PROCEEDINGS OF THE
2010 CREATING_MAKING FORUM

THE UNIVERSITY OF OKLAHOMA
COLLEGE OF ARCHITECTURE / DIVISION OF ARCHITECTURE

< 11.03.10 – 11.05.10 >

The 2010 Creating_Making Forum

A letter from OU Division of Architecture director, Nick Harm.

This forum was conceived as a means to extend dialogue regarding the creative process. It was initiated as an extension of the current exhibit at the Fred Jones Museum of Art of the work of Bruce Goff. This exhibit, a retrospective of Mr. Goff's work, became a center of discussion regarding the teaching and work of this iconic American architect. In effect, the discussions created by the organization, conceptualization, fabrication, installation and opening of the exhibit led to numerous discussions regarding how Mr. Goff taught, how he conceptualized projects, how he used materials, how he innovated and, ultimately, what could be learned from this retrospective. The discussions and, ultimately, this forum was never intended to suggest stylistic imitation of Goff's work or teaching, but, rather, a critical look at what could be learned from the past and translated to the future; i.e., an investigation of "how" he created_made rather than "what" he created_ made.

Topics that emerged from these discussions were supported by the numerous submissions to the call for papers for the "Creating_Making Forum." It is clear that the forum title was both appropriate and timely. The space between creating and making, Creating_Making, deserves a lot of attention. Paper topics suggest the importance of the following themes to those currently considering creating and making:

> *The "Nature" of the Creative Process*: Many papers address, to some extent, the innate need to manipulate, organize, imitate or work in concert with the natural world. They explore the very foundation of this human need to conceive and fabricate objects not found in nature for a variety of purposes; they hint at the deeply-seated biological, psychological and cultural origins of our need to create_make.

> *Social Imperatives*: Social responsiveness has become central to discussions of the future of design education. Disaster relief, ageing, wellness, community action, intervention, repurposing, and so on, are all gaining prevalence throughout environmental design education and practice. The education of designers in social, environmental, sustainable, legal and practical terms are fundamental to the ethos of environmental design.

> *Teaching Creative Process*: We ultimately recognize that graduates of design education are more fully equipped to solve small and large scale design problems compared to graduates of many other disciplines. The question remains as to whether students are educated to be designers or if their skills were innate to begin with? What methods are effective and which are affective? How do we isolate, identify, enhance and validate these conjectures? What models from the past do we revisit because of their effectiveness? What models have become obsolete? What models might we develop for future education in designing_making.

> *Making and Manufacturing*: From the onset of the primal process of creating, the methods and means of realizing the "object" have consistently evolved from hands-on craft to synthetic process/digital realization. This begs the question, which (hand-made or digitally fabricated) creates a more intimate object? Is the final object "known" more completely having been created/made through one process an dnot the other?

Finally, I want to thank the many contributors to this Forum and recognize the high quality of paper submissions that we have received. I would like to thank the University of Oklahoma and the College of Architecture administration for supporting this effort. Additionally, I want to thank the faculty and staff who worked tirelessly to make this Forum possible. I want to thank the director of the Fred Jones, Jr. Museum of Art, Ghislain D'Humieres, for initiating and bringing into focus the exhibit, "Bruce Goff: A creative mind," that serves as the backdrop for these discussions. And, most of all, I want to thank all of the attendees for participating in what promises to be very stimulating discussion regarding the subject of creating_making.

Nick Harm
Division of Architecture
University of Oklahoma
College of Architecture

University of Oklahoma College of Architecture

Dean of the College of Architecture

Dr. Charles Graham
cwgraham@ou.edu

Associate Deans of the College of Architecture

Marjorie Callahan
Associate Dean for
Undergraduate Programs
mcallahan@ou.edu

James Patterson
Associate Dean for
Graduate and Research Programs
jampatt@ou.edu

Division of Architecture

Faculty of the Division of Architecture

Catherine Barrett, PhD
Assistant Professor
cjbarrett@ou.edu

Dave Boeck
Associate Professor
dlb@ou.edu

Khosrow Bozorgi, PhD
Professor
kbozorgi@ou.edu

Daniel Butko
Assistant Professor
butko@ou.edu

Hans Butzer
Mabrey Presidential Professor of
Architecture and Urban Design
butzer@ou.edu

I-Kwang Chang, PhD
Associate Professor
archichang.1@ou.edu

Thomas Cline
Assistant Professor
thomascline@ou.edu

Anthony Cricchio
Assistant Professor
anthony.cricchio@ou.edu

Joel Dietrich
A. Blaine Imel, Jr.
Professor of Architecture
dietrich@ou.edu

Eren Erdener, PhD
Professor
e-erdener@ou.edu

Bob Fillpot
Professor
bfillpot@ou.edu

Lee Fithian
Assistant Professor
leefithian@ou.edu

Nick Harm
Associate Professor
nharm@ou.edu

Stephanie Pilat, PhD
Assistant Professor
spilat@ou.edu

The 2010 Creating_Making Forum
Peer Review Panelists and Session Moderators

For biographical information, see page 164.

We would like to extend our sincere thanks to the following panelists and moderators:

Catherine Barrett
cjbarrett@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Peer review panelist]
[Session moderator]

Dave Boeck
dlb@ou.edu
Associate Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Daniel Butko
butko@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Peer review panelist]
[Session moderator]

Anthony Cricchio
anthony.cricchio@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Dr. Eren Erdener
e-erdener@ou.edu
Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Lee Fithian
leefithian@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Kemal Gokturk
sgokturk@scad.edu
CNC Prototyping Manager
Savannah College of Art and Design
[Peer review panelist]

Nick Harm
nharm@ou.edu
Associate Professor
The University of Oklahoma
College of Architecture
[Peer review panelist]

Jonathan Hils
hils@ou.edu
Associate Professor
The University of Oklahoma
School of Art and Art History
[Peer review panelist]

Kelly Hutzell
kellyh@andrew.cmu.edu
Assistant Teaching Professor
Carnegie Mellon University
School of Architecture
[Peer review panelist]

Lisa Iwamoto
lisa@iwamotoscott.com
Associate Professor of Architecture
College of Environmental Design
University of California—Berkeley
[Peer review panelist]

Stephanie Liner
stephanie.liner@gmail.com
Artist
New York City, NY
[Peer review panelist]

Emily Moss
mosse@newschool.edu
Assistant Professor of Core Studies
School of Design Strategies
Parsons the New School for Design
[Peer review panelist]

Stephanie Pilat
spilat@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Peer review panelist]
[Session moderator]

Fred Schmidt
fschmidt@fsb-ae.com
Principal and Director of Architecture
Frankfurt - Short – Bruza Associates
[Peer review panelist]

Randy Teal
rteal@uidaho.edu
Assistant Professor
The University of Idaho
College of Art and Architecture
[Peer review panelist]

Contents and Index of Papers

Keynote Speakers
Bruce Goff Chair of Creative Architecture Lecture Series
Hans Butzer, Lecture Series Chair
The University of Oklahoma

Each year outstanding architects with exceptional design talent are brought to the university to teach and work with architecture students. Through student workshops, public lectures and informal discussions, these architects are provided an opportunity to further their design philosophy through creative experimentation in an academic setting and, at the same time, share fresh ideas with others.

Design Education and Tacit Knowledge
Dr. Eren Erdener, Session Chair
The University of Oklahoma

Shaped by intuitions, culture, and feelings, the development of this implicit knowledge and its visual, tactile, auditory vocabulary, created through shared cognitions of event-places, their atmosphere, referenced and enhanced by personal metaphors, this knowledge is deposited into the designer's memory and constitutes a critically personalized reservoir as a must in the creative process.

Digital Creating and Making
Anthony Cricchio, Session Chair
The University of Oklahoma

From teaching of digital tools in academia to the use of digital in fabrication, a critical point of consistency that each author addresses is that the digital tools of today require a new form of craft to obtain the equal artisan qualities of the analog craftsman. Should digital craft even be compared to the process of hand craft, the human's physical tool of choice, or, instead, be relegated to a new set of non-humanistic qualities?

Community Engagement

Dave Boeck, Session Chair
The University of Oklahoma

These papers share a pedagogical framework in which students work with "real" clients from outside the academic design studio setting. This student-client interaction can help influence students' ability to address the design-build process more meaningfully. Architects cannot do it alone. It takes architects, interior designers, clients, social scientists, politicians, engineers, natural scientists, citizens, product researchers and manufacturers and, in fact, all citizens of the communities involved in improving their environment.

The Found Object

Daniel Butko, Session Chair
The University of Oklahoma

The concept of a found object is a point of discussion and a generator of personal emotion within various forms of art. Conventional artists who create two- and three-dimensional artwork in the form of paintings, sculptures, collages, etc. express themselves and culture in ways that spark either conversation or controversy. Artists may integrate found objects as a basic catalyst or eventual point of discovery within their chosen form of context. Incorporation of the found object may also allow a fourth dimension to the artwork as it interacts with spectators in varied depths of human senses over time. These three papers explore the found object as an inherent design element capable of descendant thought.

Innovation, Interdisciplinarity and the Environment

Lee Fithian, Session Chair
The University of Oklahoma

Architecture seeks to transcend the mundane response of mere shelter, transforming environmentally responsive structures by imbuing them with meaning. These papers seek new and creative responses to the environment, drawing multi-scalar inspirations from adaptive and technological solutions while respecting the traditions learned through time. Each author focuses on a specific response to the environmental fabric: sustainability through time, sequestration from the elemental forces of nature, establishing the foundations necessary for creating, and technologic innovation in the human shelter interface.

Innovation, Interdisciplinarity and the Environment (CONTINUED)
Lee Fithian, Session Chair
The University of Oklahoma

Interpreting Architecture
Dr. Catherine Barrett, Session Chair
The University of Oklahoma

Can the language of technology and mass production be translated to serve individual needs? Can design processes that are messy and emotional, or organic and spontaneous be translated into forms that depend on technology for their dissemination? What is the role of individual authorship in our contemporary culture? All of these papers help to further the discussion of such questions.

History Reframed
Dr. Stephanie Pilat, Session Chair
The University of Oklahoma

In the last few decades scholars have challenged the canon of architectural history from feminist, post-colonialist, and innumerable other perspectives. This critique has motivated a productive reconsideration of how we select and evaluate projects to discuss. The canon as we once knew it has begun to disintegrate; it is no longer western-centric or even necessarily chronologically taught. These papers are part of the legacy of this reconsideration.

Creating_Making Forum Poster Session Abstracts

Biographical Information

Keynote Speakers
Bruce Goff Chair of Creative Architecture Lecture Series

Bruce Goff's work and teaching at the University of Oklahoma have, through the years, both enriched the art of architecture and established a philosophy with a paramount emphasis on creative design. His idealism provided inspiration for students who came from as far as Japan to study with him during his tenure from 1942 to 1955.

The Bruce Goff Chair of Creative Architecture was established in the early 1980s, shortly after Goff's death, and elevated to an endowed chair in 1998. Each year outstanding architects with exceptional design talent are brought to the university to teach and work with architecture students. Through student workshops, public lectures and informal discussions, these architects are provided an opportunity to further their design philosophy through creative experimentation in an academic setting and, at the same time, share fresh ideas with others.

In Fall 2010, as a part of the Creating_Making Forum, we were pleased to welcome Sheila Kennedy, Craig Borum, and Marlon Blackwell as our distinguished Goff Lecturers.

+

Hans Butzer
butzer@ou.edu
Mabrey Presidential Professor of
Architecture and Urban Design
The University of Oklahoma
College of Architecture
[Lecture Series Chair]

Sheila Kennedy - KEYNOTE SPEAKER
Principal, Kennedy and Violich Architecture, Ltd.
Professor of Practice,
Massachusetts Institute of Technology
+

Sheila Kennedy is currently Professor of the Practice of Architecture at MIT. As a founding Principal of Kennedy and Violich Architecture Ltd. (KVA), Sheila Kennedy has established a new model for an interdisciplinary design practice that explores architecture, digital technology and emerging public needs. Designated as one of Fast Company's Masters of Design, Kennedy is described as an "insightful and original thinker who is designing new ways of working, learning, leading and innovating". In 2000, Kennedy established MATx, a pioneering materials research unit at KVA which engages applied creative production across the fields of design, electronics, and architecture and material science. MATx works collaboratively with business leaders, manufacturers, cultural institutions and public agencies to create designs building components and architecture that advances the widespread implementation of sustainable digital materials. MATx has developed designs and technology applications for Dupont, Siemens, Osram, Herman Miller, Saint-Gobain, The North Face, the City of Porto in Portugal, the Federal Republic of Germany and the United States Department of Energy. The MATx Portable Light Project, a non-profit global initiative that enables people in the developing world to create and own portable energy harvesting solar textile kits has been recognized with a 2009 US Congressional Award, a 2009 Energy Globe Award and a 2008 Tech Museum Laureate Award for technology that benefits humanity.
(Information courtesy of http://www.kvarch.net/ and image from http://arts.mit.edu/fast/soft-rockers/)

Craig Borum - KEYNOTE SPEAKER
Principal, PLY Architecture
Associate Professor of Architecture,
The University of Michigan
+
Craig Borum is a Professor of Architecture at the University of Michigan, where he is the Director of the Master of Architecture Program. He is also the founding principal at Ply Architecture in Ann Arbor, MI which he established in 1999. His work at Ply has received numerous AIA Honor Awards at the national, state and local levels as well as 2 Architect Magazine R+D Awards and an American Architecture Award. In 2007, Ply was named one of "101 of the World's most exciting new architects" by Wallpaper* Magazine. Borum was a recipient of the Architectural League of New York Young Architects Forum Award in 2006. His work has been published in numerous journals and monographs including Architecture Magazine, Architectural Record, Metropolis, l'Architecture d'Aujourd'hui, Ottagono, A+T, Damdi Press, Azure, Urban Spaces - Squares and Plazas, 1000x Architects of the Americas, Young Americans, Advanced Interior Design, Conceptual Diagrams and Advanced Public Design.

In addition to teaching at the University of Michigan, he has also taught visiting studios at the Southern California Institute of Architecture and the University of Cincinnati. He has served on design juries and lectured at a number of institutions including the SCI-Arc, the University of Virginia, University of Cincinnati, University of Illinois Urbana-Champagne, University of Colorado, University of Detroit Mercy, and the University of Illinois Chicago.

Marlon Blackwell - KEYNOTE SPEAKER
Principal, Marlon Blackwell Architect
Department Head
Fay Jones School of Architecture
University of Arkansas
+
Marlon Blackwell, FAIA, teaches fifth-year design studio, technology, and design detailing at the University of Arkansas. Working outside the architectural mainstream, his architecture is based in design strategies that celebrate vernaculars and that draw upon them, and that seek to transgress conventional boundaries for architecture. The recipient of numerous AIA design awards and the ar + d prize from *Architectural Review,* Blackwell's work has been documented in *An Architecture of the Ozarks: The Works of Marlon Blackwell* (Princeton Architectural Press, 2005) and *The Phaidon Atlas of Contemporary World Architecture* (2004 and 2008). His work has also been featured in publications such as Architecture, *Arquine, A+U, Detail, Dwell, Southern Living, Summa+* and *Architectural Record* (with the honor of having the Keenan TowerHouse featured on the cover of the February 2001 issue). Blackwell's residential projects are featured in design books including *Masters of Light, New Country House, Houses of Wood, Private Towers, House: American Houses for the New Century, The New American House 3, The New American Cottage* and *40 Under 40.* Blackwell was selected by a national jury as one of the top 40 designers under 40 years old in 1995. *The International Design Magazine* selected him in 2006 as one of the "ID Forty: Undersung Heroes."
(Information courtesy of architecture.uark.edu and image from http://architecture.uark.edu/861.php)

Papers presented at the

2010 Creating_Making Forum
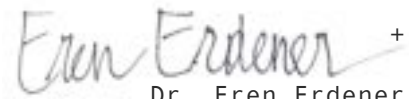
Design Education and Tacit Knowledge

The Design Education and Tacit Knowledge papers offer a platform for debating the role of *Tacit Knowledge* in learning and making architecture, which is at once both simulative and real. All three papers presented strongly dwell on the importance of learning-by-doing. Shaped by intuitions, culture, and feelings, the development of this implicit knowledge and its visual, tactile, auditory vocabulary, created through shared cognitions of event-places, their atmosphere, referenced and enhanced by personal metaphors, this knowledge is deposited into the designer's memory and constitutes a critically personalized reservoir as a must in the creative process.

Santiago Perez, in his paper "M.I. Material Intelligence," defines the tacit knowledge as that, which is "typically learned from experience by doing." It is intimate and hidden in the maker's experience with the material, which he names "embodied material awareness." He specifically argues and is rightfully concerned with the future and place of tacit knowledge in "digitally mediated" production methods and processes. He believes a co-evolutionary approach-attitude embedding the "pre-digital understanding of materiality" in a general hybrid digital craft as a means of integrating this accrued experience and combining the best of both time-honored and digital (and analog) program, design and production, is the answer.

In her paper "Designing from past experience," Irina Solovyova affirms through an extensive literature review and summary analysis that such knowledge is the result of all life experiences that shape self, both as an individual and designer. She explains that (tacit) knowledge is implicit, created as a result of exposure to and inner reflections of experiential reality, environmental experiences, and intuition, imbued with the individual's cultural disposition; she ably sums them up under the concept "autobiographical experiences." Such a reservoir of values, when created and enriched with many life experiences, become a part of one's tacit knowledge, at once implicit and observable through action. In this respect, its role in learning and creativity is not well-understood and enforced, especially in formal education.

Ernst Ng, in his paper entitled "Quad Space-Academic constructs in the real city," on the other hand, presents a learning-by-doing experiment thereby attempting/proposing a realistic way to complements academic education with architecture-making within the boundaries of the "design-build pedagogy," following the chronology of his (and his other three collaborators') experience. The narrative however leaves the reader with a question as to how the hands-on construction experience is informed by the specific project preparations, i.e., the preceding planning and programming efforts that may have afforded the reader to view the experience as a whole in creating tacit knowledge.

Dr. Eren Erdener
e-erdener@ou.edu
Professor
The University of Oklahoma
College of Architecture
[Session moderator]

M.I. Material Intelligence

Santiago Pérez

perez.sr01@gmail.com
Assistant Professer
University of Arkansas
Fay Jones School of Architecture

Abstract

What is the role of the Hand, and "Tacit" or Material Intelligence [MI], in the age of digital fabrication & robotic production?

Contemporary design pedagogy and production methods increasingly stress the importance of digital workflows and advanced fabrication processes, both engaging the maker and distancing the body from the act of making. The promise of parametric software, coupled with the increasing ubiquity of CNC + Robotic production methods, creates new relations between Material + Maker, largely unexamined from a critical perspective in the context of contemporary material production. The abstraction and reduction of material logic and embodied or "Tacit" knowledge, in favor of a seamless digital production process, displaces or recalibrates the [material] knowledge, or intelligence, that is the hallmark of Craft processes and Making.

Within this context, this paper will critically examine recent installations produced in the author's studios and seminars, focusing on the relation between the act of making, material processes, and digitally mediated production. The goal of the essay is to reconsider the role of the Hand, and Craft, within the culture of making increasingly dominated by "File-To-FAB" processes and the abstraction of material within the algorithmic logic of contemporary parametric design. New, HYBRID forms of Craft + Advanced Fabrication emerge as a result of the [critical] mediation between the Body and CNC / Robotic production, enabling an as yet undefined new generation of architectural thought and material engagement.

Material Intelligence, or MI, may be defined as a combination of Explicit and Tacit Knowledge, acquired by both direct hands-on experience, and codified knowledge transfer. Whereas explicit knowledge of material performance and fabrication techniques may be acquired through codified rules and procedures, tacit knowledge must be obtained by direct contact with material, often requiring many years to develop expertise with a given process or material. Sociable Expertise, as Richard Sennett explains in The Craftsman, involves knowledge transfer from the individual (genius) to a community requiring skill in mentoring in addition to material-specific expertise. Tacit knowledge, by contrast, is difficult if not impossible to transfer, as it relies on an intimate confluence of bodily-awareness and (material) expertise. Sennett calls this lack of transferable knowledge the "Stradivari Syndrome."

The ability to encode tacit and explicit knowledge of material practices and making, within a culture of parametric determinism and CNC / Robotic production, requires a dramatic shift away from the certainty of code, towards the ambiguity and uncertainty of Craft and the Hand, while at the same time capturing or codifying material practices. This bi-directional knowledge stream, from human hand and physical material, to software / hardware, and back again, produces as yet unknown horizons of material practice- hybrid physical / digital feedback loops embedded in both the body and the machine, encoded as (explicit) procedure in software, and (tacit) knowledge in the hand of the maker. Increasingly, the direct contact of the hand is replaced with the amplified, enhanced control of the robotic manipulator. What is the role of Tacit Knowledge, and Material Intelligence, within this new Domain?

Embodied Material Awareness

The relation between Maker + Material may be understood as a bodily apprehension and awareness of the physical constraints or limits of working directly with material, as an immediate, tacit level of knowledge. (see Fig. 1).

Fig. 1. Welding Frame Components.
University of Houston MicroLiving Studio. Photo by S. R. Perez.

The material / process flows, within this framework, are governed by the inherent attributes of a specific material, such as the malleability or melting point of steel, or the grain direction and hardness of wood, in response to the embodied skill and kinesthetic awareness of the maker, obtained over time, as Tacit Knowledge of material / process. The transformation of material in direct contact with the body ensues from a balance between *"propioceptive"* internal awareness, and *"exteroceptive"* perception of the tactile, spatial and elemental qualities of material systems. This fundamental manner of working directly with material is a primary aspect of traditional craft practices, and a hallmark of sculptural practices, such as the early work of Richard Serra, relying on

the use of an extensive "Verb List" associated with the Body in direct contact with material. Serra's verb list employed terms such as "To Cut, To Fold, To Bend," etc.

The early promise of (Digital) Fabrication practices underscored the relation between the limits of material, bodily contact and awareness of materiality, and the potential of computer numerical control to augment the relation between maker and material. To analyze these relations more clearly, we should strive to understand the difference between the (abstract) Conceptualization of a work, its means of execution or production, and the mediated, augmented relation of the body as a peripheral agent in the production of computer numerically controlled work. One key aspect of this analysis is the difference between "Intentionality" and "Contingency."

> A more polemical subtext criticizes the prevailing institutionalized segregation of artistic and scientific practices, a phenomenon that might be characterized as the reification, both within popular prejudice and academic theory, of an ideology that divides human experience between the sensual / oneiric, on one side, and the intellectual / ratiocinative, on the other.[1]

Intentionality suggests either a Contemplative (body at rest) or Performative (body in action) basis for the development of abstract (intuitive) rules governing a work, as for example in the procedural paintings of pop-artist Bridget Riley, or the action paintings of Jackson Pollock, executed with explicit geometric rules in the case of Riley, and bodily constraints overlayed on an intuitive geometric framework, in the case of Pollock. What this over simplified comparison suggests is the introduction of Gestural Logic, Chance Operations and Contingent Fabrication methods, within the overall logics of production (see Figs. 1 and 2).
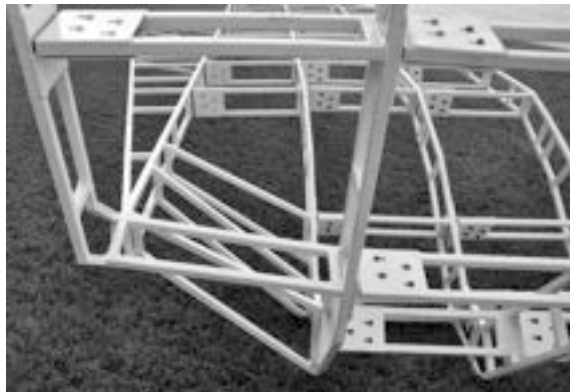
Fig. 2. Completed MicroLiving Frame.
University of Houston MicroLiving Studio. Photo by S. R. Perez.

The MicroLiving full-scale fabrication studio, co-taught with invited architect William Massie, explored the potential of Embodied Material Awareness and constrained, contingent logics of assembly, at the University of Houston in 2009. The studio developed and installed two full-scale welded steel pavilions, utilizing a single constraint on the logic of production- a notched, bent and welded one-inch tube steel element utilized throughout the entire production process. The repetition and variation of this simple element was the driver for the development of "modular cartridge" prefabricated elements constituting both pavilion designs.

Contingent Pattern Logic

The rapid deployment of generative, algorithmic patterning in current digital fabrication projects has its roots in both the disruptive pattern systems found in nature, and the mathematically inspired paintings of 1960's pop artists such as Bridget Riley. A comparison with the conceptual logic and production methods of abstract painting may serve as a point of departure, therefore, before engaging the material workflows of (CNC mediated) tectonic pattern production.

Riley's work may be seen as a link between the pre-digital logics of (bodily) performance and reductive geometric logic of late twentieth century Pop Art, and the current fascination with the algorithmic, procedural logics of digitally fabricated production, largely devoid of external contextual engagement or performative constraints. The paintings of Bridget Riley, while based on carefully orchestrated geometric logic, were nevertheless dependent on the artist's bodily awareness, during the act of production, as a result of the handcrafted transcription of mathematical patterns onto large canvases. Rule-based procedural logic encountered contingent spatial and bodily constraints, imposing a physical rigor in both planning and execution. Geometric Abstraction merged, however slightly, with Material Intelligence in this work (see Fig. 3).

By comparison, today's procedural patterning methods rely on the fluid transfer of data from the computer, using software such as Rhino Grasshopper, translated into toolpath code output directly to CNC machines. This workflow obviates the need for bodily awareness or direct contact with material during the entire production process (see Fig. 4).

With the advent of fully articulated multi-axis robotic assembly, the dependence on bodily contact during assembly of constructed systems will also be negated.

We have arrived at a point whereby Contextual, Contingent Data Streams must be imported into the development and production cycle, encoding what was previously created in the encounter between the body and material. The re-insertion of Chance, Mistakes, Physical Resistance, and inherent Material Qualities must now shift from the Maker, as Tacit Knowledge, to the machine, as digitally encoded data (see Fig. 5).
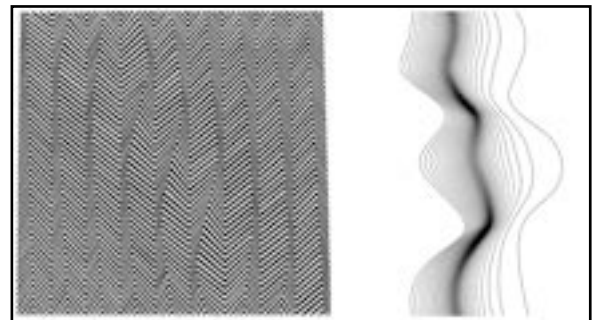
Fig. 3. Bridget Riley Pattern, Grasshopper Blended Curves.

Fig. 4. Moiré Pattern Assembly. Photo by S. R. Perez.

Fig. 5. Moiré MicroLiving Pavilion: Completed Installation. Photo by S. R. Perez.

Pattern Recognition

In contrast to the internal procedural logic driving much digital production today, the (re)introduction of diagrammatic analysis, or what architects Leven and Betts call "Pattern Recognition," suggests an alternative course for re0directing parametric production workflows away from the "machinic endgame" towards a collective intelligence stemming from the specifics of place, program and material, within the context of digitally fabricated production.[2] This was the promise of early fabrication projects, such as Massie's "Big Belt House," SHoP's "Camera Obscura," and the Trondheim Camera Obscura project in Norway, all of which deploy both procedural logics of production, with an acute understanding of pattern recognition and material intelligence. The term pattern is used in a different sense in evaluating work that results more from the analysis of what Stan Allen terms "Field Conditions," rather than the current fascination with (geometric) patterning. Within this context, *Patterns* are conceptual vehicles for understanding the city, site or locus of production, and also the means with which to develop diagrammatic abstract analyses and strategies for development of (digital fabrication) methodologies.

The return to the analytical diagram as a primary driver of geometry is the underlying theme of pattern recognition, applied towards the logic of *contingent* parametric production strategies.

Digital Craft and Combinatorial Poetics

Parametric combinatorial logic of production and assembly may ultimately be tied to a bottom-up, morphogenetic computational strategy, informed throughout the entire design and production process by the performative capacity of material logic and contextual material intelligence, as described by Achim Menges, in *Emergent Technologies and Design.* [3]

This pioneering attitude towards the co-evolution of material and digital parametric strategies, embeds what was previously the domain of human tacit intelligence, within the realm of algorithmic, machinic intelligence. The capacity to instill performative, contextual logic within the design and production stream leads to hybrid analog and digital production strategies, combining the best of both the pre-digital understanding of materiality, and the algorithmic computational capacity of digital analysis, design and production. The centuries old (procedural + contextual, contingent) material knowledge of the weaver, basket-maker, potter and woodworker, may finally enter into dialog with the (so called advanced) fabrication strategies of digital production workflows.

An early example of this hybrid **Digital Craft** approach was undertaken by the author's design students in the development of the Buffalo Bayou Cloud Installation, in Houston, Texas 2008 (see fig. 6). This bentwood modular assembly was designed to fit within the gap between existing concrete silos, created as a site-specific installation of full-scale digital fabrication strategies. The project involved both CNC-produced formwork, and hand-laminated bentwood panels. This project affirmed the author's premise of re-thinking fabrication workflows to encompass CRAFT techniques, combining traditional production strategies with advanced fabrication workflows.

Fig. 6. Buffalo Bayou Cloud: Completed Installation. Photo by S. R. Perez.

Modularity, Variation and Simplicity

Works in this oeuvre are distinguished by their ability to bridge two normally segregated domains: an abstract domain of mathematical quanta and calculi, on the one hand, and a concrete domain of sensual and affective responses, on the other.[4]

Contemporary Digital Fabrication and Computational Design increasingly utilizes complex algorithmic strategies towards the production of complex forms and surfaces. A relatively unconsidered potential of generative workflows is the capacity to generate Parametrically Constrained systems tending towards the production of Minimally Complex forms, informed by a desire for utility, directness and "fit." This is an aspect of traditional craft knowledge and production that can provide a renewed sense of value and purpose, in dedicating one's life's work toward a search for forms that are instilled with the potter's sense of touch, ecological sensitivity and material intelligence (see fig. 7).

Fig. 7. Buffalo Bayou Origami Shell: Development of Folded Plate Panels. Photo by S. R. Perez.

The introduction of increasingly sophisticated CNC machines within reach of the designer's control, may ironically lead towards a renewed search for **Simplicity**, within the work produced. This is the author's current research direction, guided not by a search for complexity, but rather for the complex knowledge of Procedure, Modularity and Variation, known for centuries in the **Procedural / Contextual Realm of Craft**, but only now beginning to engage the (Parametric) Maker's hand (see fig. 8).
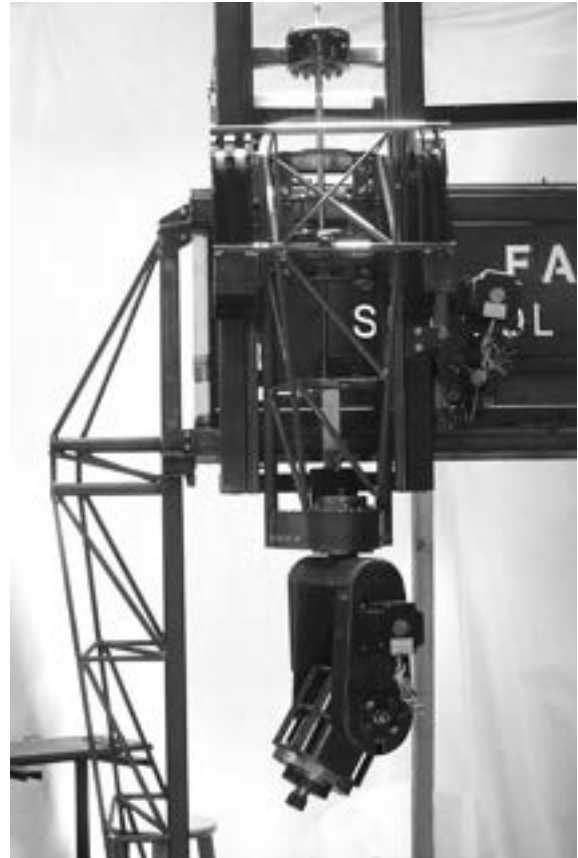
Fig. 8. Custom 5-Axis CNC Machine under development for the author's fabrication research, by CalvinoDesign. Photo courtesy of Mike   Calvino

[1] Steele, Jeffrey. 1991. "Chance, Change, Choice and Order: A Structural Analysis of a Work by Kenneth Martin" in *Leonardo, Vol. 24, No. 4*. MIT Press, p. 407.
[2] Betts, Stella and David Leven. 2009. *Pattern Recognition.* New York: Princeton Architectural Press.
[3] Hensel, Michael, Achim Menges and Michael Weinstock, eds. 2010. "Material Systems, Computational Morphogenesis and Performative Capacity" in *Emergent Technologies and Design.* New York: Routledge.
[4] Steele, p. 408.

