used the Unfold function of **form•Z**. We laid out the chair onto the XY plane of the modeling environment and we then transferred it into the 2D drafting environment of **form•Z**, where we completed the connections and joints. The design had more than 82 parts, which required five 120 $cm^2$ plywood boards (6mm thick) to manufacture them. To save material, we layed them out close together, which was done manually. These five layouts also allowed the milling machine to work more efficiently (Figure 2d). As we reached the final stages of our production, we realized that the chair was heavier than what we had originally anticipated. While we concluded that some parts could be eliminated, we did not do it because we were out of time.

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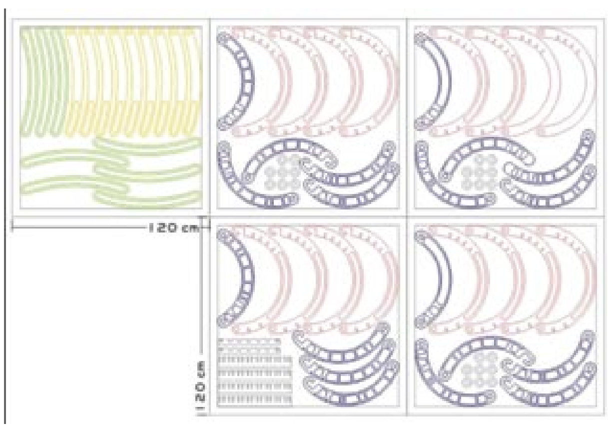



d

***Figure 2:*** Four chairs in one drawings and construction by Yun-Fang Huang:
**(a)** sections study, **(b)** section of onion and elevations of chair, **(c)** layout for fabrication, **(d)** the parts under milling.

***Figure 3:*** Ciliate desert-grass.

***Figure 4:*** Sketches of chair design by Cheng-Yuan Huang.

## One or Three Chairs

Mr. Cheng-Yuan Huang, the designer of this project, borrowed his title and inspiration from American artist Joseph Kosuth. In addition, the long legs of his chair reflect an influence by the plants he had chosen (ciliate desert-grass, Figure 3). First, he modeled a long-legged chair in **form•Z** and then he used the "lightning" function to project a shadow onto the ground. He traced the edges of the shadow and derived a basic line, which he then used to produce the lower chair in **form•Z**. The third chair was made by the shadows of the first and second chairs. Therefore, the design is titled, "One or Three Chairs" (Figure 5).

Next we had to figure out how to actually make the first and the second chairs. The preliminary design did not include all the details of the chair, so we had to think through carefully about the connections, joints, and bearings, before we could move to the production phase (Figure 6). We were able to set up three axes appropriate for manufacturing the 3-dimensional shapes. However, because of time limitations, students had only learned how to use flat cutting, which is what the chair was designed for.

The project had more than 300 pieces (Figure 7). We used six 120 $cm^2$ plywood boards of 3mm and 6mm thickness, which complicated the project further. At this time we had to redesign the details, using computer software, pretty much as we did during the preliminary stages. We had to redesign some of the parts and re-cut them to fit our initial design. The finished chairs (Figure 8) appear to be hand made, thanks to all the details that we worked out. However, presently, the chair is not strong enough for somebody to sit on. Thus we think that steel will be the perfect material to manufacture it with in the future. We shall be able to do it using the same designs we already have.

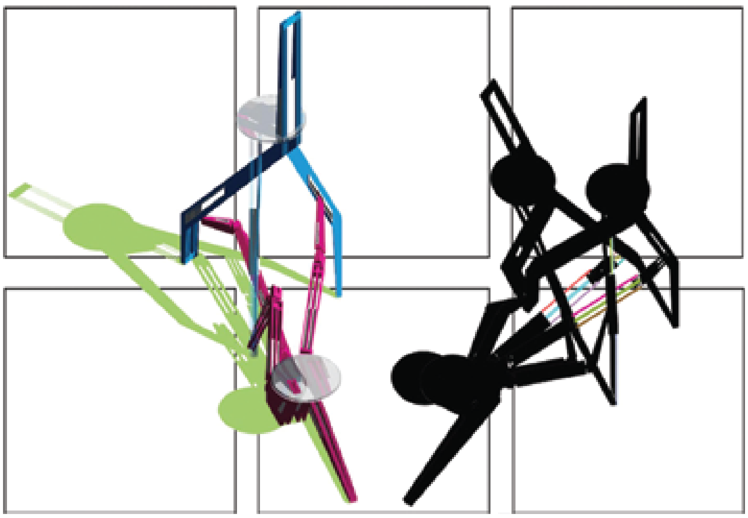


***Figure 5:*** Chair shadow study by Cheng-Yuan Huang.

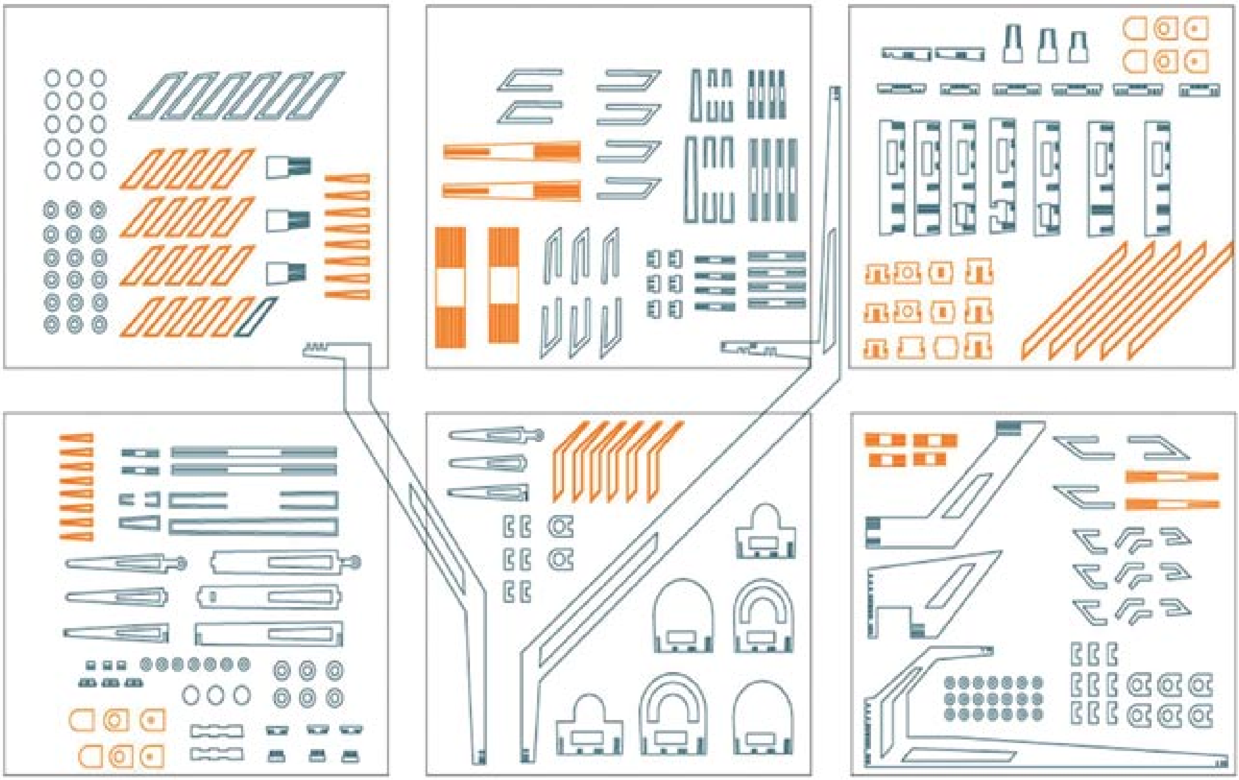
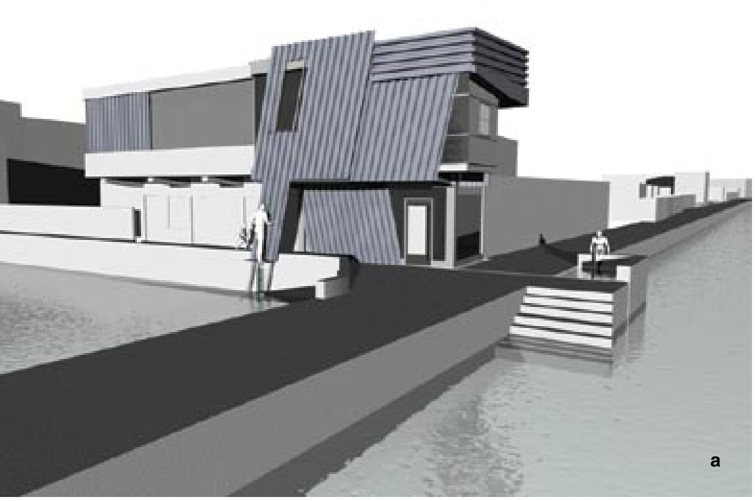
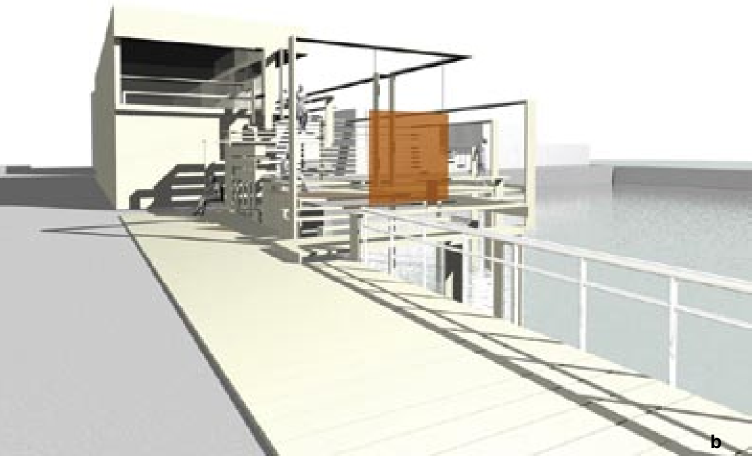


***Figure 6:*** Layout for fabrication by Cheng-Yuan Huang.

***Figure 7:*** Parts.


***Figure 8:*** Finished product by Cheng-Yuan Huang.



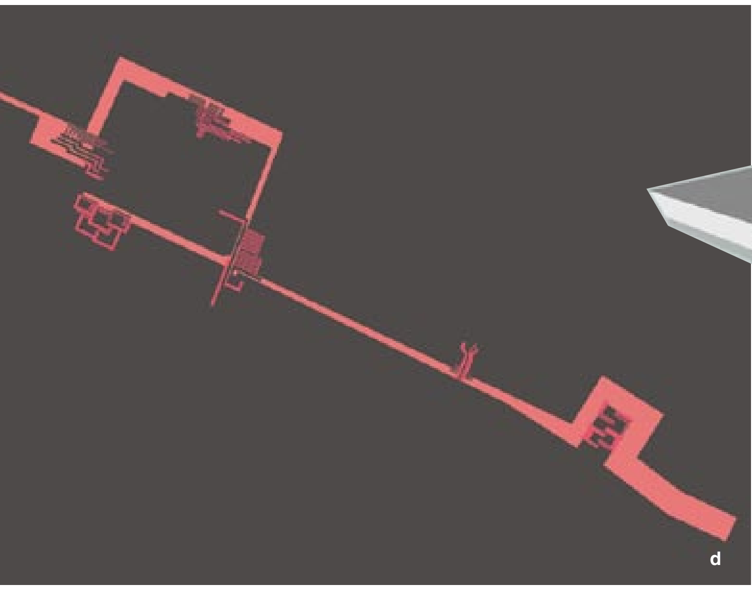


## Second Stage Design Description

After completing the chairs, the students had a week break from design, during mid-term exams. For the second stage of their studio, they had to choose a site and design six separate buildings (one large, two medium, and three small), trying to recognize the differences and the relationships between these six buildings and the site. We mainly used **form•Z** in order to quickly draft designs and this way we trained the students to think literally within the software. We also recommended that students use lessons learned from their chair designs in this second stage, which took about seven weeks to complete.

## Innovation of Tamsui Waterfront

Student Yun-Fang Huang, who designed “Four Chairs in One”, chose a site in Tamsui, Taipei County, located in northern Taiwan. She observed that, once the MRT connected Taipei to Tamsui, people flooded to this town, but visitors did not stay for the views. She wanted to design something that could keep the visitors coming to this town and hopefully show them what makes it special. In this case, she picked six interesting sites and redesigned a little park, an observatory (Figure 9a), a fishing wharf office (Figure 9b), a wharf, a coffee shop, and a post card shop (Figure 9c). She started with the diagrams of these six different sites, using the same inspiration she had for her chair design, a slice of an onion (Figure 9d). Looking at this diagram, we can’t help but think of Christopher Alexander’s “condensed graphic form” in “Notes on the Synthesis of Form” [Alexander 1964]. She continued with her sliced design as she completed her project.



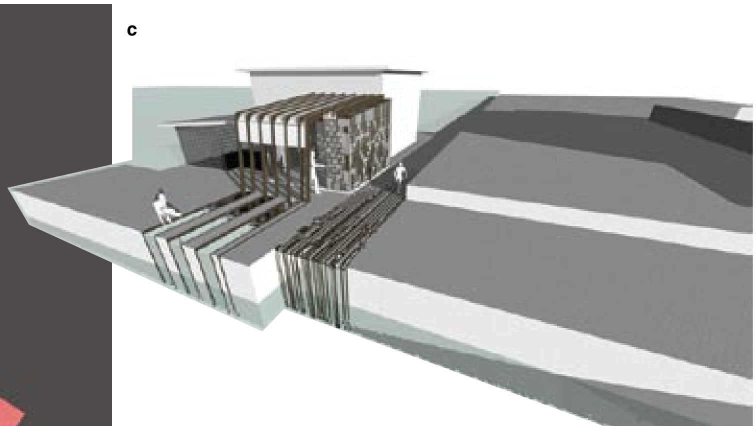
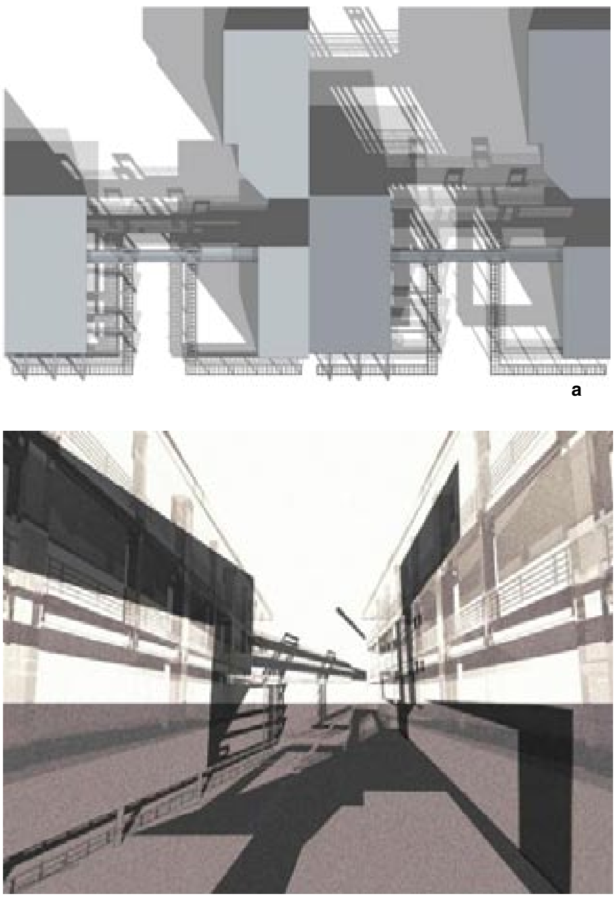


***Figure 9:*** Innovation of Tamsui Waterfront by Yun-Fang Huang:
**(a)** Observatory
**(b)** Wharf office
**(c)** Postcard shop
**(d)** Diagram.