Designing From Past Experience

Irina Solovyova
Irina.solovyova@utsa.edu
Assistant Professor
University of Texas –San Antonio
College of Architecture

Abstract

The paper argues for the significance of architects' autobiographical experience in design decision-making. The paper looks at previous studies and makes a case for importance of the further investigation into the impact of architects' life stories on what they create.

Architects are people. This seems like an understatement, however many empirical studies into design process consider architects only as professionals, especially when it comes to expertise. Can one truly separate them*Selves* with embodied experiences, beliefs, memories and emotions from the design knowledge and expertise? Previous studies show that Self is embedded and always present in the process of designing.[1] Individual's belief system partakes in choices of visual memories, precedent selection, prioritizing the design criteria, and design focus in general. Autobiographical experience together with professional expertise contributes to the tacit knowledge of a designer. Gary Klein[2] defines tacit knowledge as "being able to do things without being able to explain why," or as many architects state it, because it "feels right." In everyday life we refer to tacit knowledge as intuition. Often unconscious contribution of tacit knowledge is unavoidable. Expert designers easily recognize patterns and unusual situations without conscious analysis. Nigel Cross[3] called intuition a "convenient shorthand word for what really happens in design thinking." Tacit knowledge allows designers to capture experiential reality and meaning in a form of architecture, and makes creating more successful.[4] Intuition grows out of unique life experience of each architect. Only through direct sensory experience and emotional connection one can gain complex understanding of place. This understanding is essential for ability to design architecture, a place full of meaning, sensory and emotional richness. Israel[5] developed a method which to some degree allows tracking connection of significant life experiences to designs produced. It is critical to recognize the value of life stories. To become an expert a designer must possess not only professional skills but overall experiential maturity. If we look at current 'starchitects' like Zaha Hadid, Daniel Libeskind, Frank Gehry: they have years of experience in architectural design and rich life stories, extensive travel and exposure to multiple cultural contexts, and a vast baggage of tacit knowledge. Tacit knowledge is incredibly difficult to study, however if we do not recognize the tremendous role autobiographical experience plays in creating architecture, we can never understand the design process or teach it.

Beauty is ever to the lonely mind
A shadow fleeting; she is never plain.
She is a visitor who leaves behind
The gift of grief, the souvenir of pain.[6]
After all, beauty is an emotional experience.

Introduction

As rightly noticed by Juhani Pallasma,[7] a functional building is not yet architecture. To become architecture a functional building needs to have feeling and meaning. To my subjective opinion Peter Zumthor is the greatest architect of our time. It is amazing he is staying in business, because he takes up to 15 years to complete his buildings. But when completed, they are not just buildings, they are incredible experiences intimate with every visitor. Zumthor's architecture is about the 'feel of place', or 'atmosphere' as he calls it, and that is why it is so beautiful, engaging and unforgettable. His architecture is not cold 'frozen music', it is not a sculpture, it is "part of people's lives, a place where children can grow up."[8] I believe Architecture is that quality of place Zumthor talks about.

Because of poetic descriptions of architecture like a famous quote by Dan Rice "there are three forms of visual art: painting is art to look at, sculpture is art you can walk around, and architecture is art you can walk through," architects are often compared to artists. There has been a lot written about artistic expressions of memories and emotions, life stories becoming source for art. Architecture is not as close to art as it is to product innovation or medicine in the way it influences citizen's life and in terms of design process. If art is meant to spark an emotion in a viewer and even to change a mindset, architecture is first of all about function and purpose. Construction documents are near the opposite of an artistic expression, though they still capture the meaning and experiential reality, the 'atmosphere' of place that evolved from architect's understanding of place and its meaning into a new place.

It takes time to learn how to design a holistic space experience rather than a building. What makes some architects experts, designers capable of creating 'atmosphere,s' comparing to novices who can give materiality to a design idea leaving users of the space unengaged. Multiple studies of expertise in design focused almost exclusively on designer's professional experience. One hand is enough to count the studies in design which addressed an architect's autobiographical experience.[9] At the same time majority of architects who design meaningful

experiences rather than 'frozen sculptures' posses a large baggage of experiences: rich life stories, extensive travel, and communication with a variety of people from different cultures and with different backgrounds. In her book "Some place like home" Toby Israel[10] uncovered how environmental experience determines the look of a designer's home. Choice of home is only one example of impact of environmental memory on designers' product and process. We can argue that not only environmental memory but entire autobiographical experience shapes the product and the process of design. We cannot help it to take information at all times either intentionally through focused learning or unintentionally though exposure to new situations. All this information becomes part of autobiographical experience. In my Ph.D. study I identified several types of autobiographical experiences most often tapped into by architects during the design process.[11] However I only uncovered the tip of the iceberg. Designer's taste, style, way of making judgments, understanding of other people, construction of cultural and environmental meaning are all infected by previous autobiographical experiences of the architect.
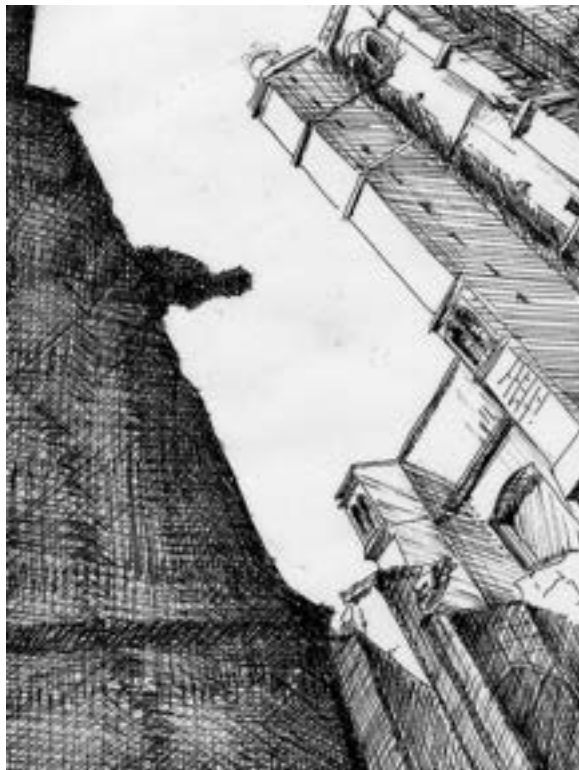
Fig. 1 Narbonne, France, ink drawing.

In my study I had designers complete a small conjecturing task in response to a given design problem. It was very common for designers to continue with a design idea because it 'felt right.' Expert designers immediately recognize patterns. However it is not only professional practice that contributes to the tacit knowledge allowing for pattern recognition, but the designer's entire experience. Once a person decides to become an architect they not only choose the profession, they choose a way of life. They begin experiencing built environment in a different way – they don't simply analyze what they see as a potential precedent, they actively seek more and better experiences and dissolve it. This experiencing contributes to a larger 'baggage' of environmental experience that feeds tacit

knowledge. Figure 1 shows part of my baggage from Narbonne, France.

The past autobiographical experiences of an architect contribute to the construction of Self as both a person[12] and a designer, establishing for that individual a value system.[13] These experiences also determine evaluation factors and the development of basic ideas at the initial step of the design process.[14] Both experiencing and the memory of past experiences are essential for the construction of meaning in general,[15] and of meaning of a place as a "qualitative totality of complex nature."[16] Naturally, the meaning and understanding of 'place' is essential for architectural design.[17] "Design is an act of understanding and the pragmatic use of past experience to identify, peruse, and imagine possible futures."[18]

In this paper we will look at a variety of contributions of autobiographical experiences of architects into design: through shared meaning, tacit processes and intuition as part of such processes. We will look at the construction of autobiographical memory and the role of emotion. We'll peek into other professions studies of tacit knowledge and wander why this subject has not been of interest in design studies. And finally, we will summarize the discussion and challenge design studies to address the scary subject of tacit knowledge in architecture.

Shared meaning

Humans are social beings, and our cognition is shared.[19] This is a critical statement explaining cognition of a designer and the way architects operate within their service profession, the critical role of architects personality, autobiographical experiences, memories, emotions, beliefs and culture. The design process and eventually the product of design are reflection of the social nature of design and the designer.

Design is always situated.[20] We can think of it in a broader sense of situated cognition. This theory is similar to Russia's 'activity theory' developed in 1920s by Vygotsky[21] and continued in 1970s by Leontyev[22]. We share common knowledge and conceptions about the world. Through that shared knowledge and concepts we share meaning, beliefs and simply understand each other. Through the design phase architects operate mainly through shared meaning and to most extent universal graphic representation. Architects like to say that they 'educate their clients'. They communicate with their clients to create shared meaning of culture and place, of architectural and stylistic concepts. When an architect does not understand the culture, and does not share meaning of that culture, we witness major architectural failures (like infamous Pruitt–Igoe project, or a more recent Santa Center at MIT) or less obvious but not less disliked examples many of which were showcased on The Architecture Hate page.[23] On a smaller scale, architectural work is not individual. Architects work in teams with other designers, with consultants and government agencies, contractors, engineers, press, and many other groups of people on everyday basis. Even 'starchitects' collaborate with others in a social process of shared decision making. In other words, by no means can we take an architect as 'a solo creator' out of the context of their culture. Everything we do, think and feel, and how we act, feel and think is dependent on our previous experiences and our culture. Emotional connection and autobiographical memory allow us to function as social beings, and for architects to design. Psychoanalytic theories recognize interrelationship

among emotions, sociocultural processes, discourse, individual experiences and unconsciousness.[24] Myers points out, "unconscious, intuitive inclinations ['it feels right' judgment in design] detect and reflect the regularities of our personal history"[25] captured by autobiographical experience.

Memory

Memory is not only responsible for storage of autobiographical experiences, it underlies all high functions of the brain. And a wealth of background information and experiences is critical for intuition and feelings. "Logic alone does not make a first class mind. Detailed knowledge does not equal conceptual wisdom."[26] Voelker links ability to design to a personality type. That brings us back to designer's life experiences that form a *Self* and personality. Relationships with other people and places form our perception of selves and others rooted in memory.

All our memories are either in place or of place. As Rachel McCann wisely noticed, 'place is an empty container for experience.'[27] "It is the stabilizing persistence of places as a container of experience that contributes so powerfully to its intrinsic memorability… We might even say that memory is naturally place-oriented or at least place-supported. Moreover, it is itself a place wherein the past can revive and survive…"[28] An anonymous woman from Perth stated the same simply and beautifully: "The more I think about this, the more I realize that the important events happening in the place make that place more memorable. I cannot get away from that."[29]

Nostalgia is the most persuasive evidence of extraordinary place's memorability.[30] Just as we have longing for special people, we have nostalgia for places that are emotionally significant to us. Figure 2 shows one of my nostalgic places – a train station in my home town Volgograd, Russia. I have many emotional memories about this place: studying it with friends for master's thesis, seeing friends off, and leaving myself to go across the world for years at a time. I can see my mom crying every time I was leaving, I can feel warm squeezing hugs of people dear to me, I can hear the clock on the station tower, smell diesel of the trains. I imagined this station many times – when drawing it for my thesis and when feeling nostalgia, being far away from home and really wanting to be there, at that train station, and see faces of my parents and friends eagerly looking at every window of arriving train searching for me. We grasp a place through intellect, senses, emotion and imagination. Though from the architectural standpoint this train station may not be the best of the precedents, it definitely formed my understanding of what a train station is.

It is the lived body that allows us to be familiar with a particular place. "For familiarity to begin to set in, we must project a state of already *having inhabited it*."[31] Familiar places are 'attuned place,' "a space with which one feels sympathetic at some very basic level"[32]. It is through bodily and emotional experience in and of a place that familiarity is established. This familiarity is critical to architectural designers: it allows the embodied understanding of place that can be projected into the designs of new places by imaginary inhabitation of them. Emotion is a strong part of this familiarity: we *feel* at home, we *feel* oriented in place, we *feel* familiar. We are never indifferent to a place, our feel about it is intrinsic to place experience and

place memory; and it is often a certain feel of place, or 'atmosphere' as Zumthor[33] calls it, that architects attempt to design.

Fig. 2 Volgograd 1 train station in Volgograd, Russia.

Obviously, architects use imagination when they design. Memory feeds imagination. Maguire and Hassabis's study[34] of memory recall and imagination led her to the following conclusion: "We think scene construction underpins not just autobiographical and spatial memory and imagination, but a whole host of other critical cognitive functions."[35] Other studies reported by Schacter and colleagues[36] echo Maguire: the less of autobiographical experiences one remembers, the less vivid those memories are, the poorer is the capability to imagine the future. And it seems to be the place rather than temporal factors that allows us to remember or imagine the future.[37] I can say that now neuroscience proved what orators and philosophers have known for centuries.[38]

Several latest studies show the same neural mechanisms are used in imagining the future as in remembering our past.[39] The discoveries of those ground-breaking studies led to the new theory of memory: the purpose of memory is not, as Kathleen McDermott put it, "sitting around reminiscing about the peanuts we ate yesterday"[40] but "an ability to envision and so better negotiate an unknown future."[41] In a nutshell, we design from the past experiences.

Emotion

 "Emotion is not just unconscious memory: it exerts a powerful influence on declarative memory and other thought processes."[42] Emotions define the most memorable moments of our existence.[43] Emotional Self is always embodied, because it is through the body that we construct and make sense of emotions.[44] Emotions have an unconscious dimension or they incorporate meaning derived from the unconscious, from beyond rational.

Emotions and memory are inseparable. Emotional intensity and personal significance of an event give rise to detailed autobiographical memories that are highly available for recall, and resistant to forgetting. Autobiographical memories serve many different functions in cognition: they provide the basis for extended social interactions, maintain a dynamic concept of Self, and represent the meaning of concepts. Remembering is an active process and depends upon reconstruction and beliefs, theories about the self.[45] Even when an architect consciously recalls a place previously visited as a precedent, he or she does not remember this place in the same way, and thus the design process is affected by beliefs and situation.

The strength of an experienced emotion rather the pleasantness of it makes memories of emotional events more vivid.[46] For architects this can mean that a place can become special simply because of an intense personal experience (for example, a first kiss). Such memories contribute to the formation of tastes and preferences and frame the choices architects make during the design process.

Architects become more attuned and sensitive to our environment. By default they notice more details of the environment than other people. No study has been done to examine of the environmental qualities an architect can remember compared to a non-designer. I can speculate that architects may not have more environmental memories, but they remember places in more detail. In case of an emotional event, that as described above, that is more memorable, environment where the event was experienced becomes an easily available image in the image bank of an architect. Figure 3 captures an image from my image bank. The dot in the middle is my reflection in the Cloud Gate that made me feel so small and so meaningless in the big world around.
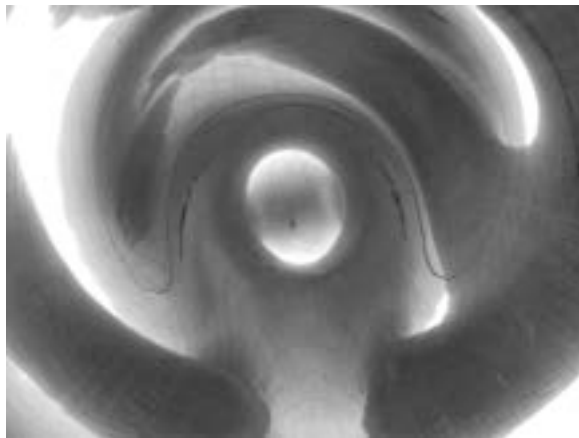
Fig.3 Cloud Gate, Chicago, IL.

 "It is emotional evaluation, not a reasoned one, that ultimately informs our behavior."[47] Emotional intelligence is described in terms of being able to use one's emotions to facilitate thought and direct thinking. Clinical and neurological studies show that people with emotional deficits can't make rational decisions.[48] Emotion physiologically is a part of our judgment system. "Emotions are more central to rationality than even reason and reasoning, for without them, reason has no point or focus. Current psychological and neurological research tends to confirm this"[49]. Remember the architect's reasoning - 'because if feels right.'

Tacit knowledge

The tacit system is composed of processes that occur automatically, which includes intuition, perception, and memory triggers. Because tacit processes are subconscious and pre-linguistic they are difficult to study. We will look at some components of tacit processes and knowledge in attempt to determine their influence on design process.

Intuition

Colman wisely noticed[50] that architects prefer not to believe that it is not 'unconscious and irrational group processes' that guide the design but overt intentions and methods. In reality because the overwhelming complexity of any ordinary design project an architect simply cannot rely on logic and rationality alone. Porter and Sotelo call intuition a "tool to understand what is apparently incomprehensible, and in the process we become empowered, developing our potential."[51] Compare to Nigel Cross's definition of the design process: intuition is a "convenient shorthand word for what really happens in design thinking."[52]

Explicit thought is most valid when an algorithm exists. In complex decisions, analytical methods do not capture the nuances of the situation. Tacit thought is holistic and associative and allows for integration of desperate elements of the puzzle into a coherent understanding of how to proceed. When we make choices or decisions, we base them first on preferences shaped by prior experiences and intuition.[53] It is no surprise that designers prefer intuitive way of working[54] and possess intuitive personalities.[55] The results of the study described by Durling and colleagues[56] show that over three quarters of architects who participated in the study preferred using their intuition during the design process. In other words, designers naturally give a right of way to their intuition over rational thought. And this is where we get into murky waters of how much autobiographical experience versus professional experience and knowledge contribute to design process. Many years ago architects' education consisted of apprenticeship and travel, personal experience and professional experience blended into one. Currently architectural education is separated from life with strong emphasis on rational thought. Obviously, like young violinist who cannot express emotion in a musical piece until the technique of playing violin becomes automated, an architect cannot design until (s)he has the basic understanding of design principles. To be able to express rich and complex emotion in music a violinist has to experience them first. An architect must do the same: live in different environments and cultures in order to grasp their meaning.

Simply by actively interacting with places that house us, we create a vast collection of experiences always at our fingertips as we design. The essential point is that while designing, intuition and tacit processes draw on the *entire* experience, not only on what a designer explicitly isolates as relevant information.[57] Studies in neuroscience show that to understand any new situation, people capitalize on existing mental representations that reflect the *entire* stream of previous experiences associated with that event.[58] In other words, experiences we have shape us as Selves, and intuition is an inherent part of the self, most useful in its assistance in shaping future actions. "The ability to pluck qualitatively salient information from the passing stream and to act efficiently on fragmentary information is what leads to imagination and an aesthetic capacity. Intuition, for example, is the expression of a decision based on the efficient use of partial information."[59]

Metaphor

Architects conceptualize and operate with many abstract concepts. Lakoff[60] contends that "structures of conceptual thought are based in bodily experience because humans are embodied." Abstract concepts or concepts that are not themselves grounded in experience imply metaphor, metonymy or imagery derived from embodied experience. Metaphor joins reason and imagination.[61]

Modell[62] suggests that "metaphor functions unconsciously as pattern detector. Finding the pattern of metaphoric similarities is the means through which we interpret emotional memory." Lakoff and Johnson[63] in their book "Philosophy in the flesh" claim that we can hardly think about subjective experience without a metaphor. "Metaphors are realized in our brains physically and are mostly beyond our control. They are a consequence of the nature of our brain, our bodies, and the world we inhabit"[64]. Metaphors provide us with inferential structure, imagery and "feel". Metaphors are embodied, they allow us to use sensorimotor and emotional inference for abstract conceptualization and conception; our entire conceptual system is embodied. Cytowic[65] echoes Lakoff and Johnson: "the coherence of metaphors and the beliefs that arise from them are not based in logic or rational thinking. They are rooted in concrete experience, which is what gives metaphors their meaning." Metaphors allow for irrational transition from one connotation to another. The emotional and irrational Self is much wiser that the knowledge we posses, and metaphor allows to see similar in dissimilar and make connections that logic cannot capture. Cytowic calls metaphors 'empathetic.'[66] Our conceptual system that allows us to think and act in a certain way is mostly unconscious, and provides manifold assistance to architects. It gives architects understanding of meaning, spatial and material qualities of place, connection with social and cultural aspects of the place, recognition of the typology of buildings experienced, and form their personal aesthetic preferences and believes. Metaphors provide architects with means for grouping of concepts at low level of abstractions in memorable patterns.[67] Abstractions are based on human assumptions, and assumptions are based on person's life experience. Metaphor allows an architect to create a humane place while taking advantages of technological developments.

Creativity

Creativity is a vast and difficult subject, and we are not going to investigate into it in this paper. However, since architecture is considered to be a creative profession, a few points are important to mention.

We shall adopt Bannard's definition of creativity: it is "the act of reinterpreting reality in the light of present circumstance and doing something about it. Creativity is judgment and adaptation. Creativity is essentially what all life has been up to since the beginning of time."[68] Creativity in design and science or creativity in general is based on previous knowledge and is considered to be a restructuring of such existing knowledge into a novel combination, the discovery of hidden similarities.[69] Creativity always has a purpose. When talking about creativity one always thinks of an 'Aha' moment. What is important here is that like with intuition, in creativity the 'Aha' condition relies on the *entire* knowledge and experience of a person and not only on the information explicitly distinguished as relevant. Metaphors help in making the leap.

Tacit knowledge

"So what moved me [in the experience of square across the street]? Everything. The things themselves, the people, the air, the noises, sound, colors, material presences, textures, forms too – forms I can appreciate… What else moved me? My mood, my feelings, the sense of expectation that filled me while I was sitting there [in the sun.]"[70] With vastness, depth and richness of experience there are a lot of things that we know and can do but can't tell. This applies to both knowledge and skills. The father if tacit knowledge Polanyi states that explicit (or focal) knowledge and tacit knowledge are not only different but also near mutually exclusive.[71] Tacit knowledge can be defined as "procedural knowledge that guides behavior but … is not readily available for introspection."[72] Tacit knowledge always comes from experience. Tacit system is psychological and social phenomenon[73] and includes intuition, perception and memory. Perception and memory always involve emotion and embodiment, always entail *entire* experience of a designer rather than professional expertise alone. Design is based on an understanding of experiential reality and meaning of form. Though it is possible to understand meaning through deliberate studying, every individual mainly constructs the meaning through lived experience, and it is that always evolving lived meaning that a designer brings into the design process.

According to Wong and Radcliffe,[74] design know-how is inarticulable, tacit. Tacit knowledge "is typically derived from experience, from learning by doing, rather than from learning by theory."[75] Since tacit knowledge is implicit, how do we know it exists? We know about tacit knowledge because it can be observed through action. Wong and Radcliffe[76] list six tacit characteristics effecting design: judgment facilitating, estimation and envisioning capability, physical maneuvering, efficiency enhancing, image formation and recognition, and handling of human relationship. If for some of those identified categories it may be problematic to prove (for example, envisioning) that autobiographical experience feeds tacit knowledge, in case of the handling of human relationship it

doesn't even need proof. We can accept it as an axiom since only through personal interaction with different people (not only clients or other designers) do architects learn communication and understanding of human nature.

It is established by multiple disciplines that tacit knowledge is important if not essential for success in the profession.[77] In other professions the importance of tacit knowledge and the need for opening up the inquiry into this kind of knowledge of individuals and organizations is widely recognized.[78] It is a hot topic in business, law, medicine, but in design it is far from ripe. We can begin by looking at other professions studying tacit knowledge to draw similarities. For example, law. Lawyers have to see through ambiguity of legal rules. In design the task itself is ambiguous. Lawyers study past cases for analogy, designers study precedents. But are the tacit processes truly the same?

It seems logical that in case of an architect autobiographical experience will contribute to tacit knowledge substantially more than in case of a medical doctor or lawyer. We are at all times surrounded by a built environment and thus an architect is continually (whether consciously or subconsciously) submerged in their profession feeding tacit knowledge. "Tacit knowledge lies below the surface of conscious thought and is accumulated through a lifetime of experimentation, perception and learning by doing."[79] Whether it is an architect or a manager, it is the highly trained intuition and pattern recognition that distinguish an expert from a novice. Mascitelli argues that breakthrough innovators can come up with solutions without a conscious ability to explain it, and the tacit knowledge embodies this vision in a tangible form. Later of course the solutions are analyzed and tested. Just as "breakthrough innovations are a manifestation of subconscious knowledge and experience,"[80] so is design.

Conclusion

Intelligent architecture (intelligent in the sense of relying only on the logical principles of construction of space and intellectual architectural theories) gives food only to our mind, but does not engage us as holistic selves, leaves us curious but indifferent. Solving the puzzle can be fun for a while, but then we get bored or frustrated, and we want to read our favorite, read million times fairy tale. Same holds true for experience of architecture: the many grand amazing shiny and unusual architectural forms amaze us, we take photographs of them as an exotic animal at the zoo. Soon we get tired of glare of glass and steel, get lost in the labyrinth of spaces, get confused by the signs of foreign to us language, and we run to our imperfect, but 'our' intimate and happy, full of meaning home where we can be ourselves rather than 'universal visitors'. In order to create happy and comfortable experiences an architect first needs to have an understanding of place and the world. "Explication of theories in standard textbooks cannot guarantee that they would be applied at the right place and in the right fashion. Without the proper understanding, design just cannot proceed."[81] Autobiography is what gives us understanding.

Peter Zumthor tells us that it's only own experience we can trust. "Postmodern life can be described as a state in which everything beyond your own personal biography seems vague, blurred, and somehow unreal. The world is full of signs and information, which stand for things that no one fully understands because they, too, turn out to be mere signs of other things."[82] Spatial awareness is achieved through immediate experience and embodiment. When we search internet for precedents or see an interesting building in a magazine we interpret those mediated places by remembering and imagining places we experienced personally. And architects use the same kind of imagery for creating new places. "The representation of autobiographical memories become entangled in many knowledge structures during the process of encoding… It is, therefore, hardly surprising that memories 'pop' into mind during activities such as conceptual processing, problem-solving, reasoning, and explaining."[83] The design process is a constant interplay of emotion and reason. The feelings and preferences, demand to be given a form will later be verified by logic, but it is our feelings and intuition that tell us where abstract considerations can work.[84]

To conclude I would like to refer to Peter Zumthor again. He admits that designing does require establishing and understanding of an ordering system. But he also believes that 'essential substance' of architecture comes from feelings and intuition. Intuition is hard work, but it is also "a powerful drug suddenly taking effect. Everything I knew before about the thing I am creating is flooded by a bright new light. I experience joy and passion, and something deep inside me seems to affirm: "I want to build this house!"[85]

1   Frances Downing, *Remembrance and the design of place* (College Station: Texas A&M University Press, 2000); Toby Israel, *Some place like home* (London: Wiley-Academy, 2003); Irina Solovyova, "The role of the autobiographical experiences with emotional significance of an architect in design conjecturing" (Ph.D. diss., Texas A&M University, 2010).

2   Gary Klein, "Comment: Jumping to conclusions can make for good decisions," *Science News* 177 no. 9 (2010): 22-32, 23.

3   Nigel Cross, "Natural intelligence in design," *Design Studies* 20 (1999):25-39, 29.

4   Leanne Woolhouse and Rowan Bayne, "Personality and the use of intuition: Individual differences in strategy performance on implicit learning task," *European Journal of Personality* 14(2000): 157-169.

5   Toby Israel, *Some place like home* (London: Wiley-Academy, 2003).

66 Robert Nathan, *Selected Poems by Robert Nathan* (New York, NY: Knopf, 1935).

7   Juhani Pallasmaa (1996) "The geometry of feeling, a look at the phenomenology of architecture," in *Theorizing a new agenda for architecture, An anthology of architectural theory*, ed. Kate Nesbitt (New York: Princeton Architectural Press, 1996), 448.

8   Peter Zumthor, *Atmospheres: Architectural environments - Surrounding objects* (Boston: Birkhäuser Basel, 2006), 65.

9   Frances Downing, *Remembrance and the design of place* (College Station: Texas A&M University Press, 2000); Toby Israel, *Some place like home* (London: Wiley-Academy, 2003); Irina Solovyova, "The role of the autobiographical experiences with emotional significance of an architect in design conjecturing" (Ph.D. diss., Texas A&M University, 2010).

10 Toby Israel, *Some place like home* (London: Wiley-Academy, 2003).

11 Irina Solovyova, "Autobiographical memories with emotional significance in architectural design conjecturing" (paper presented at 7th International Conference on Design and Emotion, Chicago, Illinois, October 4-7, 2010).

12 Martin A, Conway, *Autobiographical memory* (Philadelphia: Open University Press, 1990); Frances, *Remembrance and the design of place* (College Station: Texas A&M University Press, 2000); Bryan Lawson, *How designers think: The design process demystified* (Oxford: Architectural Press, 1996); John A. Robinson. "Perspective, meaning and remembering," in *Remembering our past: Studies in autobiographical memory*, ed. David Rubin (Cambridge: Cambridge University Press,1996), 199-217.

[13] Howard Rugg, *Imagination* (New York, NY: Harper and Row, Publishers, 1963).

[14] Howard Rugg, *Imagination* (New York, NY: Harper and Row, Publishers, 1963); Jane Darke, "The primary generator and the design process" (EDRA 9 Proceedings, Washington, DC, 1978): 325-337.

[15] Susan Langer, *Philosophy in a new key* (Cambridge, Massachusetts: Harvard University Press, 1980); Eugene T. Gendlin, *Experiencing and the creation of meaning* (New York, NY: The Free Press of Glencoe, 1962).

[16] Christian Norberg-Schultz, *Genius loci: Towards a phenomenology of architecture* (New York, NY: Rizzoli International Publications, Inc., 1980).

[17] Frances Downing, *Remembrance and the design of place* (College Station: Texas A&M University Press, 2000); Bryan Lawson, *How designers think: The design process demystified* (Oxford: Architectural Press, 1997).

[18] Frances Downing, *Remembrance and the design of place* (College Station: Texas A&M University Press, 2000): 3.

[19] Daniel Reisberg and Friderike Heuer, "Memory for emotional events," in *Memory and emotion* eds. Daniel Reisberg and Fredreike Hertel (Oxford: Oxford University Press, 2004): 3-41.

[20] John Gero and Udo Kannengiessers . "The situated function-behavior-structure framework," in *Artificial Intelligence in Design'02*, ed. John Gero (Dordrech, The Netherlands: Kluwer Academic Publishers, 2002), 89-104.

[21] Lev Vygotsky, *Consciousness as a problem in the psychology of behavior* (Moscow, Russia: Psychology and Marxism, 1925).

[22] Alexei Leontiev (2003) .. 2nd edition. Moscow: Smisl.

[23] The Architecture Hate Page http://www.bbvh.nl/hate/ Accessed October 15, 2003.

[24] Deborah Lupton, *The Emotional Self* (London: SAGE Publications, 1998).

[25] David G. Myers, *Intuition: Its Powers and Perils* (Yale University Press, New Haven, CT, 2004), p. 29.

[26] William Voelker, (1985) "Psychological aspects of design process" *Crit* 15: 6-12.

[27] Rachel McCann "On the higher side of depth" in *Writing in Architectural Education,* ed. Ebbe Harderi "Emotional memory, metaphor and meaning," *Psychoanalytic Inquiry* 25, no 4 (2005):555.

[28] Edward S. Case, *Remembering. A phenomenological study* (Bloomington: Indiana University Press, 1987), 186-7.

[29] Peter Read, *Returning to nothing: The meaning of lost places* (Melbourne, Australia: The Press Syndicate of the University of Cambridge, 1996), 159.

[30] Edward S. Case, *Remembering. A phenomenological study* (Bloomington: Indiana University Press, 1987).

[31] Edward S. Case, *Remembering. A phenomenological study* (Bloomington: Indiana University Press, 1987), 190.

[32] Edward S. Case, *Remembering. A phenomenological study* (Bloomington: Indiana University Press, 1987), 192.

[33] Peter Zumthor, *Atmospheres: Architectural environments - Surrounding objects* (Boston: Birkhäuser Basel, 2006); Peter Zumthor, *Thinking Architecture* 2nd ed. (Boston: Birkhäuser Basel, 2006).

[34] Demis Hassabis and Eleanor A. Maguire, "Deconstructing episodic memory with construction," *Trends in Cognitive Science* 11, no. 7 (2007):299-306; Demis Hassabis, Dharshan Kumaran and Eleanor A. Maguire, (2007) "Using imagination to understand the neural basis of episodic memory," *The Journal of Neuroscience* 27 no. 52 (2007):14265-14374.

[35] Susan Gaidos, "Thanks to the future memories: To the brain, remembering the past and visualizing the future look surprisingly similar," *Science News* 173 no. 19 (2008):27-29, 29.

[36] Daniel L. Schacter, Donna Rose Addis and Randy L. Buckner, "Remembering the past to imagine the future: the prospective brain," *Nature* 8, September (2007):657-661.

[37] Daniel L. Schacter, Donna Rose Addis and Randy L. Buckner, "Remembering the past to imagine the future: the prospective brain," *Nature* 8, September (2007):657-661; Demis Hassabis and Eleanor A. Maguire, "Deconstructing episodic memory with construction," *Trends in Cognitive Science* 11, no. 7 (2007):299-306;

Demis Hassabis, Dharshan Kumaran and Eleanor A. Maguire, "Using imagination to understand the neural basis of episodic memory," *The Journal of Neuroscience* 27 no. 52 (2007):14265-14374.

[38] Frances A. Yates, *The art of memory* (Chicago, IL: University of Chicago Press, 1966).

[39] Daniel L. Schacter, Donna Rose Addis and Randy L. Buckner, "Remembering the past to imagine the future: the prospective brain," *Nature* 8, September (2007):657-661; Susan Gaidos, "Thanks to the future memories: To the brain, remembering the past and visualizing the future look surprisingly similar," *Science News* 173 no. 19 (2008):27-29; Demis Hassabis, Dharshan Kumaran and Eleanor A. Maguire, "Using imagination to understand the neural basis of episodic memory," *The Journal of Neuroscience* 27 no. 52 (2007):14265-14374.

[40] Susan Gaidos, "Thanks to the future memories: To the brain, remembering the past and visualizing the future look surprisingly similar," *Science News* 173 no. 19 (2008):27-29, 28.

[41] Ibid.

[42] Joseph E. LeDoux, "Emotion, Memory and the Brain; The Hidden Mind," *Scientific American,* Special ed., April, 2002, 70.

[43] Rober C Solomon, *True to our feelings: What our emotions are really telling us* (New York, NY: Oxford University Press, 2006).

[44] Deborah Luptop, *The emotional self* (London, UK: SAGE Publications, 1998).

[45] Martin A. Conway MA, *Autobiographical memory* (Philadelphia, PA: Open University Press, 1990), 104

[46] Daniel Reisberg and Friderike Heuer, "Memory for emotional events," in *Memory and emotion* eds. Daniel Reisberg and Fredreike Hertel (Oxford: Oxford University Press, 2004): 3-41.

[47] Richard E. Cytowic, *The man who tasted shapes. A bizarre medical mystery offers revolutionary insights into emotions, reasoning and consciousness* (New York, NY: Putnam Book, 1993), 156.

[48] Robert C Solomon, *True to our feelings: What our emotions are really telling us* (New York, NY: Oxford University Press, 2006).

[49] Ibid., 5

[50] Arthur Colman, "Notes on the design process: a psychiatrist looks at architecture," *Journal of Architectural Education* XXVII, no 2,3 (1974):1-26, 55.

[51] Luis Porter & Sergio Sotelo (2005) Design by narrative. *Educating Imaginative Mind,* 2nd International Conference on Imagination and Education, July 14-17, Vancouver, Canada, accessed September 3, 2005, http://www.sfu.ca/conferences/ierg2004/virtual/Submissions/Porter_Sotelo_IERG2004.pdf

[52] Nigel Cross, "Natural intelligence in design," *Design Studies* 20 (1999):25-39, 29.

[53] Robin M. Hogarth, *Educating Intuition* (Chicago, IL: The University of Chicago Press, 2001).

[54] David Durling, Nigel Cross and Jeffrey Johnson, "Personality and Learning Preferences of Students in Design-Related Disciplines," (Leicestershire, UK: Loughborough University Institutional Repository, 1996), accessed April 24, 2008, http://hdl.handle.net/2134/1477 (1996).

[55] Donald W. MacKinnon, "The Personality Correlates of Creativity: A Study of American Architects," in *Proceedings of the Fourteenth Congress on Applied Psychology*, ed. Gerhard S. Nielsen (Copenhagen, Denmark, Munksgaard, 1962), 11-39.

[56] David Durling, Nigel Cross and Jeffrey Johnson, "Personality and Learning Preferences of Students in Design-Related Disciplines," (Leicestershire, UK: Loughborough University Institutional Repository, 1996), accessed April 24, 2008, http://hdl.handle.net/2134/1477 (1996).

[57] Irina Solovyova and Upali Nanda, "Embodied Intuition," *International Journal of Architectural Theory* 12, no. 2 (2008), http://www.tu-cottbus.de/theoriederarchitektur/Wolke/wolke_neu/inhalt/en/issue/issues/207/Solovyova_Nanda/solovyova_nanda.php.

[58] George Lakoff and Mark Johnson, *Philosophy in the flesh: The embodied mind and its challenge to Western thought* (New York, NY: Basic Book, 1999).

59 Richard E. Cytowic, RE, *The man who tasted shapes. A bizarre medical mystery offers revolutionary insights into emotions, reasoning and consciousness* (New York, NY: Putnam Book, 1993), 191.

60 George Lakoff, *Women, Fire and Dangerous Things: What Categories Reveal about the Mind* (Chicago, IL: University of Chicago Press, 1987).

61 Richard E. Cytowic, RE, *The man who tasted shapes. A bizarre medical mystery offers revolutionary insights into emotions, reasoning and consciousness* (New York, NY: Putnam Book, 1993).

62 Arnorld H. Modell, "Emotional memory, metaphor and meaning," *Psychoanalytic inquiry* 25, no. 4 (2005):555-568, 561.

63 Geaorge Lakoff and Mark Johnson, *Philosophy in the flesh: The embodied mind and its challenge to Western thought* (New York, NY: Basic Books, 1999).

64 Geaorge Lakoff and Mark Johnson, *Philosophy in the flesh: The embodied mind and its challenge to Western thought* (New York, NY: Basic Books, 1999), 59.

65 Richard E. Cytowic, RE, *The man who tasted shapes. A bizarre medical mystery offers revolutionary insights into emotions, reasoning and consciousness* (New York, NY: Putnam Book, 1993), 206.

66 Richard E. Cytowic, RE, *The man who tasted shapes. A bizarre medical mystery offers revolutionary insights into emotions, reasoning and consciousness* (New York, NY: Putnam Book, 1993).

67 Terence Love, "Philosophy of design: a meta-theoretical structure for design theory. *Design Studies* 21 (2000):293-313.

68 Walter Darby Bannard, "Art and Nonsense: A Non-Creative Look at the Creative Process," in *Proceedings of Jungian Conference*, ed. DW Fritz (Oxford: Old Northwest Publication, 1979): 42.

69 John S. Gero, "Creativity, Emergence and Evolution of Design," *Knowledge-Based Systems* 9, no. 7, 1996, 435-448.

70 Peter Zumthor, *Atmospheres: Architectural environments - Surrounding objects* (Boston, MA: Birkhäuser Basel, 2006), 17.

71 Michale Polanyi, "Tacit knowing: Its bearing on some problems of philosophy," *Reviews of Modern Physics* 34, no. 4 (1962):601-616.

72 Robert J. Sternberg, "Epilogue. What do we know about tacit knowledge? Making the tacit become explicit," in *Tacit Knowledge in Professional Practice: Researcher and Practitioner Perspective* ed. Robert J. Sternberg & Joseph A. Hovath (Abington, UK: Psychology Press, 1999), 231-6.

73 Joseph A. Horvath, "Preface: Tacit knowledge in the professions, in *Tacit knowledge in professional practice*, eds. Robert Sternberg and Joseph A. Horvath (Abington, UK: Psychology Press, 1999), ix-xiii.

74 W. L. P. Wong and D. F. Radcliffe, "The Tacit Nature of Design Knowledge," *Technology Analysis & Strategic Management* 12, no. 4 (2000): 493-512.

75 W. L. P. Wong and D. F. Radcliffe, "The Tacit Nature of Design Knowledge," *Technology Analysis & Strategic Management* 12, no. 4 (2000): 493-512, p. 494

76 W. L. P. Wong and D. F. Radcliffe, "The Tacit Nature of Design Knowledge," *Technology Analysis & Strategic Management* 12, no. 4 (2000): 493-512.

77 Sternberg, Robert J. "Epilogue. What do we know about tacit knowledge? Making the tacit become explicit," in *Tacit Knowledge in Professional Practice: Researcher and Practitioner Perspective* ed. Robert J. Sternberg & Joseph A. Hovath (Abington, UK: Psychology Press, 1999) 231-6.

78 Sternberg, Robert J. "Epilogue. What do we know about tacit knowledge? Making the tacit become explicit," in *Tacit Knowledge in Professional Practice: Researcher and Practitioner Perspective* ed. Robert J. Sternberg & Joseph A. Hovath (Abington, UK: Psychology Press, 1999) 231-6.

79 Ronald Mascitelli (2000) From experience: Harnessing tacit knowledge to achieve breakthrough innovation. *Journal of Product Innovation Management* 17, 179-193, p. 179.

80 Ronald Mascitelli (2000) From experience: Harnessing tacit knowledge to achieve breakthrough innovation. *Journal of Product Innovation Management* 17, 179-193, p. 183

81 W. L. P. Wong and D. F. Radcliffe, "The Tacit Nature of Design Knowledge," *Technology Analysis & Strategic Management* 12, no. 4 (2000): 493-512., p. 508

82 Peter Zumthor, *Thinking architecture* (Boston, MA: Birkhäuser Basel, 2006), 16.

83 Martin A. Conway, *Autobiographical memory* (Philadelphia, PA: Open University Press, 1990), 184.

84 Peter Zumthor, *Thinking architecture* (Boston, MA: Birkhäuser Basel, 2006), 21.

85 Ibid., 21.

Quad Space—Academic Constructs in the Real City

Ernest Ng
Ernest.ng.hh@gmail.com
Visiting Assistant Professor
Mississippi State University
College of Architecture and Design
[Paper Presenter—Session 1]

Abstract

The paper presents a collaborative thesis project, Quad Space, completed at State University of New York (SUNY) at Buffalo, School of Architecture and Planning, by four masters students, Michael-John Bailie, Paul Dudkowski, Ernest Ng and Dan Stripp. Quad Space is an insertion of an architectural academic exercise as a full-scale construct to spatially and structurally manipulate and define the division of four spaces within a 400 sq. ft. house. The project re-evaluates the operations of architectural exercises within the academia and its role and relationship with the social, communal and economic environment that it is based within. The project critically investigates the effort and process of establishing an academic architectural research project as a full-scale construction inserted within the city of Buffalo, involving the physical manipulation and conversion of an existing derelict house into a habitable space.

This project operates within the entanglement of architecture, academia and the current economy. The premise is set up by two current economic situations: the first being the stagnant and derelict economic landscape of Buffalo's domestic environment in which the insertion of this academic project, self-motivated and independently funded by architectural students/ designers/ builders/ owners attempts to create a sense of iconography and raise awareness for innovative attitudes towards the re-considering the banal within such an urban landscape. The second being that of the general American economic recession crisis which the thesis tries to acknowledge and provoke by challenging the perception of conventionally extensive domestic spatial needs within the concept of the ideal American home and domestic landscape, through re-defining and re-interpreting conventional building codes requirements for minimal living.

This is a project that operates upon a desire for a return to a sense of reality in architecture and the academia. Sharing similar academic intentions as design-build programs like the Rural Studio in Auburn University and Studio 804 at University of Kansas, where architectural learning is based on a hands-on experience with the process of budgeting, estimating and building; this project exemplifies the architecture-making process as a highly collaborative environment where an architect learns to design and realize the design through understanding and appreciating the building process. This challenges and expands the definition of an architectural thesis as an individualized process of research, graphic representations and theorized speculations into an academic exercise that acknowledges the collaborative environment of a professional architectural practice and appreciates the process of architectural construction.

Quad Space- Academic Construct in the Real City

Like many other major cities along the Rust-Belt region, the derelict urban landscape of post-industrial Buffalo, New York is filled with vacant lots and houses which require extensive demolition work by the City of Buffalo every year. However, most of these abandoned infrastructure slated for demolition are still structurally stable and suitable for alteration and adaption for new functions and uses. Many current urban revival plans that are implemented to inject new life into streets and neighborhoods are unable to be effective at an intimate level to revive individual infrastructures.

The paper presents a collaborative thesis project entitled QuadSpace, completed at State University of New York (SUNY) at Buffalo, School of Architecture and Planning, in Fall 2009. This collaborative project was initiated by four graduate students, Michael-John Bailie, Paul Dudkowski, Dan Stripp and myself, and is privately funded and physically built by the four authors. This thesis was inspired by the potential of these abandoned houses as found objects within the urban landscape of the city and seeks to use this academic opportunity to explore ideas and possibilities for these houses. Rather than leaving them as abandoned urban debris, this thesis hope to demonstrate an effort to revive such derelict infrastructure into habitable spaces.

Fig 1 Front Facade,139 Howell St, Buffalo, New York.

The search for a House and a Thesis

After three months of searching around the City of Buffalo and looking into the public auction list issued by the Buffalo

City Hall known as the In-Rem List, a, a derelict house located at 139 Howell St in the Black Rock neighborhood in the City of Buffalo was identified. Based on information from a local non-profit housing agency, it was understood that 139 Howell St will be slate for demolition if it was not sold at the auction. 139 Howell is a two level, brick-veneered 400 sq. ft footprint house built in the early 1900s, roughly a 550 sq ft interior space in the main house with a 200 sq ft back addition. At the subsequent auction in October 2008, after much competition with a few other bidders, the house at 139 Howell was obtained for $6500.

At the beginning of the search, it was agreed among the four authors that this house will simply serve as a physical site for four individual projects. As such, the initial idea was to figure out a logical manner of dividing the house into four parts for each of the four authors. It began with a systematic series of research on volumetric, programmatic and infrastructural precedents of contemporary domestic issues by artists, architects and currently established practices, including art works by Gordon Matta-Clark, Rachel Whiteread and Tony Smith, and residential projects by Ludwig Wittgenstein, MVRDV and SANAA. Each of the precedent informs a test study of the division of the house, with specific interest in the method of division and the construction technique.
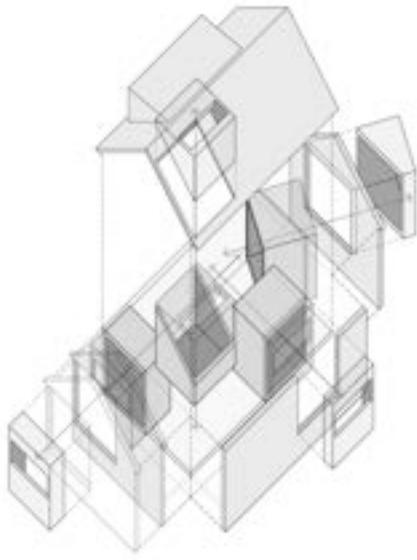
Fig 2 Axonometric Diagram .

However at this point during the research and design process, it was increasingly evident that this academic full-scale exercise in the City is a thesis project on its own. This thesis project investigates the process of architecture-making and academic education at two main levels. The academic project is no longer contained within the walls of academia, but is a design/ build pedagogical reality in the City of Buffalo, involving real architectural issues like time, budget and weather conditions, and not forgetting other necessary coordination work like plumbing, electrical work and a tedious approval process with the City Hall Building Department. The project is also an investigation of the idea of architectural collaboration with a real sense of construction and domesticity. Since all four authors have equal stakes in the house, collaborative negotiations and compromises work took place throughout the entire design process of the private spaces for four

bachelors in the house. (Full disclosure: each author invested $9000 towards the project, culminating to a total budget of $36000, of which approximately $7000 of the entire budget was used on the purchase of the house at the auction.)

Fig 3 Interior view during construction.

Designing and Constructing the Quad spaces

The series of research studies were subsequently manifested into a strategic framework to develop and fine-tune the method of division and construction process, in order to maintain four equal parts within the house. The final design strategy involved four equal parts within the house to be defined as four equal volumes of differing dimensions and floor area. Due to the requirement of the New York State residential code to define the four parts as legal bedrooms, further development of the specific placement and floor area resulted in the creation of a minimum floor-to ceiling height clear volume of a seven foot by seven foot area, with a seven foot six floor to ceiling height space as an expansion 'cube' beyond of the boundaries of the house. All four 'cubes' extend out of the house in different direction from each of the four sides of the house: the front, the side driveway, the back and the roof (since one side of the house sits directly on the plotline), where the horizontal window opening on the end wll defining the direction of the movement.

These cuboid protrusions cantilevering beyond the walls of the house are, on one hand, necessary to expand the interior space of the house in order to accommodate four bedroom spaces within the 400 sq ft footprint, while maximizing the structure of the existing house. On the other hand, the very act of protrusions and cantilevering out of the existing house was also due to the weather constraint in Buffalo. Since the most of the design work were done in the Fall and construction will not start until mid-Winter, the strategy was to construct the first two cuboids on the ground floor inside the house during the freezing months and schedule to be 'pushed out' of the house when the weather turns warmer in early Spring. In this instance, the notion of creativity of design and architecture-making is limited by the constraints of the site and weather, but expanded and exploited by the mere act of constructing and making process.

These cuboids are wood-frame construction, clad in marine plywood on the exterior and sheathing plywood in the interior, emphasizing the new wooden expansion contrasting with the old brick-veneered wall, that of protrusions of objects within a found object. As the 'cuboids' defines only a portion of the required floor area of the bedroom, the rest of the bedroom is defined by the use of an open-stud wall system with oriented-stranded board (OSB) as wall panels and flooring material. The

rest of the house- the interstitial living space, kitchen and bathroom are defined by the grey-stained hardwood flooring. All the interior walls circumscribe the private bedrooms, which leaves the bathroom, a semi-private space within the interstitial space surrounded by a rubber curtain, a soft-wall.

Fig 4 Interior view of a bedroom.

Postscript

This project operates within the entanglement of architecture, academia and the current economy. The premise is set up by two current economic situations: the first being the stagnant and derelict economic landscape of Buffalo's domestic environment in which the insertion of this academic project, self-motivated and independently funded by architectural students/ designers/ builders/ owners attempts to create a sense of iconography and raise awareness for innovative attitudes towards the re-considering the banal within such an urban landscape.

The second being that of the general American economic recession crisis which the thesis tries to acknowledge and provoke by challenging the perception of conventionally excessive domestic needs within the concept of the ideal American home and domestic landscape, through re-defining

and re-interpreting conventional building code requirements for minimal living.

This is a project that operates upon a desire for a return to a sense of reality in architecture and the academia. Sharing similar academic intentions as design-build programs like the Rural Studio in Auburn University and Studio 804 in Kansas University, where architectural learning is based on a hands-on experience; this project exemplifies the architecture-making process as a highly collaborative environment where an architect learns to design and realize the design through understanding and appreciating the building process. The project re-evaluates the operations of architectural exercises within the academia and its role and relationship with the social, communal and economic environment that it is based within. This challenges and expands the definition of an architectural thesis as an individualized process of research, graphic representations and theorized speculations into an academic exercise that acknowledges the collaborative environment of a professional architectural practice and appreciates the process of architectural construction.

Fig 5 Back facade of 139 Howell St, Buffalo, New York.

Digital Creating and Making

As with any making endeavor, the use of tools and the artistry in the use of those tools plays an integral part in the creating process. These papers look at the use of digital tools in the creating and making process. The papers deviate from the analog verses digital debate and explore a new set of dilemmas.

From teaching of digital tools in academia to the use of digital in fabrication, a critical point of consistency that each author addresses is that the digital tools of today require a new form of craft to obtain the equal artisan qualities of the analog craftsman. Should digital craft even be compared to the process of hand craft, the human's physical tool of choice, or, instead, be relegated to a new set of non-humanistic qualities? In *Abstracting Craft, The Practiced Digital Hand*, Malcolm McCullough states:

> Craft remains skilled work applied toward practical ends. It is indescribable talent with describable aims. It is habitual skilled practice with particular tools, materials, or media, for the purpose of making increasingly well-executed artifacts. Craft is the application of personal knowledge to the giving of form.

As we read these papers, we do not look at craft as belonging exclusively to "the hand" or to "the digital," but see it, instead, as an integral part of both. As with analog craft, the tools used play a significant role in the attainment of a high level of craftsmanship. The digital tools of today are as specialized as the differences between the draftsman's French curve and triangle to the cabinetmaker's planes and saws. Should the level of digital craftsmanship be limited to those chosen few with the new gizmo, or should it be measured on the order of a multi-use tool? In a carpenter's hand, a quick twist of the blade or a bend of a sleeve will produce a tool to tackle a job, but is it the right tool for the level of craft expected? The questions can be asked of software. Can a program which is limited in tools, but has an ease of use and speed of skill, affect the same job of a digital craftsman? What set of measures would then define the digital craftsman?

As we read these papers, a final set of questions arises pertaining to how to develop the skills needed for the digital craftsmen of the future. How do you teach craft in a world of preciseness when the highest levels of craft are measured to the pinnacle of perfection? Can forms of articulated play be the way of learning how to use these tools as part of a creative design process? Can the habitual lessons of the analog be transferred to the digital, or does the digital need to release itself to explore new ways of developing digital craft?

Although these questions are at the forefront of architectural education and have been debated for years, these papers look at applied examples where the "digital art" of making has been recently explored and these papers begin to raise their own sets of questions towards the making of digital craftsmen.

Anthony Cricchio
anthony.cricchio@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Digital Fabrication in Denmark: As Tool and Craftsman

Edward Becker
egbecker@calpoly.edu
BArch Student
California Polytechnic
Architecture Department
[Paper Presenter—Session 2]

Abstract

This research specifically addresses digital fabrication and related digital tools in regard to their impact on the process of making in Denmark. A small country known for its exquisitely crafted and timelessly designed products including furniture, lighting, and certainly architecture, Denmark currently is at a crossroads between its past acclaim of quality, simplicity, and regard for the human and today's increased accessibility to digital tools; specifically, these tools can physically remove the designer or craftsman from constructions and place the process of design and fabrication into the synthetic or virtual.

Research on this topic was conducted partially as a written investigation into the history of Danish fabrication and its current state within the country and partially as a physical investigation in association with Scaffidi_Design, culminating in a 1:1 furniture production.

This form of investigation explores the intricacies of the Danish design mindset and its relation to the use of the digital-digital being both software and fabrication equipment. Based upon the research of Julius Wolff and his bone transformation studies, the research project with Scaffidi_Design, through the use of Maya software and its deformation forces {fluids and gravity}, applied anticipated post-production forces early in the design process to generate structural form. This process allowed the digital software to assume the role of designer, thereby forfeiting almost all humanistic requirements. As the computer lost control and the chair developed more rationally, the complexity associated with digital design necessitated the use of digital related production methods. This specific design process addressed whether digital methods could be used simply as a tool rather than as a designer or craftsman in a Danish context.

Production facilities and woodshops in Denmark characteristically use digital tools only as a means to recreate. However academia, with access to digital tools early in the educational process, shows traits of a digitally commensalistic design generation exploiting the software of its benefits but slipping from past tradition.

From an outsider's perspective, the author had the opportunity to objectively study current design trends and, with access to fabrication facilities, current furniture-design contacts, and educators in Copenhagen, the written research and chair design are oriented to portray current characteristics of the digital's impact within Denmark.

Introduction

It could be argued that Danish furniture is perceived in two ways by the international public, exquisitely crafted and timelessly designed. This is supported by the continual interest and substantial purchasing of Danish furniture by an international market, especially considering the time period in which many of the most popular pieces were produced and the relatively simple, yet beautifully designed items themselves. This virtual perception is an issue worth noting but not as a means to analyze. What is fascinating, however, are the formal, material, and technological variables that generated the platform for this impression of Danish furniture and also how these factors, especially materials and technology, will continue to subtly dictate the products of this country. Just as advances in technology led to Danish furniture phenomena such as the bentwood Ant Chair by Arne Jacobsen, or its globally popular four-legged offspring, the Series 7 Chair, technological advances are still furthering both the global and Danish furniture industries respectively. Explicitly, because digital tools have been introduced into the Danish furniture industry and are being employed by young designers at Danmark's Design Skole to master craftsmen at the famous P.P. Møbler production facility in Allerød, digital fabrication's impending effect on the Danish furniture industry is both a cause for concern and a hope for the potential of things to come.

Tooling Methods: The historical context of Digital Fabrication in Denmark

This particular document is specifically about digital fabrication. However, rather than merely employing this term as a product of our current digital state, it is advantageous to establish which technologies will be referred to as the "digital", simply because other various methods of machine calculation have existed for millennia. The digital could encompass tooling from the very beginning of man and machine. From drafting compasses to a spokeshave and from steam-bent plywood to high-definition CNC machines, the list of digital (digital being of the computer and the computer being of machine) could be an impractically wide range of implements. The digital will specifically be defined as a computer-based tooling method developed or highly implemented after 1980. For example, the CNC was developed in 1949 by the United States Air Force at MIT but came into widespread use in the mid 1990's.[1]

In order to understand the computer's impact on Danish furniture design, it is necessary to examine previous tooling methods and the relationship between historical chair typologies, their production methods, and the ways in which

these specific tooling methods influence the perception of Danish furniture as a whole. In essence there exists a perception about Danish design, whether furniture or architecture, that could be said to have started with Kaare Klint and furthered by his pupil, Hans J. Wegner. The following statements by Noritsugu Oda in the book "Danish Chairs" essentially summarize Danish design:

"The creativity of the designer and the excellent technique of the craftsperson coalesce in Danish furniture. This applies both to handcrafted and mass produced furniture. The skills of the designer complement those of the maker and vice versa, and the comfort and needs of the users are considered whether the product is expensive or inexpensive."[2]

The father of modern furniture design in Denmark, Klaare Klint, was born in Copenhagen in 1888 and was trained initially as an architect before transitioning into furniture. In 1924, Klint was appointed director of the furniture department at the recently founded Copenhagen Art Academy. Through this association, he was able to establish a basis for design education in Copenhagen and promote his style and views on design, many of which have had a lasting impact on Denmark's most famous designers. "While modernism (Bauhaus) was rejecting its heritage, Klint embraced it. He believed that a thorough understanding of materials, proportions and constructions of classical furniture was the best basis for designing new. The design of Klint's pieces were always based on a relentless research; every piece must fulfill its purpose, be absolutely clarified in its construction, have proportions which correspond to those of the human body, and display materials and craftsmanship of the highest quality."[3] Additionally, in terms of design ideology, Danish furniture designers' approach into modern design, as patterned after Klint's teaching, started with a form of reductionism that simplified classical forms into basic-structural forms, and applied organic abstraction as opposed to Bauhaus's geometric abstractions.[4] This statement exposes the origins of modern Danish furniture design in its divergence from Bauhaus design and production methods; in contrast to Klint's early works in Denmark, the Bauhaus-era Breuer Club-Chair was constructed of machine-welded metal tubing with overall proportions differing from those generally constructed during the pre-WWII era. At this point of conscious divergence, the distinction between machine as craftsman and the human as craftsman was established.

Kaare Klint introduced Denmark to the highest quality of furniture that served to supplement the functions between man and machine (ergonomics) but gained acclaim through the dis-involvement with the machine or quality through hand craftsmanship. This paradox continues, possibly due to the teachings at the Danish Academy of Art, and manifests itself in the works of both Hans Wegner and Poul Kjærholm among many others.

Craftsmanship, quality, and expressive-yet-refined are terms synonymous with the furniture of Hans J. Wegner. Born in southern Denmark and a carpenter's apprentice, Wegner attended The Danish School of Arts and Crafts before gaining early fame with the Easychair in 1937. This particular piece of furniture served as a forerunner for a series of related chairs that signified his design approach. Wegner's process fundamentally consisted of stripping the old chairs of their outer style and letting them appear in their pure construction.[5]

A more in-depth look brings certain aspects to light; many of Wegner's most famous chairs including the Y and China Chairs are two-piece designs. The legs are simplified to their essence. Where strength is needed, the cross-section is wide and, where lesser amounts of forces are applied, material is taken away.[6] This approach allows the chair to be lightweight and fluid formally while being extremely pragmatic at the same time. Additionally, the two chairs are enhanced through the contrast between the rigid lower legs and fluid upper backrest and seat; hence, the assembled chairs are considered two-piece. This leads to an important point in regard to modern Danish furniture as a whole and Wegner's success specifically. It is the manipulation from an ergonomic and formal standpoint of the backrest that is associated with quality in this sector of Danish furniture.

The backrest in this context is important because it is often the most dynamic element in the chair, thus making its tooling the most challenging. The Chinese Chair (1945) was Wegner's first to display the elaborate back member. This was furthered by The Chair (1949) and then relatively quickly by the Wishbone, Round, Cowhorn, Heart, Valet, Swivel, Elbow, Arm, Ox, Bull, and PP701 chairs.[7] Because of their significant popularity and number of different models, this style of backrest signified Danish furniture and influenced other pieces such as the "Coat Hanger Chair" by Hans Olsen in 1957 and others, through the turn-of-the-century production of Gubi's Masculo Lounge Chair.[8]

In summary, the skills of master Danish craftsmen and the potential of material were exploited, thus helping to define both a new image of Danish furniture and a relationship between man and material through tooling.

Fig. 1. Backrest formation at the P.P. Møbler workshop

Tooling as a catalyst for style evolution

To say that tooling methods affect design methods could be demonstrated by the sharp change in Danish furniture design during the middle of the 20th century. Changes in tool types and the industrial potential of steam or laminate bending significantly impacted the Danish furniture industry by shifting the production of handcrafted "Wegner chairs" to a new typology, one indicative of mass production. "When new technologies are contrived, new possibilities of working with existing materials arise. When the technique of steam bending was developed by the Thonet brothers, new ways of designing

furniture were rendered feasible. Suddenly, it was possible to move, in a simple way, from the vertical to the horizontal plane without having to do so via an assembly or via joining. Not only did the new possibilities have an influence on the form. They also affected the whole process of formation. Consequently, the world's first industrial articles of furniture could be mass-produced."[9]

Architecture {or furniture} divides constructions into different categories, such as pillar-beam and wall-slab constructions. Tectonic articulation is regarded here as a matter of how the joining is to be formulated.[10] The furniture ideals of Kaare Klint, one of member-to-member construction, were developed in a new direction with the revolutionary Ant Chair {1952} by Arne Jacobsen. This chair, of which three hundred were produced for the Danish pharmaceutical firm Novo Nordisk, implemented a laminated or bentwood strategy that made the shell sturdy, yet flexible, and also lightweight, and ideal for its use. Formally, the Ant chair symbolized a shift in Denmark's furniture industry from strictly handmade furniture reminiscent of the American Shakers to furniture that was fluid and could be mass-produced. Furthermore, the phenomenological affects of materiality were neglected for the chair's gray, lacquered paint, a functional choice for its assumed rough usage in Novo Nordisk's canteen. This again showed the brief transition away from the typically Danish. Eventually, as previously mentioned, Jacobsen adjusted the Ant Chair by adding a fourth leg and redesigning the shell's form.[11] The new Series 7 Chair, as it was named, gained international acclaim through its functionality, versatility, physique, and bentwood material usage. Somehow, despite form, materiality, and process, the Series 7 Chair is still regarded as characteristically Danish. Perhaps it is due to its versatility and visual elegance through simplification. Two of the other more notable bent wood pieces are the molded plywood PK0 chair{1952} by Poul Kjærholm and the Easy Chair by Grete Jalk {1963}. They both could be said to be offspring of the Ant Chair.

An important anomaly should be emphasized. Kjærholm, a designer known for his simple use of materials, honest material usage, and minimal industrial intervention {as seen in his 1952 PK 25 lounge chair}, broke his own boundaries with the PK0 lounge chair by producing a chair of smooth, laminated curves requiring intensive molds and pressurization. It could be argued that the impact of industrial processing was not an important design consideration because the chair was initially modeled in paper maché independent of machine processing. However, the most suitable production method at the time was bentwood, laminate and steam bending, and, therefore, the complexity of applicable production methods would have most likely been acknowledged. Bentwood, a technology that is used worldwide, has had a specifically large impact on the design of Danish furniture, most notably because of the significant shift in ideals and methodologies just after its introduction. This is just one of many technological advances in wood design; other advances included compression bending as well as wafer-fiber and wood-composite injection molding. Lastly and most importantly, all of these methods removed the craftsman's touch from production and put furniture manufacturing/creation in a realm of the super-machine, suitable for mass production but alternative to the "handcrafted" terminology in which Danish furniture was marketed.

Denmark now

Currently, digital tools such as 3D scanners, CNC mills, laser cutters, digitizers, and 3D scanners are used in design schools across Denmark, specifically Denmark's Design School and the Royal Academy of Fine Arts School of Architecture, both in Copenhagen. Unlike previous curricular experiences at these schools, students today have access to these tools early in their education, making the digital even more integrated into their design thinking (as indicated both by the types of projects produced and the means required to build the proposed projects). By observing the process of design at these schools, we can see that the projects are shifting in an expected direction. The question is not whether signs of digital tools will be manifested in students' work, but the question should be whether design students will continue to emphasize craftsmanship, simplicity, and quality to the extent that has characterized Danish design in the previous century. Will the software become the designer, as exemplified by the Dutch Joris Laarman's Bone Chair, or will student designers in Denmark's schools tend to adhere to their pedagogical roots? Denmark's Design School sets itself apart from the Royal Academy of Fine Arts, most notably in the furniture department, because students are essentially required to be trained as craftsmen before attending the design program. This sequence solidifies the student's foundation in manifestations of the physical before digital possibilities become available. Because a majority of the teachers in both schools are "predigital," seemingly it will take a number of years before digital technology's impact on Danish design will become clearly apparent. Organizations such as the Center for Information Technology and Architecture (CITA) in Copenhagen are becoming highly influential regarding current architectural trends through installations and exhibitions. CITA, although positive in its push for "new-age information" architecture is generally international, with their work being geographically undistinguishable from projects produced by firms and schools in England, France, the United States, etc.