## Hsin-Yi Square Design

Student Cheng-Yuan Huang, who designed “One or Three Chairs,” picked the newly developed Hsin-Yi business square as his site, which still has many large empty spots. He created the building mass of the department stores around this area in **form•Z**. He used the same method as in his chairs project. He projected the shadows of these buildings at 3 pm on the spring equinox, the summer solstice, the autumnal equinox, and the winter solstice (Figure 10a). The edge of the shadows became the basic outline of his design. He worked hard on the plan, elevation, and section of his design (Figure 10c). He designed a passenger bridge, resting booth, outdoor theater, sitting area, display area, and garden (Figures 10b and 11). He used **form•Z** and designed his spaces applying a constructivist’s approach. With his project, he hoped to show the relationship between light and shadow in what was previously a homogeneous place.



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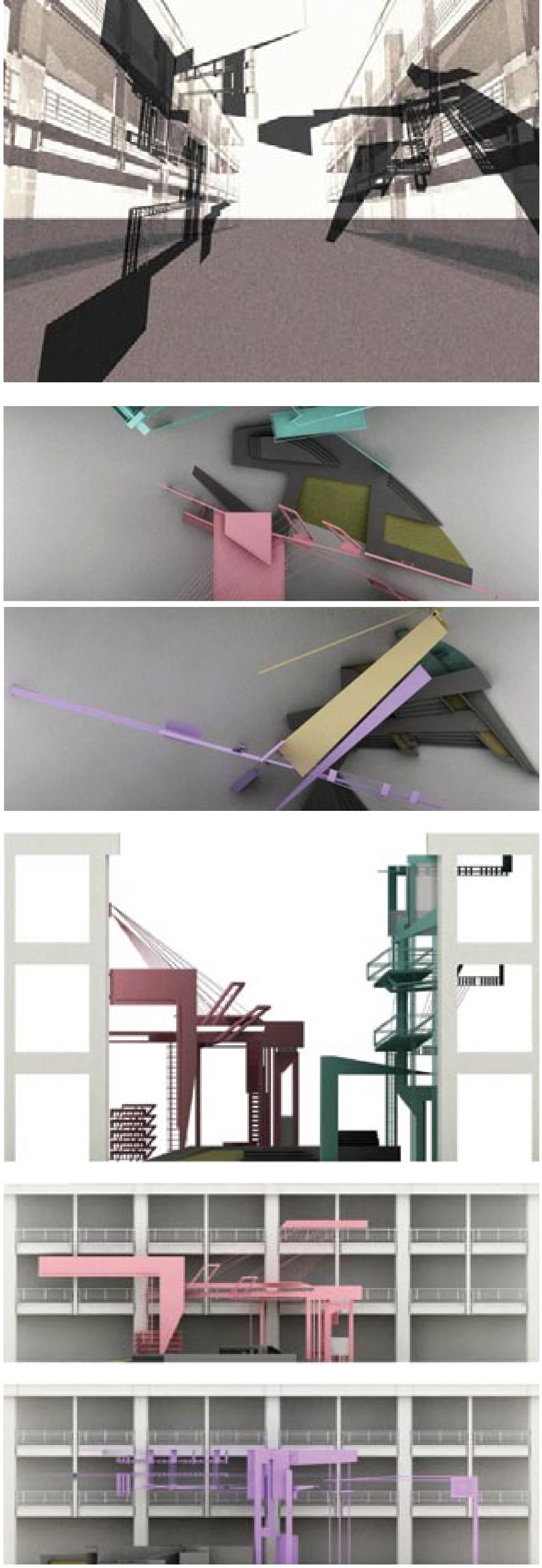

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***Figure 10:*** Hsin-Yi Square Design by Cheng-Yuan Huang:
**(a) (b) (c)** shadow studies, **(d)** site plan, **(e)** section, **(f)** elevations.

## Conclusion

This semester, we found the students' thought processes during the development of their designs quite interesting. They used different methods to solve critical design problems and they also resorted to different techniques for absorbing the concepts we taught them. At the end of the semester, the members of the jury were appreciative of the final results. However, we still have some issues that remain unresolved. For example, "Four Chairs in One" was too heavy when it was finally manufactured, because weight was not taken into account when it was designed on the computer. Also, "Three Chairs in One" was too fragile to be usable. These unanticipated problems remind us of a quote from Mr. Buckminster Fuller: "How much does your building weigh?" We need to keep in mind that students are always trying to come up with cutting-edge designs and when these designs turn out to be repeating designs that are already familiar to more experienced designers, they are very disappointed.

In our program, the content of the first stage design is directly affected by the second stage design. Consequently, it is especially important for a teacher to be thinking about the first stage design in terms of where it might lead with respect to the second stage design. In addition, the second stage design had a shorter production period than the first stage, and the design projects of the second stage were a bit more complicated for the students. Overall, these senior architecture students had an opportunity to learn different aspects of CAD/CAM and to use the friendly interface of **form•Z**. Thus they managed to operate the software effectively and to complete their designs in sixteen weeks (meeting twice a week, three hours a day).

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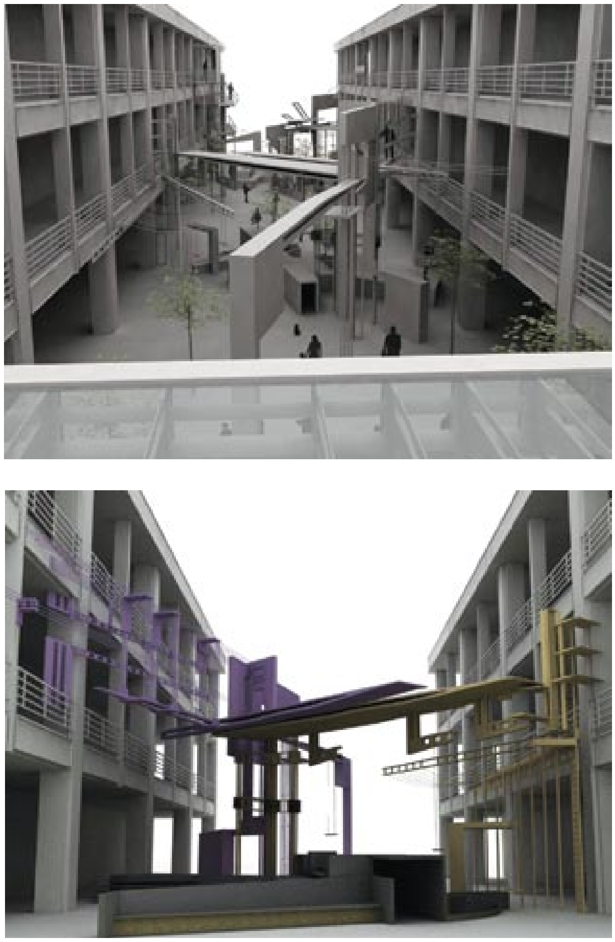

***Figure 11:*** Hsin-Yi Square Design by Cheng-Yuan Huang: perspectives of the square.

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# Conjectural Intersections: Conceptual design with form•Z

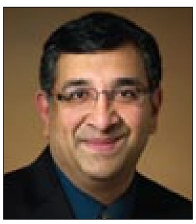
by Ganapathy Mahalingam

One of the common criticisms of computer-aided design is that design that is done using computer software such as **form•Z** is a virtual analog of "real" design done with materials or more tangible representational media. Proponents argue that most of design which can be done on a computer with software can be done with physical materials and hand tools. However, there is a realm where the virtual, computer-mediated representational world provides a conceptual design liminal that has immense promise.

This is the world of conjectural intersections. In a recent class at North Dakota State University, I asked students to visualize a simple conceptual scenario. I asked them to take two lumps of clay and visualize a form that is the intersection of the two lumps of clay. Of course, I had shown them what a form of intersection is, using a simple demonstration of the Boolean tools in **bonzai3d** prior to this request. I then asked them how they would create this form from the two lumps of clay. There was an air of puzzlement and then a student suggested that we could carve a form from one lump of clay, do the same with the other lump of clay, and fuse the two parts that had been carved out into the form of intersection. If the lumps of clay that had been carved out maintained their physical extents when being fused, the resultant form would not be a "true" form of intersection. Any further inter-penetration of the two lumps of clay that had been carved out would have to be resolved using the same method, which could lead to infinite regress.

How do we resolve this conjectural intersection computationally and physically? Could this be done with a plane of intersection? A plane of intersection between the two lumps of clay could be defined by a planar boundary that is shared by both lumps of clay. If the planar boundary is shared by both lumps of clay, then the points on the boundary must share the same spatial location. These points belong to the surface set of each lump of clay. Where they coincide, depends on the origin of the lumps of clay. A common origin for a lump of clay can be thought of as its center of gravity. The locus of the center of gravity of each lump of clay determines the points on the boundary of the plane of intersection. This should be obvious to users of **form•Z**. You create an object, then create another object, move the objects so that they overlap, and then execute the Boolean operation of "intersection" to get the form of intersection. Once you have a plane of intersection, you can slice the lump of clay at the plane of intersection in each of the carved lumps of clay and fuse the objects together. Now what if there is no plane of intersection, instead there is a 3D boundary in freeform space that floats around as a loop of a piece of string? This floating string could be fixed into a plane of intersection, otherwise how could you avoid infinite regress again in fusing the two carved lumps of clay together to form the physical "form of intersection?"

This is the stupendous form of parts of two physical lumps of clay occupying the same space, which can be the epitome of the challenge of giving human relationships between two human beings a physical form. Of course, in **form•Z**, you can intersect many forms together, giving rise to the physical form of "community." Besides, the form of intersection can be arrived at by three subtractions when two lumps of clay are involved. One of the lumps of clay has to give up the shared form. When multiple lumps of clay are involved, all the lumps of clay except one have to give up their shared form to arrive at the form of intersection. Is this mirrored in human relationships? Is this the realm of the "virtual" or the realm of the "real?" The architecture of human relationships and human community can arise from the "conjectural forms of intersection" made possible by George Boole and **form•Z**.



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**Hampton University**
**Hampton, Virginia**

# Learning & Teaching:
## moving neophyte into expert

**by Carmina Sánchez-del-Valle and Sean Creque**

Teaching 3D modeling in a rich modeling environment, such as the one offered by **form•Z**, is a challenge. The inevitable question, when first confronted with it, is where to start. This short essay came about when an experienced teacher and a new one got together to critique their approach to introducing three dimensional modeling in the architecture design studio. During the course of the conversation we found ourselves agreeing on many points, even though we belong to different generations, and have had different academic experiences. One of us has taught with **form•Z** for almost fifteen years, and the other has had two years of intensive study in **form•Z**. The questions we considered are probably typical: how to start, and how to evolve initial understanding so that students can compose their own protocols for modeling. The most critical learning occurs at the start, because it provides the student with the tools to continue learning, and makes visible the structure of the working environment. We agree with David Matthews' statement in the **form•Z** Journal 15 "that the conceptual foundation allows students to build their own understanding of the relationship between the virtual and the physical processes of designing." Also, as with a musical instrument, the time spent practicing advances knowledge and skill.

We agree that students find it easier to navigate a new modeling environment when they have had experience working in another. For example, basic operations such as selecting objects for manipulation are standard in any program. However, each software imposes its own conditions, and ways of defining building order. Moving from a known system to an unfamiliar one can be disorienting. For example, while in simple modelers only one tool is active at a time, in **form•Z** several tools may work in conjunction, each one offering a variety of settings that may affect the behavior of the other active tools. We debated how useful having prior knowledge of other programs facilitated, or speeded up learning to model in **form•Z**, and eventually agreed that knowing how to build physical models was essential. In **form•Z**, particularly at the beginning when one is learning, it is easier to construct the model as if one was cutting and sculpting material. This requires seeing the model as perforated surfaces and sculpted solids. It is the kind of model where space is defined by elements composed from the plan, elevations, and sections (working on the XY, XZ, and YZ Cartesian planes).

To start modeling in **form•Z** it is fundamental to understand object selection, knowing which tools are for drawing, and how tools interact. In the beginning the objects to be modeled need to make the most use of this basic knowledge. Nancy Cheng has written how in the context of learning through play "constrained geometry fosters an understanding of basic elements and operations." The new teacher recalls that when he was first learning **form•Z** the class was asked to model a chair, a stapler, etc. as a way to present tools and operations to build complex form. Yet, later he found it difficult to translate this understanding into building an architectural model. In his article published in the 2005-2006 **form•Z** Joint Study Report, David Steiner observes that to construct 3D models students need to have the ability to disassemble complex forms into parts, understand their geometry, and strategize the process needed to build it step by step. Although we concur, one important point is missing: it is crucial to also define a working context with discrete links to the assembly of buildings. Cheng among others has also written on the opportunities and mishaps posed by the translation from the physical to the digital.

**form•Z**, and similar modeling environments, requires the student to know a lot about the building—detailed design information—that the student has not yet figured out. We have found that a direct entry into digital study models is to build starting with a 2D plan, section, and elevation. This approach to modeling allows students to see conflict areas while designing. Plans are drawn and used to build walls and other components. If the model has varying horizontal sections, then one builds with the elevations or the sections. Yet, when modeling by mimicking other media one can lose sight of new ways of building, new procedures that lead to new forms. A direct translation from traditional media tends to hide the attributes of the digital. In some programs one "draws" the model by drawing the outline of components including holes to extrude. The model starts as planes of infinite thinness, and magically grows into volume and material. Modelers such as **form•Z** offer other possibilities for building. In these the working environment can be populated with objects of several types: 2D drawing objects, templates of unknown thickness, complex surfaces, and constructed volumes.

In studio the model is an analytical, representational, and communication tool. Here we will focus on the analytical aspect, arguing it is a way to advance modeling skills. An essential operation before building any part is to understand the project to then formulate a strategy for building its model. The most challenging projects are those that have transformable geometries. Transformation usually requires that shifts operate on a surface changing its general form, and assemblies made of rigid components change their configuration while maintaining the initial connections. These modeling projects are less dependent on 2D templates to be extruded, because they require most of the building to happen in space. Creque tested this proposition building models of the Hylite Wall, Muscle Room, and Muscle Body by ONL/Oosterhuis, in collaboration with students at TU Delft. All of these projects use the Festo muscle as the actuator inflecting form change. Creque had only photographs and written descriptions to reconstruct the projects and imagine their movement. His goal was to understand how they were built, and how they changed form as they moved. **form•Z** was not intended to be the setting for movement simulation.