The fading of autonomy in Denmark's design industry is further exemplified through the re-introduction of the Easy Chair{1963} or GJ Chair. In a recent interview at Lange Productions of Copenhagen, the director discussed his company's reincarnation of Grete Jalk's Easy Chair, originally produced in 1963. Roughly 600 chairs were manufactured by hand in Denmark during the 1960's, a significant number considering the complex bends and tight tolerances. Today, the company only assembles the two-part chair in Denmark. Wood laminate is cut in batches on Northern Europe's largest CNC machine located just south of the Danish boarder in Germany, and then bent/laminated by other computer-controlled machinery before being shipped back to Denmark for assembly. Though production costs are significantly reduced through outsourcing, Denmark is now essentially importing one of the very chairs used to establish its own manufacturing reputation.[12] In a sense, the sovereign nature of Danish furniture manufacturing is dissolving, due in part to Denmark's self-imposed isolation, leading to high labor costs, and the speed, ease, and accessibility of digital technology.

To further exemplify digital fabrication's impact on "Danish Craftsmanship" as a typology, an interview at the Danish furniture company of P.P. Møbler provided insight in regard

to the company's attitude toward and use of the company's newly acquired 5-Axis CNC mills. P.P. Mobler is famous worldwide for its skilled production of furniture from many designers, most importantly Hans J. Wegner and Zaha Hadid. As Wegner's designs and career were previously discussed, it seems appropriate to specify how the production process of his chairs has changed. Originally in the process of production, P.P. Møbler imported very specific stocks of quality-controlled lumber and then, using a copying lathe, completed the massing of basic furniture components before beginning the intricate task of complicated and precise joinery. For the chair PP124 designed by Wegner, over twenty different woodworking steps were required to produce a long component that forms the structural half of both the backrest and leg system, often taking more than two to three man hours to complete.[13] Today, the same components are carved by the CNC robotic arm in less than five minutes, significantly lowering production costs and increasing profit margins. Afterwards in both cases, assembly and upholstery or lacquering complete the production process. Characteristic of the Danish attitude towards craftsmanship, a P.P. Møbler craftsman stressed that wood gains a patina and character with time, making it more beautiful as it is used and ages; however, the application of lacquer, which is rarely used by the company, only leads towards visual degradation. Additionally, the craftsman emphasized that the CNC robots were merely used as a tool. That is, the robots were never used to alter the design of joints, dimensions, or tolerances due to specific mechanical characteristics of the machine, even if production time could be further decreased. This is somewhat in contrast to previous production methods where the original design was altered to accommodate certain hand-tooling methods. Today, the same quality and care is used in wood selection, assembly, and finishing with a strict acknowledgement of uses and implications of computer-controlled machining.

In summary, the projects in design and architecture schools today foreshadow what is to come tomorrow. Because schools of higher education breed avant-garde design and architecture, they could essentially be termed "Canaries" for architecture as a whole. The projects produced in Denmark's design schools should be recognized as the best example of digital technology's current impact on "Danish Design"(the term being employed as a type of trade name) at least until the graduates begin competing to build projects in an international market.

The digital and its impact on design process

The impact of the digital during design processes and into construction phases could be said to have reorganized thinking in terms of production. Essentially, the complexity of form no longer matters because, once the process of fabrication is out of the craftsman's hands and into the realm of the computer, complex geometry and simple volumes such as a cylinder or rectangle can take an equal amount of time to form; this assumes all other variables are held constant. It has again become economically feasible to produce intricate geometry on a large scale because the computer could be said to have taken the place of cheap labor.

The interaction between furniture and digital production seemingly cannot happen without some type of digital technology usage during the design process and, occasionally, the required continuation of digital usage. Because forms become so complex or so simple but exact, it is almost a necessity that the project be manifested in the computer at a premature stage to obtain accurate models. Decisions from this point are relative to the maker but the role of the computer must be addressed. Does the computer design or does the craftsman? Do the forms and means of connection result from the "personality" of the software or does the craftsman use the computer simply as a tool to recreate pre-constructed ideas? Is it this "personality" that makes Danish digital production internationally ubiquitous? If the forms are dictated by the type of software, it is extremely important to realize what is happening and what specifically led to the final result; this means that the designer essentially organizes, categorizes, and understands the process of design-to-production.

Independent Research: Digital fabrication in a Danish context

In Copenhagen and in association with Scaffidi Design, a furniture research project was conducted by this author, which was conceptually developed from the writings of Julius Wolff. Wolff was a 19th century French physician best known for his publication "The Law of Transformation of Bone" in 1892. His publication's essential statement follows:

"As a consequence of primary shape variations and continuous loading, or even due to loading alone, bone changes its inner architecture according to mathematical rules and, as a secondary effect and governed by the same mathematical rules, also changes its shape."[14]

The argument was made that the process of transformation due to external forces or loading should not be restricted to the realm of science and physiology but could also be applied to architecture, and specifically to furniture design. In this study of applied bone-transformation logic, the design process attempted to push Wolff's discovery of "shape changing over time due to structural forces" into something that considered the materiality and function of architecture/furniture. It was initially proposed in the research and chair development that, rather than a chair being designed and made structurally feasible through the introduction of additional screws, thickened members, etc, instead the external forces, which would potentially be applied to the chair during usage, be digitally applied early in the design process to generate structural form. By using Maya dynamics that include fluid and gravity simulations, early chair study models were deformed to appropriately adhere to potential strength demands. Lateral forces were stabilized through branching or member thickening with locations chosen at the software's discretion. For example, in illustration A (see Fig. 2.), with the addition of a semi-lateral force, the digital material was softened and allowed to flow parallel to the force's vector.

By doing such and with the innate tendency of flowing fluids to stray to and from a linear path, a porous membrane of geometrically-standardized branching was created (Fig. 3), thereby strengthening the joint.
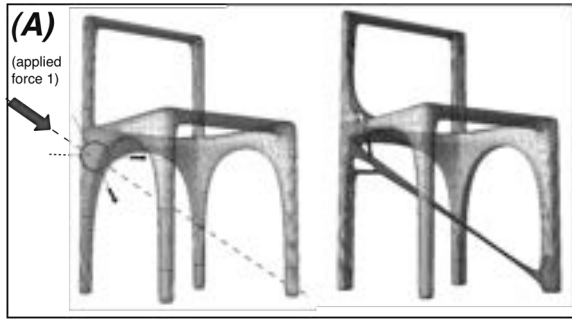
Fig. 2. Application of semi-lateral forces
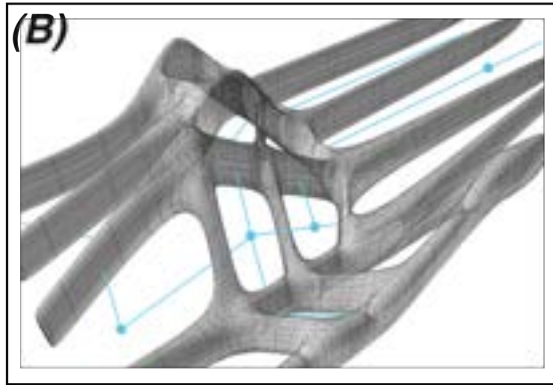
Fig. 3. Porosity and geometric branching in joint material
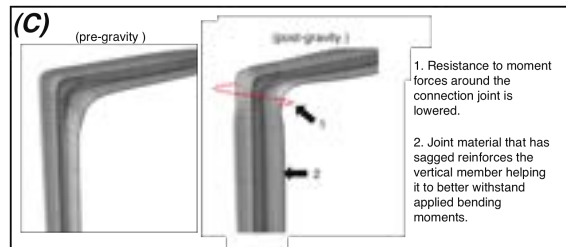
Fig. 4. Alteration of joint material

Similarly in example, the ever-present force of gravity was tested to better prepare the chair for actual performance. As in Fig. 4, a simple chair joint was created and then allowed to sag based on an environmental force of 9.8m/s^2 in the downward direction. By sagging, some material was moved from the joint downward to the joint's base before the force was removed in Maya. As a result of this deformation, material around the joint, which would be highly suitable for moment resistance, was moved downward, strengthening it specifically for buckling and the force of gravity.

In the early stages of design development, the design process with Maya was very methodical. Stress points on the human torso were plotted and then translated to the ground by means of the template chair, or the basic test chair that was used to establish the form in Maya. These points, interconnected by lines, were then given digital volume in the computer model and subsequently were subjected to controlled deformation. By using Maya deformers, it was possible to adapt the study

models to their potential forces and thereby generate a responsive shape. The design, in response to humanistic considerations of which digital software is inherently not aware, further evolved through the adjustments of proportion and simplification of form to adapt to pragmatic concerns.

Through the academic introduction of Danish colleagues and advisors, this point of collaborative involvement in the design process tied the furniture into its cultural context. Namely, through the process of digital tooling (see Fig. 5), machining, and ergonomic research, the furniture was developed in accordance with Danish pedagogical methodologies.

Fig. 5. 3D print used to help rationalize proportions
** Chair EB003 currently in production by C.P.dFAB (2010)

Conclusion

Like typically refined Danish design, this investigation attempted to push both material and craft while creating a piece of furniture that responded pragmatically to its functional context. Because the computer cannot respect material traits and functional concerns, it is critically important, both for this specific project and the Danish furniture industry as a whole, to understand the implications of digital design during both the design and production stages.

As digital manufacturing becomes less cost prohibitive in Denmark, the increase in digitally produced works will tell whether Denmark has lost its fascination for and expertise in the art of tectonics. Additionally, as is true with other current Danish industries facing transformations associated with digital technology, either the emergence or proliferation of a characteristic philosophy will occur, or the classic Danish ideology will develop into a standard internationalism. At this stage of redefinition, the importance of design education

cannot be overemphasized. The future designer must learn to distinguish between the digital's intrinsic potentials and pitfalls. This is a tough differentiation when the digital seemingly begs, due to its time effectiveness and ease of use, to control all subdivisions of design.

1   *The History of CNC*, directed by MclarenF1CMS, 2006.

2   Noritsugu Oda, *Danish Chairs* (San Francisco, CA: Chronicle Books, 1996)*, pg 8*.

3   *Danish-Furniture*. (n.d.). Retrieved 6 13, 2010, from www.danish-furniture .com: http://www.danish-furniture.com/designers/kaare-klint/

4   Jamaludin, B. &. (2005). *ITB Journal*. Retrieved 6 18, 2010, from The Official ITB Scientific Journal: http://proceedings.itb.ac.id/indeks.php?li=article_detail_id&id=307

5   CSP, *Danish Furniture*. (accessed 2 11, 2010). http://www.danish-design.com/designers/weg/catalogue/HJW2/

6   Antonio Scaffidi, (3 04, 2010). *Digital Fabrication: History in Denmark*. (E. Becker, Interviewer)

7   CSP, *Danish Furniture*. (accessed 2 11, 2010). www.danish-design.com/designers/weg/timeline/all/

8   Linophoto Janson, *Danish Furniture 1957-1966* (Copenhagen: Teknologisk Instituts Forlag).

9   Nicolai de Gier, *Chairs' Tectonics*. (Copenhagen: The Royal Danish Academy of Fine Arts School of Architecture, 2009), pg 20-21.

10 Nicolai de Gier, *Chairs' Tectonics ,* (Copenhagen: The Royal Danish Academy of Fine Arts School of Architecture, 2009).

11 Mount, C. (2004). *Arne Jacobsen*. San Francisco, CA: Chronicle Books LLC.

12 ApS, D.L.P (2010, 2 15). *Manufacturing and Distribution*. (E. Becker, Interviewer)

13 P.P.Møbler_Jesper, (4 17, 2010). *CNC Production Implications*. (E. Becker, Interviewer)

14 Julius Wolff Institute, "Julius Wolff Biography," *Charite*, 2010, http://jwi.charite.de/en/institut/julius_wolff/ (accessed 4 13, 2010).

Process of Making in Analog and Digital

Seung Ra

Seung.ra@okstate.edu
Assistant Professor
Oklahoma State University
School of Architecture
[Paper Presenter—Session 2]

Abstract

This paper will explore how to implement digital thinking into the design process; structurally as a whole, and on an individual project basis. The BIG 12 Fellowship Program with the College of Architecture at the University of Nebraska-Lincoln focused on exploring the integration of digital technology in early architectural education. The main research element explored how digital tools are integrated into early design education through a collaborative studio project.[1] A typical abstract design exercise was given in both digital and analog formats in early design studios. The outcome of the study was examined in terms of process, speed, and complexity, as well as the impact of geometric study. The design process itself was altered, in addition to the design product. Through these types of experimental exercises, we can begin to explore how the digital process can be integrated at a fundamental level.

Using digital tools to create complex geometries became an efficient vehicle for students to explore expressive form. The complex forms generated with the analog group also challenged us to adapt the thought process of hand making. Once we successfully integrate both digital projects and theory into beginning design, students will have the capacity to use digital tools earlier to expand design exploration in studio. This will create a longer timeline for students to reach a greater level of digital design integration in their academic career. Integrating digital thought into architectural thought supports a design process which can grow with technological innovations.

Introduction

In William J. Mitchell's analysis of how the economy of shapes has been changed by traditional design tools, he gives the example of transparent drafting paper allowing the designer to transform the shapes by moving the sheets around and to quickly produce transformed shapes by tracing.[2] In early phases of the CAD system, the tool wasn't more than a straightforward tool for efficiency, which we could use to gain better quality control and a cost effective design process.[3] In the film *Logic by Machine: Computer and the Mind of Man*, the revolution of the computer was described as an "order of magnitude", a term often used by scientists to explain the great change in speed or sizes.[4] In this case the computer was expressed as at least "six orders of magnitude". New media opened countless possibilities and possibilities are increasingly realized by "six orders of magnitude" for contemporary architecture. This multi-order of magnitude grants the progress in our environment, way of thinking and our moral of design. Computation in the design industries has come to the point where we cannot separate computation and design. What is the specific contribution of digital design in the *process of making* beyond the ability to simply make expressive and complex forms? Digital media and design thinking will be discussed through questions: How is the design process altered by the digital media? How will this affect the end result of each design and ultimately the future of design? How can we find a balance between digital and analog design? What if we entirely shifted to digital education and production? Is it the responsibility of our education system to preserve analog processes or move toward digital? Can the digital design process still integrate the hand? Is digital media just another tool with which to create like drafting with a pencil? These are all relevant questions for us to examine the changing world around us.

Professional practice has been more successful in utilizing new tools and integrating digital thought with architectural thought, creating a new design process with profound results. During the 2005 AIA Convention, Thom Mayne expressed that we will have to "Change or Perish" as a profession.[5] He confirmed the idea that "Today I would think that you couldn't even run a practice without having advanced performance techniques for understanding the way your projects operate within functional terms, within environmental terms, within technological terms, and for looking at the development of a project in the early stages…. It's not evolutionary … our clients expect this."[6]

Initial Studies

This paper describes an ongoing investigation into integration on the small and large scale, by comparing two recent projects and an ongoing experiment. On the smaller project scale, we began by adapting a traditional design exercise to a digital medium. The abstract Tartan Grid project was given to the beginning design studios of both schools of architecture at New York Institute of Technology and Oklahoma State University in different time frames and classes. Having introduced this fundamental design exercise in both analog and digital formats, in separate courses, it generated varied outcomes.

The design process itself was altered, in addition to the design product. Through these types of experimental exercises, we can begin to explore digital integration at a fundamental level. A description of the methodology of the two projects follows.

Analog Tartan Grid

The traditional Tartan Grid exercise was given to students in NYIT's Introduction to Visualization course. Students were asked to create a complex three-dimensional figure using a system of grids as a fundamental design tool. It required understanding a scale, measuring, and making lines. Students drew a series of eight 6" squares, with the first six to be divided into 1, 2, 3, 4, 5, and 6 parts equal grids. They then superimposed two grids (the 4th, 5th, or 6th) on the 7th and 8th square to form two different tartan grids. Using one of these tartans as a matrix, students made two figure/ground studies. Based on the figure/ground study, students extruded a 3D object using only the Cartesian coordinate system and described the object using axonometric projection. Further development required students to create a contiguous solid and a contiguous void within their object, with the void changing direction in the x, y and z axes at least once. Axonometric drawings were created to study the object, and to describe it for presentation. Final pencil presentation drawings on velum consisted of plan, elevation, and axonometric to convey the student's design (see Fig. 1).
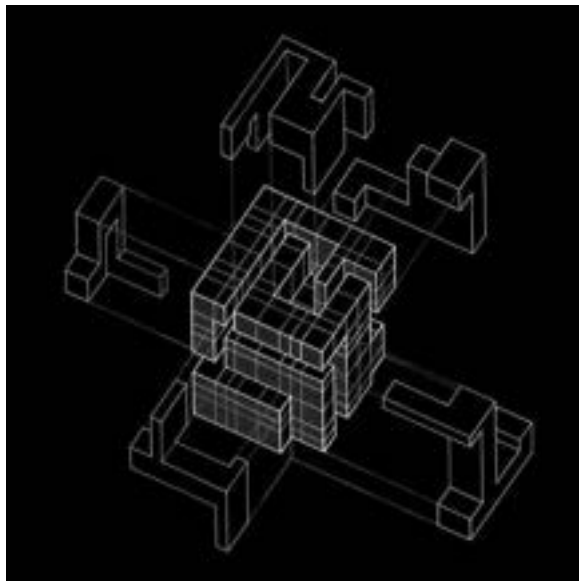
Fig. 1. Example of Tartan Grid_Analog at NYIT by Jin Jong.

Digital Tartan Grid

The analog Tartan Grid exercise was adapted to a digital medium for the Digital Visualization course at Oklahoma State University in order to explore design thinking for the same project, but using a digital process. Students were asked to draw the same series of superimposed grids, to form two different tartan grids. Using one of these tartans, students created a 3-D matrix, and used various operations which we covered in class to derive a 3-D object from it. Using the presentation techniques shown in lecture such as line weights, hatching, and mapping raster images, students generated drawings of the tartan grid object. They were asked to use

innovative, unconventional drawings to explain their concept, and to illustrate both the 3D object and the simpler tartan grid that the object was derived from. While students were likely to use some combination of plan, elevation, and axonometric, they were given freedom to experiment with various layouts to best describe their unique design. For final presentation, students were also asked to fabricate their design in a physical model to express the complex form (see Fig. 2).
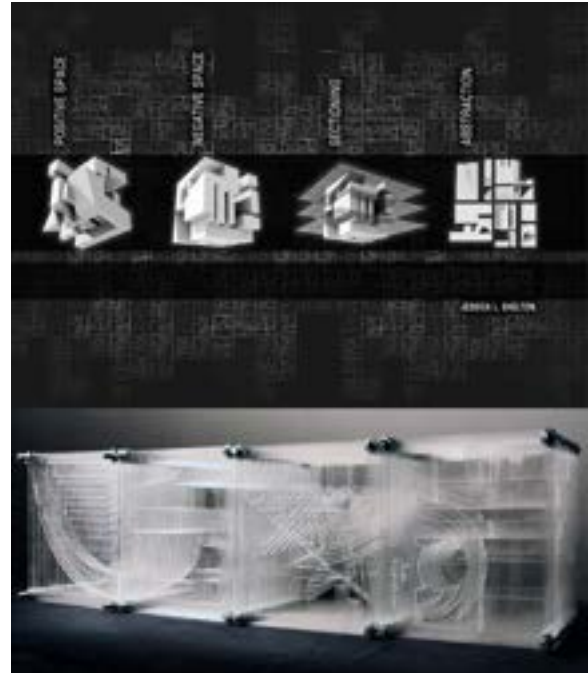
Fig. 2. Example of Tartan Grid_Digital at OSU by Jessica Shelton (top), Scott Blosser, Brian Miller, Jessica Shelton and Jon Pontious (bottom left to right).

Outcome of the Initial Studies

While the initial process of two-dimensional study was similar, once the figure ground was extruded into a three-dimensional object, the analog and digital processes were more varied. The design process can be thought of as a series of decisions, and the medium influences how those decisions are made. Because the computer is a tool which requires numeric input, ideas become certain more quickly. Computation in digital design translates an ambiguous design (architectural form) into more definite data. The data is interpreted into a certain idea to be visualized.[7] For example, the way in which the object was studied changed between groups. A hand-drawn axonometric only shows three faces at a time, whereas a 3-D model may be rotated to infinite views to instantly study the spatial impact of a Boolean operation on all faces. With this limitation to hand drafting, some ambiguity existed throughout the process for students drawing by hand.

Overall speed did not vary between the analog and the digital studios as much as expected, but the groups spent their time differently. While the digital formal experimentation perhaps was faster, students were in the beginning phases of learning to use the computer programs. Therefore, they were in general

not able to use them quickly or to their full potential yet. Even so, the digital group still spent more time experimenting with spatial configurations, and less time spent in the act of drafting. For the analog group, slightly less time was spent in spatial experimentation and more time was focused on drafting and presentation.

Students in the analog studio tended to stay on a more orthogonal grid throughout the process, while the digital studio tended to wander more from the grid, using free forms. Those within the digital studio who already knew the tools well were able to develop their ideas further, and were less frustrated during the process than those more novice. Students made more complex geometries early on with the computer, but may not have fully understood the forms or how they were constructed. This was further evidence of the need to incorporate fundamental geometry to enable this rapid transition.

The digital studio was able to use the tools to enhance the learning experience in other ways as well. The computer allowed exploring the translatability of digital design; the digitally formatted information was translated into multiple media with infinite possibilities.[8] Students used their CAD models and the laser cutter to create physical models for display. They also were able to upload their work to the class blog throughout the process, enabling class discussions and enhancing communication among the group.

Process of Making: BIG12 Fellowship Studies

The next evolution of this research was part of a fellowship study. The abstract design exercise *Investigating Expressive Form* was conducted in both digital and analog formats at Oklahoma State University (OSU) School of Architecture and University of Nebraska at Lincoln (UNL) College of Architecture in the formative design studios. The project, which was part of a BIG12 Research fellowship, is focused on the investigation of the current approaches to digital design education.[9]

The purpose of the study was to compare the schools' digital initiatives. OSU and UNL have different approaches in both Analog and Digital education, and by initiating a dialogue, we began to exchange ideas. The pedagogical difference in digital education seemed to be timing. What is the appropriate time for introducing or using the computer as part of the design process partially and entirely? A more significant question was how we introduce and encourage digital design as a creative endeavor.

This fundamental design exercise was introduced in both analog and digital formats, in separate groups. The purpose was to analyze the design process and product of two separate mediums, while developing an understanding of the basic structure of architectural geometry. The objective for the course was implementation of digital thinking. Developing the digital thinking process is necessary to prepare students for contemporary practice. Investigating expressive form in digital and analog formats allowed us to compare the difference in thinking process.

In terms of the design process as *making*, experimentation is what we do in design studio and it is also the only way that we

get the full benefit of computational design as a design process. Thom Mayne discussed the design process as "the invention of something that you couldn't get to without that process, of course the computer really advances those ideas."[10] In our experiment in both OSU and UNL, we deliberately identified the difference between computation and computerization.[11] The thinking process in our mind was recognized as a computation and the *process of making* was the byproduct of this exercise. Intentionally, we avoided the digitization of entities or processes; so that we could explore ambiguous and ill-defined processes which resembled how we imagine.[12]
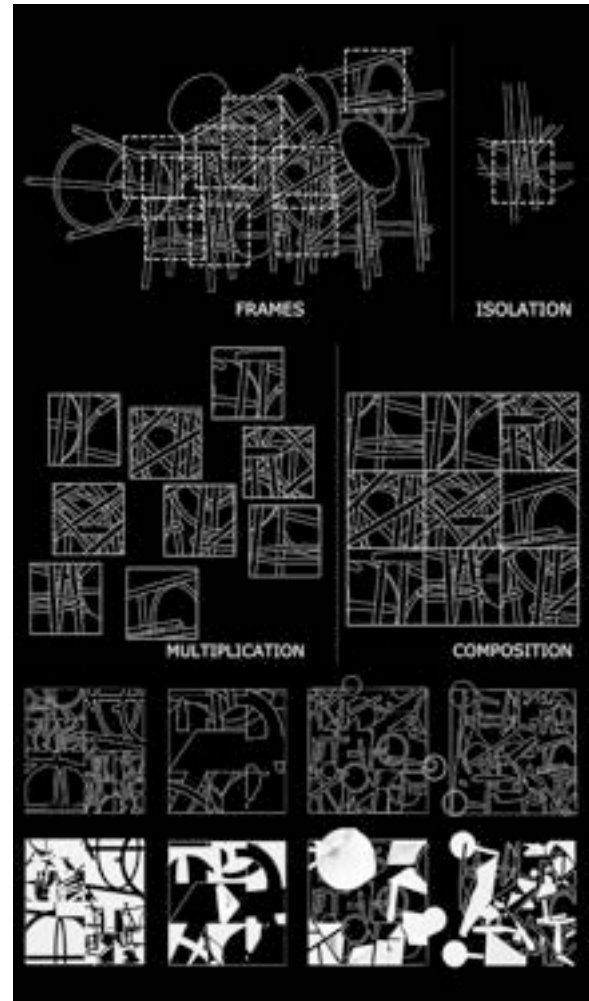
Fig. 3. Example of Investigating Expressive Form at OSU by Jordan Brauser (top and middle) and Kelsey Fields, Juston McKinnon, Chris Brennan and by Jordan Brauser (bottom left to right).

Project: Investigating Expressive Form

For OSU's *Investigation of Expressive form* course, a design challenge was developed to experiment with a group of students in a formative studio. The course consisted of a series of lectures, workshops and assignments. It gave an abstract design problem as the root of the experiment. It is inevitable and necessary for the beginning design studio to broaden

digital thinking, so that the students are able to progress in a computer-driven and global practice[13].

Students were separated into two groups for the initial analysis and documentation of a found object. The first group, Team Analog, studied and documented the object in an analog manner, using hand sketch or photography. The second group, Team Digital, conducted the same documentation, but used a digital process to create a 3D model of the object to explore its formal properties. The object chosen for the challenge was a studio stool, which displays a transition between circle and square for a basic geometric analysis. When the stools are stacked, they create various geometric elements with linear and curved lines. For Team Analog, perspective projection of the object was documented by hand sketch. For Team Digital, AutoCAD aided in flattening the 3D model into a parallel projection (see Fig. 3).

For the UNL portion of the study, we focused on exploring the integration of digital technology in early architectural education. An experimental and hybrid process was established, using both analog and digital tools, to be utilized for creating the formal concept for the 2nd year studio project. This was a parallel experimental design challenge with OSU's study, consisting of a series of workshops and assignments. The primary difference was that UNL's students are already utilizing digital tools as a primary instrument. Early digital literacy allowed students to explore many alternative options through integrated process.

It was critical that the project itself had enough ambiguous and imaginative components to avoid simply pre-determining design into digitized shapes. Both groups used the technique of framing views to find geometric compositions and extend and shrink lengths and areas of geometric elements. Students then translated the compositions into a series of 3x3 figure/ground studies. Using the 3x3 squares, students composed a 9x9 figure/ground study. Based on these two-dimensional investigations, three-dimensional forms were created. Students then conducted spatial studies of the objects. For both groups, the project culminated with a design presentation and discussion of process differentiation. The exercise gave us an opportunity to study and debate the method and value of both processes.

Outcome of the Study

The outcome of the second study allowed us to begin to address some of the questions proposed earlier.

How is the design process altered by digital media?

This question could be answered in different ways based on the students' perception of the computer as a design tool. Digitized abstract models helped them to present their ideas quickly and easily. The generative aspects of digital tools allowed them to be more adventurous, but at the same time form-making could take over the design thinking process because of the automated and compressed nature of CAD software. A student who was initially introduced to a 3D modeling software commented, "What I dislike about using a computer is that it does not encourage thought the way that analog process does. While it does create many opportunities that would not have been possible by hand, the speed with which you can do things and the option to undo or erase mistakes gives your decisions less weight than before. A wrong decision in the analog format could cost you hours, so every option is carefully weighed before making a choice. However, on the same note the digital could allow a freedom to experiment which wasn't possible before because mistakes can be undone or erased."[14]

Representation still seemed highly focused on the students' minds, so that the computer was treated as a drafting tool rather than a design tool at first. At the same time, students also began to realize the visual connection of conceptual ideas is extremely powerful as a design tool to open more possibilities. The distinction between representational and design tool must be addressed while students are learning how to apply the computer into their design thinking and how to use their digital thinking in the formative studio.

This brings us to the second question:

Is it the responsibility of our education system to preserve older processes or move toward digital process? Can the digital design process still integrate the hand?

The notion of digital design as 'mindless process' raises much opposition for computer use in formative studio and keeps the computer out of design process as a whole, relegating it to a representation tool introduced later. This prevents the kind of integration that is important in developing digital thinking processes. The earlier the computer is introduced, the more we can expect that integration to develop. Making physical models and sketching by hand are critical to developing students' design thinking, and must begin to be interwoven with digital thinking.

Is digital media just another tool with which to create like drafting with a pencil? Do machines only influence the technical aspects of our lives, or beyond?

Technology has reached much farther, changing our culture and social lives. Media theorist Marshall McLuhan expressed the idea that social and cultural change is the product of technological transformations.[15] In the film *Logic by Machine: Computer and the Mind of Man*, materials and intellectual affects of air transportation, particularly jet airplanes, transformed our thinking of speed and actually make our world smaller.[16] The speed of calculation by computers couldn't be comparable to human hand calculation. Rather than confirming that one process is better than another, we should identify the differences in thinking processes and evaluate the results.

For the experiments at OSU, the speed of each group and student varied somewhat, as expected, with each person progressing at their own pace. The digital group was required to participate in a brief software tutorial and to spend time becoming familiar with the program. But the speed of the digital tool quickly overcame the extra step; the computer already translated the found geometry into rational and digitized information. However, Team Analog progressed faster with the two-dimensional figure/ground exercises, but more slowly with three-dimensional studies. But as the 3D exercises evolved, Team Digital was able to conduct more spatial exploration at a faster pace.

Feedback from Team Digital suggested that the computer facilitated an easy transition between options, allowing them to overcome cautious decision making. The computer required

more input from the digital group, but allowed them to explore more options quickly, while Team Analog could not consider all potential configurations in advance.[17] On the other hand, Team Analog started the design process right away and each subsequent step reflected the thought process distinctively. Through students' observation and documentation, the objects became more ambiguous. For the analog group, instantaneous decisions were made when they chose a view to sketch and how to configure the each 3x3 square. The degree of abstraction was larger for this group; each distinct step served as another layer of abstraction.

On the other hand, the formative studio at UNL generated a much different perception of speed because of their "digital literacy".[18] They were relatively more familiar with both analog and digital media, and we immediately began to work on the project itself (see Fig. 4). This studio progressed faster and the process was overall more integrated between digital and analog. The challenges for students were deciding what media is appropriate for the design process and how to apply the concept through computational thinking. The capability of both mediums, not a proficiency of both techniques, allowed that the students could take a multiplicity of paths in the initial thinking process, using various methods.
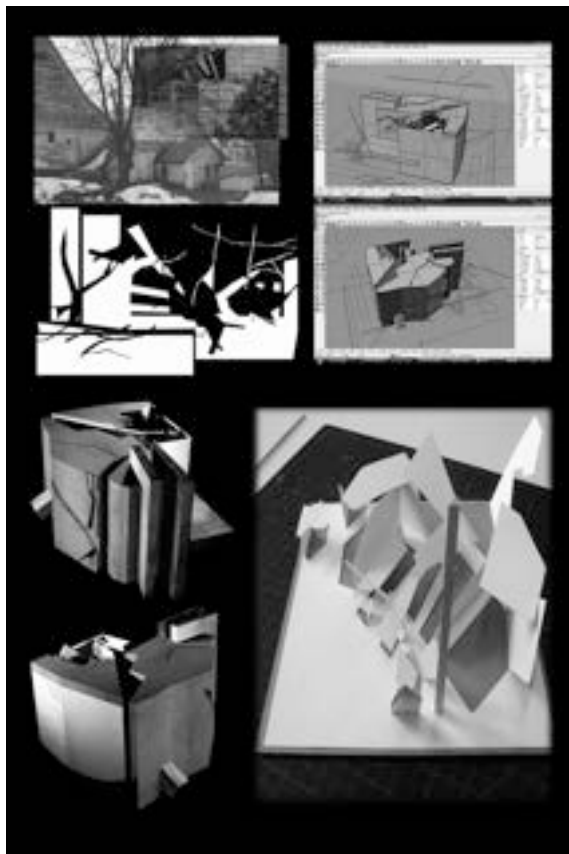
Fig. 4. Example of *Investigating Expressive Form* at UNL by Justine Brown [http://expressiveformbig12.blogspot.com/2010/03/after-critique.html].

Regardless of the medium, generated forms and images can be complex and ambiguous. As a generative process, students will

have to express the architectural concept through a form. In the book *Abstract Space*, architectural concept is imageless, with virtually formed concepts evolving and actualizing within expressive media.[19] Digital media allow students to generate new possibilities because their expression could be realized by the creation of innovative technologies.[20]

How can we find a balance between digital and analog design?

The geometric analysis portion proved helpful in engaging them to translate the geometry into their two-dimensional designs. It also raised the question of the role of digital tools in understanding the impact of geometric study. Using digital tools to create complex geometries became an efficient vehicle for students to study three-dimensional compositions as well. It gave them the confidence to explore expressive form. The complex forms generated with the analog group also challenged us to adapt the thought process of hand making. Hand-making as a computation of the human mind is necessary to the process of digital thinking (see Fig. 5).
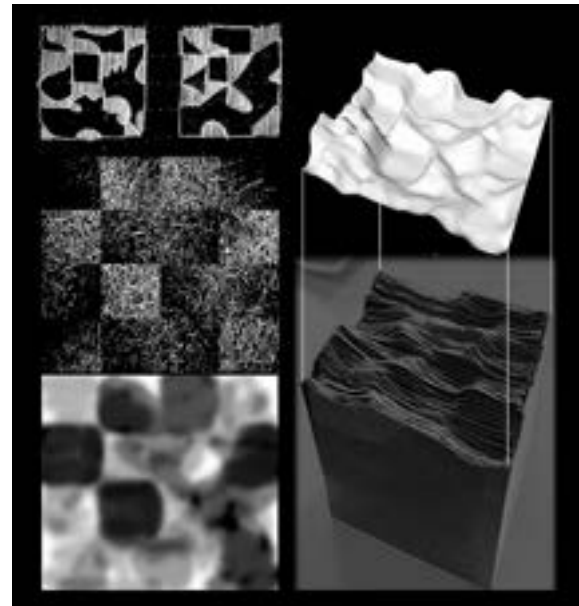
Fig. 5. Examples of *Investigating Expressive Form* at UNL by Hieu Cao [http://expressiveformbig12.blogspot.com/2010/03/hieu-cao.html].

Conclusion

How will this affect the end result of each design and ultimately the future of design?

Digital work has allowed instantaneous interaction between architects and engineers, increasing speed and precision in early phases of the design process.[21] This digital evolution has fundamentally shifted the design process of practicing architects, from global firms to local offices alike, and changed the way we conceive and assemble buildings.[22] Continually evolving digital technologies have begun to pressure the existence of two-dimensional CAD drafting in practice. Building Information Modeling (BIM) systems have already taken ownership of the multidimensional production of the design industry. As technological evolution is constantly and

instantaneously moving around us, we will draw new perspective of design processes.

"I think we're entering a second digital revolution. When I started school in the '80s, everything was done by hand, and when I left it was all digital. It changed the way we design—it enabled all those dramatic geometries of the last 20 years… We should be preparing our students to build with these methods. I hope we don't repeat the '80s, arguing whether it's a good thing or not."[23]

1   Kostas Terzidis, *Expressive Form: A conceptual approach to computational design* (New York: Spon Press, 2003), 1-7.

2   William J. Mitchell, Forward to *Expressive Form: A conceptual approach to computational design* by Kostas Terzidis (New York: Spon Press2003), vii-viii.

3   Mitchell, Forward to *Expressive Form: A conceptual approach to computational design* by Kostas Terzidis, vii

4   Produced, written and directed by Richard Moore and National Educational Television, *Logic by Machine: Computer and the Mind of Man,* MPEG2 http://www.archive.org/details/logic_by_machine_1 (Accessed August 8, 2010).

5   Thom Mayne, "Change or perish" (Remarks on building information modeling at the 2005 American Institute of Architects Convention, Las Vegas), Accessed September 14, 2009, http://www.aia.org/aiaucmp/groups/aia/documents/document/a ias076762.pdf

6   Thom Mayne, interviewed by Robert Smith, 2009 and Beyond | Revisiting the 2006 Report on Integrated Practice, *AIArchitect This Week, Vol. 16* (October 9 2009). Accessed September 27, 2010, http://info.aia.org/aiarchitect/thisweek09/1009/1009rc_mayneint erview.cfm

7   Kostas Terzidis, *Algorithmic Architecture* (Oxford: Architectural Press, 2006), 37-63.

8   Therese Tierney, *Abstract Space: Beneath the Media Surface* (New York: Taylor & Francis, 2007), 7-23.

9   A collaborative studio project: *Investigating Expressive Form* by Assistant Professor Seung Ra (OSU) and Assistant Professor Tim Hemsath(UNL).

10 Mayne, "Change or perish."

11 Terzidis, *Algorithmic Architecture,* xi

12 Terzidis, *Algorithmic Architecture,* xi

13 Terzidis, *Algorithmic Architecture,* 57-59.

14 Juston McKinnon, e-mail message to author, February 6, 2010.

15 McLuhan. Marshall, *The Essential McLuhan: The Medium is the Message* (New York: Basic Books, 1995).

16 Moore and National Educational Television, *Logic by Machine: Computer and the Mind of Man.*

17 Manuel De Landa. "Deleuze and the Use of the Genetic Algorithm in Architecture." *Rethinking Technology: A Reader in Architectural Theory.* Edited by W. W. Braham and J. A. Hale. (New York: Routledge, 2007), 407-412.

18 Anne Balsamo, "Design," International Journal of Leaning and Media, Volume:1, Issue:4 (2009): pp:1-10, accessed March 28, 2010, doi:10.1162/ijlm_a_00036

19 Tierney, *Abstract Space: Beneath the Media Surface,* 127.

20 Balsamo, "Design," 2.

21 AIA Documents Committee and AIA California Council, *Integrated Project Delivery: A Guide.* Version 1, Section1 (2007): 21.

22 Tierney, *Abstract Space: Beneath the Media Surface,* 7.

23 Monica Ponce de Leon, interviewed by William Bostwick, *Newsmaker Interviews,* Architectural Record, Accessed April 17, 2010, http://archrecord.construction.com/news/newsmakers/0905moni caponcedeleon.asp

Feeling Before Knowing:
Form-making with the use of Digital Simulations

Andrzej Zarzycki
andrzej.zarzycki@njit.edu
Assistant Professor
New Jersey Institute of Technology
College of Architecture and Design
[Paper Presenter—Session 2]

Abstract

Developments in digital design have brought a new design freedom into architecture. Emerging tectonic trends, combined with research into new materials and fabrication technologies, make it possible to pursue imaginative designs with new expectations of space and form. However, these innovative designs often exist exclusively as visual propositions, deprived of the deeper structural, constructional, or functional logic necessary for well-developed designs. Similarly, the proliferation of analysis software tools has helped engineers to calculate sophisticated structural models, yet this ability seldom translates back into architecture. Consequently, these two parallel developments, while promising in their individual capabilities, fall short in terms of synergizing into successful designs.

To bring these two distinct components together, this paper discusses the strategies for generative design validation using dynamics-based modeling tools: specifically, tools that realistically portray physical processes such as rigid/soft body dynamics, including cloth simulations, forward and inverse kinematics (FK/IK), and particle interactions. Through the use of dynamics-based software, a promising direction for generative architectural designs emerges. An architectural form not only can be analyzed based on its structural performance, but also can be derived through the process of structural simulations.

Introduction

As creative individuals, we often have sensation before realization, an intuitive reaction or guess before we are able to clearly verbalize our intensions and explain the rationale behind our actions. This may be associated with a tacit knowledge gained through past experiences or through characteristics of the medium we are presently working with, such as wood or clay. Similarly, we are able to dial a phone number without recalling a numeric sequence, thanks to kinetic memory that helps us to remember the "feel" of dialing (how to move our hand over a telephone dial). The combination of all of these factors (eye, hand, and mind) contributes to what I will call "creating–making" in design.

This paper looks at recent development in computational design from an intuitive and explorative perspective along the "creating–making" theme, where creating is directly associated with the act of making, possibly before it is truly and fully conceptualized. The creative process is both intentional, following deductive reasoning, and reactive, responding to the localized nature of the object being designed. This perspective considers intuitive thinking or tacit knowledge, unencumbered by rational processes, as an important component of creativity. It looks into materiality and the act of making both as a formative drive and as validation criteria. It extends Louis Kahn's concern regarding the appropriate and effective use of architectural elements such as a brick—"Brick, what do you want to be?" Beyond the process of creating that involves a designer (hand, mind, and eye), there is also a "createe," an object undergoing creation with its own personality. The "creating–making" perspective recognizes that some level of creative decision-making happens not with the artist or designer, but through the materiality of the designed object. This latter element of the process is particularly critical because it is the unique connection to the act of making. Thus, "creating–making" unavoidably connects tools and materials with an author. In the context of digital tools, this means transforming the "inert geometry" into "smart geometry" with associated material properties and behavior.

This paper brings the aspect of "tools and materiality" into digital environments and looks specifically at new ways to be creative in the context of computational tools. However, these new (computational) forms of creativity continue the tradition of engagement with materiality and intuitive thinking. The creating–making approach also sets new expectations for computational creativity to evolve beyond inert geometry with zero-thickness surfaces and include physically driven behavior and materiality.

Dynamics-Based Approach

This paper focuses on such a possibility that emerges out of dynamics-based tools in architecture: specifically, computational tools that realistically portray physical processes such as rigid/soft body dynamics, including cloth simulations, forward and inverse kinematics (FK/IK), and particle interactions. Through the use of dynamics-based software, a promising direction for generative architectural designs emerges: designs shaped by physical processes and material characteristics with unique, yet technologically sound solutions. Thus, an architectural form not only can be analyzed based on its structural performance, but also can be derived through the process of structural simulations.

Performance-based simulation is emerging as a critical component of the contemporary design process[1] [2], where it can function as a mechanism for the generative design validation. Performance-based simulations could facilitate human design by interactively responding to design parameters or function as semi-intelligent, self-optimizing agents that preselect promising generative scenarios and then channel them through a hierarchical portion of the design production (BIM software). The genetic algorithm (GA)[3] [4]and other evolutionary algorithms (EAs) are among the strategies that integrate structural analysis with architectural design.[5] For example, Schein and Tessmann have developed a procedure for the space truss optimization based on a collision detection analysis. However, this and similar tools are still in the developmental stages and are harder to implement in a classroom context to test complex designs.

The gap between generative design tools, which are often used to pursue exclusively formal gestures, and building modeling tools (BIM) is narrowing. Generative tools start considering form's performance as well as material behaviors, while BIM tools define architecture as a parametric, spatially resolved object that can be freely manipulated and explored. This mutual convergence between generative and BIM tools is particularly effective in a scale of design components, where individual elements and properties can be parametrically interrelated. Both approaches also establish an active link between an object (component) and the entire system (whole) with an ability to manipulate individual design characteristics. While each software environment achieves this in a different way, the ability to interrelate a fragment with the entire design is common for both environments: generative dynamics and parametric BIM.

For example, a rigged, inverse kinematics (IK) bone system demonstrates behavior similar to that of parametrically controlled composite beam-column, foldable, and umbrella-like structures. (figs.1,2) It can also be used to evaluate adaptable structures and their design possibilities, Both BIM parametric and IK components are defined by degrees of freedom as well as controlled by a set of constraints. While there is still a need to develop ways to effectively bridge these two digital design environments, the strategies for forming this connection emerge with parametric simulations and dynamics playing key roles. Consequently, dynamics-based simulations not only create an opportunity for design validation, but also serve as stepping stones toward parametrically defined architectural models (details) that could be utilized throughout the entire design process.

Capitalizing on this opportunity and exploring designs afforded by this approach became a central theme for case studies discussed below. These case studies aim to combine conventional generative design with building modeling software and provide promising results for further studies.

On many occasions, special effects tools such as dynamics, cloth or IK can facilitate form finding in a more intuitive and visually accurate way than traditional digital modeling tools used in architecture. This intuitive and visually accurate way is coupled with a usually instant feedback typical of dynamic simulation. Design forms respond immediately to given loads or support conditions. They acquire new shapes or indicate stresses occurring within.

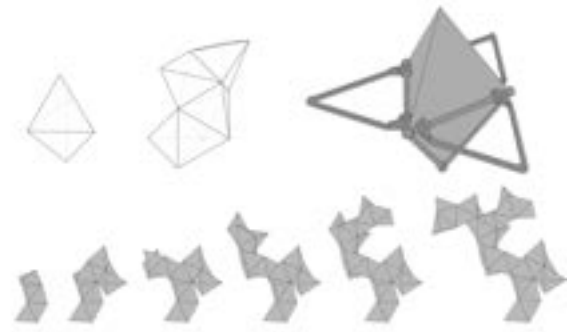Fig. 1. IK system after translation into BIM model with parametrically controlled components. (image by Cozens, Mitrovic, Ordonez, Borth).
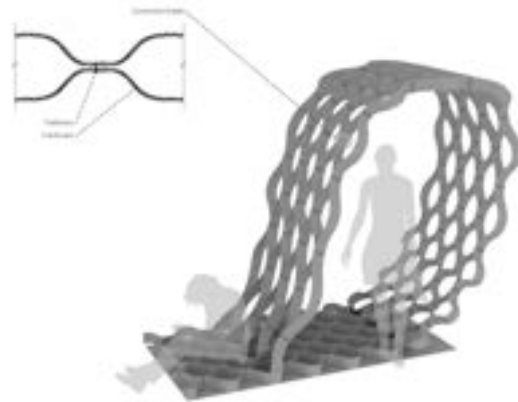

Fig. 2. Hinge-like structure after translation into BIM model with parametrically controlled components. (Image by Cozens, Mitrovic, Ordonez, Borth.)
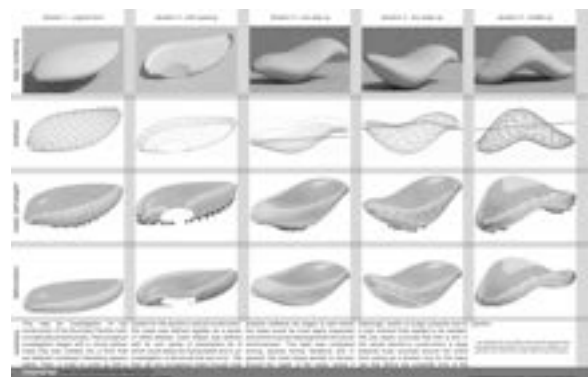

Fig. 3. Results achieved with advanced Finite Element Analysis (FEA) simulation software. .(image by Collars and Justice).

Dynamics-based tools such as cloth, particles, or IK bring a combination of interesting functionalities into design. They are suggestive, visually inspiring modeling tools that function well as generative tools. They also consider material and form behavior, and as such bring a component of real-life performance into design. Both of these interactions happen interactively, unlike more involved simulation tools such as finite element analysis (FEA). (fig.3)

Case Studies Discussion

In the case studies, we focused on design methodologies relating to the use of dynamics-based tools. We investigated approaches that incorporated optimization and form generation mechanisms: specifically, mechanisms that openly consider form, but also interact with simulations in a bi-directional manner. This bi-directionality becomes a vital component in the form generation feedback loop. While the form finding could have been achieved in various software packages, an ability to animate transformations and interactively change design parameters was seen as crucial feature of an effective generative tool. Animation tools allow for scanning an entire spectrum of possible solutions by analyzing a class of situations rather than an individual instance.

Furthermore, animating simulations puts a particular design scenario in a wider spectrum of design performance. This approach has broader design and educational benefits, as discussed by Shea: "generating new forms while also having instantaneous feedback on their performance from different perspectives (space usage, structural, thermal, lighting, fabrication, etc.) would not only spark the imagination in terms of deriving new forms, but guide it towards forms that reflect rather than contradict real design constraints."[6]
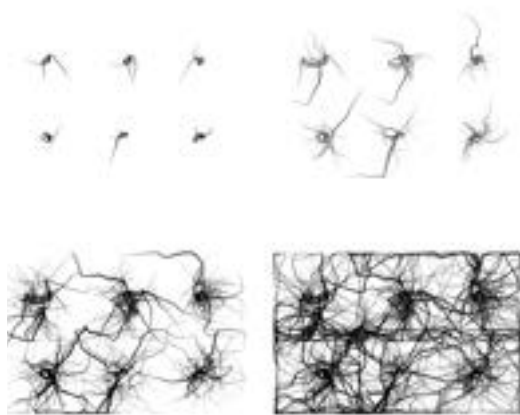
Fig. 4. Generative form-finding. Semi-autonomous "vine"

The class engaged these possibilities by employing dynamics simulation tools that are used in other industries, specifically, for the creation of special effects, gaming and character animation. (fig.4) While this may seem as stepping outside a conventionally defined architectural education, these tools were readily available and could be easily integrated within a small number of software packages.

The following examples show specific applications of dynamics tools such as rigid/soft body dynamics, forward and inverse kinematics (FK/IK), and particle systems. While each of them represents a narrow aspect of design performance simulation, a combination of them quickly becomes a potent design tool.

Soft-Body Dynamics

Cloth behavior exemplifies generative properties of performance-based simulations. (fig.5) Cloth simulations, by the very nature of this material, follow the stress flow and visualize the logic of a form. (figs.6) One of the projects (fig.7) explores architectural forms that result in or mimic the tectonics of a drape, including facades similar to the artist Christo's wrapping of the Reichstag building in Berlin in 1995. To achieve this design intent, a student investigates digital tools that employ dynamics and physically based behavior as form-making elements. The student investigates ways to simulate cloth-like behavior, producing a form that would result from physically defined characteristics, not something that is modeled outside real-world behavior. Such a model considers geometry not as a fixed spatial entity, but rather as a dynamic object that responds to external forces and displays physically based material properties.

Commonly used software packages provide a wide range of material properties such as weight, flexion, stiffness or friction. (fig.8) They also consider physical forces including wind and gravity. As a result, one can not only model a spatial configuration of the cloth object as a response to acting forces, but also include material properties allowing for tearing limits and fractures. This interdependence between the performance of a form and material parameters brings a level of reality into design discussion, even when particular units or physical values are not immediately understood by students.

Cloth dynamics-based simulations are analogous to rigid and soft body dynamics in their ability to incorporate physically driven behavior. An architecturally interesting extension of these capabilities is the ability to animate a cloth behavior with the use of colliders. Colliders in this application provide a skeleton for a canvas-like membrane that has the ability to react dynamically to skeleton's reconfigurations. In such a designed object, cloth becomes a dynamic skin that repositions itself based on the changed geometry of the collider framework. This can be achieved in the context of animated mesh or dynamics-based objects such as particles or_bones.
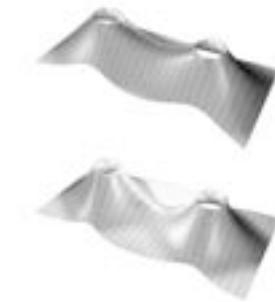
Fig. 5. Variations in material properties result in different catenary shapes.
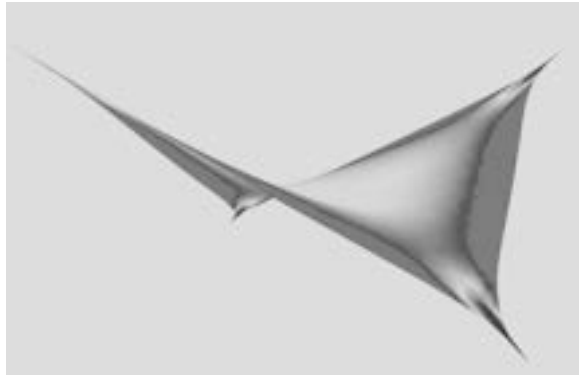
Fig. 6. Cloth tension map; dark gray color indicates fabric in tension and light gray indicates areas of minimal tension. Simulation renditions similar to these achieved with Finite Element Analysis (FEA) software (see fig.3).
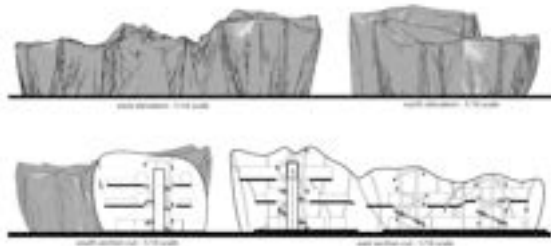
Fig. 7. Model that follows cloth geometry with the cloth skin responding to gravity and material properties. (Image by M. Litus.)

Fig. 8. Material properties of a cloth object.

Systems with Constraints

Inverse kinematics (IK) techniques, adopted from character animation modules, were used investigate structural skeleton systems with integrated and interconnected framing members that mimicked sophisticated architectural structures. (fig.9) The ability to rig complex bone arrangements into a hierarchical system with a small number of control points allows for interactive and intuitive structural configuration. New skeletal shapes can be quickly derived from repositioning a small number of control points. After solving the IK chain and hierarchical structure of the bone system, the IK framework was connected with a cloth object. The resulting composite design integrated cloth with bone framework and could have been simulated dynamically as a single, morphing object. (fig.10, 11)

While using IK in defining structural frameworks creates certain limitations in the type of design solutions one is able to achieve, it also allowed students to purse unusual and imaginary designs without the need to resolve constraint requirements necessary in a BIM system.

Particle systems bring yet another simulation opportunity into design. In my course, students used them to evaluate the aerodynamic properties of an architectural form. This was a narrowly defined approach dictated by a wide range of various simulations they were expected to do. Other possibilities for particle system applications include aerodynamic simulations of urban spaces as well as smoke and fire spread in buildings.

The most interesting characteristics of a particle system are particles' physically driven parameters. Particles can be designed to interact with other objects in a dynamic way, as well as to interact among each other. These inter-particle collisions not only allow modeling a particle system as a comprehensive force, such as wind, interacting with a building, but also allow modeling the system within itself due to its volumetric properties.[7]

Reconciling Differences

After the initial explorations of generative designs, students were asked to transfer them into a BIM environment for further analysis. (fig.12) The path from generative to building modeling software was difficult and convoluted. Students often had to use other software packages to make transitions possible. This could have involved rebuilding a cloth surface in a non-uniform rational B-spline (NURB) modeling package or recreating structural elements that behave like IK bones in BIM software. While there are not direct and easy ways to go back and forth between various types of software, the process of "crossing the divide" was educational and gave students a better understanding of the design possibilities afforded by various software packages. Additionally, by recreating IK chains in BIM software, students became exposed to the logic of constraints and degrees of freedom.

Fig. 9. Interconnected frames mimicking adaptable structures.
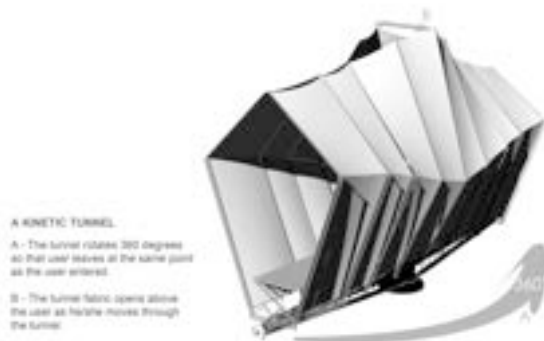
Fig. 10. IK bone system helps to control structural frameworks (Image by Alsieux, Djuric, Patel, Petersen, Seredyak.)

Fig. 11. Detail of the kinetic structure from the figure 10. (Image by Alsieux, Djuric, Patel, Petersen, Seredyak.)

Fig. 12. Space frame with suspended cloth elements. (Image by Benson, D'Angelo, Darling, Emara, Morrow, Piccone, Siegel, Tait.)

Dynamic toolsets can define design in ways that would be difficult to arrive at with more traditional digital techniques such as NURB or solid modeling. This became particularly evident to students in the class who were attempting to recreate certain aspects of their IK models within BIM software. They quickly realized that using a constraint system of IK produced results faster than a fully parameterized and initially less constrained BIM model/object.

Students learned from constraint and parametric models how to define parameters in a way that brings flexibility into a design system, but at the same time define parametric flexibility that would not over-constrain their designs. Since each new parameter introduces a set of constraints (parameter range), a large number of parameters may result in increased constrains or inability to resolve them.

This parameter-versus-constraint relationship allows students to realize that creativity of solutions is achieved not by excessive "parameterization" of their design objects but rather by balancing parametric freedom and simplicity of an approach—structuring parameters for effective and creative use.

Dynamics–based generative models can become stepping stones for parametrically driven BIM models. This tendency can be seen in case of CS-FEM plug-in for Maya software[8], which is a further step toward integration of generative and validation tools within a single design environment.

Pedagogical Underpinnings

This method builds on the notion postulated by Eduardo Torroja in "Philosophy of Structures," where he emphasized the priority of qualitative over quantitative structural thinking.[9] Computationally based digital structural simulations address Torroja's postulate of qualitative structural thinking. They do it in a way that emphasizes a structural model with calculations being a critical determinant, but not a primary visual communication component. Consequently, computer-based simulations can become a core element of structural design education by forming "connections with ideas" [Torroja 1958] and creating opportunities for students' educational development.

Torroja's suggestion is a particular case of a broader "learning by doing" approach, often called experiential learning, which

41

refers to acquiring skills and knowledge through activity. There is ample precedent with philosophical and scientific backing for the learning-by-doing approach. Some trace it as far as Confucius, with his memorable adage from around 450 BC: "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand." In more recent times, David Kolb defined the concept of experiential learning theory (ELT).[10] Another "learning by doing" contributor, Roger Schank,[11] defines multiple aspects of experiential learning that directly correspond to methodologies applied in teaching architecture students, particularly in the context of digital tools. These methodologies are based on the five "teaching architectures": simulation-based learning by doing, incidental learning, learning by reflection, case-based teaching, and learning by exploring. Each of the above teaching architectures applies directly to the computational design teaching discussed in this paper.

Additionally, digital simulations allow students to look at more complex structural systems and to better understand their behavior. Specifically, educators can extend structural teaching models into interdependent systems that consider an entire structure. While calculations, in an architectural class context, usually stop with statically determinate structures, digital simulations can easily be extended into statically indeterminate systems such as continuous beams, at the minimum. This is an important distinction between traditional and computer-assisted teaching methodologies. Traditional structural education would focus calculation-based learning on individual structural components such as a beam or a column. It would address integrated systems or complex framing in a descriptive, not computational way. Students would be told how a system would behave, but would not be able to experience it by themselves.

Coincidentally, these complex systems need to be visualized most often because their behavior is less commonsensical to students as compared to simpler models. Unlike the flexion of a beam or a column, of which a student might have had observed a similar phenomenon on his or her own in the past, complex and integrated systems typically lie beyond our immediate experience. As a result, we often calculate and experiment most with structural examples that are the easiest to experiment with, but also the least educational, since they often are already intuitively understood by students. This realization is not proposing an elimination of simple model simulations, but rather argues for extending those simple models to understand them as components of a broader, interdependent system.

Educational Benefits of Dynamic Simulations

As discussed earlier in the context of experiential learning, the primary concern is not to transfer the teacher's knowledge but to expose students to situations where they can experiment with tools, develop design propositions, and later evaluate their designs themselves. This approach provides students with a lifelong approach to knowledge acquisition and an ability to advance their skills.

On numerous occasions, students showed a great deal of enthusiasm whenever they were introduced to various aspects of simulations within a design studio context. Their enthusiasm went beyond the "coolness" of used tools or their outcomes, and addressed students' need to understand discussed topics. This concept of feeling the knowledge as much as understanding it is critical in development of intuitive thinking and deeper, holistic understanding of a given subject. Furthermore, the development of an intuitive knowledge may to some extent compensate for a lack of experience. In this meaning, intuitive knowledge (or primary process knowledge—we all have sensations before the verbalization or organization of a thought) is an unprocessed comprehension of an idea or a process that can be relied upon in preliminary decision-making. This pedagogical approach responds to Michael Polanyi's "Theory of Personal Knowledge," where the author observes that knowing is an art form in which the knower understands significantly more than he or she can articulate. This comprehension of external facts without being aware of them specifically, called "tacit knowledge," accounts for the human ability to function in the world: "tacit knowledge forms an indispensible part of all knowledge"[12], and this part of knowledge allows us to process meaning and reach goals beyond our verbalized or processed thinking. What we often call experience is closely related to such defined, tacit knowledge. This connection suggests that experience can be reinforced or partially substituted by other forms of learning. Simulations can be one of those experiences. Additionally, simulations offer an ability to ground a student in a physically based knowledge of architecture. In this sense, digitally based simulations relate to the teaching of materials and methods or building technology, since they bring physical properties and dimensionality to abstract designs.

Limitations

While the examples discussed above were successful educationally and as designs, this approach also comes with limitations. In the case of the cloth tool, the limitations are associated with a relatively narrow range of outcomes generated by a cloth engine and with a strong visual signature of designs. This signature becomes repetitive, possibly monotonous, and may be hard to overcome. At the present state of development, dynamics-based tools solve a narrow range of problems and provide a narrow range of design solutions. Thus, this approach becomes a specialty tool rather than a broad brush for design. Nevertheless, this approach establishes a new precedence and perhaps a strategy for tackling a broader range of design problems in the future.

Case Study Contributions

Generative and performance-based designs have emerged as important topics of design research. However, much of the interest focused on theoretical underpinnings and on relatively particular design applications that addressed narrow functionalities. This study attempts to broaden this framework into multiple dynamics tools by interconnecting them into an integrated model. This is seen in an example that combines multiple dynamics tools, such as inverse kinematics (IK) and the cloth engine interoperability, into an architecturally relevant model.

Furthermore, the discussed case studies interrelate behavioral aspects of the dynamics-based tools with database models. They map individual capabilities and correspondences between both platforms and propose a direction for further developments in the BIM platform. They show the need for and opportunities associated with combining behavior-based and database characteristics into a single design model:

broadening BIM not only as a database, but also as a behavior/performance model.

Finally, these case studies allowed students to integrate multiple criteria and introduce them to comprehensive design thinking, first by developing strategies for conceptual design and later by recreating conceptual designs within the BIM platform by mapping the relationship between dynamics and BIM tools.

Conclusions

The approach discussed here—representing a renewed interest in building technology in general, and performance simulations in particular—sets new expectations for digitally based architectural practices and education. It sets an expectation for architecture to behave like a 21st-century structure, not merely be fashioned to look like one.

These studies focus on the integration of form-finding with building performance simulations from a conceptual perspective, where the intuitive understanding of structures—a general and qualitative point of view—is more important than a quantitative and numeric approach. The ability to visualize structural performance and interactively study the impact of forces on an architectural form can result in an integrated design process. Furthermore, these interactive simulations have an ability to translate into a visually inspired, virtual hands-on experience for students and young practitioners by helping them to develop an intuitive knowledge of architecture.

This simulation-based, interactive approach shifts the students' focus from the visualization of objects to the visualization of physical behaviors. As a result, a new and promising direction in generative architectural design emerges, facilitated through the use of dynamics-based software. An architectural form not only can be analyzed based on its structural performance, it can actually be derived from the process of generating structural simulations.

The fundamental question that needs to be further investigated is how we should relate a generative design system with performance simulations and analysis. The recommended approach would be to combine both in the performance-based generative system, not unlike the example discussed above of soft dynamics–cloth simulations with IK bones and their translations to parametrically driven structural frameworks.

[1] Kloft, Harald; Non-standard Structural Design for Non-standard architecture; in Performative Architecture: beyond instrumentality; ed. Branko Kolarevic and Alim m. Malkawi; Spon Press, New York and London, 2005.

[2] Oxman, R: 2008, Performance-based design: current practices and research issues, International journal of architectural computing, Vol. 06, pp. 1-17.

[3] Sasaki, Matsuto; Morphogenesis of Flux Structure, in From Control to Design: Parametric/Algorithmic Architecture; Verb Monograph, 2008 p.106; also available at www.isozaki.co.jp.

[4] Benoudjit, Mohamed Amine and Coates, Paul S., Artificial networks for spatial analysis;, IJAC journal 2008.

[5] Schein, Markus and Tessmann, Oliver 2008, Structural analysis as driver in surface-based design approaches in IJAC p.19.

[6] Shea, Kristina 2004, Directed Randomness, in N. Leach, D. Turnbull and C. Williams (eds), Digital Tectonics, London: Wiley-Academy, pp.89-101.

[7] Ophir, Y: 2008, Go with the flow: particle systems for program modelling in high-rise buildings, IJAC, Vol.06, pp. 172-196.