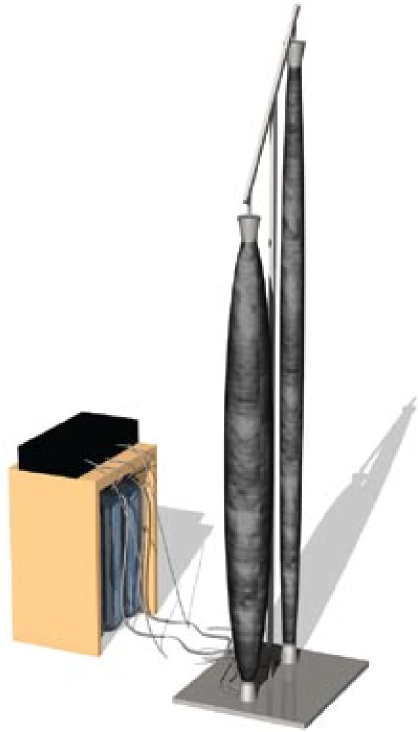

***Figure 1:*** Festo System Diagram.

***Figure 2:*** Hylite wall detail.

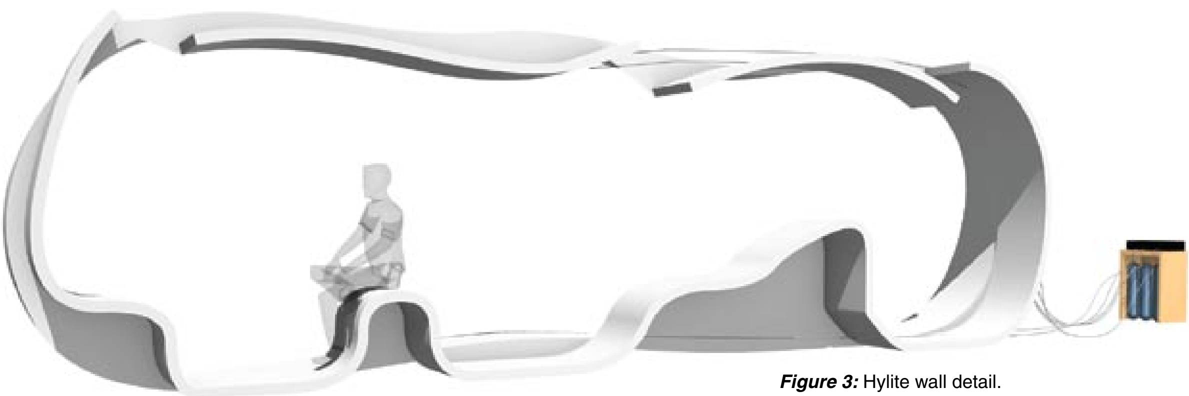

***Figure 3:*** Hylite wall detail.

Creque also wanted to build directly from measurements, rather than from 2D templates.

The Hylite Wall is a system composed by self-supporting panels assembled in a continuous strip. The panel element can perform as floor, wall, ceiling, openings, and furniture. It has actuators that compress or stretch the panel form to assume various configurations. Changes in the panels impact the volume of space they define. To build the model of the wall it was broken down into types of volumes, number of parts and types, materiality for rendering, and relationships (connections). This process involves both reverse engineering, a process discussed by Prichard-Schmitzberger among others, and re-engineering to put it back together in a digital form. To build different states of this panel Creque had to manipulate some of the panel components, including the Festo actuator for it to decrease or increase its length. The digital model of the continuous wall strip shown here is a simplification of the system. To build it accurately Creque would have had to manually manipulate each panel, and adjust it to the position of the ones attached to it, to show the wall transforming as a whole.

The Muscle Room is a system made of wood frame panels with moving parts connected by hinges (joints). Running through the frames are Festo muscles, the actuators that contract or stretch to place frame parts in predefined locations. For the Muscle Room a model of the pieces that would remain in place was first built, and then those that changed position were added in. Modeling the various states of the room walls is easier than in the Hylite project because all it takes is to manually rotate and move the parts into new positions, while maintaining the connections between them. However, this is a time consuming process.

***Figure 4:*** Muscle body section elevation.

The last project, the Muscle Body, is a structure made of translucent and transparent Lycra that forms a conglomerate of quasi-spherical balloons or bubbles. Air pressure is used to expand the space, and Festo muscles to contract, or squeeze the air out. It operates like a shaped toy balloon, where the twists in the balloon are equivalent to the Festo muscle. Modeling the body presented many challenges, in particular aligning the muscles precisely on the Lycra surface curvature. The muscles are located on the seams where the bubbles connect. In this case, the **form•Z** tutorials were helpful. Another challenge was to create the Lycra bubble shells. After many tests, a procedure involving “sweep” seemed simple and obvious. Finally, the last obstacle to having a model matching the object in the photographs was to show the varying translucencies of the Lycra surface. After much searching, modeling this condition also proved to be simple, resolved by applying Booleans operations accurately.

A productive initiation into modeling in **form•Z** is better supported by having some experience building physical models. Models of architectural objects with known parameters and basic geometry are best at this stage. Graduating into 3D complexity can be encouraged through the reverse engineering and reconstruction of an architectural project with complex geometries. The analytical model, rather than the design study model is the best context for exploration and learning at this point. In any case, a creative eye is critical for strategizing the process of making.

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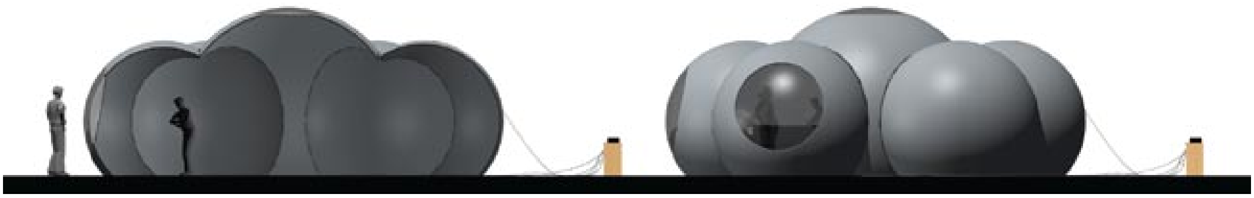

***Figure 5:*** Muscle room detail.

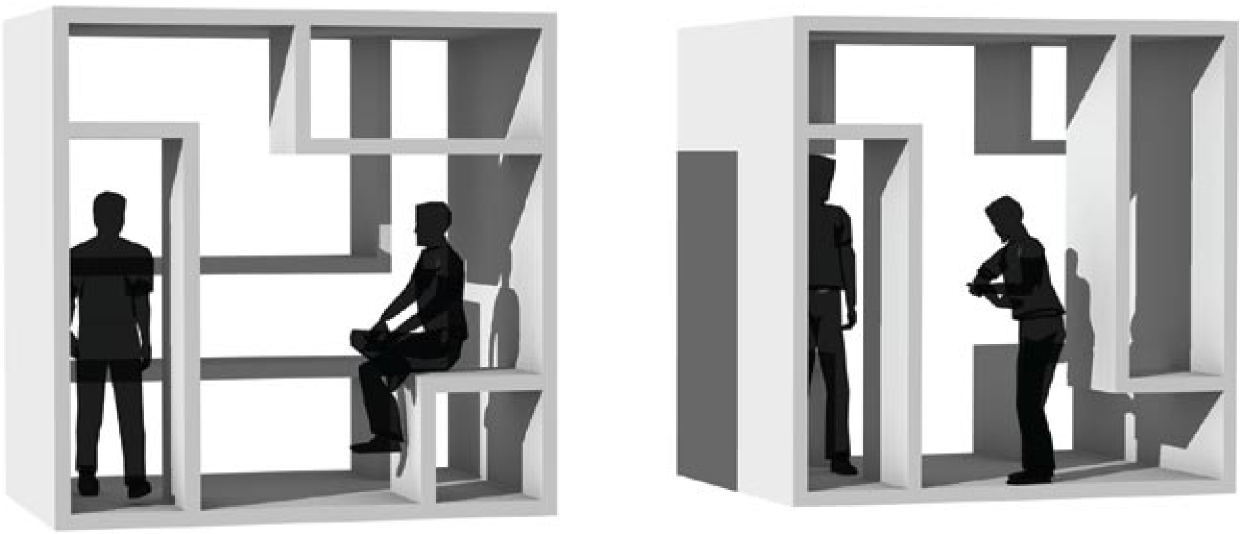

***Figure 6:*** Muscle room states.

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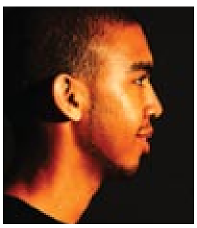

**Sean Creque** is a M. Arch student at Hampton University's Department of Architecture. His thesis challenges traditional ideas about what walls are and what they can contribute to a space. The research tools have been 3D physical and **form•Z** models exploring the relationships between walls, space, forms, and uses. He plans to pursue a postgraduate degree in Structural Engineering to have a deeper understanding of structures, so that his architectural work can become more expressive. He is particularly interested in tensile structures to create lighter more flexible systems.

University of Cincinnati
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# Digital Iteration: Defining a Synthesis between Manual and Digital Craft

by James F. Eckler Jr.

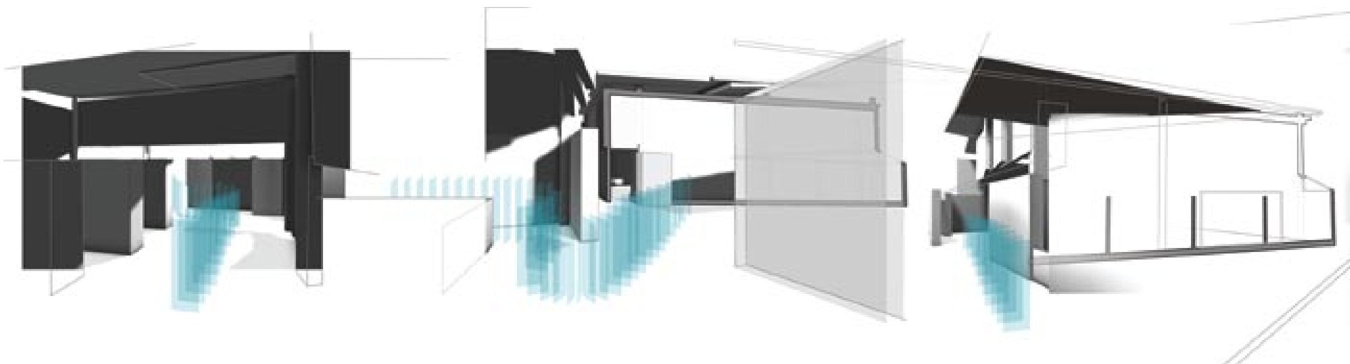
## Preamble

Digital modeling has established a firm foothold in the industry and education of architectural design. Nevertheless its role in the development of architecture is still as undefined as it was at the inception of these technologies. Often digital, three-dimensional modeling is relegated to a presentation tool in mainstream architectural practice. It has little impact on the conception or the development of the design. This is symptomatic of a disconnect between conventional design thought through iterative process, and the immediacy of virtual design. The mantra of design software is often expediency. However, this is a proposal that explores the possibility that design software can become an integrated component of the iterative process; that it can add to a way of thinking through making. In the exercise detailed in this paper, digital design achieves a synthesis with the conventional ways of making and integrates a way of thinking in virtual space with that of manual manipulation. The digital design software doesn't replicate or replace skills already possessed through drawing or modeling by hand, but augments them and provides a different way of viewing and understanding the possibilities of architecture. A single and continuous process of design is achieved.

## Engaging Process

What role might digital, three-dimensional modeling play in the process of design? In seeking an answer to this question, a beginning graduate studio of architecture at the University of Cincinnati was given an assignment that would develop, not only a proficiency with the **form•Z** tool, but also an understanding of its potential to be used as a component of process that would facilitate thought and discovery. They were tasked with integrating other techniques of making and thinking with this digital mode of thought. The students used techniques of collage to move from digital manipulation of form and space in **form•Z**, to manual methods for organizing, structuring, and thinking of tectonic assembly. The bridge between two methods for creating architectural space would facilitate an understanding of the potential for digital modeling to have a significant impact on the way experience is structured through architecture; it was envisioned as a stage along a process of invention and discovery rather than a means to visualize something "complete."

At this stage of the curriculum the graduate students were in their second academic quarter of architectural design. Each has a different background and bring different skill



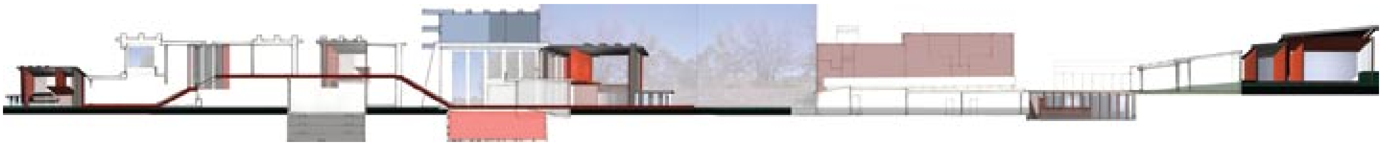


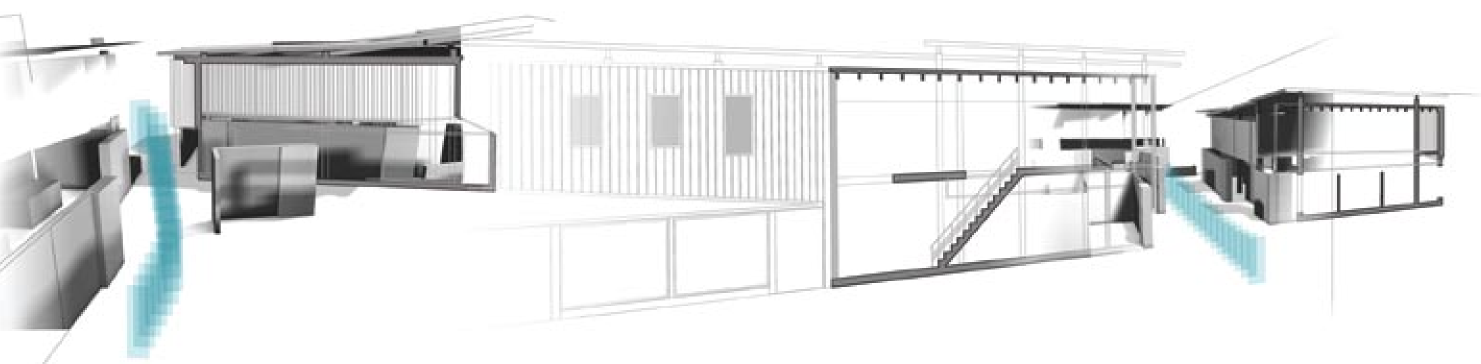
***Figure 1:*** Jessica Helmer. The wandering, itinerant section that is unfolded in the construction of this collage is apparent. The primary moment of focus – the vignette in the center of the composition – is well resolved. The layering of the rendered vignette and the hand drawn section effectively communicates the relationship between event and path; movement and pause. The other vignettes – toward the edges of the composition – are less integrated with the unfolded section, which acts as an organizational datum for the drawing. This lack of integration makes them read as incidental or autonomous. These peripheral experiential moments, while individually well considered, seem not to contribute as much to the overall architectural scheme. This accurately reflected some of the struggles this student was having with the direction of her design, however the use of the section as an organizational tool had the potential to push her in a direction of greater integration for subsequent iterations.

sets to the development of their own way of viewing and making architecture. The students were given a project that incorporated multiple disparate programs into a single architectural construct (or, as the project evolved for some students, a collection of smaller structures). They worked on developing the design continuously in this skills course as well as the primary design studio taught by Prof. Karl Wallick where the project was introduced. The overarching goal for both the design studio and the skills component was to provide an opportunity for the students to explore the possibilities of tectonic assembly in the conception of architectural space. The studio focused on the development of tectonics in the structure, organization, and sequence of space, while the skills course focused on experiential qualities of light, proportion, scale, texture, and the event of space using **form•Z** in conjunction with other more conventional design tools.

"*Architecture begins with a metaphysical skeleton of time, light, space, and matter in an unordered state; modes of composition are open. Through line, plane, and volume, culture and program are given an order, an idea, and perhaps a form. Materials—the transparency of a membrane, the chalky dullness of a wall, the glossy reflection of opaque glass—intermesh in reciprocal relationships that form the particular experience of a place.*"[1]—***Steven Holl***

**form•Z** was introduced to the students at a point in the development of their designs where an understanding of programmatic and spatial relationships was leading to experimentation with built form. In this way the digital tool became a component of the iterative process as opposed to a means of representing its results. Here they were able to continue refining spatial and experiential ideas as

***Figure 2:*** Brian Ballok. Here the section is less apparent than in Figure 1. The lack of a central organizational component reflects complex movement patterns created by irrational geometries in the design. The integration of rendered vignette and drawn section communicate relationships between disparate components of the design well in the right half of the composition, however the left side degenerates into a series of independent renderings. Their relationship to one another is impossible to determine. Essentially they are completely different drawings. It is however difficult to overlook the sophistication that directed the composition and established relationships between itinerary and programmatic moments along the path of the right side of the collage.