[8] Vollen, J, Clifford, D, Winn, K, and Gindlesparger, M, 2007 Digital Fabric: Generating Ceramic Catenary Networks." Expanding Bodies: Proceedings of the ACADIA 2007 Conference. Ed. Brian Lilley and Philip Beesley. Halifax, Canada: Riverside Architectural Press, 2007. 48.

[9] Torroja, E. Philosophy of Structures. Trans. J. J. Polivka and Milos Polivka. Berkeley: U of California P, 1958. 1-3.

[10] Kolb, D. A. Experiential Learning; Experience as the Source of Learning and Development, Prentice Hall, 1984.

[11] Schank, Roger and Cleary, Chip; Engines For Education, Lawrence Erlbaum Associates, Inc. 1995.
also
The Five Teaching Architectures,
http://www.engines4ed.org/hyperbook/nodes/NODE-36-pg.html *The Institute for the Learning Sciences*, accessed 2/28/2010.

[12] Polanyi, Michael 1983, The Tacit Dimension; Peter Smith, Gloucester, MA, p.20.

Community Engagement

After reviewing these three papers, several common threads related to community engagement become apparent. A cursory reading reveals that two of these papers connect on the level of regionalism, which serves as a sustainable criterion for evaluating sustainable design and construction processes—one paper does this at the scale of a micro-project (that of a Solar Decathlon house); and the other at the scale of a macro-project (by approaching the redesign of urban slums).

A closer reading, however, finds an underlying common denominator that ties all three papers together—a pedagogical framework in which students work with "real" clients from outside the academic design studio setting. This student-client interaction can help influence students' ability to address the design-build process more meaningfully.

These papers address projects that are each of a different scope and have unique program requirements:

> One focuses on the importance of redefining architectural design to include the social, spiritual, political, as well as materiality and formal building outcomes.

> The second focuses on the sustainability of creating-making in addressing of materiality and its selection and use, and on the development of an evaluation of both sustainable design and construction processes.

> The final paper focuses on the learning outcomes from approaching the studio experience using an interdisciplinary approach to project development.

As architecture schools move to address the professional issues of the 21st century we will certainly come to see that the issues covered in these three papers are some of the most important. A successful architectural practice must include the knowledge and experience of many professions involved in improving the built environment, and a multi-disciplinary approach that begins in the academic design studio reinforces this notion early on in the education process.

Architects cannot do it alone. It takes architects, interior designers, clients, social scientists, politicians, engineers, natural scientists, citizens, product researchers and manufacturers and, in fact, all citizens of the communities involved in improving their environment.

+

Dave Boeck
dlb@ou.edu
Associate Professor
The University of Oklahoma
College of Architecture
[Session moderator]

The Client-Based Studio:
Meeting Pedagogical Needs and Serving the Community

Chris Cosper
ccosper@caad.msstate.edu
Adjunct Instructor
Mississippi State University
College of Architecture and Design
[Paper Presenter—Session 3A]

Abstract

Client-focused design studios can both support community design projects and serve as a pedagogically sound means of drawing students into their work.

This spring, the Educational Design Institute (EDI) at Mississippi State University conducted its second studio-based project. This project explored three critical questions:

> What does it mean to have both client and pedagogical missions?
>
> What are the advantages and pitfalls?
>
> How does working with a "real" client alter the process of making in the design studio?

Project and Institute History

The Educational Design Institute (EDI) was created by the Mississippi legislature in 1997 to develop the Mississippi School Design Guidelines and to otherwise promote good K-12 educational design. EDI's vision statement follows:

> The Educational Design Institute, in collaboration with students, parents, educators, school administrators, school boards, and communities, will encourage the creation of safe, accessible, flexible, and developmentally-appropriate learning environments that will help students learn and teachers teach.

The Spring 2010 EDI Studio is the second of two EDI studios conducted since an architect/educator was hired as assistant director in 2008. The first EDI studio, conducted fall 2008, centered on a master plan and "phase one" project for Forrest County Agricultural High School (FCAHS), located about 15 miles south of Hattiesburg, Mississippi. Although addressing that studio in detail is beyond the scope of this paper, it is important to note that lessons learned from the first studio were applied to the second studio.

One of the main challenges when designing a client-based studio is matching the needs of the client to the needs of the students. Of course, such a statement is predicated on the idea that an architectural design studio should be student-centric, not faculty-centric. For a research and service center such as EDI, the client-based studio provides a tempting way to economically address some aspect of the center's services. However, if the studio is conceived and designed without thinking about the needs of the students taking the studio and performing the work, then a great disservice has been performed to the students.

The faculty conducting a client-based studio should understand that the studio might imperfectly address the client's needs. This requires a leap of faith and a belief in the studio students. In his exploration of the most effective college teachers, Ken Bain says:

> [T]he best teaching can be found not in particular practices or rules but in the *attitudes* of the teachers, in their *faith* in their students' abilities to achieve, in their *willingness* to take their students seriously and to let them assume control of their own education, and in their *commitment* to let all policies and practices flow from central learning objectives and from a mutual respect and agreement between students and teachers. (Bain 78-79, emphasis by original author)

The faculty of a client-based studio must relinquish some control of the studio to give the students the opportunity to succeed on their own. If the faculty cannot do that, then they should consider performing the design services themselves under some other mechanism, or they should walk away from the project.

The Fall 2008 EDI Studio was offered as a "topical" studio to fourth-year students who had a second studio from which to choose. All of the members of the fourth-year class were asked to pick the EDI studio, the second studio, or "no preference." The class divided itself neatly in half, with the "no preference" students allowing the faculty to balance the two studios easily. Although individual topical studios often attract students of a type (e.g. strong designers), the fall 2008 studios were well balanced in their student composition.

The above-mentioned scenario is the preferred scenario. However, the Spring 2010 EDI Studio included all 34 possible students (18 fourth-year architecture students and 16 senior interior design students). Since both the fourth-year architectural class and the senior interior design class were small, no alternate studios were offered. Thus, these students were "forced" to take a client-based studio.

While not ideal, this scenario was acceptable. The interior design director wanted her senior level students to have an instructor with significant experience with practice. Thus, the EDI Studio was a good fit for her class, because the faculty met that criterion and, by design, the studio itself was practice-oriented.

Through casual conversations with the architecture students, the EDI faculty found that many members of that class had not connected with previous projects or studios. The students felt that their class was in a permanent state of "experimentation," and they had difficulty seeing the learning objectives of their work. Not surprisingly, this group of students had developed a negative reputation among the wider faculty.

A closer examination of the class, however, reveals that they do have talent. Their performance in the junior-level mechanical and electrical systems course was more than adequate, and, anecdotally, the structures professor described them as very bright. In general, the class displays a strong pragmatism combined with a deep skepticism of the theoretical frameworks.

For such a class, the client-based studio is a good fit. Having a clear program, a real site, and a real client provide the concrete platform the class needs in order to feel comfortable with their architectural explorations.

Semester Timeline

When the Toyota Motor Corporation announced that they were building a manufacturing facility in Blue Springs, Mississippi, they also announced the establishment of a $50 million endowment ($5.0 million per year for 10 years) to boost educational opportunities in northeast Mississippi. The Toyota Education Enhancement Fund Advisory Committee (TEEFAC) was charged with planning the use of the education endowment, and one of their ideas was creating a "magnet" high school based on an advanced vocational school in Frisco, Texas. Once this priority was established, TEEFAC approached EDI and Mississippi State University, asking for assistance with the project.

Because the client was not ready to meet with the studio during the first week of class, the spring 2010 semester started with the architecture students and ID students performing case studies working in pairs by discipline (i.e. architecture students were paired together and ID students were paired together). The class performed case studies on schools, structural steel projects (anticipating the ACSA/AISC steel design student competition), and sustainable interior design.

When the case study phase was complete, each pair of architecture students and each pair of interior design students rated their perceived proficiencies in a variety of categories ranging from presentation skills to spatial design skills. With the surveys in hand, the EDI faculty attempted to create nine teams that were as equal in skill level to each other as possible. When this process was complete, the studio consisted of nine "uber teams" – with each team typically consisting of two architecture students and two interior design students.

On January 20, 2010, the faculty and students drove to the Blue Springs site, which is located about 15 minutes northwest of Tupelo, Mississippi. Emphasizing the egalitarian nature of the studio, the interior design students participated in the site analysis along with the architecture students.

After the site visit, the studio met in Tupelo with TEEFAC, which is advised by Dr. Larry Anderson, a prominent education consultant. During this meeting, the committee members and Dr. Anderson outlined their vision for the magnet high school.

One of the most critical themes that emerged from the client meeting was the prominence of a prototype school to the committee's thinking. The committee had visited Frisco, Texas, to discuss the educational program of the Career and Technical Education Center (CTE) with its principal, Dr. Wes Cunningham. As an afterthought, the committee toured the CTE and immediately saw the benefits of an inventive and exciting school building.

Knowing the importance of the prototype school to TEEFAC, the EDI studio faculty asked the Tupelo-based CREATE Foundation to sponsor a field trip to the CTE, which they generously did. Thus, a field trip to the CTE in Frisco and the recently renovated Booker T. Washington High School in downtown Dallas was planned, and on February 4-7 the faculty and students traveled to Texas.

After returning from the field trip, the students had approximately five weeks before mid-terms to present a design to an in-house (i.e. non-client) jury. The in-house jury (which included a local architect with extensive educational design experience and an interior design faculty member) gave the student teams feedback at an important juncture in the semester. The mid-term jury was successful enough that the students were advised to enjoy Spring Break, but be ready to return to work once the holiday was over.

The students spent the remaining weeks of the semester methodically preparing for their final presentation. Explicitly citing the model of a working architecture firm, the EDI faculty stressed an active but measured pace.

On April 21, the final jury for the 2010 EDI Studio was held in Tupelo in front of TEEFAC. Each of the nine teams had 20 minutes to present their projects via Power Point. Although fourth-year work deserves more time, committee members could not commit more than three hours to the presentations. Of all of the components of the semester, the three-hour final jury was the one compromise to the client that was detrimental to the pedagogical mission of the studio.

To address the brevity of the presentations in Tupelo, students were given additional time in Starkville to present to other students and faculty in "walk-around" juries. Specifically, the walk-around juries were designed for the students to display their ACSA/AISC steel design student competition boards and to receive feedback on those boards. (One unanticipated downside of the walk-around juries was the larger faculty not understanding that the competition boards displayed only a fraction of the studio's work, which led to some criticism of the EDI Studio.)

Regardless of the criticism, the EDI faculty were pleased with the quantity and quality of the student work, and the design studio grades were exceptionally high.

Student Survey

In addition to filling out the standard university class evaluation surveys, the EDI Studio students were asked to complete an online survey that specifically addressed the client-based studio. A total of 23 of 34 students participated in the survey; 75 percent of the students who indicated a major were architecture students.

When asked in the Spring 2010 EDI Studio met the students' expectations for a fourth-year or senior level design studio, 21.7 percent strongly agreed, 47.8 percent agreed, 21.7 percent

were neutral, 4.3 percent (i.e. one student) disagreed, and 4.3 percent strongly disagreed.

The students were asked if the expectations in the EDI Studio were higher than the expectations of previous design studios. Asked to discount the fact that the EDI Studio was the highest level studio the students have taken to date, 18.2 percent of the students said that expectations were significantly higher, 40.9 percent said they were higher, 27.3 percent said they were about the same, 9.1 percent said they were lower, and 4.5 percent (one student) said they were significantly lower. As one student noted, "We had an actual client. We were no longer designing for our likes and needs but [had] to consider what the client wanted and their expectations." In general, the students felt that more was at stake because a client was involved.

Next, the students were asked if they learned more or less in the EDI Studio than in previous studios. Three students (13.6 percent) said significantly more, 36.4 percent said more, 36.4 percent said about the same, 13.6 percent said less, and no student indicated that significantly less was learned.

From the standpoint of "creating_making," the questions concerning client interaction and the prototype school are the most informative. When asked about client interactions, 50 percent of the students said they significantly helped the design process, 40 percent of the students said they helped the design process, 10 percent said they neither helped nor hurt the design process, and no students said that client interactions hurt or significantly hurt the design process.

Discussing client interactions, one student said, "It's always good to know what the client is interested in. It gives you direction." A second said, "As architects, we learn that everything beautiful and grand is not necessarily good. Looks are important but sometimes they tend to overshadow functionality." A third said, "Knowing what they [the client] wanted to incorporate and how they felt about the design really drove how we began the design process and research."

During our initial client meeting, the prototype school (the CTE Center in Frisco, Texas) weighed heavily in the clients' comments. One member of the client team went so far to say that he wished the design team could pick up the Frisco school with a helicopter and drop it on the proposed site. Obviously, such a strong precedent has the potential to be problematic; however, the EDI Studio students had no difficulty addressing the prototype school.

When asked about traveling to the prototype school, 36.8 percent of students said seeing the school significantly helped the design process, 47.4 percent said it helped the design process, 10.5 percent were neutral, and 5.3 percent (one student) said the visit hurt his or her design process.

Far from being inhibited by client interaction and the visit to the prototype school, the students saw these activities as part of the broader research performed during the semester. Only a single student indicated that client interaction or the prototype school interfered with the design process, a clear indication that students can succeed when asked to look beyond themselves and their limited experiences. In her study of architectural design studio project handouts, Beatriz Maturana found a design studio handout (for a housing project) that succinctly captures what she considers to be the right attitude toward client interaction:

> The needs to which your design responds must be established by research, because they cannot be drawn from your own limited experience.... Before all other considerations, dwellings must 'work', and they must do so for some identifiable range of users other than yourself. (Maturana 2010, 166)

The final question in the survey asked whether the School of Architecture and the Interior Design Department should "offer more client-based studios (i.e. studios that work with 'real world' clients)." Sixteen students (84.2 percent) said yes, while 15.8 percent said maybe. No student said no.

Interestingly, the final question generated the most comments. Here is a sampling:

> The client-based studio gives such a "real" feel to the studio. It feels like you are working toward an actual, attainable goal.

> When given real world clients, students are pushed to have more thorough projects because they have to deliver a "finished product" at the end of the semester and present it to non-architecture people.

> I am [wary] of blending academics too heavily with the real world. While I recognize the benefits of learning about realistic situations, I [believe] studying design in an academic sense is very different from designing for a client.

Although the first two quotes are clear endorsements of the client-based studio, the final quote captures a feeling that is not uncommon among some students and many faculty. Even when a client-based studio is successful, there still exists this concern that it is something "other" than what school should be.

Final Thoughts

The aforementioned student survey addresses the relative success of the EDI Studio from the student perspective, but it is equally important to consider the client's perspective. Speaking for TEEFAC, Dr. Anderson says:

> The Toyota Education Enhancement Fund Advisory Committee (TEEFAC) was honored to have the assistance of the Mississippi State University Architecture Studio class students during the Spring 2010 semester. We found the students to be eager, energetic, full of ideas, and displaying a willingness to share those ideas to a real client....

> One of the major projects the TEEFAC decided upon was the opening of a new type of school for our region. So, during early discussions, we learned that the MSU School of Architecture might be able to participate. That is when we met Chris Cosper, faculty member, and learned of the Studio class.

> Working with these students was a joy and thrill. We appreciate the level of enthusiasm they contributed to the project ideas. This was a "plus" to them, as well, since they were working with a real client....

We look forward to seeing where the impact of students in the Studio experience takes us. (Larry Anderson, email message to author, September 28, 2010.)

Because the projects in client-based studios are real, faculty must have a mechanism in place to "finish" or revise the projects if necessary. In the case of the 2010 EDI Studio, that mechanism is EDI itself.

Knowing that EDI staff members and student workers are available to continue work on a project takes the pressure off the EDI Studio to produce a final product, allowing the EDI faculty to steer the project toward pedagogical goals without worrying about the client's reaction to that decision. For example, none of the nine studio teams explicitly emulated the design of the Frisco school. Had this been a problem (it was not), EDI had the capacity to provide an alternate project after the studio work was complete.

Next Steps

The faculty associated with EDI are interested in pursuing future EDI Studios. Ideally, these future studios will be topical studios, allowing students from architecture, interior design, and perhaps building construction science to "opt in" to the client-based studio.

Furthermore, the EDI faculty would like to continue research into other programs that provide client-based studios, with the ultimate goal of placing the EDI studio into the relevant curricula at Mississippi State.

Although the literature addressing client-based studios is not extensive, it should be noted that a growing number of publications suggest a demand for client-based studios:

> [M]ost architecture schools place no emphasis on the role that clients and users play in the design process. In most studio projects, the client and users are merely fictional characters described in the design problem handout. When students are not encouraged to consider the role of the user in the design of a project, design habits and ideas are formulated by theoretical explorations void of critical cultural and social considerations…. Yet, upon graduation, students will be asked to enter a world where they must design for someone other than themselves or their instructors. (Koch et al. 2002, 20)

The 2010 EDI Studio suggests that students can successfully address "critical cultural and social considerations" without damaging their intrinsic design skills. [1]

Bibliography

Bain, Ken. What the Best College Teachers Do. Cambridge, MA: Harvard University Press, 2004.

Koch, Aaron, Schwennsen, Katherine, Dulton, Thomas A., and Smith, Deanna. The Redesign of Studio Culture: A Report of the AIAS Studio Culture Task Force. New York: American Institute of Architecture Students, 2002.

Maturana, Beatrice C. 2010. "How Spike and the Slumdweller Find Reality in Design Studio Handouts: An Exploration of Reality in the Design Studio." International

Regionally Inspired, Regionally Designed, Regionally Constructed: Material Selection and the Ethics of Making

Gregory Thomson
thomsong@uwm.edu
Assistant Professor
The University of Wisconsin—Milwaukee
Department of Architecture
[Paper Presenter—Session 3A]

Abstract

From 2007 to 2009, the University of Wisconsin – Milwaukee Department of Architecture (UWM) participated in the U.S. Department of Energy Solar Decathlon Competition. For the students and faculty at UWM, the conceptual framework, and pedagogical intent of the project, was not simply to answer the question of *"what is making?"* but to simultaneously increase depth and breadth to include the questions *"why"* and *"how."* By asking *"why are we making?"* and *"how are we making?"* the project must, of necessity, be placed into a larger context – where decisions take on broader and deeper ethical meaning with respect to environment, economy, and society.

Out of the network of interlocking questions for the design team, the questions focusing on the selection of materials are the emphasis of this paper. Of primary importance was the creation of a decision making structure for selecting materials. The project conceptual framework is best described as "regionally inspired, regionally designed, regionally constructed." While this construct has clear connection to theoretical approaches to building and place as argued by Frampton and Norberg-Schulz, it pushes *critical regionalism* and the *genius loci,* respectively, to address the ethics of material choice and their impact on economy, environment, and society. By applying the questions *"why are we making?"* and *"how are we making?"* as criteria to the selection of materials, the UWM team began to address the responsibility of the designer to be aware of the difference between *shopping for* materials and *designing with* materials – creating a process for making ethical decisions about materials and making in a global economy using qualitative criteria interconnected with quantitative ones. The intent of the decision making structure was to engender a process by which materials were selected for high performance, and minimal environmental impact, with maximum connection to locality and benefit to community. In this context trade-offs and compromise become evident, and issues of aesthetics, performance, cost, and feasibility were weighed against one another.

The Project

From 2007 to 2009, the University of Wisconsin – Milwaukee Department of Architecture (UWM) participated in the U.S. Department of Energy Solar Decathlon Competition. The Solar Decathlon is a student design-build competition emphasizing the creation of a net zero energy building to be displayed, and tested, on the National Mall in Washington, DC. The competition is held biannually, and is international in scope, with a highly selective entry process.

The Problem of Making

For students and faculty at UWM, the Solar Decathlon was less about entering a competition for a zero energy home, and more about the experience of a design-build project. A project the scale of a house is complicated by the absence of a tradition of making, both at UWM and in general amongst the pool of students comprising the student body.

In student design-build projects, keeping in mind *"who is making"* is crucial. Steve Badanes, the director of the Neighborhood Design/Build program at the University of Washington, has described the steady decline in the understanding of materials and construction processes among students of architecture. As the U.S. has moved from an agrarian society and economy to one that is urban, students in schools of architecture have become divorced from the realities of construction. They no longer know how materials feel, or respond to being worked, nor do they understand how materials come to be their ubiquitous dimensions. A 2 x 4 is something that is found at a lumberyard. It is not a tree, or a rough piece of lumber, or even something that one could create using a table saw, a joiner, and a surface planer. This disconnection was made clear to this author in two distinct and connected experiences while working on the Solar Decathlon.

Fig. 1: The UWM Solar Decathlon project, on site in Washington. D.C. October 2009. Courtesy of Joseph Rice, UWM Solar Decathlon.

The first experience with the problem of making occurred during conceptual design. Investigations into roof form and structure were in process. During review of the design, the author worked directly with the student built digital model. Unbelievable, but true nevertheless, was that fact that no two members were the same dimension, and no dimensions were either off-the-shelf nominal dimensions, nor dimensions that could be arrived at except for without any thought of measurement. Unless the intention was to epitomize the *genius loci* of the primitive hut in the Wisconsin woods, there could be no other explanation than student unfamiliarity with materials and process of assembly.

The second experience with the problem of making occurred during fabrication of the building itself. The team was fortunate to have access to a supply of FSC© certified wood from the Aldo Leopold Foundation, some of which was planted by Leopold himself. This material has a significant monetary, cultural, and environmental value. The materials were rough-cut, and required milling from actual 1" x 4" dimensions to nominal 1x4 (actual 3/4" x 3 1/2"). In order to accomplish this students were trained to not only use the equipment (table saw, joiner, and surface planer), but also to learn to read the material (direction of grain, type of imperfection, e.g. warp, wain, twist, bow). Students learned how to design and fabricate a 1x4 with their hands, eyes, and industrial equipment. They learned that a nominal 1x4 cannot be created out of material that is already 3/4" thick, and still has one side to be surfaced. This lead to the second lesson: anything less than perfection with a scarce resource is unacceptable. Using only 75% of a 1x4 is grossly inefficient for three reasons. One: FSC© materials are financially costly; two: working with material hand planted by one of the most important environmental stewards in the U.S. is a once in a lifetime opportunity; and three: one careless pass over the joiner (less than five seconds) can render useless that which took fifty years to grow.

The Why and the How

"Early industries relied on a seemingly endless supply of natural 'capital.' Ore, timber, water, grain, cattle, coal, land."[1] We know this to be far from the reality of our current condition, because we know that globally resources are part of a finite system. "Our ancestors' morality was based on the axiom that man himself was the only living being that could be harmed by human actions… Today… [t]he way in which we manage natural resources may have irremediable consequences for future generations of all life forms. Paradoxically, we still cling to antiquity's anthropocentric moral philosophy, often mingled with some of the Enlightenment's mottos of man's sovereign supremacy."[2] It is for this reason that questioning why and how things are made is important. And the knowledge requires architects to be personally and professionally obligated to change their behavior to match this reality.

Why Are We Making

By asking *"why are we making?"* the UWM Solar Decathlon team began searching for answers to a series of questions, some rhetorical, some banal, but most complex and layered. The obvious answer is that making was required as part of a competition. Specifics of the making were clearly delineated by the organizers: life safety, height restrictions, and bearing capacity soil, for example. Another reason for making was our own edification (students, faculty) and that of the public. From this author's perspective it is of vital importance that architecture programs engage the public in the questions of *"why"* and *"how we are making."* Architecture, as a profession and educational pursuit, is misinterpreted in much of the U.S. By engaging people outside of the discipline, students, of necessity, must make their intentions clear, in clear language. This critical reflection on process and thought is an invaluable skill in the life of a designer, and is central to understanding *"why"* and *"how"* we are making.

The Permanence of Building

Out of this critical reflection on the question of *"why are we making?"* one of the most interesting ethical questions arose. Why are we making a building for an event that is only twenty-one days long. Like an exhibition of visual art, which can vary from hours to months, but has a permanent and lasting impression on those that see it, so too does the Solar Decathlon. Despite this certainty, two years of planning, design, and construction for three weeks of assembly, exhibit, and disassembly, makes it hard to argue for an ecologically responsible project. It is at this point that the inquiry engages issues of permanence and repurposing of buildings and materials.

As Fernandez writes in his book *Material Architecture*: "The material reality of typical buildings is not the static and unchanging permanence that monumental architecture aspires to."[3] He also states that "[i]t is reasonable to suppose that enhancing the knowledge of materials, traditional and novel, will improve the ability of designers to better respond to contemporary needs and produce a more humane built environment that also serves the contemporary imagination."[4] In the context of the Solar Decathlon, the issues of permanence and repurposing unfold to reveal three base conditions that will be answered by asking *"why are we making?"* Are we making an object (building) that is disposable, recyclable, or reusable? By engaging in the evaluation of materials, the team hoped to better understand which of these conditions best responds to contemporary needs.

In any building there are elements that are sacrificial, in order for the larger whole to survive. But, given the duration of the event, there is an argument for a building with only the capacity to last as long as the event. The ethical question of a disposable building is no more complex than the wastefulness of resources used in its creation, be those measured in time, physical and mental effort, money, or materials. "The recycling of used building materials is becoming necessary because of our diminishing natural resources, the increasing scarcity of dumps and landfills for the disposal of debris, and out of concern for the energy investment those materials represent."[5] On the material front, there is ample evidence that disposing of buildings outright is not longer the ethical path. Deciding which parts are disposable cannot be left to chance or expedience.

The creation of a temporary building is easier to rationalize, and argue for in the case above, if pieces of the building are seen as not just disposable, but rather recyclable. Conceptually a recyclable building is a perfect thing. Materials and

components go in when it is new, and when they have reached their useful lifecycle they go out. This is all part of contemporary practice where "[b]uildings use and discard materials in huge quantities.."[6] The constuct William McDonough proposes is one where there is zero material entropy. All materials would be recycled in parallel flows, with no loss of function or integrity. The existing framework for reuse and recycling of materials is much less ordered. Ensuring that recycling of building materials and components is possible the system needs to have innovation on both the original material manufacturing side, and the recycled product side. "Equally important," is the need for "ready markets for the recycled material to go into useful objects acceptable to the public."[7] Identifying ready markets for local materials (both in and out of the recycling stream) became part of the UWM framework for evaluating materials.

This does not, however, answer the question of permanence and repurposing in its entirety. Buildings do not exist in perpetuity, particularly those that are not monumental in their materials and design. The reality is that all buildings exhibit characteristics of all three typologies of construction: disposable, recyclable, and reusable. It is simply a question of which parts are which – and up to the responsible designer to ensure that those parts that are disposable/recyclable/reusable are placed in the optimal location with the optimal function to realistically become part of a "ready market" rather than a waste stream.

How Are We Making

The question of *"how are we making?"* demands inquiry into a variety of subtexts about architecture generically, and architectural education and practice more specifically. For this argument we will include those practices at the periphery of architecture where it overlaps with construction and construction management.

To create an object (a building) with a long life span that is reusable, recyclable and disposable is the ultimate goal of a number of philosophical approaches to the act of making. The degree to which these philosophies are dogmatic about limiting the application of materials below a certain standard of future function is the primary variable. For example the *Cradle-to-Cradle* construct envisions no loss of technical or biological mass: waste equals food.[8] Whereas *Open Building Systems* uses interchangeable parts, and the *Living Building Challenge* promotes self-containment of all energy and water resource demands.

There are certain facets of a building constructed for longevity that are mutually exclusive of a building constructed for recyclability, as there is of one constructed for reuse. A building with a long life span, of necessity, must be made of very durable materials, which have been trending toward disuse in contemporary construction. There are, without question, highly durable, naturally occurring materials – stone immediately comes to mind. But, like all things, there are shades and categories of durability, workability, and availability. Materials that are aggregates or composites of natural materials, designed for durability, often become unrecyclable. "[G]iven the changes in materials used in

construction and the prospect that current trends of increasing lightness, more synthetics and composites, tighter assemblies of multiple layers will continue, then the value of recycling many building materials becomes questionable."[9] On the other hand, buildings designed with flexibility in mind can create circumstances where the individual flexibility of components leads to quick deterioration of critical components. For example, connections are the most frequently damaged, but, more complex connectors rely on those doing the disassembly being of the same skill level as those doing the assembly. This discussion becomes one of trade-offs based on professional values about what should be reused, recycled, or disposed.

The Shopping For or Designing With

Anecdotally, the practice of making in the architectural profession has become enthralled with the appearance of materiality and materials, and less critical of the impact of those materials on economy and environment. This is, in part, due to the scale and reach of the building materials industry, and the global economy that creates the possibility of using new and exotic materials in a manner that is cost effective and easier than previously possible. The UWM Solar Decathlon team struggled with this model, being successful in some areas and unsuccessful in others. This is neither a unique nor new dilemma in the marketplace of green building.

Perhaps the biggest challenge to the creative thinking required for addressing the question of *"how are we making?"* is the existence, in the U.S., of substantial fiscal and scheduling pressure to use "off-the-shelf" materials. Industrial production of building materials and components in the U.S. is based on minimizing the cost of production by manufacturing a limited number of standard materials and components. This practice has reduced the cost of production, but has made the ability to work outside the standard set of materials and components costly in both time and money. In the design of the UWM Solar Decathlon project there were many places where using the off-the-shelf products simply made sense. Structural materials are easy to find for wood frame buildings. The question then becomes not what, but how are we going to meet our needs. Is solid lumber preferred over engineered lumber? What drives this decision – structural performance, cost, appearance, or local material harvest? What are the impacts of our decisions on local economies and social structures? Is there a solution that fulfills all of our requirements?

A Framework for Decision Making

Creating new practices for material selection in this specific design-build setting was central to the project goal of developing a net zero carbon building for construction and operations. (Where carbon can be described as CO2-e, which is inclusive of all green house gases.) Establishing new practices for the making of buildings implies that we know what the existing practices are, and why they may not apply to our current condition. As William McDonough writes of the Industrial Revolution, "[t]he attempt to impose universal design solutions on an infinite number of local conditions and customs is one manifestation of this principle [of brute force] and its underlying assumption, that nature should be

overwhelmed… to make such solutions 'fit.'"[10] Understanding that a net-zero carbon building cannot be constructed using existing solutions was an underlying assumption of the project.

Developing a tool to evaluate the impact of materials allowed the UWM Solar Decathlon team to look past the "universal design solution," and toward a solution based on dependant relationships. Other systems and techniques exist for the selection of environmentally friendly materials. Of those, three were identified for developing the base criteria. *Cradle to Cradle* was used for it's philosophical approach to the problem, while the *Handbook of Sustainable Building: An Environmental Preference Method for Selection of Materials for Use in Construction and Refurbishment*, and the *Construction Materials Manual*, were used for their technical merits. These sources were used to design the decision-making framework.

Like Wooley and Kimmins, the UWM Solar Decathlon team was reluctant to create a system by which the designer simply is given an answer based on a table or chart. The design of buildings demands more interaction from the team, therefore a passive system of selection wasn't deemed appropriate. "[W]e have not attempted to create a standard system of classification so that users only need to apply a formula or simply give numbers to particular materials or products. Our aim has been to empower the user of the information to reach his or her own conclusion on the basis that they will do the best they can within the limits of current technology."[11]

While architects engaged in pushing forward material and design praxis chafe against the inertia of standard details and components, the reality of their use has allowed for a broad set of typical assemblies to be analyzed for their environmental impact. The Athena Institute has created a database of commonly used assemblies that allows for the assessment of the more prosaic buildings being built. This, however, is not a tool flexible enough to address the issues customized assemblies or emergent materials. Because "[l]ife cycle analysis is a complex and time consuming activity… essential [to the making of] a comprehensive analysis of the environmental impact" of materials it is necessary to develop a set of practices that has flexibility in application.[12] This flexibility is what fits with the design process; because it engages the designer in the decision making, rather than depending on a matrix or index to give the answer.

Empirical and Phenomenological

The UWM approach to materials selection necessitated a balance between empirical information and phenomenological presence. The design team believed that using the CO2-e data from the *Construction Materials Manual* created a picture highlighting the distinction between materials with processing embodied energy (e.g. concrete), and those with natural growth cycles embodied energy (e.g. wood). The choice of references echoes the desire to draw attention to renewable resources and non-renewable resources. "[S]cientists attempt to measure the environmental impact by establishing indices which can measure emissions, life cycle impact, disposal costs, energy used and so on are vital, but it is a mistake to assume that the issue can be brought down to sets of figures. Instead someone, somewhere has to take decisions or make assumptions as to what is or is not good or bad for people and

the environment."[13] It is at this point in the argument, where creating the decision-making structure intersects the design process – resulting in the need to take an ethical stance.

Phenomenology of Materials

The UWM Solar Decathlon team dictum for guiding decisions for the project was "regionally inspired, regionally designed, regionally constructed." Meaning: the form and aesthetics of the building were to be inspired by the physical context of the region, materials used to manifest the formal argument were to be selected from available regional materials and components, and the manufacture and fabrication of those materials and components were to take place within the region.