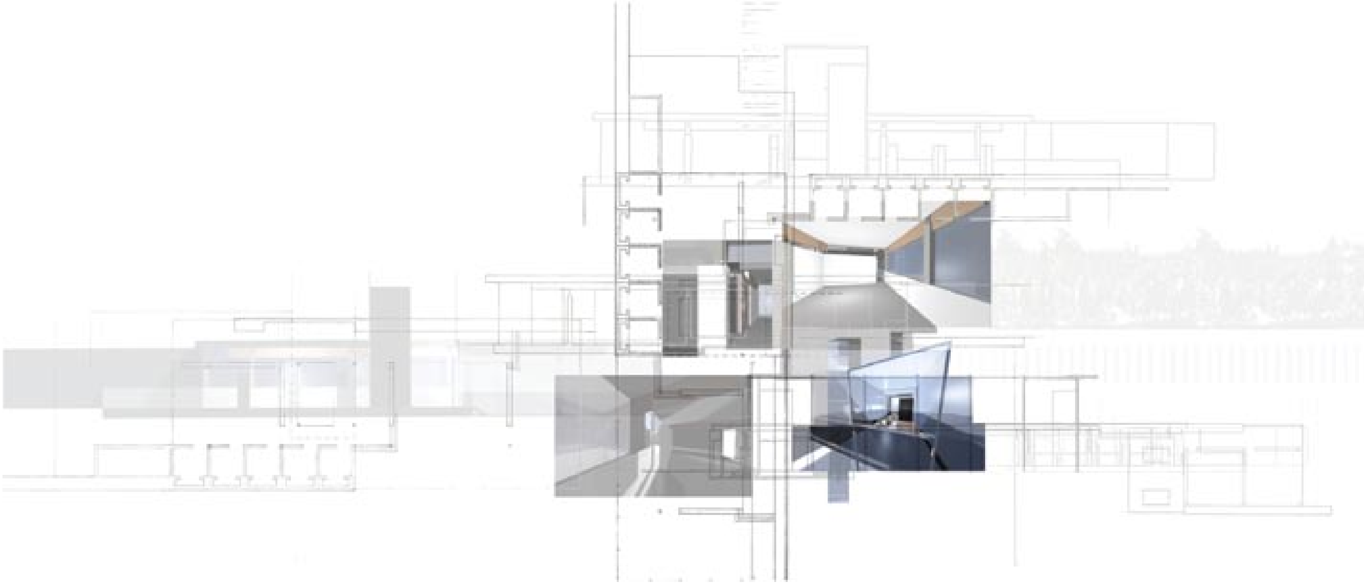


***Figure 3:*** Christopher Bartell. The four primary vignettes are positioned centrally. The composition details the proximal relationships between them while major differences in material and light quality speak to variations in program and interaction between occupant and architecture. The positioning of the four distinct moments as an organizing device for the entire collage addresses placement of the individual spatial moment within the overall scheme, as well as its contribution to that scheme. The juxtaposition of hand drawing and digital rendering at that central node is compositionally seductive without offering much information regarding a relationship between the event and the path. This becomes clearer as the composition becomes simpler toward the edges of the drawing, but there is still work to be done on the weaving of the two drawing systems in order to be effectively communicative.

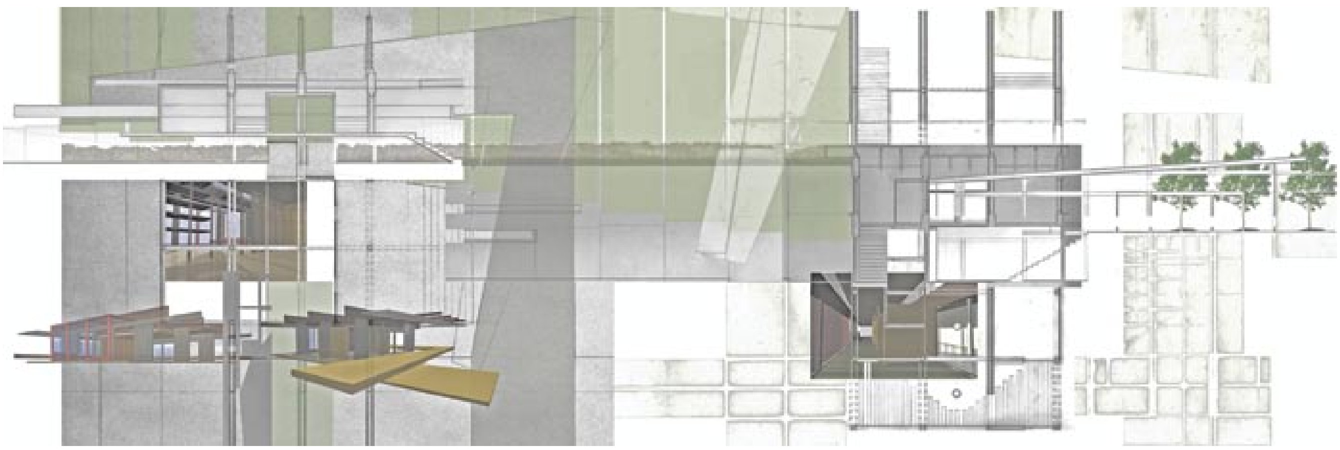


***Figure 4:*** Michael Westrate. In many moments the path becomes completely overshadowed by the presentation of the experiential aspects of the vignette. The composition communicates, almost inversely of Figure 3, the contribution of the event to the entirety of the architectural scheme—they are nearly one in the same. The heavily manipulated drawings integrated with the rendered components (which in most cases are also heavily manipulated) show a continued progression of design development through the course of the construction of this collage. The level of integration between the two drawing types serves to communicate the relationship between tectonic systems of organization and spatial experience in the ultimate conception of the architectural scheme. The one moment that defies the general cohesion of the rest of the drawing is at the bottom left corner. Here the placement of an exterior rendered view of the digital model undermines the compositional integration of drawing types in that region of the drawing and offers no information relative to space, structure, or experience.

discoveries made in the hand-built model were tested and manipulated digitally. This exploration yielded a synthesis between ways of making and visualizing architecture.

The assignment was composed of two concurrent exercises. One was the advancement of the design through iterative drawing in plan and section from the studio curriculum. The other was the advancement of design through virtual assembly and manipulation of tectonic components in **form•Z** from the skills curriculum. As the plans and sections were developing schemes for organizing and relating space, the digital models were exploring the possibilities of experience and its impact upon architectural design. The students virtually built several important spaces within their project that were determined by the assigned program. How does one interact with the forms that contain them, and how does this interaction facilitate a prescribed activity within the space? At a particular point of resolution in these two concurrent exercises the students were asked to consider the hierarchies of space and relationships between programs in the development of a sequence; an order of encounter. How might one move from moment to moment within the project, and what happens to that individual along the way? (See Figures 1 and 2).

## Vignette

How does an occupant interact with built form? What are the implications of this interaction for the programming of a space? Consider each virtually constructed space a vignette; a short narrative that describes the experience of a space and the activities it holds as a result. In the construction of the vignettes characterizing important spaces the students considered ways in which the tectonic assembly of architecture could be manipulated to produce very specific experiential qualities of space: the "transparency of membrane," the density of a screen, texture, reflectivity, joinery, the behavior of light. Each vignette was characterized by an event that the architecture was meant to house. The vignette that describes this space of event also describes the architectural response to program. It addresses not only what an occupant perceives, but also the way that the perception is structured by the architecture (Figures 3 and 4).

## Itinerary and Sequence

Architecture can be understood as a series of events positioned relative to one another in the creation of a building. How then does the architecture assemble the transition from one event to another? How does an occupant move through space from one programmed moment to another? And how does this transition impact a perception of space and event? The students were asked to consider the sequence of movement in the construction of a single path through their projects. They explored ideas of arrival and the way that an occupant is introduced to a space/event as well as notions of direction, progression, expansion, compression, turning, vertical movement, pause and many other components that define movement along a prescribed itinerary. Using the plans, sections, and various renderings extracted from the digital models the students were to construct an "itinerant section" along a path winding through their project. This construct was a collage that positioned the vignettes relative to one another and investigated the linkages between as a path from one to the next (Figures 5 and 6).

## What is Gained…What is Lost?

Why is this synthesis between modalities of making important? As designers we think through making. This iterative thought process has been undermined by the ability to immediately arrive at a solution through the use of design software. In this immediacy, much in the way of understanding and consideration of space and experience is lost; replaced by formal manipulations made possible by the computer. At the point in the process where spatial relationships and experiential considerations are sacrificed in favor of formal experimentation, architecture is reduced to a novelty. A synthesis defines a role within traditional ways of thinking and making for the possibilities and advantages of digital design. The thinking behind the design process is not altered by the tools we use to make, but instead defines the way in which we use them. The energy devoted to accelerating production is rechanneled into the development of a built form that is responsive to site, experience, and program.

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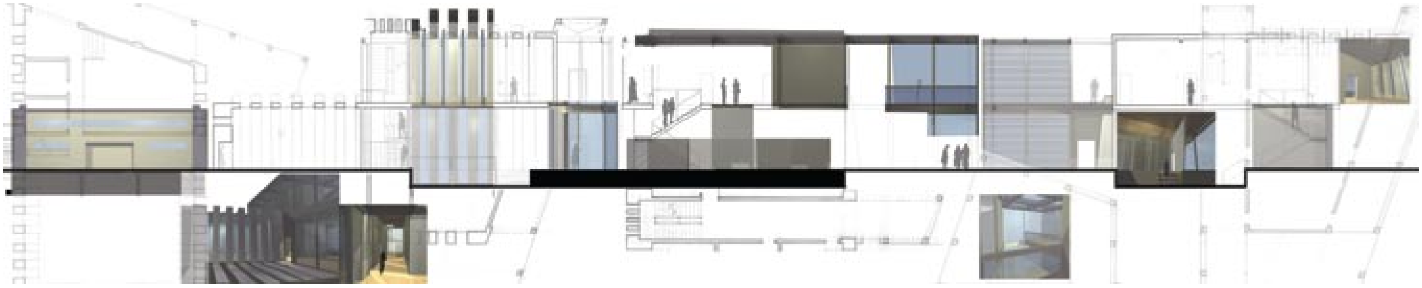

***Figure 5:*** Kyle Campbell. The sequence of space and event is apparent. This is a solid drawing that effectively communicates the relationship between the path and the moments of program along it. The use of scale to define ideas of movement is used most effectively. The density of drawing elements, as well as scale figures, and transitional elements speak to the structured sequence of movement. Ideas of compression, elevation, turning, pause, and progression are addressed in this way. The tectonic nature of path is far more resolved than the experiential vignettes that positioned along it.

***Figure 6:*** Noah Bergman. In this composition path and vignette are blurred and become nearly indistinguishable. The contribution of the programmed event to the structuring of movement seems to be a primary focus for the derivation of tectonic assembly as well as the composition of this collage. The flow of spaces as a vignette make transitions into another reinforces the structure of the path created by the overlapping plans and sections. This facilitates the creation of a continuous sequence of events that conspire to generate a notion of path rather than path and event being independently considered and later brought together. The one major compositional failure of this collage occurs just toward the left of the center where a large rendering of a somewhat neutral space serves to disrupt the otherwise continuous sequence without providing much useful spatial information. It distracts from the overall communicative nature of the drawing and does not reflect the qualities or conditions of the actual design. However, both the components to the left and right of this moment are well crafted and integrated to effectively communicate the co-dependence between itinerary and event.

**James Eckler Jr.** received his Master of Architecture, as well as a Master of Architectural Studies in Pedagogy, from the University of Florida. He is currently a Visiting Assistant Professor of architecture at the University of Cincinnati, where he teaches design, representation skills, and digital skills. In addition to teaching, James is actively engaged in research concerning place and place making within an urban environment, particularly the city of Cincinnati.

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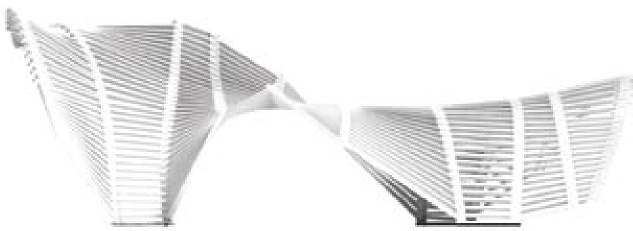
# Hylomorphic Surface:

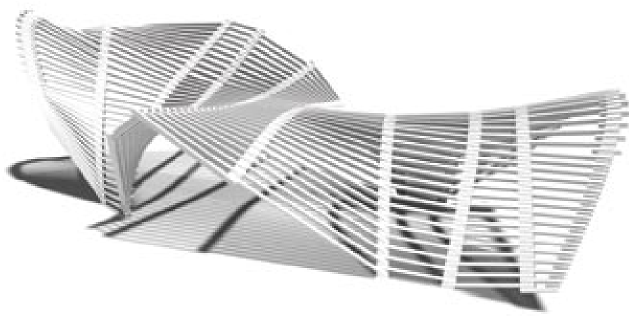
## Proximate Design and Relational Modeling

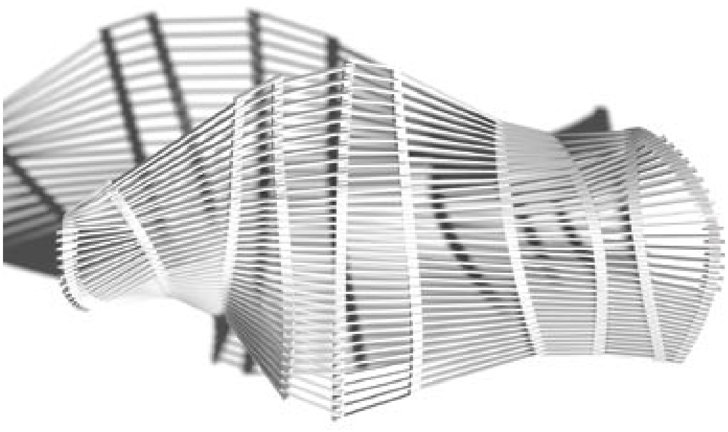
**by John Cirka**

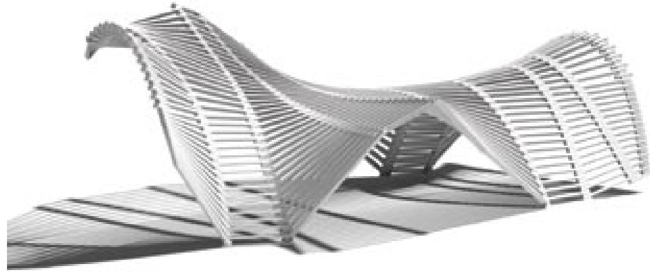
The philosophical problem of substance posed in the relation of matter and form shifts from an abstract terminology to a dynamic coupling of material and forces when considering an actual material, rather than matter in general. The detailed mapping of forces in the material world established by various branches of science has provided a clear comprehension of forces in materials. Less examined is the direct relationship between form and force, suggesting that form might be a resultant of the direct interaction of materials and forces or a configuration imposed from outside the energetic material system.

Ann Lee of the Shakers succinctly related form and force: "every force evolves a form."[1] Deleuze expresses Nietzsche's insight that "…the object itself is force, expression of a force. This is why there is more or less affinity between the object and the force which takes possession of it. There is no object (phenomenon) which is not already possessed since in itself it is not an appearance but the apparition of a force."[2] In the Introduction to On Growth and Form, D'Arcy Thompson writes, "…the form of an object is a 'diagram of forces'…" and "Morphology is not only the study of material things and of the forms of material things, but has its dynamical aspect, under which we deal with the interpretation, in terms of force, of the operations of Energy."[3] Closer to architecture, Eduard Sekler suggests:

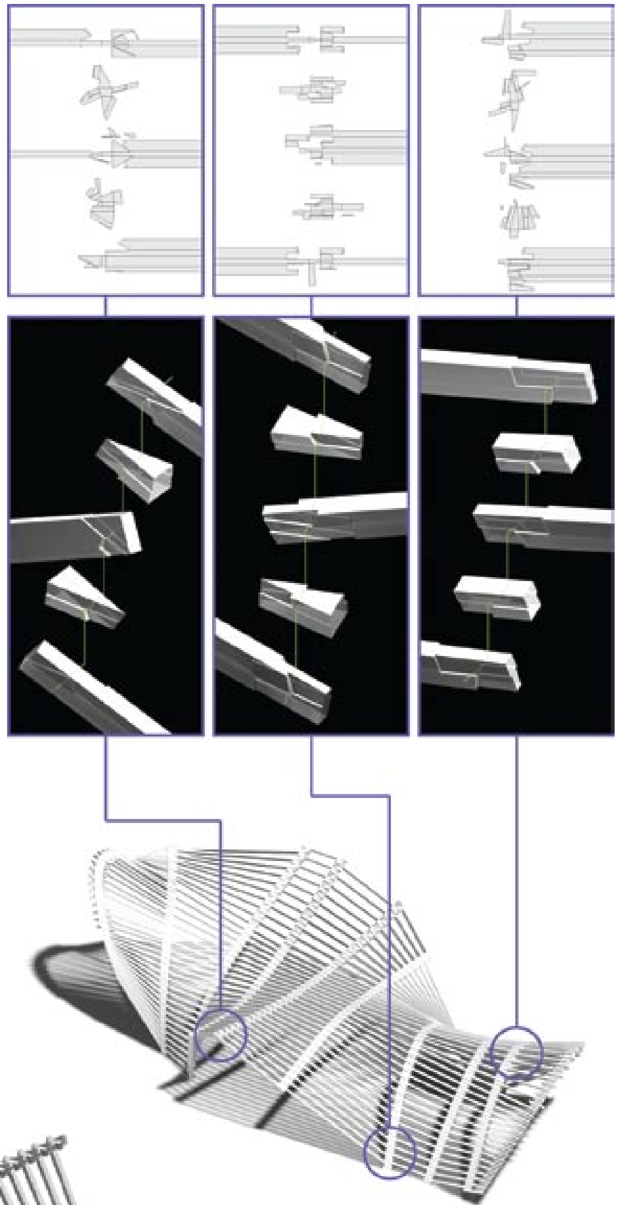






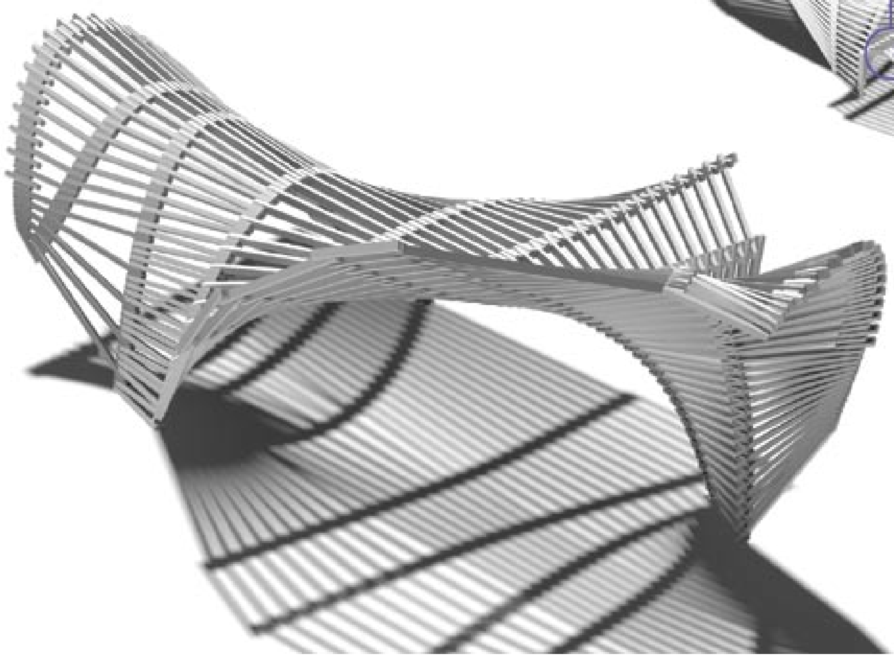


“When a structural concept has found its implementation through construction, the visual result will affect it through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building yet cannot be described in terms of construction and structure alone. For these qualities which are expressive of a relation of form to force, the term tectonic should be reserved.”[4]



An artisan working with a particular material is sensitive to the flow of forces at play in the material. Designers have not traditionally had the same intimate relationship with the materials which they specify and detail in the process of developing the form of their intended object. Modern techniques of production add further layers of complexity and put at a distance the link between designers, form and materials. In an attempt to overcome the gap between the design and production of built form, architects are increasingly developing closer ties with manufacturers and fabricators of building components to bring the parameters of component construction into the design process with the desire of achieving greater specificity in the definition of form with implicit consideration for forces at scales smaller than those normally falling into the range of scrutiny by structural engineers.

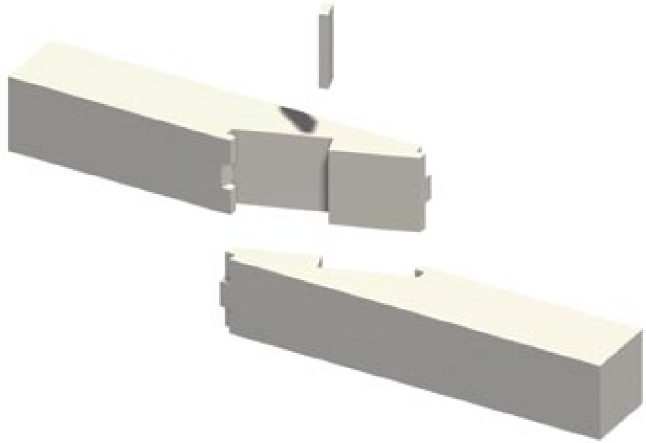
Designing repetitive components is a strategy for dealing with the complexities of component manufacturing and building construction. The tools of design coupled with the tools and machines used in the construction industry in the past were limited in the amount of information which could be transmitted through the design-construction system. Remarkable exceptions exist, but the bulk of



the geometries used in historical, including modern, architecture relied on simpler forms. In contrast, design tools today have the capacity to rapidly develop complex geometries and pass this dense information along for analysis or for manufacturing purposes.

In spite of the increased complexity possible in today's designed components, they do not approach the levels of complexity in the cellular matrix of organisms. Living cells display a much higher degree of flexibility in their ability to respond to varying conditions and they accomplish this feat with local interactions which accumulate and become expressions of global patterns. The network of individuals interact in a proximate space necessitated by the chemical basis of their information transfer and production.

The transfer of design information to a builder relies heavily on the accuracy of dimensioned drawings. The fluid nature of relational modeling has been slow to develop in part because of the need to stabilize design ideas into a fixed object and the computing resources required, both to operate and program. The model developed here as an exploration into relational modeling and cellular design incorporates the concept of proximate space to define the detailed form of each of its subcomponents. Each element acts as a cell, responding to its local conditions, rather than performing as a repeating modular block in a Cartesian space. The long slats stretch between geodesic lines following lines of force across the doubly curved surface, where threaded rods hold the wood members in place. Each long slat and each spacer block are oriented with their longer cross section axis aligned normal to the B-Spline surface at their centroids. The resulting normals populate a vector field across the undulating surface.



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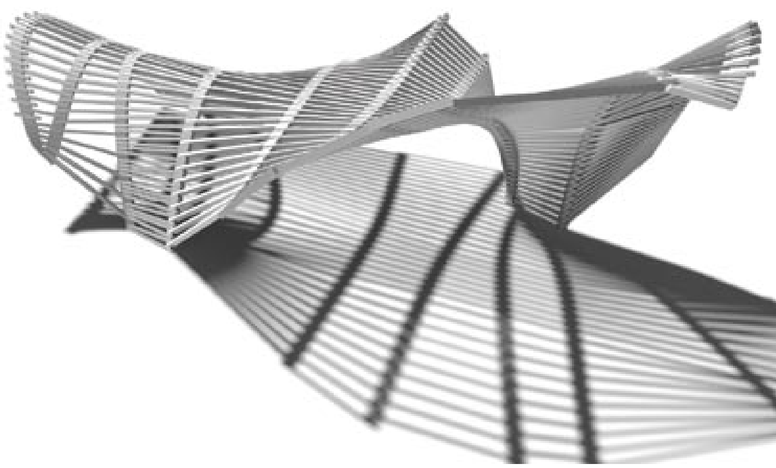


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# Journals of a Digital Design Studio

by Sarah Jester and Thomas Fowler IV

Week 1

## Student's Weekly Journal Entries[2]

### Journal: Friday, 09.26.08

*1. This week I remembered what it feels like to stop thinking and just produce. When you're forced in that way, you sort of swallow your fear and hesitation, and move forward into a place you didn't think you'd be able to go. I was resenting turning the analog diagrams into digital ones, but it had to get done. I found myself looking at the source image (a Richard Diebenkorn painting) in a whole new way and I ended up having fun using Illustrator to do what pens can't. I think the major reason I have so much bitterness toward the computer is that it does such a poor job imitating the quality of hand made work. However, what I am coming to terms with is the fact that it can actually help to create okay stuff, it's just entirely different. So analog/digital can go hand-in-hand, but like you were saying, you can't just let one be the clean-cut copy of the other.*

*2. Next week I am hoping our group can work together more, or maybe I should say, have a better attitude about functioning as a team. We had group discussions, and agreed on directions, and bounced ideas off of each other, but there was a subtle "I don't really like/respect your vice"*

## Instructor's Assignments[3]

### 1. Group Warm-Up… Diagramming Exercise

The quarter started with students working in groups for a week long intensive diagramming and modeling exercise that provided a structured framework for students to focus on using digital modeling software and traditional media as an integral part of the design process.

This Analog Digital Language of Vision (ADLV) assignment (Figure 1) provided students an opportunity for those not as familiar with the 2D & 3D technology tools, to do quite a bit of the 'driving' in the creation of the assigned projects. The learning objectives were:

- Outcomes from exercise provided students in the studio with a starting architectural language to build on for a future design project
- Exercise provided an introduction of the tools and strategies that were used for studio project analysis and synthesis for developing eventual studio project
- Exercise provided an opportunity for students to work on a collaborative design project.

## Instructor's and Student's Post Studio Reflections[4]

### Instructor's Reflections

*The initial group warm-up exercise provided the first steps in building a classroom environment for the collaborative sharing of using digital technology in the context of the design process. This exercise established the tool kit for developing analog and digital strategies for the eventual quarter-long building design project. The group analysis of selected case study projects that happens later in the quarter continued this collaborative spirit of the studio. Students often mention by the end of the quarter that there was a strong collaborative atmosphere in the studio, which assisted with the integration digital media in the design process. Even though students are exposed to digital media much sooner in our curriculum, I have not seen much change in a 12-year period of integrating digital media into the design studio in how students view the need to use in the context of other media or as a useful tool for design. This warm-up session is therefore very important for getting students on the same page and skill levels before moving forward in the studio on design work.*

***Figure 1:*** Digital relief model from Group Assignment #1.

*sometimes. I'm not totally sure how to fix this, I tried this week to be proactive…but I guess I'll just try harder? You can't really force a person to change their attitude, but hopefully next week will be more unified. Also, I need to do some 3D modeling stuff on our project, but concerned since it scares the crap out of me to use digital modeling software, because my work always looks so terrible when I have used it in the past…*

*3. This weekend I think I'm going to go up the coast for a nice long morning run and for some time to myself.*

The team of students that Jester participated on analyzed a painting by Richard Diebenkorn (four teams total in the studio each had a different painting) through a series of analog and digital diagrams and models. The team developed the following analysis narrative, "Through diagrammatic analysis we chose to emphasize the strong 'L' force moving through the image like complex layers of light and shadow cast through a window. The reliefs also allowed us to explore the blank space and interpolate the possibilities in the void of the source image"[5]

## Student's Reflections

*At the time, no one understood the significance of the group warm-up diagramming exercise, but this assignment gave us a base so that we could launch into the vocabulary development of our next project without hesitation. We didn't have to overthink or make arbitrary decisions. This has taught me to DO and learn from what I have done, instead of waiting to commit until I find the perfect idea.*

*In my current design studio, I did initially feel lost beginning a new process without establishing some kind of beginning point (like the diagramming exercise), but I have figured out how to get pieces of my project to have them take their place, and I have figured out how to maintain a connection in the steps of the new process and hopefully I will end up with a cohesive project.*

***Figure 2:*** Selected diagramming assignment outcomes:
Left: Original Dibenkorn painting. Center: Painting diagram. Right: Digital relief model.

Week 2

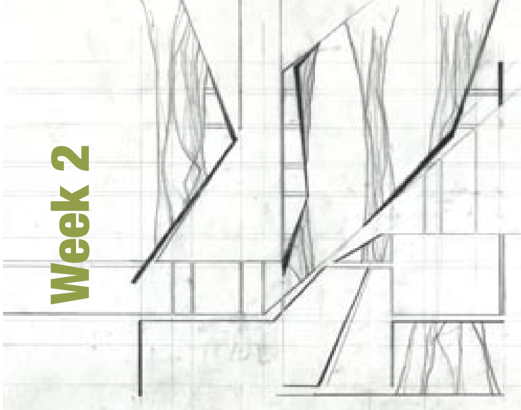


***Figure 3:*** Diagrammatic analysis of Ito's Sendai Mediatheque buildiing.

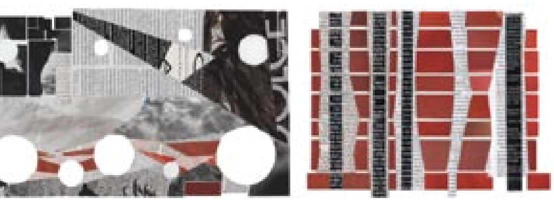
## Journal: Friday, 10.03.08

*1. I 3D modeled in Revit(!!), the reading spaces for both the Abbey Library. I decided it is a lot like using the editing software that comes with your Kodak Easy Share Camera, instead of Photoshop, so it was annoying. I really didn't want to deal with it, but it actually wasn't that bad at all. The collaging exercises were really fun—it definitely makes it easy to visualize volumes, but I think I spent too long on them—it could have happened quicker. Shaping the ADLV's to architectural context was a good challenge —because now the composition is affected by program and concept.*

*2. Inhabitable book—pretty cool. I hope I can keep myself from subconsciously defining it as architecture. I'm excited for where it will go, since I'm revved up from those diagrams. Those Mediatheque structure lines are burned in my brain right now—I close my eyes and they are glowing there. Group stuff was better this week, but we still need to have a little more respect for one another. I can't really think of anything else right now, except #3*

*3. ……….sleep.*

***Figure 4:*** Selected Re-Represented Drawings: Left: Plan Collage; Right: Vertical Cross-Section Collage.



## 2 (a) Individual Re-Representations of Selected Case Study Projects.
## (b) Group Library Case Study Project Analysis.

Students were randomly assigned a precedent project to re-represent it in a series of analog drawings. The assignment was to redraw plan and vertical cross-section as a series of line and negative space collage drawings for analyzing the structural, circulation and programmatic patterns of the project.