The physical experience of the building, inside and out, was as important as the visual experience. The phenomenological experience of the building is one that emphasizes a choice of materials that preferences familiarity to context. Local materials from solid hardwoods, to composites of agricultural waste and new materials made from local, urban waste streams are all used. (See Fig. 2) The potentials of using the phenomenology of locality is replete with inquiry about the *"why"* and *"what"* of making. The UWM Solar Decathlon pulls from a broad spectrum of influences, addressing regionalism from formal, aesthetic, and material perspectives. By placing value in a deeper and broader sense of the regional character of the building, the UWM Solar Decathlon team placed an emphasis on linking context (physical location), climate (bioclimatic condition), and cultural (socio-political-economic framework) issues into a framework for decision-making.

Fig. 2 Zones indicating miles traveled by materials for the UWM Solar Decathlon. Local materials by their very nature reduce the fiscal and environmental cost of transportation. This has two benefits. It preserves the use of valuable, high-grade energy sources (fossil fuels) for use in the creation of other necessities (energy), and minimizes impact of emissions. UWM Solar Decathlon.

This stance requires one to think critically about regional and local building traditions and materials, and how the theory of the *genius loci* and the rigor of *critical regionalism* can bend to accommodate a framework for material selection that is regionally specific. The power of place is as much embedded in the materials of that place as it is in the formal relationships of volume and tectonics. Perhaps an approach to *critical*

regionalism and the *genius loci* in the context of ecologically responsive and responsible design in one that acknowledges the power of place in the naturally occurring resources as well as those resources that have become naturalized through the creation of ecologies of reuse, recycling and waste.

environment	Renewability (GENERATIONS REPLACEMENT)	A ratio for the lifespan of a material compared to the time it takes for the materias to be renewed, e.g. wood has a good ratio with trees being able to grow in 30 years and providing wood that can last 60 years.
	Lifespan (YEARS)	The longevity of a material for its intended purpose, e.g. steel has a much better lifespan compared to wood.
	Reuse Potential (CYCLES OF REUSE)	The ability for a material to be reused after its intended purpose, e.g. wood can be reused in many ways while SIP's have very limited reuse potential.
	Recycled Content (% RECYCLED CONTENT)	recycled materials versus materials made from virgin material, acknowledging differences between post-industrial and post-consumer
society	Material State (CO2-E)	Comparing the amount of processing required for various materials from a raw state to a finished state e.g. a wood beam has a low amount of processing required.
	Building Load Impact (U-FACTOR)	This aspect favors passive systems that require no additional electricity over systems that consume energy and produce heat adding to the required cooling load and requiring more energy use.
	Volatile Organic Compounds (NUMBER)	Some materials contain VOC's which can cause health problems in people as well as more problems for the environment, materials with low VOC's or no VOC's at all were favored.
economy	Economy (DOLLARS / MILE)	68% of dollars spent at locally owned and operated business stay local. The use of local materials from local craftsmen and suppliers will help contribute to the local economy.
	Distance Traveled from Source to Site (MILES)	Required transport for materials adds to the carbon footprint of a building, so local materials were favored for their close proximity to the site.
	Cost per Unit (DOLLARS)	An economic aspect ranking materials on their overall cost compared to a similar material compared to other systems where the lowest cost is the main deciding factor, this system weighs this aspect equally with other aspects.

Fig. 3. Table of Criteria for Evaluating Materials Based on Environmental, Economic, and Social Impacts. UWM Solar Decathlon.

Environment, Economy, Society

To address the ethics of material choice and the profound impact on society, economy, and environment, the argument for the UWM Solar Decathlon project was based on the assumption that local is better. This argument is based on the standard tripartite argument for sustainability: in order to not impact the capacity of future generations to survive the current generation must ensure that environment, economy, and society are all considered equally. If processing must be local, and if processing must have no negative impact on the health of social systems, then using local materials will not negatively impact the health of natural systems – therefore creating a balanced Venn diagram of society, economy, environment.

The Criteria

The environmental impact of material selection in the design process is well-documented, despite this there is not an accepted standard for assessing the depth and breadth of that impact. There are, however, commonalities across most of the systems used to rate materials. According to John Fernandez, "[t]he most commonly applied metrics assigned to the environmental impact of building materials are embodied energy, toxicity and fraction recycled."[14] For the UWM Solar Decathlon team these issues did not address a complex problem, but were a good starting point. The criteria needed to fall into three categories – environment, society, and economy; standard triple bottom line boxes, (see Fig. 3.). The environment box contains criteria for *lifespan, renewability, reuse potential,* and *recycled content*, as these directly impact cycles of growth and resource regeneration. Those criteria addressing society were *building load factor, volatile organic compounds*, and *material state*. Economic criteria were limited to *local economy, distance*, and *cost*. Our goal was to examine environmental issues as dictated by material lifespan, societal issues in terms of CO2-e emissions, and economic issues as characterized by how compact the distribution of dollars was.

Conclusions

The real lesson learned was that creating categories that allow for legitimate comparison or analysis is incredibly difficult. One of the primary reasons for this complexity is the complexity of the materials themselves. Many contemporary construction materials are "being engineered for a minimum of materials with the use of many more adhesives."[15] One of the categories that floated in and out of our analysis was *multi-functionality*. Many building products are multi-functional, e.g. structural insulated panels (SIPs), which can be structure, weather barrier, and moisture barrier. But by having this number of functions, their capacity for reuse and recycling is diminished. Is this good or bad? Or is it just a value judgment that the designer needs to address. This composite characteristic is the most complex part of the equation. It requires the development of an approach to building that allows for comparing longevity of materials and assemblies to their need for longevity based on the energy investment in their creation. Architects need to be more careful about not only what materials they select, but where they are placed in the building. The design of buildings must be given a new level of responsibility, in order to prevent undo waste of materials

by changing the building unnecessarily or because of poor original design. "[N]o human activity that uses energy or materials is sustainable, no matter how renewable the material.[16] For this reason, taking inspiration from regional conditions, based on the availability of regional resources and capacities will, at the very least, make us aware of the degree to which we are, or not, aligned with the globalized building industry, and, as Frampton states, it will create a condition that remembers that value of being "opposed to the tendency of 'universal civilization.'"[17] As for the creation, and use, of a system for rating materials, our conclusion was that the act of making the rating system promoted generative discussions, debate, and engagement, among students, of the issues, which would not have happened by using an existing system.

[1] McDonough, William and Braungart, Michael. "Cradle to Cradle: Remaking the Way We Make Things." North Point Press, New York, NY, 2002. P. 24.

[2] Berge, Bjørn. translated by Chris Butters and Filip Henley. "The Ecology of Building Materials, 2nd ed." Elsevier/Architectural Press, Boston, MA. 2009. P. xiv.

[3] Fernandez, John. "Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction,"Architectural Press, Burlington, MA. 2006. P. 6.

[4] Ibid. P. 6.

[5] L. Reed Brantley, Ruth T. Brantley. "Building Materials Technology: Structural Performance and Environmental Impact." McGraw-Hill, New York, NY. 1996. P. 44.

[6] Fernandez, John. "Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction,"Architectural Press, Burlington, MA. 2006. P. 58.

[7] L. Reed Brantley, Ruth T. Brantley. "Building Materials Technology: Structural Performance and Environmental Impact." McGraw-Hill, New York, NY. 1996. P. 214.

[8] McDonough, William and Braungart, Michael. "Cradle to Cradle: Remaking the Way We Make Things." North Point Press, New York, NY, 2002. P. 92.

[9] Fernandez, John. "Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction,"Architectural Press, Burlington, MA. 2006. P. 68.

[10] McDonough, William and Braungart, Michael. "Cradle to Cradle: Remaking the Way We Make Things." North Point Press, New York, NY, 2002. P. 30.

[11] Woolley, Tom, Sam Kimmins. "Green Building Handbook: Guide to Building Products and Their Impact on the Environment, Vol. 1." E & FN Spon, London, UK. 1997. P. 8.

[12] Ibid. P. 5.

[13] Woolley, Tom, Sam Kimmins. "Green Building Handbook: Guide to Building Products and Their Impact on the Environment, Vol. 2." E & FN Spon, London, UK. 1997. P. 5-6.

[14] Fernandez, John. "Material Architecture: Emergent Materials for Innovative Buildings and Ecological Construction,"Architectural Press, Burlington, MA. 2006. P. 105.

[15] Ibid. P. 68.

[16] Ibid. P. 105-106.

[17] Frampton, Kenneth. "Modern Architecture : A Critical History." Oxford University Press, New York, NY. 1980. P. 327.

Thinking More, Designing More, Making More:
Abbau and the Expanding Capacities for Architecture

David Fortin
david.fortin@montana.edu
Assistant Professor
Montana State University
School of Architecture
[Paper Presenter—Session 3A]

Abstract

Based on recent work by our university on housing design strategies for Nairobi, Kenya, and the concept of *Abbau* (un-building), this essay examines current shifts in architectural thinking towards systems and networks over spatial or object-oriented design. The complexity of urban networks is often treated as auxiliary to our professional responsibility to 'the building' or 'the thing', rather than understanding the building as one component of a much larger system. Led by an emerging wave of architects, most notably Teddy Cruz, there is expanding interest in transcending the spatial and phenomenological capacity of architecture to simultaneously embrace the social, economic, cultural and even political aspects of design. This systemic approach, which depends on better understanding the myriad networks acting on and through design, is necessitated by a global urban condition where vast economic and social disparities have led to misrepresentations and misunderstandings of the city as a series of compartmentalized spaces with impenetrable boundaries. Posited here is the question of making and its limitations if considered solely in its material capacity. Making is recognized as a physical act with physical and poetic dimensions, but it is also a social act, a cultural act, and potentially a political act. If these aspects of making are ignored in favour of solipsistic approaches to design that fixate on sensorial experience and/or object-based formalism, the comprehensive capacities of architecture are swiftly compromised along with the potentials for the societies they serve. Making architecture is here considered as having the capacity to provide beautiful and engaging spaces, but also contribute to social, economic, cultural, and even political aspects of our environments. These are not added to the designed object but rather form it, architecture acting multi-dimensionally as a truly sustainable endeavour (comfort, energy/material efficiency, job creation, income generation, cultural relevance, socially beneficial, etc.). Such an approach offers the act of making the possibility to extend and proliferate in other beneficial ways, architecture supporting inhabitants in making their own communities and neighbourhoods, making themselves heard, and even remaking themselves as dignified citizens.

We have hitherto failed in our comprehension of life mainly because we have been involved in the absolute method of dealing with things – have been more intent on discovering what units are for themselves than finding out how they are related and influenced by the systems to which they belong.[1]

> E. Noble, "Purposive Evolution," quoted in William Morton Wheeler, *Emergent Evolution and the Development of Societies* (1928)

Un-Building, Un-Dwelling, Un-Thinking

The issue of how to *make* more inclusive and equitable societies is a timeless and comprehensive one. However, while concerns over inadequate housing has existed for hundreds of years, as aptly discussed by others such as Robert Neuwirth,[2] informal settlements today owe much of their formation to the emergence of the industrial city. Friedrich Engels' description of nineteenth-century Manchester, for instance, where "one penetrates into this chaos of small one-storied, one-roomed huts, in most of which there is no artificial floor," could easily describe living conditions for an increasing percentage of the world's population today.[3] For Lewis Mumford, such disparity was entrenched during early industrialization, through *laissez-faire* economics and capitalist ideologies, where the belief that "maximum public good through the dispersed and unregulated efforts of every private, self-seeking individual" would ultimately prevail.[4] Such principles, founded on the protected autonomy of the 'atomic individual' over communally-centred development, for Mumford, led to widespread utilitarianism including a significant reduction in government functioning, and resulting in a socially neutral process that merely supplemented "the old privileged classes with a new one."[5] To elucidate the effects of such urban utilitarianism, Mumford employs the notion of *Abbau* – or un-building – to describe how industrial processes such as mining brutalized the previously intricate and balanced relationship between natural resources and human use (i.e. agriculture). The various factories and railroads supporting the industries propagated a grossly unbalanced and simplified society based on material exploitation and the unadorned goal of wealth and progress. Citing entomologist William Morton Wheeler, Mumford argues that such a simplification of society ultimately brings about "an evolution downward, toward simpler and less finely integrated organisms."[6]

While the overall networks that emerged from industrialization were observably complex, the "natural balance of organisms within their ecological regions," according to Mumford, "was upset, and a lower and simpler biological order...followed Western man's ruthless exploitation of nature for the sake of his temporary and socially limited profit economy."[7] Through the process of urbanization in industrial societies, all resources - including laborers - became straightforward calculations for maximizing profit, while protecting the system through such institutions as human desire and comfort. Describing the techno-totalitarian and simplifying capacities of such industrial and commodity-driven societies, Herbert Marcuse writes,

> The products indoctrinate and manipulate; they promote a false consciousness which is immune against its falsehood. And as these beneficial products become available to more individuals in more social classes, the indoctrination they carry ceases to be publicity; it becomes a way of life. It is a good way of life - much better than before - and as a good way of life, it militates against qualitative change. Thus emerges a pattern of *one-dimensional thought and behavior* in which ideas, aspirations, and objectives that, by their content, transcend the established universe of discourse and action are either repelled or reduced to terms of this universe.[8]

More recently, David Kolb has described our late-capitalist society in similarly simplified terms.

> Advertisements entice consumers to become simplified versions of parents, workers, bosses, and tourists, one after another. Single-issue politics simplifies political complexities. Modernist urban planning tried to break cities and lives into homogenous zones for residence, work, recreation, and commerce.[9]

It is ultimately within such a compartmentalized urban framework, with hard lines drawn and fortress walls constructed between the haves and have-nots, that slum communities have steadily proliferated around our planet.[10] Authors such as David Harvey and Edward Soja have long cautioned us about the spatial and social implications of capitalist ideology when it comes to urban space,[11] and it is increasingly impossible to disregard their positions when travelling to global cities today.

It is against such perceived simplifications in capitalist un-building, that many architects have attempted to recapture the atrophied experience of our world through a re-building effort centred on physical structure and space. Yet, combined with its historical bias towards the visual, this has arguably led to a certain fixation on the physically constructed environment at the expense of the other essential aspects of design. Recognizing the limitations of narrowly objectified design process, architects have turned to philosophers such as Martin Heidegger for more meaningful directions, often related to his notions of poetry and craft. "Making is, in Greek, *poeisis*," he writes.[12] However, alluding to an oversimplification of the term 'building', Heidegger further notes that cultivation (as linked to the notion of *bildung*) and construction (through the raising of actual edifices) frequently claim the name *bauen* (building), at the expense of what he calls the "real sense of *bauen*, namely dwelling..."[13] The overemphasis on making as a physically-oriented process of material and tectonic expression

arguably aims to re-build industrial society through craft, but this clearly cannot comprehensively address what Heidegger meant by dwelling. Approaches to architecture oriented solely towards subjective interpretations of objects and space remain fixated on, and limited to, a certain scale of components - the detail, the object, the building - in the hope that they might enhance one's world experience primarily through sensorial engagement. While presenting a worthy effort to counter the existential vacuum resulting from Mumford's industrialized *Abbau*, Marcuse's one-dimensional society, or Kolb's simplified culture, this ultimately reverts back to the very one-dimensional process it aims to counter.
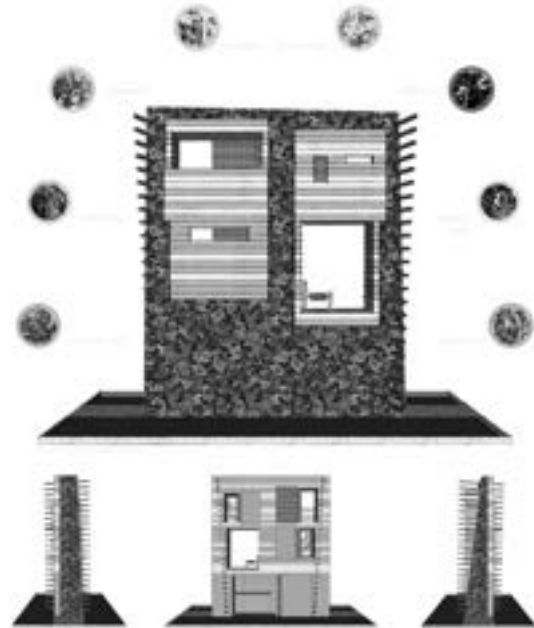
Fig. 1. Student work by Kara Miller. Wet-core scheme also acts as a vertical farm to address malnutrition and offer potential economic generation. Security issues and incremental building also addressed.

Related to the housing crises in our global cities, architects have, until recently, been evidently perplexed at how to best intervene. Decades of emphasis on the sensorial-based building-as-object, left the profession without a sound understanding of the role for design in improving these communities. Architects such as John Turner and John Habrakan attacked slum upgrading projects for their dismissal of informal systems and community structures, but added little to the question of design beyond basic wet-core schemes and more autonomy in the self-construction of homes.[14] Aside from these contributions, it is apparent that design strategies have largely remained focused on the physical structure as an awkward architectural remedy for the explosion of slums globally. For San Diego-based architect Teddy Cruz, such strategies, including the benevolent efforts of respectable organizations such as Architecture for Humanity, fall victim to solving "short-term problems, not communities in the long term," which results, for Cruz, in an even wider gap between 'formal' and 'social' approaches to design.[15] The building-as-object here fails to have any significant effect on the essential issues cultivating economic and social disparity and therefore handcuffs the capacities of architecture in these realms. Related back to Heidegger's building-as-dwelling, we might reconsider Christian Norberg-Shultz's acute observation that "true freedom presupposes belonging, and that 'dwelling'

means belonging to a concrete place."[16] A concrete 'place' is not simply a matter of a robust physical structure, but instead implies the systemic condition of that place as linked to health, security, education, social interaction, political representation and policy, and so on. Hence, it is the overall *settlement system*[17] that must ultimately be considered.

Abbau as Complex Making

The above discussion of *Abbau* largely centers on the simplifying capacities of un-building, but we now shift to Mumford's observation of the complexity that simultaneously occurs in industrial urban systems. Again citing Wheeler, he writes that there is an evolutionary process where complication and simplification emerge concurrently, and that this can often occur in the same organism.[18] We here recognize an opportunity in the un-building of society, in the deconstruction of the traditional city into its compositional elements in order to better understand their interdependencies and ultimately improve it. As Heidegger writes with regards to phenomenological philosophy,

> ...there necessarily belongs to the conceptual interpretation of being and its structures, that is, to the reductive construction of being, a *destruction* – a critical process in which the traditional concepts, which at first must necessarily be employed, are de-constructed down to the sources from which they were drawn. Only by means of this destruction can ontology fully assure itself in a phenomenological way of the genuine character of its concepts.[19]

Given that he describes dwelling as "*the basic character* of Being"[20] the above quote gains relevance in any discussion on building and making. The implication by Heidegger is that to better understand dwelling, in an existential sense, requires a critical understanding of the sources or concepts forming it. Thus, de-construction is part of a tri-fold method that includes re-duction (where there is a required apprehension of 'a being' to bring forth the 'being of that being'), construction (the "projecting of the antecedently given being upon its being and the structures of its being") and deconstruction.[21] One of Heidegger's essential points is that construction is necessarily deconstruction in that it breaks down traditional concepts in what he calls "a positive appropriation of tradition."[22] Deconstruction is, likewise, construction. This optimistic take on deconstruction was the basis for Jacques Derrida's highly influential use of the word during the 1970s. As he writes,

> ...I wished to translate and adapt to my own ends the Heideggerian word *Destruktion* or *Abbau*. Each signified in this context an operation bearing on the structure or traditional architecture of the fundamental concepts of ontology or of Western metaphysics. But in French 'destruction' too obviously implied an annihilation or a negative reduction much closer perhaps to Nietzschean 'demolition' than to the Heideggerian interpretation or to the type of reading that I proposed.[23]

Derrida's use of Heidegger's *Abbau* is thus not intended to simplify the system (as Mumford implies) but rather to take it apart in order to reveal its constitution. As Mark Wigley writes,

Derrida follows Heidegger's argument that this 'destructuring' or 'unbuilding' disturbs a tradition by inhabiting its structure in a way that exploits its metaphoric resources against itself, not to abandon the structure but to locate what it conceals.[24]

Despite his insistence that deconstruction cannot be reduced to an instrumental methodology given that it necessarily deconstructs itself, it implies an essential recognition of the *existential* value in better understanding the component through its myriad networks.

It is here that we return to current struggles to identify appropriate strategies for architecture with regards to the global housing crisis. By fixating on the building-as-object as the single aspect related to improving living standards in the slums negates the potentials of architecture to address the essential active systems (formal and informal) that are, as Koolhaas has noted regarding Lagos, clearly interdependent.[25] The building-as-object becomes the same hindrance for the architect that the delineated plan is for the planner, both falsely outlining their extents of context. Daniela Fabricus describes the inherent problems with such 'mapping' of the favelas (slums) in Brazil, writing that,

> ...a map of Rio de Janeiro can be drawn showing its favelas, and this map will resemble a sea filled with islands large and small, a city with many smaller cities and overlapping sovereignties. This map *could* render the favelas not as blind spots in the psychological and epistemic charting of the city but as places of spatial and urban consequence. But it would nevertheless divide urban space along a hard line: favela/not favela (or *morro/asfalto* – hill/asphalt – as it is locally called). The city appears as continuous and connected, while the favelas appear as isolated not only from the city but also from one another.[26]

The isolation of the 'informal' from the 'formal' recalls the negative aspects of *Abbau* as such categorization of physical space regresses back to conceptual simplification. Saskia Sassen similarly notes that focussing on the geographical boundaries of slums negates the essential links to other aspects of the city. Thus, she instead refers to informal settlements as analytic borderlands.

> In constituting [slums] as analytic borderlands, discontinuities are given a terrain of operations rather than being reduced to a dividing line...A topographic representation would capture the enormous discontinuity between the places and built environments of each informal economy and the financial or design district in a city, and fail to capture their complex economic interactions and dependencies.[27]

Sassen's notion of analytic borderlands begins to address the potential of *Abbau* to un-build false preconceptions of informal settlements and their relationships with the city. Considered as such, they counter the reductive tendency to conceptualize societies (and cities) as disconnected aggregates of individual components, a process Manuel De Landa links to 'phenomenological individualism'.[28] De Landa instead argues

that there the social ontology of systems should be considered, the properties of which emerge from the very interactions between the components, a "strict reciprocal determination between parts."[29] Significantly informed by philosopher Gilles Deleuze, De Landa asserts that societies are assemblages, "wholes characterized by *relations of exteriority*," not as aggregations of components but rather "the actual exercise of their capacities."[30] The components have the aptitude to stabilize or destabilize the system through Deleuzian processes of territorialisation and deterritorialisation (which can be material or expressive). One of De Landa's essential points is that of 'nonlinear causality', where external causes become 'triggers' and 'catalysts' that are deterministic *not* in a linear way, but rather "*increase the probability* of the occurrence of a given effect."[31] Hence, by deconstructing the oversimplified boundaries between informal and formal systems in a city, as Saskin argues, we find opportunities for design to act as such triggers or catalysts that might increase the probability of improved and more equitable 'dwelling.'

This brings us to the essential question of how, more precisely, design strategies emerge from a systemic approach to informal communities. For Kolb, the process of place formation (recall Norberg-Shultz's note that "'dwelling' means belonging to a concrete place") ultimately relies on "the degree of awareness and participation that is present or encouraged" in spatial and normative structures.[32] He asks the following essential questions:

> Can the place be lived as an active unification of the multiple factors resulting from its social and spatial divisions and unities? Does the place encourage inhabitants to be aware of their own processes of active interpretation and their resolution of multiple roles and demands?...Are there opportunities to participate in the reformation or reproduction of the place's spatial structures and social norms?
> [...]
> Does the place show explicit spatial or symbolic links and signs of its belonging within larger systems, social contexts, and their genetic processes?...Becoming aware of the larger processes involves being conscious of causal forces and political decisions, of their interactions and intersections, and developing possibilities for intervening in those processes.[33]

Fig. 2. Student work by Brian Johnson. A designed philanstery for six families that focuses on communal space, kinship structures, private/public spaces, and gender issues.

Related more directly to architecture and seemingly critiquing its interpretations of deconstruction in the late 1980s by architects such as Peter Eisenman, Bernard Tschumi, Coop Himmelblau, and Zaha Hadid, for example, Kolb argues that places should have explicit links and signs to their larger contexts, but be more focused on the "complexity of program than with spatial or visual effects."[34] He asserts that a square room "could exhibit far more social complexity" than a visually complex place because complexity "is not a matter of observing a place's web of possibilities but of acting within that web, maintaining and reproducing it."[35]

Cruz's work, largely focussing on the disparate conditions along the Mexico-USA border near San Diego and Tijuana, explores design strategies that transcend the building-as-object by embracing policy, economics, and political structures within the realms of architectural context. As if directly responding to Kolb's provocations, he writes,

> I would argue that a reversal of thinking must open the idea that architects, besides being designers of buildings, can be designers of political processes, economic models and collaboration across institutions and jurisdictions.[36]
> [...]
> As artists and architects, we can contribute to the rethinking of urbanism by designing and conceptualizing political and economic processes. But without an understanding of the conditions that produced this crisis—which can themselves be thought of as the architect's material—we will just be making public art or decorating the failings of misguided planning and selfish economics. This is what I consider to be the political in art or architecture: not the production of political architecture, but the construction of the political itself, towards an architecture of social relevance.[37]

The "conditions" emerge as the fundamental components of our settlement systems that we must deconstruct and reconstruct alongside conventional architectural analysis (climatic considerations, building code, materials, structure, sustainability, and so on). In this sense, *Abbau* is the un-building of more than individual building components and spaces, as explored in earlier postmodern architecture, but instead seeks complex understandings of the social, economic and political contributors to architectural space and program. For example, in San Diego, Cruz worked with local skateboarders to reappropriate a piece of municipal land by redesigning the space, but also through rewiring the various stakeholder and political relationships involved, the skateboarders forming into an NGO to facilitate their cause. His widely publicized "Manufactured Sites" project consists of designing a framework - physical and economic - for appropriate re-use of American housing components in Mexico. But perhaps most tellingly, are Cruz's design diagrams focussing on the various interest groups and people influencing and affected by the design process. While there is undeniably a question as to how effectively an individual architect can alone impact political and social processes, Cruz's approach is consistent with Bruce Mau's proposition for 'massive change' in that architects are but members of a much larger design network oriented towards long-term social and environmental sustainability.[38]

At our university we are similarly adopting systemic approaches to design thinking through a series of seminars and studios that inform an ongoing project with Kenyan architect Ronald Omyonga and students and faculty at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) in Nairobi. Inspired by Omyonga's vision for more socially relevant housing developments that better address the existing challenges for those living in the slums, we focus on the systems in place that might be reconsidered through the design of manufactured housing components. The housing components are not considered on their own, or in their assembly into the house (building-as-object), but rather as components of a much larger settlement system that includes job generation for those living in the slums and considers other social, economic and political factors. The best solution to improving the living conditions in the slums, as we have determined under Omyonga's guidance and in consideration of the existing settlement systems in Nairobi, is perhaps *not* to build directly in the slums but instead to address the housing shortage in the lower-middle income range. The business plan for the development is specifically designed to empower slum dwellers through skills training and income generation. Rather than handing out a short-term solution for the problem, we feel this model holds far more potential for acting as a catalyst for building-as-dwelling.

Pedagogically, diagramming exercises encourage students to consider the various issues linked to the housing industry. These have ranged from urban-rural relationships and micro-financing, to incremental housing, economic supplementation, houses that grow food, and increased water access, for instance. Furthermore, students from JKUAT provided a series of industry analyses to possibly identify latent potentials in existing manufacturing systems. A current graduate studio taught by Mike Everts examines how the factory itself holds the potential for positive social and economic influence, repositioning Mumford's reading of the industrialized factory closer to Heidegger and Derrida's notion of *Abbau*. Here the housing component is designed in full consideration of the place where it is manufactured, how that place affects the surrounding neighbourhoods, and how it links into the various informal and formal economic and social systems (including issues related to transportation and gender inequalities, for instance). These are considered the primary factors driving the designs, not the component, the house, the factory, or city independently. Instead, students are encouraged to design a manufacturing *system* focussed on positive social and economic change.
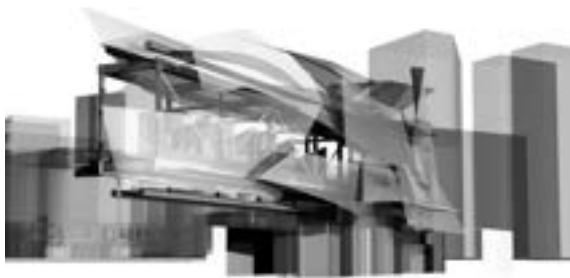

Fig. 3. Student work by Phil Ballard. Exploration of the synthesis between infrastructure and habitation where access to resources such as power and water are exposed and intertwined with daily living.

Summary

The implications of *Abbau* as a systemic design strategy offers architecture increased relevance in an economically and socially unpredictable future. Design has the capacity for social change, each component having the capacity to act as a catalyst for a more equitable world where more people have the potential to dwell in the truest sense. This requires a shift in the way we approach design, away from the building-as-object and instead towards building-as-dwelling. This requires architects to be more informed, aware, and active with regards to social, economic, and political issues shaping our societies, and embracing them as design opportunities for making a better world.

[1] William Morton Wheeler, *Emergent Evolution and the Development of Societies*. W.W. Norton and Company: New York. 1928. p. 9.
[2] See Chapter titled "The 21st Century Medieval City," in Robert Neuwirth, *Shadow Cities: A Billion Squatters, a New Urban World* (Routledge, 2005) 177-204.
[3] Friedrich Engels, "The Great Towns," in *The Blackwell City Reader*, Gary Bridge and Sophie Watson eds. (Wiley-Blackwell, 2010) 14.
[4] Lewis Mumford, *The City in History: Its Origins, its Transformations and its Prospects* (Harcourt Brace Jovanovich, 1961) 452.
[5] Ibid., 453.
[6] Mumford, 451.
[7] Ibid., 452.
[8] Ibid., 12
[9] David Kolb, *Sprawling Places*. University of Georgia Press: Athens. 2008. p. 54.
[10] See Chapter Four, entitled "Fortress L.A", in Mike Davis, *City of Quartz*. Vintage: New York. 1992. 223-263, and epilogue entitled "Down Vietnam Street," in *Planet of Slums*. Verso: London. pp. 199-206
[11] See David Harvey, *Spaces of Hope*, University of California Press: Berkeley, 2000, and "The Urban Process under Capitalism," In *The Blackwell City Reader*. eds. Gary Bridge and Sophie Watson (Wiley-Blackwell, 2010) 32-39, and Edward Soja, *Seeking Spatial Justice*, University of Minnesota Press: Minneapolis, 2010.
[12] Martin Heidegger, "Poetically Man Dwells," in *Rethinking Architecture: A Reader in Cultural Theory*, ed. Neil Leach (Routledge, 1997) 110.
[13] Martin Heidegger, "Building, Dwelling,Thinking," in *Rethinking Architecture: A Reader in Cultural Theory*, ed. Neil Leach (Routledge, 1997) 101.
[14] See John Turner, "Squatter Settlement: an architecture that works," in ed. Barbara Miller Lane, *Housing and Dwelling: Perspectives on Modern Domestic Architecture*, Routledge: New York, 2007 (originally published in 1968), pp. 310-314, and *Housing by People: Towards Autonomy in Building Environments*, Pantheon: New York, 1977, as well as John Habraken, *Supports: An Alternative to Mass Housing*, Urban Press: UK, 1999 (originally published in 1972).
[15] Teddy Cruz, "Foreword: Transcending the Foresight Divide," in The Architectural League of New York, *Young Architects 11: Foresight, 2009*. Princeton Architectural Press: New York. 2010. 10-11.
[16] Christian Norberg-Shultz, "The Phenomenon of Place," in *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965-1995*, ed. Kate Nesbitt. Princeton Architectural Press: New York. 1996. p. 414-428.
[17] This term is borrowed from an important exploration of urban and rural networks by Tony Champion and Graeme Hugo. "Introduction: Moving Beyond the Urban-Rural Dichotomy," in *New Forms of Urbanization: Beyond the Urban-Rural Dichotomy*. Ashgate: Hants, UK. 2008. pp. 3-17.
[18] Mumford, p. 451.
[19] Martin Heidegger, *The Basic Problems of Phenomenology*. Indiana University Press: Bloomington. 1975. pp. 22-23.
[20] Heidegger, "Building, Dwelling,Thinking," p. 109

[21] Heidegger, *The Basic Problems of Phenomenology*, pp. 21-23.

[22] Ibid., 23.

[23] Jacques Derrida, "Letter to a Japanese Friend." Available online at: http://everything2.com/title/Letter+to+a+Japanese+Friend+by+Jacques+Derrida (accessed: August 15, 2010).