The learning objectives were:
- To learn how to properly represent building system components graphically.
- To learn how to show the integration of structural patterning, life safety systems, and building program spaces.

Students were assigned to work in groups for the analysis of two Library Case Study Projects. Jester re-represented Ito's Sendai Mediatheque Building.

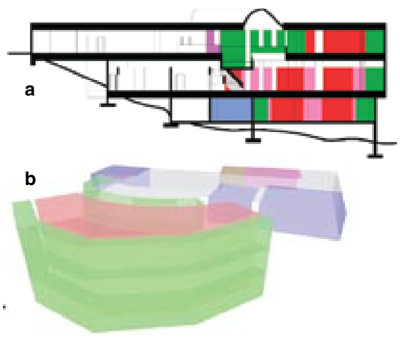



***Figure 5:*** Selected Work: **(a)** Cross-Section; **(b)** Volumetric Program Model from Case Study Project #1 (Mount Angel Abbey Library, Alvar Aalto).

## Instructor's Reflections

*The re-represenation exercise provided students a foundation for understanding the proper way to represent space in 2D. Over a 12-year period I have seen a dramatic decline of the use of 2D drawings to represent 3D space, which seems to be prevalent in many programs. It seems that a lazy reliance on digital media to represent 2D space (or the use of 3D programs to navigate through space in real time) does not seem to be adequate for students to really understand the implications for understanding both the navigation and spatial implications for design work. These representations allowed the studio to have a discussion regarding lessons learned about the importance of the connection of program, structural pattern, vertical space(s) (and the best ways of showing it) for developing the identity of their own project.*

## Student's Reflections

*The re-representation exercise was a quick way to learn both about how this case study building worked and how to re-represent and learn about the spatial qualities of this project as a way for using later in our own projects. This exercise introduced collage and line drawing representation techniques in a context for applying to our own designs.*

*Overall, the first two weeks helped eliminate fear and hesitation, so that when the time came to begin our own work, we could have the confidence to dive in.*

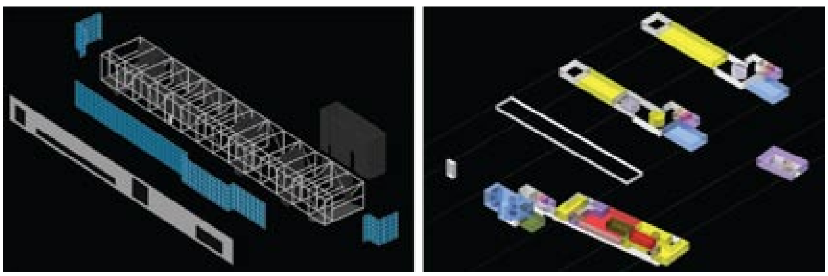


***Figure 6:*** Selected Work: Left: Exploded Axon of Project; Right: Program Model from Case Study Project #2 (Clinton Library, Polshek Architects).

Week 3

## Journal: Friday, 10.10.08

*1. The analog models were a lot of fun and learning this week. It was easier than I thought to disregard the 'building' aspect of it. I thought I would try and make it into architecture, but it was fun to just make spaces that interact with each other and work together with found objects- but it wouldn't be nearly as good of an experience if it weren't based on the ADLV compositions and ideas about reading—they don't completely rationally connect, but it fuels intuitive decisions with the same vein... if that makes any sense. Also, I found that doing collages made me take a step back from the model making, (which was a nice break in itself) and look at the space from another perspective, which serves to solidify underlying ideas, and forces more commitments to my evolving project design. I developed a small program model on Monday (I think this was the day?), which helped a LOT in focusing my decision-making.*

*2. I don't know if this counts as whole week goals—but this is what I'm thinking about right now…the book collection (reading section of it) and atrium needs to be developed further. The presence of books cantilevered over the readers shows up as a nice interaction between the readers and the books, which shows well in my 2nd iteration of my analog Inhabitable Book model—but it keeps getting oversimplified in my program studies. So the #1 goal for next week is to refine the translation of my program as it relates to what I'm trying to do conceptually. I'm super excited to make these Inhabitable vocabulary model studies as they relate to my project concept. Also my project concept needs to be solidified. There is a bit of tension in how my ideas for my concept of the "Power of the Book" relates to the evolving vocabulary of these models, but I will just need to sort this out as I move further down my design path. Goal # 2—I'm excited to work with* **form•Z** *modeling software this weekend. My digital media skills need a lot of work, but now that I've gotten back into using it, it's really fun and there's a whole other realm of possibilities to achieve similar compositional qualities of the analog models that I created.*

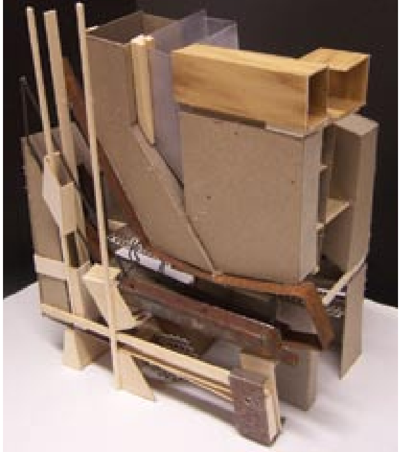


***Figure 7:*** Found Materials Inhabitable Book model, by Jester.

## 3. Inhabitable Found Materials Book Model

The Inhabitable Found Materials Book project asked students to develop an inhabitable series of spaces that reflected a student's personal views about reading. Students developed several physical models integrating both found materials and others materials such as chipboard, wire, plexiglas, etc. into the project. Analog vertical cross-sectional views and plan collage drawings were also developed.

***Figure 8:*** Analog Found Materials Inhabital Book model and vertical cross-section collage drawing, by Jester.

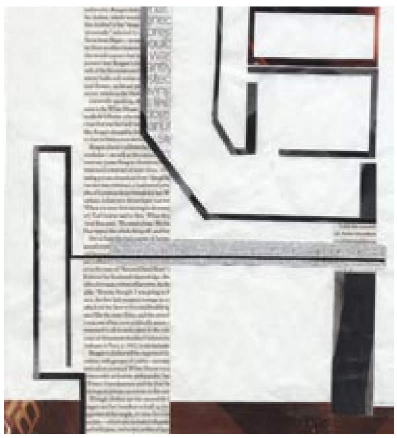


***Figure 9:*** Cross-section collage of Found Materials model, by Jester.

## Instructor's Reflections

*The inhabitable book project became a pivotal point in the quarter for assisting students in the synthesizing knowledge acquired from the group Library Case Study Projects and individual representation exercises. This was also the point in the quarter where each student established their foundation vocabulary and started to connect their concepts of reading to space.*

## Student's Reflections

*The found materials model was an excellent way to suspend anxiety and develop vocabulary. It was the foundation that tied the whole project together. It allowed for constant progress and development in the project; there wasn't the typical leap from a non-spatial concept to architecture.*

*In the early stages of the project, the found materials model was so rich that it was overwhelming to understand how it could function spatially. Collages offered a clarification of the spatial qualities of the model and became a diagram of my intentions and expressed a visceral sense of my project. At one point, I felt like my digital model was leading me in the wrong direction, so I used one of the initial collages as a guide to keep me on track.*

*Later on when the building was more developed, I had built all the pieces of my digital model, but there were parts that I could ignore because they were just difficult to see on the screen or they were never obvious in any rendered views. So it doesn't work to just draw all the lines cut in the digital model. Analog drawings forces you to clarify your vision for project's spaces, and also deepen the thoughtfulness of the spaces developed. I feel like my project could have used more drawings to solidify the program earlier in the design process.*

## Journal: Friday, 10.17.08

*1. I learned that using digital media during the design process is a useful tool... and I'm kind of surprised to admit that. It's challenging for me, because I still don't think the digital models that I have developed look that good, but I'm learning a lot about my design in using* **form•Z** *as my modeling tool. I just need to not fiddle around too much—but make sure I am exploring the bigger idea of the project, quickly, and not taking too many steps backwards. I've also been noticing an actual concept emerging from my design, that seems to be becoming clear as to how to develop the architectural vocabulary of the spaces to support this idea! I can start to talk about what my design is doing and how it relates to a user and how my ideas about reading work… and I don't feel like I'm making things up.*

*2. We are doing site analysis—for one, I hope all the group work goes well, but for myself—I hope I stay grounded by the site. I feel like I have a tendency to get carried away, and I end up with something that relates in my own head only, but maybe isn't clear to anyone else. I make a lot of compositional decisions that feel right—but maybe that's okay? I have a clear, rational logic to my decisions —but things (my diagrams/collages) seem to end up too 'abstract.' I mean, I think that they work-but maybe they could be better? I don't really know how direct things should be—so I hope to have a better idea of that within the next couple weeks.*

*3. I'm pretty excited to work with acrylic paints in developing my site analysis painting!!!! I never have done this before, but it's turning out to be really fun! I just have a few more layers to go…*

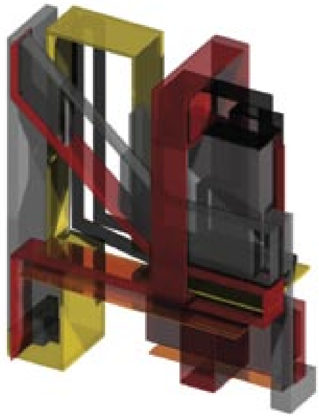


***Figure 10:*** Digital Model of Found Materials analog model (Alternative 3).

## Continuation of Inhabitable Book Project

As a continuation of the Inhabitable Book project students continued to develop the vocabulary of the spaces and sequences that were tied to their concepts about reading.

Instructor's Notes: The translation of the physical found materials models into a range of alternative digital models continues the design process development. The digital models do usually start out very stiff (this is pointed out in Sarah's weekly journal) but these models evolve over a series of weeks to become more dynamic as they are worked into. As students work digitally they are required to freeze the development of digital models by both printing out views and saving as application files. This process always allows students to go back to earlier versions of a designed project, if the clarity of modeling becomes fuzzy. Many times the earlier digital models are more cohesive.

As students were developing their digital models, the studio took a field trip to San Francisco, CA to visit and analyze the project site.

***Figure 11:*** Digital model alternatives of Inhabitable Book, by Jester.

## Instructor's Reflections

*I require that students work from the original group warm-up exercise digital model and use the analog found materials models and collage studies to inform how they work into this digital model. I have always found that when digital modeling is more of an editing process, as opposed to developing a digital model from a blank slate, these digital models never seem to take on the animated qualities of the design project being developed. I tell the students that the editing process of working into this digital model is more akin to Michelangelo carving out a body from the solid piece of stone.*

## Student's Reflections

*At the beginning of the digital modeling process, I was very unhappy with the digital model because there are so many ways to alter the rendering. It's not like a physical model where you use the given physical properties of the material you chose.*

*But once I became more comfortable with how it looked and just used it as a tool, I started to really enjoy working in my digital model. I could feel when I needed to update it, and I looked forward to it because I knew I would figure out a lot that I was struggling with, and then take that and work physically again.*

*I've learned that the value of all these tools we have—digital, physical modeling, 2D work—is that they are tools that allow for their own distinct development of the whole. How they are used in the process and how they reveal different aspects of the design becomes the best means of representing the project. As opposed to using them only as clean cut representation.*

Week 5

## Journal: Friday, 10.24.08

*1. I can't even remember what happened this week – painting – group precedent stuff – program translation – field manipulation… Working with the field of the site has clarified some things for me, (mostly the sequencing of how I want the approach to work) and this way of generating it off the painting is a lot of fun, I keep learning new things about how my design works… or wants to be.*

*2. AHHHgg vertical building circulation – I don't know what it wants to be – I figured out a couple wrong answers, but I'm really struggling with it – so I hope to figure out how you actually get to some of my upper floors, because this direct connection to circulating through my project is an important aspect of reinforcing the "power of my book concept" in my project. Maybe I should develop a magic carpet that allows you to just jump up to the last level? I just need to build some more physical and DIGITAL models to sort this out!! The digital model does need at this point to get updated again... but at this point just don't know about how to improve the digital model so it does not look so digital.*

*3. I thought something out of the ordinary was happening this week… but now I can't remember.*

***Figure 12:*** Site painting analysis.

## 4. (a) Site Painting Analysis and (b) Group Site Analysis Exercise

**Site painting analysis:** This site analysis painting exercise had students revisit the initial Richard Diebenkorn diagrammatic analysis accomplished the first week of the quarter in groups. Students were encouraged to adopt a Diebenkorn typology for painting to connect to the painterly way that he was able to capture the Bay Area landscape as part of "The Bay Area Figurative Movement"[6]. The learning objectives of this exercise focused on having students anchor the library project to the site based on their evolving project concept.

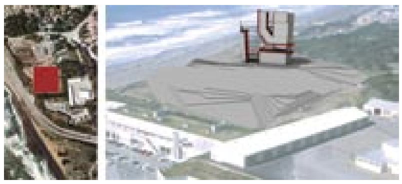


***Figure 13:*** Site aerial (left) and bird's eye view (right) location in San Francisco, CA's Sunset District with Jester's Library project shown, by Jester.

**Group site analysis exercise:** Students worked in groups to build physical and digital models of the site. One group constructed a digital contour model of the site, the second group built a physical contour model of site, the third group developed a series of site vertical cross-sections and the fourth group documented site artifacts via a series of drawings and photographs.

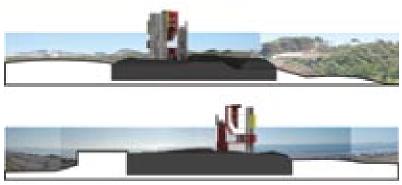


***Figure 14:*** Site cross-sections with Jester's library project shown.
Top: Site section looking north;
Bottom: Site section looking west.

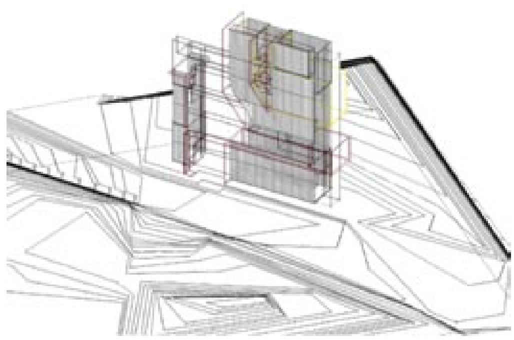
## Instructor's Reflections

*Building placement on an open site always poses a problem for students. I find the more constraints that can be provided for project siting the better the developed strategies. I do think the introduction of the painting requirement did help, but there are still issues of dealing with such a small project on a large site that we did not get to regarding site access and the overall processional qualities as it relates to the sequencing into the building.*

## Student's Reflections

*My painting focused and anchored the way I thought envisioned my building on the site. The site manipulation and project placement would have been overwhelming without the painting analysis. It was very easy to use an underlay of the image of my painting in the site context in* **form•Z** *to develop the topography of the site. It let me easily manipulate the contours and make changes, without getting overwhelmed by the arbitrary quality of site contour lines. The painting was a crucial step in the process, but it had even greater value because of how it could be used in conjunction with digital media.*

***Figure 15:*** Digital wire frame of site and library project, by Jester.



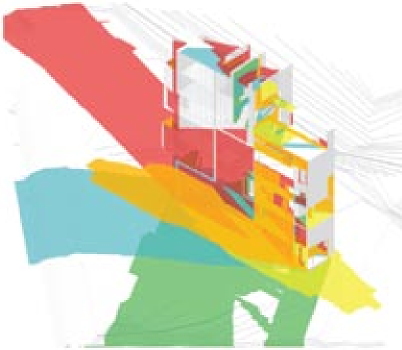


*Figure 16:* Color-coded solar orientation analysis, by Jester.

## Journal: Friday, 10.31.08

Mid Review Comments Summary from Critics[7]:

*1. The jury talked about my clarity of project's design process, in that the critics could see the progression through the different phases and analog and digital media that I was using to develop my project. However, I need to remain true to those things and be very careful that I do not try to refine too much (make things too shiny) so that I don't loose anymore of the original qualities of the beginning struggle that is very apparent in my initial Inhabitable Book studies. I'm really afraid that I am going to end up with a boring building with a typical library program that is just shoved in it, but I think it will be okay. I just need to keep making things as a way of moving forward with the design refinement for my project.*

*2. Cladding system for my project needs to be further refined. I have a system confirmed, but I really need to model how it connects to the building and affects the sitting and opens itself to the exterior. Also—the way my project gets anchored on the site is a big issue. Developing the contour drawings and sun peg study will help with this site placement refinement. Clarifying how the building is reconfigured based on how it sits on the site regarding the approach and entry and overall reaction to the surrounding context are all important to address.*

## 5. A Satellite Library for San Francisco

Students were provided the entire building program for the satellite library project.

The library building program (Total of 15,000 sf):

a. (RED) Book Collection (Storage space for the number of volumes of Books) (5,000 sf).
b. (PINK) Space for Collecting Books that have are coming back (5,000 sf).
c. (GREEN) Reader(s) Spaces for reading (2,250 sf).
d. (PURPLE) Staff Work-Space (1,500 sf).
e. (BROWN) Toilet Rooms (Men & Women) (200 sf each).
f. (WHITE) Horizontal and Vertical Circulation Systems (provide horizontal and vertical systems).
g. (BLUE) Atrium Space (sf varies).
h. (YELLOW) Additional space required for special uses and miscellaneous (6,250 sf).

Students were required to translate conceptual positions that developed from inhabitable book studies in formulating the entire building program for the library, via color-coded program studies. Color-coded mapped solar orientation analysis also provided additional information on project site anchoring and orientation specific cladding system responses.

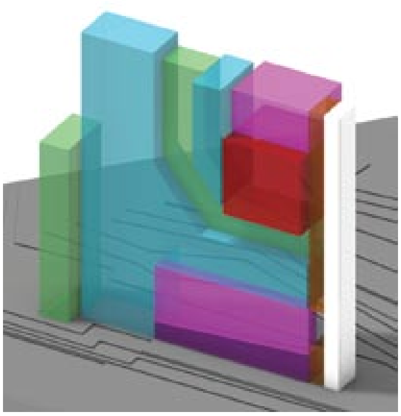


*Figure 17:* Library program model, by Jester.

## Instructor's Reflections

*Building programming is another difficult step in the development of a design project. Often the way that programming is approached takes students far away from their initial conceptual ideas, in making too much out of the shapes of the spaces, weird circulation strategies, or trying too hard to reinvent all of the program adjacencies. I have always found it better for students to jump right into the 3D volumetric configuration of the program without too much 2D program work (bubble diagrams, etc) early on, since it helps when students can connect their project concepts to the spatial strategies for how this relates what they are trying to do along with knowledge gained from case study analysis.*

## Student's Reflections

*I realized at this point in the quarter that it was very important that we were involved with learning from the precedent studies early on in the quarter. I feel like we had a good sense of what was successful in library design (beyond our own experiences with libraries), and this established a strong base that we could adapt our projects to. I think if we didn't have that sense of what was already established and necessary, we would have ended up doing weird things for weirdness sake. In the past I've been afraid of where the 'boring' things should go—the bathrooms or administrative spaces. I felt like I had to make some kind of brilliant decision about how they work. But the point is that they DO work and it's in a way that attempts to connect back to the overall concept for the project.*

*I would like to have done another phase of programming and refinement to see how I could have opened up the building more, while still working within the established vocabulary response of my project.*

## Journal: Friday, 11.07 and 14.08

**Project's Concept Title:**
*The Power of the Book*

*Haiku:*
*Traveler gathers knowledge from books and daydreams; exhales and returns.*

*Site:*
*The site is located on the coast of San Francisco, off the Great Highway, near a wastewater treatment plant.*

**Project Overview:**
*An individual makes a choice by reading. The reader acknowledges the power of books—both sacred knowledge bearers and inspiration for radical and unconventional thought. The reader becomes connected to the larger whole of society while engaging in a highly introspective, intensive activity, as well as, gains a deeper understanding of self through discussion and collaboration within a group. This library is a place to honor the power inside books and the energy created by bringing them together with readers who can investigate, wonder, and give back.*

**Program Overview:**
*The library functions as a satellite library to the San Francisco Main Public Library. The book collection hangs over the larger, more open reading spaces, which wraps through the building. The entry level, containing most of the administrative spaces, has the most informal reading space, connected to the major atrium, intended to be the place with the highest level of disruptive activity and noisemaking. Opposite the wrapping spaces, is a core of small, intimate reading rooms, allowing intensive, individual, focused thought, while having the only view out to the ocean.*

## 6. Final Requirements for Project Development

Final deliverables for the course were:

**For Design Studio:**

- Composite poster of project (4 – 20" x 20").
- All process files organized.
- Power Point of the entire quarter's design process sequence.
- A Reflective Design Process Narrative Essay that explains the student's approach to design and how design tools were used through out the entire process.

**For Building Constructability Studio:**

- Three Diagrams (Structure, Program, Circulation).
- Full set of Line Drawings for project (1/8" scale plans and sections).
- Cladding System Details.

## Instructor's Reflections

*This is my favorite part of the quarter in starting to see the synthesis of lessons learned from earlier foundation exercises into the refinement of all of the students physical and digital models and details. It seems that the range of alternatives students developed early on in the quarter and the range of media that they worked with, allows many of the students when they get stuck to get inspiration from parts of earlier studies as a way of moving forward. It also allows me as the instructor to assist students in moving them along on the project refinement path by pointing out solutions they had early on to current problems.*

## Student's Reflections

*At this point in the project, I was really overwhelmed by how the project cladding details were going to work. I had finally figured out my circulation, but I was insecure about it and it needed refinement. Having to figure out the cladding and talk about the program helped make decisions about how they tied back into the site and concept.*

*It's difficult to remember that it wasn't until Week 7 that all this was clarified. In my current design studio, I need to have patience with this new project I'm working on so that I can develop a strong vocabulary in order to let the qualities of the building emerge from this process in a cohesive way.*

a


b


c


d


***Figure 18:*** Study models of library project: **(a)** Library on site; **(b)** Color-coded sun study; **(c)** Site contour study; and **(d)** Physical study model.

**Week 9**

## Journal: Friday, 11.21.08

*1. I think the biggest thing I've been learning is that I need to do things right away so that I have a chance to develop multiple design iterations of my project. When I don't just dive into studying what is possible, I end up spending just as much time thinking about what needs to be done as opposed to just doing it. Also, I try to always tell myself that I love my project, I do love it, but sometimes I look at other people's stuff and think—oh, my building needs to be more this way, or more that way, and I seem to loose sight of the strengths that I do have.*

*2. It's just kind of crunch time (as if that was different from the rest of the quarter, heehee). But the major push will be ¼" scale vertical cross-sectional model (which focused on showing the connection of building cladding system to building structure), which is hard to work with because of the section of my building that I chose to study in this larger scale due to the angle and cantilever that I have for this book storage space, so I do hope that it is able to stand up. Also, trying to develop digital immersive views, and cleaning up the digital model a little is a focus during these last efforts to refine my project. The development of my four 20" x 20" posters are on track, but I need to print out another test print for Monday, so hopefully I can have the final prints by Wednesday because of the limited business hours due to the Thanksgiving holiday schedule.*

*3. Thanksgiving (!!!!)…still trying to decide if I want to make the drive home or not.*

***Figure 19:*** Library project Cladding System: Channel glass: Exterior side: Sandblasted, Interior side: 'carissmo' transparent.
Top: Sample application; Bottom: Detail of channel glass connection.

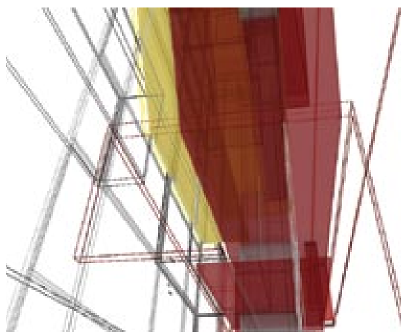
## Instructor's Reflections

*Students' have about 2½ weeks to refine and develop the details of their design projects. In the connected building constructability activity course, students are required to develop cladding details and specifications for their design project.*

## Student's Reflections

*It's stressful to be making a mess working in five different media trying to develop the design because nothing is done and I felt like I had only half a clue of what was going on. But eventually everything starts to come together in a serendipitous way. The last couple of weeks in the process were filled with producing final models and details. At this stage in previous studios, I have been unhappy and wanted to change significant parts of the design. But with this quarter, I was confident that I had worked toward a strong, cohesive design. I do feel that certain aspects were rushed and I would have liked to develop them further. But that is a much better feeling than wanting to change the building. I was able to learn a lot from the final critics comments, and I'm excited to apply the concepts from this process to future projects.*

***Figure 20:*** Immersive detail study view 1, by Jester.



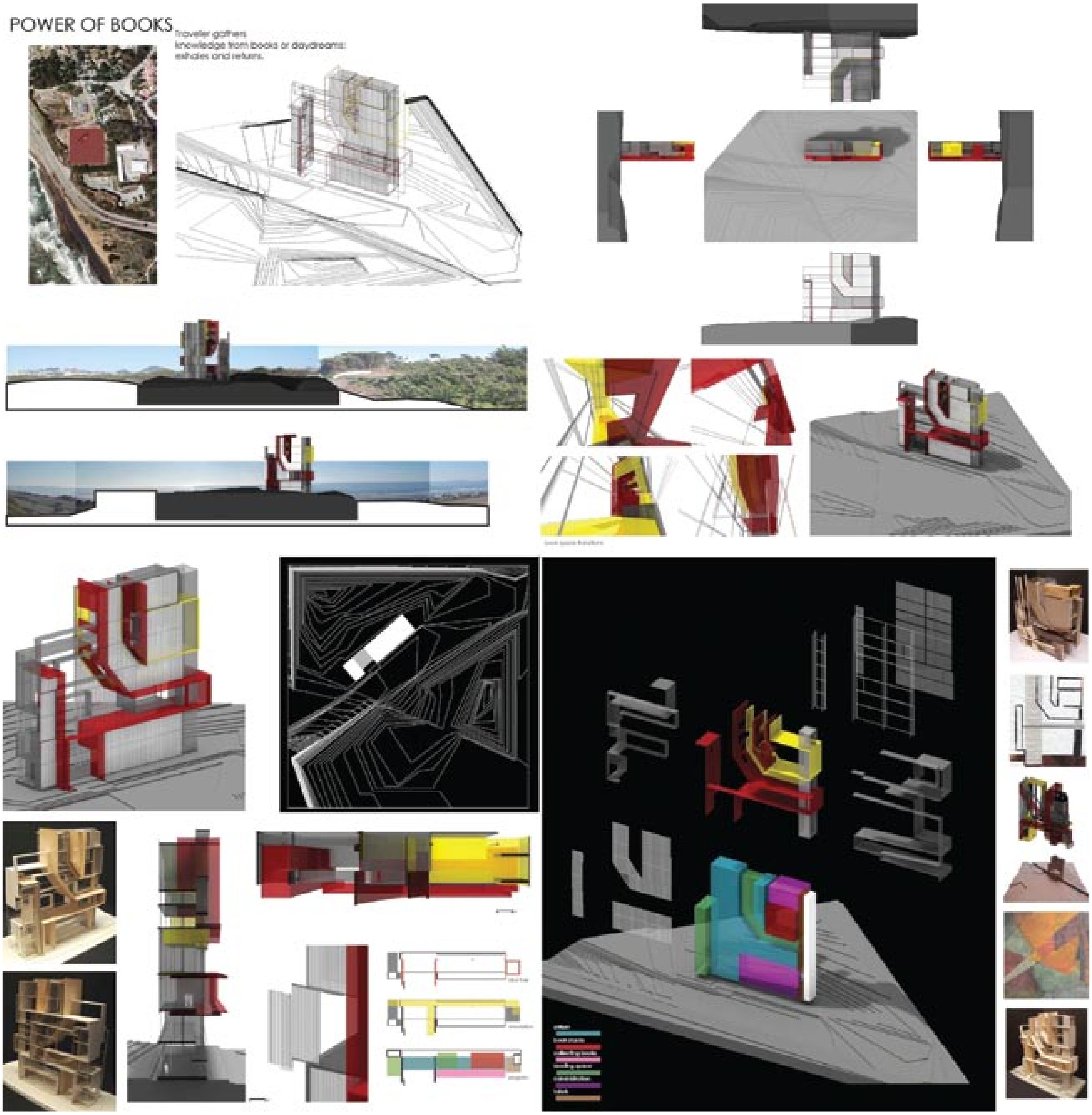



***Figure 21:*** Final project boards of Library project, by Jester.

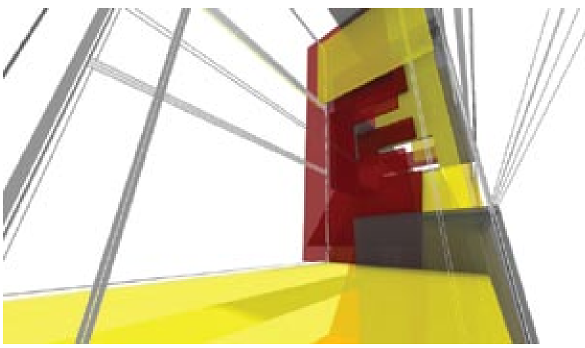


***Figure 22:*** Immersive detail view 2, by Jester.

## Student's Final Reflective Essay on the Entire Quarter's Design Process[8]

### Digital Modeling Experience

*Before this class, I had a small amount of experience with* **form•Z** *from my first year classes. I also harbored MUCH bitterness toward computers!! I have too much computer drafting experience, drawing construction documents and dreaded toilet room details for large (boring) commercial projects. I hate how flat and lifeless things are when they come out of the computer—and the computer thinks it knows how you want everything already!!! I love the way the hand can make something look raw and real, give it character, and it just naturally shows the bias of the author. I took this instructor's class even though I knew there would be a digital requirement, because I also knew that there would be a lot of physical model building as well, so I figured that my emotions could handle it, as long as digital work wasn't glorified.*

**form•Z** *isn't hard at all, you just need to know a few basic commands and it goes pretty smooth. I learned that developing digital models along with analog models gives another lens to your thinking and design development. Digitally, you don't have to worry about gravity for one thing, and it just has its own quality that adds to development of the vocabulary of the project. I did a little modeling in Revit for one of the case study projects, but I hate the interface. It's like using Microsoft image editor instead of Photoshop. It's more geared toward production than design.*

### The Design Process

*Our process began with the found materials model. It was fun to build something architectural that wasn't architecture. This process allowed me to stress less and focus on the development of the vocabulary and the first impressions of space. My digital vocabulary model was not as strong as my physical, but I think the digital work was what pushed the development of the formal 'wrap' of the buildings envelop that happens in my building. The program was easiest to explore digitally, but it still had some unclear areas until I made the jump to the 1/8" scale physical model. Until that point, I found collage to be a good way of clarifying my intent. When I would get frustrated by modeling, a collage of the plan or section acts as a quick way to diagram the important pieces that are emerging and develop the hierarchy of the project. The site painting provided a great way to look and analyze the site and provide the inspiration for the site manipulation and connect this to the overall architecture of the project. Plus, it was just fun to paint!!! After the mid-quarter review, I had to rethink my site manipulation and how it responded to the larger context. I think the sitting of my building was actually stronger before the review. There was a lot of energy in how it sat on the edge of the void that went through my site (as this was developed from my painting) but in working with the actual topography, I couldn't get the void to be as effective. It became very awkward. I think a better understanding of the approach to the site and its relationship to the context would have helped with the development of the site.*

### The Case Study Precedent Projects

*Inevitably, with group work, not everyone carries the same load, just like how the weight of a car isn't evenly distributed on the tires when it's in motion. So, at times it felt like, "I just want to do this myself if you're not going to put any effort into it!!" or "I'm really sorry because I feel like I'm not helping you right now!!" But it was actually good to work in groups because so much more got accomplished than any of us could have had time to do individually. I feel like we got a holistic view of each project—most helpful was program, cladding, and drawing representation. The only thing I think was missing was that we divided up the work the same way every time—so we would do the same part of both buildings, instead of doing something different and learning a new part.*

### Conclusion

*This quarter I learned how to develop a design process. Normally when you are moving so fast, totally absorbed in design, it goes by in such a blur that you weren't paying enough attention to absorb what you're learning. The daily aphorisms and weekly journaling forced me to take a break and reflect on what was going on. I really enjoyed that, and I hope to continue the habit. The found materials models were a great starting point and guide. I'm not sure in what ways it will manifest itself in future projects, but I think it's important to have some sort of inspiration and analysis to launch a project. Otherwise, you have an architecture that is trying to accommodate only words. I remember writing at the beginning of the quarter that I wanted to learn how words effectively supplement the development of the architecture, because I had a bad relationship to the development of my project's narrative and the connection to the developed architecture last quarter. Most importantly during the period of 11 weeks this quarter, I learned how to SUSPEND DISBELIEF and through constantly going back and forth between media—digital, physical models, drawing, collage—pieces of the project begin to surface on their own and this allows you to discover what your design wants to be. It really did feel a little like being a sculptor, like Michelangelo working to release David from the block of stone. I loved how encouraging this class was. My curiosity was always encouraged to take an idea further, develop it more and see what it could turn into. That taught me not to second-guess myself too much. Any decision you make will inform future ones, so don't spend too much time worrying about every little thing you do. Just DO SOMETHING and develop it, instead of changing and starting over and never having time to give anything depth. You have to have faith that it will turn out even if the first version looks bad. It's like painting—the whole time you are working on a painting it never looks like the final painting, you might hate it sometimes, but you keep adding layers and changing it until it's done enough.*

## Instructor's Final Reflective Essay on the Entire Quarter's Design Process[9]

### Digital Modeling

*Over a 12-year period of actively integrating digital media into the design studio's building design process, I find even though more students have knowledge of a range of digital modeling software (there is a lot to choose from today) it seems that still students do not come to class with the level of understanding of how to best use these digital tools as complementary tools in the building design process. What I also find interesting is that there are still only 30% of the students that I get in my design studio course (same as it was in 1997) that feel comfortable using digital media as an integral part of the design process. Some might argue when they see this statement that it is an issue related more to Cal Poly, but it seems to be an issue that I have seen in a number of other programs. I have found over the years that the way to bring all students to a similar level of integrating the use of digital media in their design process is to set them up in technology tools teams the first day of class and get the groups to complete a warm-up exercise that requires the use of digital media for a design assignment. These groups are balanced with a range of skill sets with students who know a great deal about the digital tools to those who know very little. The ones that know little, do much of the driving to complete this warm-up design assignment and this seems to work in at least starting the class with more of an even sense digital tool proficiency. Sarah used* **form•Z** *in a balanced and integral way with a range of 2D and 3D physical media, which seemed to assist her in moving her project along. I don't think she would have had the same success if she chose to use only physical or digital media exclusively. It was great to see her excitement at key design milestones, periods in during her design process.*

### The Design Process

*Giving students a tight framework to divide their design process into several inter related assignments, seems to assist the students in moving the development of their design process along. With the use of digital media I find it useful to have students freeze and archive digital work many times on a daily basis, since sometimes the longer something is worked into, the more it starts to loose its clarity. Models that have been archived allow students to go back a step and then continue working. Also the idea of printing out and leaving digital models up along side the physical models does help students to see how these two versions of the same thing give different readings of their project.*

*As a key part of the design process I have also found that not letting on to students what the actual building type and program are until much later in the quarter (around week number 4 or 5) allows students not to be side tracked early on in the vocabulary development stages of the project with the particulars of building program. It seems like studios sometimes are too much about designing for a particular building type and not enough about pushing the envelope of developing strong design vocabularies.*

*Sarah, like many of the other students in the studio, were very good at getting the most out of responding to the range of assignments to move the design of the project along. It seems that not all students are comfortable working on a series of parts that eventually lead up to becoming a whole project, so I need to continue to find ways of improving how this process is framed in the studio assignments.*

### The Case Study Precedent Projects

*Over the years I have discovered that the analysis of key case study projects in groups can really assist the individual students in establishing a kind of kit of parts for how these projects work regarding the connection of concept to program, structural systems and cladding system configurations. Students also discover some of the inconsistency of projects that are analyzed, which does add to the level of discussion in the studio. The difficulty that students seem to have is the using of the lessons learned from case studies as a foundation to build their own arguments for project. So framing assignments that require students to reuse analyzed case study components is always something that I am trying to figure out how to improve on as to how this happens. The individual re-representation case study project was a new assignment to see if it would help students improve the way that they were able to represent space in plan and section. Students did seem to acquire more of an appreciation representing projects in plan and cross-section drawings and did use these strategies for developing their own designs, but I needed to spend more time with the students in the refinement of their final drawings for design project. Drawings were better than usual but more improvement is needed in this area of studio regarding expectations of the level of the quality of drawings for projects. It does not seem that 2D plan and section drawings are valued the same way as 3D digital models.*

*Sarah's project benefited from her re-representation of Ito's Media Tech project in the way that she developed a series of vertical voids in her tall volumes of space. She did get stuck a bit on how to best configure the circulation system to work with the vertical voids in a thin and tall vertical enveloped building, but she did get it to work after a few iterations of design.*

## Conclusion

*I learned a great deal this quarter about lessons to improve on in future design classes. I thought I probably had students spend too much time on carving into the solid corrugated cardboard inhabitable book models (was the way that I got students started on connecting reading to space), since I think it was at the expense of the further development of the digital models. Over the years I have discovered depending on how assignments are framed in the studio and the timing of when students are being asked to use digital verses analog tools really depends on whether the outcomes of the student work will be more digitally or analogically project developed. I don't know if there has ever been an even balance of physical and digital models developed to the same level of refinement. I do think this was more of a physical model quarter with many great results, and the digital models were used as a way to understand aspects of how the projects worked regarding cladding systems and in many cases simulating the day lighting qualities in the interior spaces.*

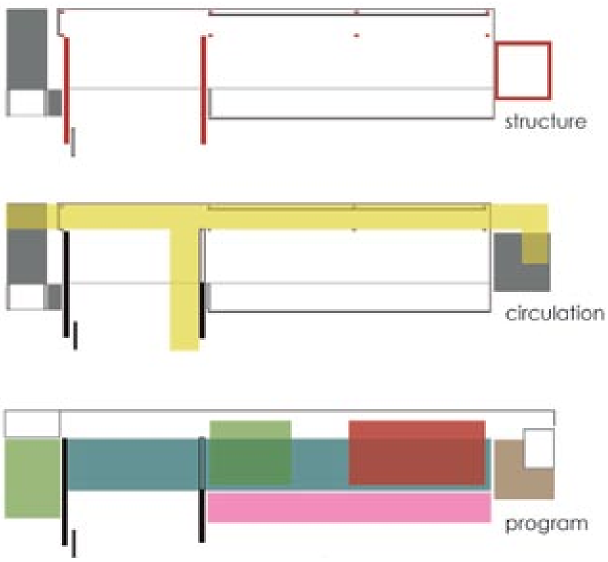


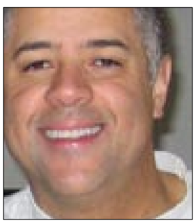

***Figure 23:*** Library project 2D diagrams (structure, circulation, program), by Jester.

## Notes

[1] All student design work in paper (except where noted) is authored by Sarah Jester.
[2] Weekly Journal by Sarah Jester, Third Year Student.
[3] Instructor's Assignments and Samples of Student's Work, by Thomas Fowler, IV.
[4] Post Studio Reflections by Instructor (Thomas Fowler) and Student (Sarah Jester), these comments were written after the quarter was over.
[5] Concept Statement from Group ADLV Warm up Exercise, Sarah Jester, Naoko Miyamoto, Shawn Morse, Paul Hedgcock.
[6] The Bay Area Figurative Movement, <http://en.wikipedia.org/wiki/Bay_Area_Figurative_Movement, Accessed September 26, 2008>.
[7] Response to Mid Review Comments made by Critics, by Sarah Jester. Each student responded to their buddy note taker's summary of the comments made by critics during this review.
[8] Final Reflective Essay on the Entire Quarters Design Process, by Sarah Jester.
[9] Final Reflective Essay on the Entire Quarters Design Process, by Thomas Fowler, IV, AIA.

## References


1. Fowler with Bermudez, Univ. Of Utah, Bennett Neiman, Texas Tech Univ., "On Improvisation, Making, and Thinking", October 2005 ACSA South West Regional Conference Proceedings [Conference Cancelled, but proceedings published].
2. Fowler, Muller, Physical and Digital Media Strategies For Exploring "Imagined" Realities of Space, Skin and Light, ACADIA 2002.


**Thomas Fowler IV**, AIA, NCARB, is a Professor at the California Polytechnic State University, San Luis Obispo. His teaching responsibilities include third year design and building technology courses, working with a range of independent study students, co-teaching an interdisciplinary fourth year design studio (architecture and architectural engineering) and directing his digital media facility founded in 1997, called the Collaborative Integrative-Interdisciplinary Digital-Design Studio (CIDS). During his career he has received numerous awards in recognition of his teaching and research activities, which includes: American Institute of Architects (AIA) Education Honor Awards for the Integrated Project Studio (IPG) taught in collaboration with full time Lecturer Barry Williams, AIA in 2009 and for CIDS in 2008, selected for the AIA Doer's Profile in 2008, received the College of Architecture and Environmental Design Wesley Award for Teaching Excellence in 2007, the Architecture Department's Faculty Teaching Award in 2005, received the Young Faculty Teaching Award from the ACSA/AIAS in 1996-1997, and was selected as part of the Young Architects Competition, Progressive Architecture magazine, July 1994.



**Sarah Jester** is originally from Placerville, CA, a historic gold rush town. Outside of architecture, she likes being outdoors, hiking and running. She also has a classical piano education, and enjoys drawing and poetry. She is very interested in the design process and the way different digital and analog media contribute to the understanding of a project. Before using **form•Z** in the fall, Sarah did not understand how digital media could benefit a project. Since then, she has realized how crucial it is to developing the project and keeping it moving forward. Sarah looks forward to next year when she will be participating in Cal Poly's SOM Professional Studio for Advanced High Rise Buildings, where she will gain valuable experience in the building design process and how technology is used in practice.

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**American Film Institute**
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PI: Richard Reynolds
**California College of the Arts**
• School of Architecture
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**California Polytechnic State University, San Luis Obispo**
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PI: Tom Fowler IV
**California State Polytechnic University, Pomona**
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**Chabot College**
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PI: Dong Kim
**City College of San Francisco**
• Department of Architecture
PI: Nestor Regino
**Los Angeles City College**
• Art Department
PI: Gayle Partlow
**Los Angeles Institute of Architecture and Design**
• Architecture Program
PI: Carl Smith
**New School of Architecture and Design**
• Digital Media Arts
PI: Avery Caldwell
**University of California at Los Angeles**
• Department of Architecture and Urban Design
PI: Anthony Caldwell
**University of California at Los Angeles**
• Capital Program
PI: Sharif Rahman
**University of California, Berkeley**
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PI: Nicholas deMonchaux
**University of Southern California**
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PI: Randall Stauffer
**Woodbury University, San Diego**
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PI: Marcel de Lange

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**University of Bridgeport**
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**Yale University**
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PI: John Eberhart

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PI: Aron Temkin
**University of Florida**
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PI: John Maze

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PI: Christopher Welty

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**Loyola Academy**
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PI: James E. Cleland
**Rosa Parks Middle School**
• Industrial Arts
PI: Charles Ivory

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**Harvard University**
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PI: Stephen Ervin
**Massachusetts College of Art**
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PIs: Robert S. Coppola, Meg Young
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Technische Universität Darmstadt
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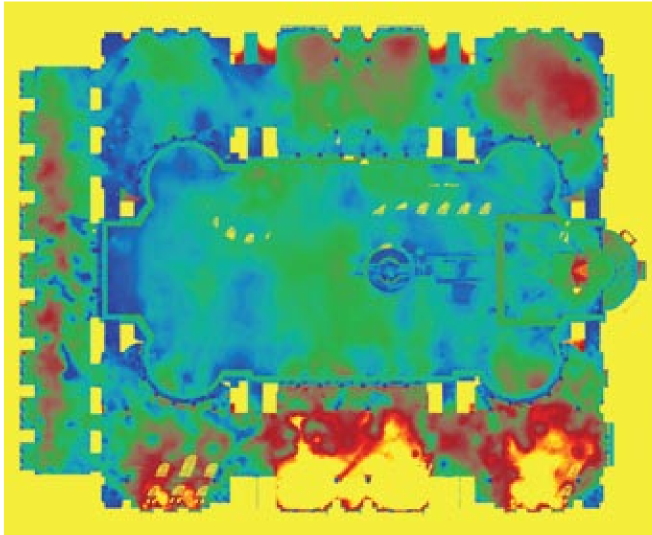
# Computing the "Holy Wisdom"

## form•Z and Radiance as analytic tools for historic building research

by Oliver Hauck



The church of Saint Sophia (Holy Wisdom) in Istanbul – formerly known as Constantinople – was the cathedral of the city. This unique building with its wide cupola was built by emperor Justinian I (527-565) between 532 and 537. The first design by Anthemios of Tralles and Isidor of Milet had to be changed during the construction phase because of statical problems. During the following centuries, many windows had to be filled with brickwork because of structural collapses after several earthquakes.

For the project "The Saint Sophia of Justinian in Constantinople as a scene of profane and secular performance in late antiquity" which was funded by the Deutsche Forschungsgemeinschaft (German Research Foundation) in the framework of the priority programme "theatricality" a CAD model of the Saint Sophia in Istanbul has been generated at Technische Universität Darmstadt's faculty of architecture. This model is based on the architectural survey of the American Robert van Nice as well as on personal inspection of the actual building.

We found out very quickly that the light effects of the architectural concept do not only depend on the number and location of the windows and that common render software was not able to reproduce the original light situation. The whole building is a highly complex interaction between the occurring daylight and the window openings, the materials, and even some of the detail geometry.

The vaults which are mainly covered by gold mosaics are a major component of the light effects. The vaults reflect the daylight which occurs mostly through the openings of the aisles into the nave. This was the reason why these vaults but also all the other surfaces of the internal architecture of the building had to be reconstructed concerning their original geometry as well as light reflecting qualities.

The geometrical part has been done using **form•Z**. The light simulation has been done using Radiance and Make. To bring both programs together, we developed a special kind of workflow using **form•Z** libraries and a data management system which allowed us to work on the geometry and the materials independently.

The work has been shown in the exhibition "Insight into the virtual sky" at the Universitäts und Landesbibliothek Darmstadt. (Catalogue ISBN 978 3 8030 0691 2)

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The Project will be part of the exhibition "Byzantium, Splendour and Everyday Life" at the Art and Exhibition Hall of the Federal Republic of Germany in Bonn from February 26 – June 20, 2010.

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