[24] Mark Wigley, *The Architecture of Deconstruction: Derrida's Haunt*. MIT Press: Cambridge, Mass. And London. 1993. p. 42.

[25] *Lagos: Wide and Close* (2006), Dir. Bregtje van der Haak.

[26] Daniela Fabricus, "Resisting Representation," *Harvard Design Magazine*. 28. 2008. p. 6.

[27] Saskia Sassen, "Fragmented Urban Topographies and Their Underlying Interconnections." In *Informal City: Caracas Case*, eds A. Brillembourg, K. Feireiss, and H. Klumpner. Prestel: New York. 2005. p. 84.

[28] Manuel De Landa, *A New Philosophy of Society: Assemblage Theory and Social Complexity*. Continuum: New York. 2006. pp. 4, 8.

[29] Ibid., 5.

[30] Ibid., 10-11.

[31] Ibid., 20-21.

[32] Kolb, *Sprawling Places*, 55.

[33] Ibid., 55, 56

[34] Ibid., 62

[35] Ibid., 64, 67

[36] Cruz, "Foreword", 11

[37] Teddy Cruz and and Caleb Waldorf. "Learning from Tijuana." *triplecanopy* (2009), Available online at: http://canopycanopycanopy.com/7/learning_from_tijuana (accessed January 2, 2010).

[38] See Bruce Mau and the Institute without Borders, *Massive Change*. Phaidon: New York. 2004.

The Found Object

The concept of a found object is a point of discussion and a generator of personal emotion within various forms of art. Conventional artists who create two- and three-dimensional artwork in the form of paintings, sculptures, collages, etc. express themselves and culture in ways that spark either conversation or controversy. Artists may integrate found objects as a basic catalyst or eventual point of discovery within their chosen form of context. Incorporation of the found object may also allow a fourth dimension to the artwork as it interacts with spectators in varied depths of human senses over time. These three papers explore the found object as an inherent design element capable of descendant thought.

Just as an artist may repurpose materials to convey a creative means of expression, designers can allow both the physical and conjectural to define spatial relationships as the inhabitable and/or experiential found object. The creation becomes a sculptural element that is either finely tuned with the overall context, defiantly in a state of juxtaposition, or somewhere nestled between those extremes.

The found object in design can either relate to the presence of repurposed materials as enclosure or surface, a salvaged item being used in a new and creative manner, or an implied climax and culmination of activity inherent to the overall experience. The object may be figural in nature as if the building materials and/or structure as a whole are attempting to relay a story, strike up a conversation, or foreshadow something yet to happen along the procession.

Designers in the fields of architecture, interior design, and regional planning are artists that also tap into the power of the found object as either the tangible manifestation of material studies or purely theoretical to the overall design. Planning and designing the placement, style, materials, and internal workings of an inhabitable sculptural piece of architecture is where a generative idea creates beauty. The found object can carve space, define materials, influence procession, and be the heartbeat of the experience. This is the moment when the found object not only influences individual portions of the overall design, but it can be the thread of thought blending macro and micro details.

The catalyst for incorporating found objects may have varied definitions among creator, owner, inhabitant, visitor, and critic; but the driving need for various levels of discovery will always be rooted in the basic elements of design.

Daniel Butko
butko@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Found Objects

Brian Kelly
criticalframe@hotmail.com
Visiting Professor
The University of Nebraska—Lincoln
College of Architecture
[Paper Presenter—Session 4A]

Abstract

Found objects and their injection into creative media attained their modern genesis in the collage works of several Cubist artists at the beginning of the 20th century. Although used before in varying capacities, found objects were incorporated in ways that did not concern themselves with the origin or context with which the objects came from, but rather celebrated the juxtaposition of them within a new context. Although primarily concerned with two-dimensional media such as newspaper clippings, wallpaper remnants, and sheet music, collage also became intrigued with the use of three-dimensional objects in the works of artists such as Pablo Picasso, Marcel Duchamp, and Jasper Johns. Within these works, the pieces not only challenged definitions of what these objects were and where they came from, but also what art was and to what context it should be afforded. This frictional juxtaposition encouraged the seemingly random placements and viewpoints of disparate objects in order to create new definitions for the viewer.

Design curriculums often utilize projects that incorporate found objects. Particularly in beginning design, these objects serve as a catalyst to cultivating and exploring ideas, while still achieving curricular goals. The obvious benefit of this at the beginning level is its suggestive potential for setting a course of investigation and response, avoiding the blank canvas syndrome. Other tangential benefits include encouraging students' exposure to alternative positions on tectonics, materiality, formal strategies and organizational systems.

The approach of using found objects as a design catalyst suggests that the objects themselves have a communicative ability through the activation of memory or cultural knowledge. This is not to suggest that the objects directly communicate, rather that they trigger memories and reactions that are culturally ingrained. This potential commonality of cultural legibility allows for the redefinition of a context that can offer a fresh perspective and provoke the student beyond where they may go without them.

Although the label uses the term 'object', one can argue that the injection of found objects into design curricula should not be limited solely to objects. Expansion outside of the object realm might include the use of imagery (utilizing Sergei Eisenstein's montage theory), film, shadow projections, and music.

This paper will survey the historical lineage of the use of found objects and interrogate their benefit in design education today.

This will be done through a survey of various professional and student projects incorporating found objects and their relative success.

Collage and Found Objects

Britain's Tate Gallery defines a "found object" as:

> "A natural or man-made object (or fragment of an object) found (or sometimes bought) by an artist and kept because of some intrinsic interest the artist sees in it. Found objects may be put on a shelf and treated as works of art in themselves, as well as providing inspiration for the artist. The sculptor Henry Moore, for example collected bones and flints which he seems to have treated as natural sculptures as well as sources for his own work. Found objects may also be modified by the artist and presented as art, either more or less intact as in the Dada and Surrealist artist Marcel Duchamp's readymades, or as part of an assemblage. As so often, Picasso was an originator, from 1912, when he began to incorporate newspapers and such things as matchboxes into his Cubist collages, and to make his Cubist constructions from various scavenged materials." [1]

Although collage and found objects were used well before the beginning of the 20th century, they came into significant exposure through the Cubist movement and more specifically through the work of Pablo Picasso. Picasso's collages exploited the everyday, making it part of his work. Items such as sheet music, wallpaper remnants, newspaper clippings, and cigarette wrappers were among the many objects that were fair game for use in his art. The intentional juxtaposition celebrated the redefinition of these objects into something other than what they were intended for. These works often afforded a glimpse into various artists' world incorporating items taken from their life and surroundings.

At this point, the use alone of found objects was enough to shock the art world. The art establishment privileged academic painting, and did not typically recognize works that existed outside of that system of rules. The use of everyday materials and rubbish was found by many to be unacceptable. In light of the increased use of the camera coupled with its better capacity to capture realism's detail, painting was trying to find its place. If the camera was more effective and precise, what was painting's role in the documentation of life and culture? Out of this dilemma rose movements like cubism,

which brought its own interpretation and systems of seeing the world, and along with it, the technique of collage.

This being the historical context, I would argue that found objects have primarily been utilized for their visual effects, missing out on the potential of these objects reading and communicating on another level. These objects, exhibiting a more performative agenda, might still fully use the visual realm but this expansion of function and communication also might bring another layer of depth that is otherwise lost.

Marcel Duchamp, for example, would integrate found objects either within or as the piece of art. His readymades aggressively challenged whether found objects belonged within the fine art world. With works such as Bicycle Wheel from 1913 and Fountain from 1917, the object itself was juxtaposed against the context of the gallery making a statement on what the bounds and definition of art is. While appropriate for its purpose and context, the found object at this point is used solely for its visual in a way to gain a response.

Jasper Johns would also often use found objects in his work, but beyond the obvious visual benefits, they also gave a glimpse into the process of the work's conception manifestation. In John's mixed media *Near the Lagoon* from 2002-03, he uses an encaustic panting technique to capture his process through the layering of media. The focal feature, a cord that is attached to the top corners hanging down into a catenary curve, is set against a field of grey. Within this field of grey are two additional curves that are traces of previous locations of the cord. These traces incorporate the element of time, allowing one to deduce that the same cord had been placed in two other positions some time before. The viewer is also allowed to place him or herself within the process of the work. This method is self-referential in a way that reveals the mechanism of its own creation. In this piece, the object participates in assisting the legibility and the creation process.

Ocularcentric Culture

As a contemporary culture, we are increasingly drawn to the visual realm through the use of imagery, both in static and moving form. Many authors have noted this effect but most pointed and relevant to the architectural discourse is Juhanni Pallasmaa in his book *The Eyes of the Skin*. He states that "sight has historically been regarded as the noblest of the senses, and thinking itself thought in terms of seeing"[2]; where clarity of thought is referred to as seeing clearly. This ocularcentric culture, as Pallasmaa refers to it, is further perpetuated in the digital world where the senses are even more separated, giving increased prominence and significance to the visual realm.

This condition poses a challenge within the context of a design curriculum to administer projects that are encouraging students to go beyond the literal surface as a means to developing richer conceptual directive and intentions. One way that this can be done is through the use of found objects as a catalyst to a design problem with the caveat that this ability and result is not a given.

Memory, Knowledge, and Reaction

Walter Benjamin argues in *The Work Of Art in the Age of Mechanical Reproduction* that the aura of a work of art is destroyed in its reproduction. His text referred to this in terms of print and film media, still and moving. He continues and asserts that the original piece, in its uniqueness and individuality, contains an aura which is lost through the process of mass production. While our contemporary, web-based culture has moved past the need for originality in imagery, there still remains an attraction to the original object.[3]

The existence of an aura is important to the topic of found objects since most times the designer is working with the original. Whether this object is a mass-produced item or not, the nuances of this specific one becomes the basis of decision making. Material defects, patinas, or scars serve as a means to tap into the history of this specific piece. Conversely, the lack of an aura in a found object might be a result of its ubiquitous character.

These nuances and characteristics of the object are what affords the designer a reaction, and what beginning design programs find most beneficial in the context of their curriculum. Students are provided with something that solicits a response, and that response can be bracketed within the format of the project statement and curricular goals.

Found Object as an Object?

In most cases and to this point, we have referred to found objects solely as that - objects. Is there a place for the expansion of the definition to include more than tangible physical matter? Can the 'found' appeal to other senses, serving as a catalyst in the design process while also somehow manifesting itself in the final piece? I would submit that so long as the found condition that served as generative tool finds itself represented in some way in the representation of the object, that this expansion is acceptable.

An example of this can be seen in the beginning design project pan'SHADOW given to first year architecture students. This project begins with a photography exercise where students are challenged to capture shadows in the built environment with the camera, purposely excluding the object making the shadow. Photographs are presented in class and critiqued based on the composition and contrast of the image.

Students then go through a design process that re-presents the shadow in various media techniques including figure ground, outline, and transparency. The final phase of this project asks students to work real-time with light and shadow to craft a form that projects the shadow. This composition should be an entirely different formal and spatial condition than the original object making the shadow (see Fig. 1).

In this case, the shadow from an object in the built environment, which lacks placement and tangible materiality, is taken through the design process finding itself manifest in the final iteration through a projection of light. The object is simultaneously there and not there.
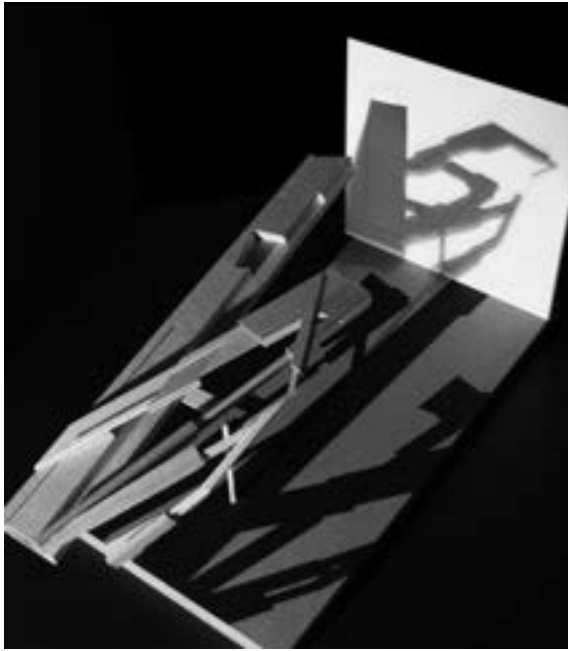
Figure 1: student model with shadow projection (J. Schmidt)

Found Objects in the Built Environment

The use of found objects is not as frequently utilized in the client-based profession. Most cases are focused on second-generation use, most often in the repurposing of materials for another function. Even more rare is the incorporation of an object into the space, which does more than exist in a curatorial state.

Architects such as Lewis Tsurmaki Lewis have reused materials that are specific to the client or function of the space to add another layer of legibility. In the project Ini Ani Coffee in New York City, the found object was used, but only a trace of itself remained in the final built form. The architects seemed to approach this project as if they were deconstructing the ubiquitous disposable coffee cup, and creating a space out of its components. Gesturing to the insulating sleeve, walls were made from stacked corrugated cardboard, offering material properties not available through traditional means. The corrugations allow quick views through the walls when the view is perpendicular, cutting off other views that attempt an oblique line of sight. Additionally, a partition near the service counter incorporates a pattern and texture from the incorporation of numerous coffee cup lids. This wall simultaneously serves as a typological review of the various available disposable coffee cup lids, while also making a statement about their involvement in our throwaway society's mentality. The object, a lid, was not actually in the space but rather a trace of it, re-presented for another interpretation.

Tod Williams and Billie Tsien's Neurosciences Institute in La Jolla, CA is a concrete and stone structure that is sited such that it forms a interior courtyard space. Between the perimeter masses sits a rather modest concrete stair which becomes the place for the insertion of found objects. During the construction process, a site visit by the architects incorporated the recording of an event into the building which was not planned. With the forms for the concrete walls at the stair in place, the architects inserted 4 drink cups from the construction workers into the formwork. This act created a series of protrusions from the wall, leaving a trace of the objects manifest in another material with much more stability and longevity. These protrusions also serve as a representation of an event and a time, marking not only the object but also the people and process involved. Although most people visiting the space are not aware of this element due to its placement and obscurity, its participation in the architecture is undeniable.

Forest Installation

A forest preserve in Omaha, NE was the atypical site for this small-scale, temporary, educational installation designed by the author while employed at Randy Brown Architects. This forest, surrounded by urban development on three sides, occupies a small pocket in the city. The client, a nature association, sponsored a competition soliciting a series of designs to be located within its property. An existing wood nature walk took visitors though the forest offering varying perspectives from ground level to views in the tree canopy. This one mile long walkway, made with traditional deck construction materials and techniques, was to be the site. Entrants were asked to select a location for the temporary structure and to design a piece that would not alter the forest in any permanent way.

The competition brief also asked for submissions that would be educational in regards to the topics of sustainability and stewardship, and that they exhibit some level of interactivity. Topics critiqued varied widely including the reuse of shipping pallets, alternative energy, and plastic bottle recycling. The design for this project was set up as a critique on the current state of cities and suburban sprawl perpetuated by the automobile. All materials for the structure were recycled or repurposed including auto parts as 'landscaping,' and a deck salvaged from a suburban home. The design, positioned at the edge of the boardwalk, takes advantage of a spectacular view of the downtown skyline, the epicenter of the city's sprawl.

Interactive elements included several designed situations that brought awareness to the effects of the personal vehicle, the city, and its sprawl. Educational displays included chronological maps of Omaha's growth, facts regarding automobile use and emissions, and the resultant pollution created. Elements included a car door in which the viewer sits adjacent to and rolls down a foggy window, revealing the view of downtown. Exhaust pipes were repurposed in the nearby forest, positioned in the ground as if they are a landscaping of sorts. A handrail, made of repurposed suspension leaf springs and exhaust pipe, held car mirrors and maps that illustrated the growth of Omaha since 1900. Lastly, the deck platform itself was formed as if caught in motion, folding out into the forest, metaphorically extending itself out into nature in the same fashion as suburban sprawl (See Fig. 2).

Figure 2: forest installation photograph (Randy Brown Architects)

Figure 3: student lamp made from a music stand and fish fry racks (T. Young)

Found Objects in the Design Curriculum

Due to its flexibility and effectiveness at various scales, the use of found objects in the design curriculum has a long history. The following are examples of this process and how the found objects can be more than simply a visual artifact. The three examples attempt to show various ways of using found objects. The first is a more traditional injection of the object and a response to it. The second is a use of found materials

with a more liberal ability to manipulate that material within the final design solution. The last example takes a ubiquitous object and encourages the expansion of this object and its reading through re-contextualizing it and altering its formal state.

RE:

A more traditional method of incorporating found objects into the design curriculum occurred in the furniture design project called *RE:*. Students were asked to find an object of a manageable size and to redefine it into a piece of furniture. The found objects were required to exist in their first context outside of the realm of furniture or architecture, and to be clearly identifiable as an object within our culture. Initial critiques explored the existing context of the object and how altering it can bring about new uses, and a new life. The project statement encouraged obscuring the found object in such a way as to delay its immediate recognition. Examples included medical crutches, a turkey roaster, music stands, fish fry racks, and an industrial mixer. While the results of the projects were compelling, the objects inability to go beyond the visual surfaced as their biggest critique (See Fig 3).

paraSITE

Urban graffiti and installation art inspired a series of group design-build projects that were seen as a way to gain exposure for a first year design program suffering from lack of visibility. Students attended class at times other than the typical time slot for upper level studios, which in turn was used to our advantage throughout the design and fabrication process. In a program whose philosophy was 'Learning by Doing', students in the upper levels were well versed in material composition and manipulation. We felt this attitude and skill set should be set in the beginning of their education.

Curricular areas focused on include siting, site analysis, materiality, spatial composition, and path/sequence. The process began as a typical project with site documentation and analysis followed by design relative to that analysis. While typical of most projects, the process outside of the design itself and the use of found materials and objects is where the focus lies. Students were asked to remain silent about the project outside of studio hours, and to not do anything that would draw attention to the events about to occur. Once design reached a certain level, students went into production, incorporating found objects, found materials, and borrowed assembly processes. This was also kept under the radar so as to not draw attention.

The sites were located throughout the 1960's Brutalist concrete structure that housed the architectural program. This building, with its exterior circulation and courtyard, was a major thoroughfare for students of many disciplines inside and outside of architecture. Project sites were located throughout this structure, tucked into the residual spaces not typically noticed. Students were charged with 'tagging' the building with built structures that would accentuate and, in the words of Steven Holl, explain the site.

The designs were installed at midnight under the cover of darkness. The events of that night included an ad-hoc parade of structures from the construction shop where they had been

stored, and the final install of the compositions. The following account describes the events as they unfolded the following morning as students and faculty arrived to start another day.

"At its core an austere cavernous three level monumental open stair court, the building gathers covered exterior corridors and walks with dreary shadows. Entering from the South and lowest level, I immediately enjoyed seeing that a variety of interventions had been placed there literally over night; suspended, cantilevered, spanning. These were interventions full of color, lively experiments in surface and construction, frames and volumes, tucked in corners, and springing from the walkways; works that carefully spilled through structural gaps between levels. The site suggested new relations within, and emerging from, the established building elements, reaching and stretching toward near campus landmarks and distant landforms. These were provocative objects to look at, but more importantly, newfound spaces and marked places of engagement within the building framework." [4]

Found objects incorporated into the projects included things such as patina-laden sheet metal, rebar, soil, steel studs, expanded and perforated metal, and an umbrella frame (See Fig. 4). The project framework encouraged a more liberal and flexible exploitation of found materials, allowing them to inform and extend the legibility of the design. At some level, because of this injection of materiality, the final designs became perceived as found objects themselves as opposed to clean, new constructions sitting within their site.
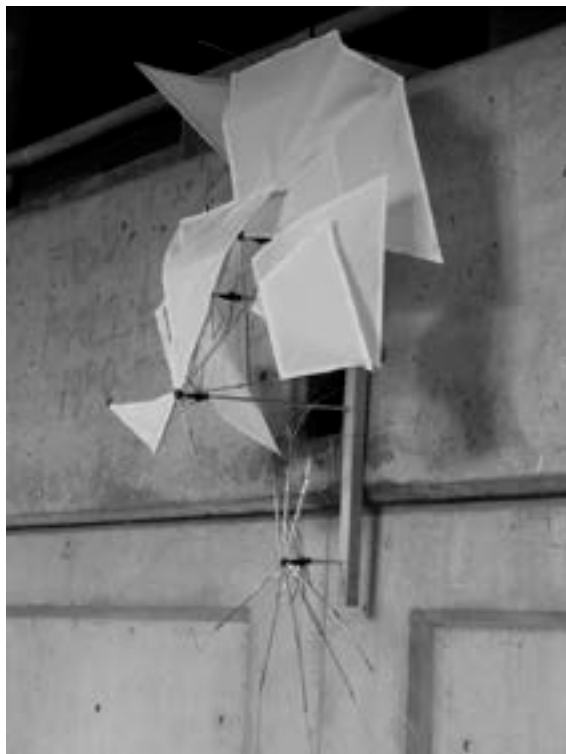
Figure 4: student paraSITE using umbrella remnants and nylon (E. Becker)

Frequency Modulation

The final example explored the use of an object that would be consistent across all students in the studio, and one that might find itself in everyday life. This process allowed the focus to be on the manipulation and legibility of that object, as opposed to what the original object was.

The design process began by asking students to bring a box of playing cards to studio. The playing card was chosen for its simple planar quality, materiality, and juxtaposed graphic condition from front to back. Students were unaware of the process they were about to undergo, one which celebrated an iterative attitude encouraging lateral thinking and responsive problem solving.

The initial phase of the project served as a collaborative research endeavor rejecting ownership. Students were asked to create as many ways as possible to assemble a modular composition that would communicate a sequential manipulation of form and space. Students were not allowed to use glue, and all connections were to be designed with the use of joinery. The lack of ownership encouraged cross-pollination of techniques, further pushing the limits of possibility.

The next phase of the project asked students to choose an arrangement (linear, planar, volumetric) and an operation (bend, twist, overlap, pinch, weave, nest, flock, warp) and to design a composition that incorporated the results of their research. Projects worked with the found object, a ubiquitous playing card, and created spatial and formal compositions exhibiting a high level of complexity and dexterity. The found object was redefined, and a new level of functionality and aggregate structural potential was realized (See Fig. 5).

This project was offered in a course taken by various design majors including architecture, interior design, landscape architecture, art, fashion design, graphic design, and advertising. The intent was to create a project that would make common ground of the design principles, and to allow enough flexibility for appropriation to their chosen discipline. Projects became reminiscent of structures, partitions, landscapes, garments, and packaging. The benefit of incorporating the found object was to establish a common starting point that encouraged disciplinary specificity simultaneous to communal vocabulary.

The Act of Making and the Notion of Creativity

creativity –*noun* 1. the state or quality of being creative. 2. the ability to transcend traditional ideas, rules, patterns, relationships, or the like, and to create meaningful new ideas, forms, methods, interpretations, etc. 3. the process by which one utilizes creative ability.

make –*verb* (used with object) 1. to bring into existence by shaping or changing material, combining parts, etc. 2. to produce; cause to exist or happen.

The use of found objects in the design process is an important variable relative to relationship between the craft of making and the notion of creativity. The use of found objects exerts a physical presence into the creative process, and although the

creation relative to it may happen elsewhere, the object is always present. This often encourages a more intuitive working method where sensual awareness happens in and out of the visual realm. The existence of the object itself also encourages more interaction with material properties that can inform the design including but not limited to texture, reflection, transparency, and color.

The measurable benefit of found objects relative to the notion of creativity is difficult to quantify. Within beginning design curricula, this process has proven beneficial in avoiding creative blocks and blank canvas syndrome. In the context of an architectural curriculum, the benefits of working with the object itself include an exposure to materiality and tectonic connection. The definition of creativity states that it is "the ability to transcend traditional ideas, rules, patterns, relationships, or the like to create meaningful new ideas, forms, methods, interpretations, etc." which is definitely accelerated with the injection of found objects. This being said, the creative process is not reliant upon it, only supplemented through it.

Figure 5: student model made from playing cards (S. Braaten)

[1] "Found object," *Tate Modern," Available from* http://www.tate.org.uk/collections/glossary

[2] Juhani Pallasmaa, The Eyes of the Skin (Seattle: Academy Press, 2005), 15.

[3] Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction" in *Illuminations: Essays and Reflections* (Harcourt Brace Jovanovich, Inc., 1968)

[4] Quote from Michael Lucas, Associate Professor and Associate Department Head of Architecture, California Polytechnic State University in San Luis Obispo. Letter to author dated 10 March 2006.

The Merz Mill and the Cathedral of the Future

Matthew Mindrup
mmindrup@maryu.marywood.edu
Assistant Professor
Marywood University
School of Architecture
[Paper Presenter—Session 4A]

Abstract*

Despite the frequent identification of Walter Gropius' crystal Cathedral of the Future with the early Bauhaus, his contemporaries in the early twentieth century architectural culture did not embrace it as a universal metaphor for a new German architecture. For these individuals the crystal offered an apt description of what the new architecture could do once it had already been conceived, but it did not provide them with a method for construing it. It is precisely this lacuna in Gropius' cathedral metaphor that the artist and architect Kurt Schwitters sought to fill with his introduction of a small cathedral model entitled *Haus Merz* in 1920. With his model, Schwitters sought to replace Gropius' cathedral with a mill as a metaphor for both constructing and construing new architecture. This paper seeks to illuminate the limitations underlying Gropius' cathedral of the future by examining the themes surrounding Schwitters' introduction of *Haus Merz*.

*Note: For full paper, please contact Matthew Mindrup at
mmindrup@maryu.marywood.edu
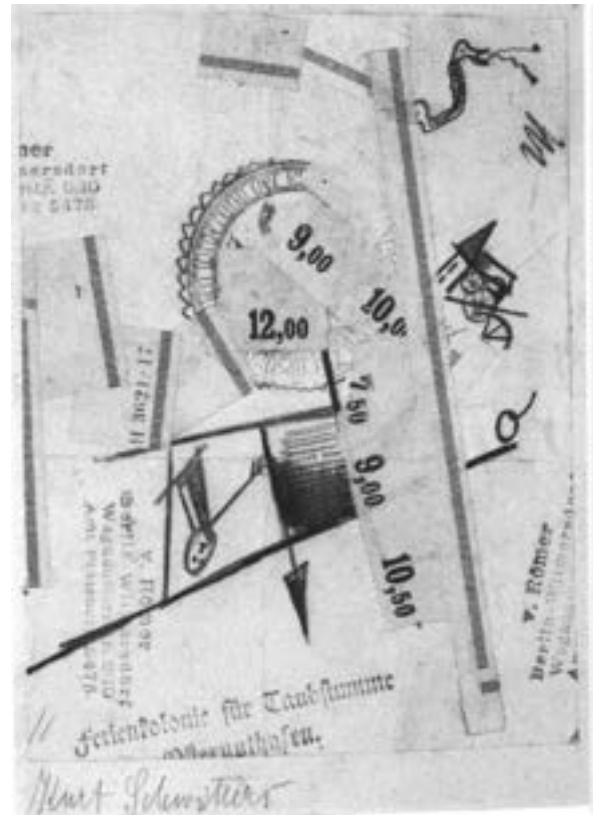
*Kurt Schwitters, Ohne Titel: Ferienkolonie für Taubstumme
(No Title: Vacation colony for deaf-mutes), 1919.
Galleria Blu, Milan.*

The Found Object in Design

Chris Ford
Cford4@unl.edu
2008-2010 Steward Professor of Sustainable Design
The University of Nebraska—Lincoln
College of Architecture
[Paper Presenter—Session 4A]

Abstract

While artists have an established record of scholarship about the role of found objects in their work, there is a disappointing lack of scholarship that considers the role of found objects in design. Perhaps this can first be attributed to the different motivations by which an artist and a designer choose to incorporate a found object. This difference in motivations illuminates that primary reasons for selection are rooted in the source disciplines themselves -- The found object in art has no responsibility to perform beyond its aesthetic affect, and the found object in design has no further responsibility beyond its pragmatic (i.e. mechanical, structural) affect.

Because the incorporation of found objects is non-essential to all design solutions, then as designers, there is a need to explicitly understand the benefit of incorporating found objects, the criteria for their selection, their impact on design thinking, and their ramifications of use.

This paper will articulate four generative strategies for how found objects are / can be used within the design discipline: Resourcefulness, Political Heuristics, Creative Heuristics and Aesthetic Heuristics. Design solutions from both architectural design and industrial design are used in support of the formation of these categories, and includes work by Michael Rotondi, Phoenix Commotion, Baker + Hesseldenz Design, and LOT-EK. Ultimately, this paper showcases the finished design work of students from the University of Nebraska for an assignment titled "*FOCO: The Found-Object Craft-Object*," in which each student-author must answer the question of how *ought* a found object be used in design. This design work was generated during the SPR 2009 and SPR 2010 semesters in a three credit hour graduate-level elective titled *"Introduction to Craft."*

Introduction

While artists have an established record of scholarship about the role of found objects in their work, there is a disappointing lack of scholarship that considers the role of found objects in design. Perhaps this can first be attributed to the different motivations by which an artist and a designer choose to incorporate a found object.

Discipline-centric Motivations

If we generalize, artists are creative thinkers who produce aesthetic objects that respond to problems of their own creation. However, designers are both creative and analytical thinkers who produce functional objects responding to performance-based problems demonstrated by the needs of others. Despite the similarities and differences between the realms of art and design, the defining characteristic between them is this level of utility found in the artifacts produced – While both require creative thought, it remains that objects of fine art are considered with aesthetic attitudes, and objects of design are considered with pragmatic attitudes. Between these two realms however is a thin threshold that places equal weight upon both the aesthetic and pragmatic qualities of a specific object. As this threshold is enjoying an increasing amount of scholarship, designers are renewing an interest in the discipline of Craft. Members of this discipline whose work is particularly expressive of Craft principles include George Nakashima, Dale Chihuly, and the Teutul family.

With regards to our interest in found objects, this difference in attitudes illuminates that primary reasons for selection are rooted in the source disciplines themselves. The found object in art has no responsibility to perform beyond its aesthetic affect, and the found object in design has no further responsibility beyond its pragmatic (i.e. mechanical, structural) affect.

Across all design disciplines, the solutions that designers propose typically require the deliberate processing of raw materials to produce a new idealized solution that is performatively consistent throughout its entirety. This holistic approach enables designers to combine the desired structural and performative attributes together thereby finding an economy in design that is not burdened with extraneous and superfluous parts. In turn, the integrated aesthetic dimension of this designed object can either be of deliberate consideration or of collateral effect.

The Impact of Found Objects

The incorporation of a found object in a design solution presents interesting generative opportunities that are not otherwise available in more traditional acts of design.

While some designers are personally comfortable with, and effectively operate within, the openness afforded by traditionally-formed design problems, the decision to incorporate a found object suddenly impacts the structure of the design problem with a high degree of new information. No longer does design generation begin in response to an

assessment of constraints, but now there is a physical artifact within the larger design problem that exudes intelligible information regarding its own structural, mechanical and compositional qualities. In many ways, this starting point for design thinking suddenly advances the maturity of the final design, which emphasizes the importance of good decisions about the actual selection process of found objects in the first place. While the found object effect can positively disrupt the performative and aesthetic expectations of end users and find new resonance for appreciation, it can also bomb where the merit of the final designed craftwork fails to transcend the incorporated found object on its own terms, thereby revealing a kitsch appreciation for the found object incorporated and exuding an unhelpful reverence for the original found object.

Because the incorporation of found objects is non-essential to all design solutions, then as designers, there is a need to explicitly understand the benefit of incorporating found objects, the criteria for their selection, their impact on design thinking, and their ramifications for use. This paper identifies four generative strategies for how found objects are / can be used within the design discipline: Resourcefulness, Political Heuristics, Creative Heuristics and Aesthetic Heuristics.

Resourcefulness

Adhocism is a popular term to describe a type of interest in found objects. First coined by Charles Jencks in 1968, and popularized again in his 1973 title with Nathan Silver, *"Adhocism: The Case for Improvisation,"* their case returns to the issue of Resourcefulness and how this impacts the finished aesthetic character and pragmatic operational attributes of the finished work.

For non-designers solving their own problems of need, using found objects in an ad-hoc manner is the most popular strategy found in contemporary society. While the examples featured on websites such as *www.thereifixedit.com* is not the result of professional design services, the solutions are very much the result of an act of design by non-designers, however precarious, short-sighted, or ill-advised. For these ad-hocist solutions, found objects present a means for practical solutions to problems rooted in necessity.

Resourcefulness is also the strategy featured most often in popular culture. In terms of Hollywood movies, we see this in the genre of post-apocalyptic films where new resources are no longer available, and society must survive using a honed sense of ingenuity in the ad-hoc repurposing of found objects. Consider *Mad Max* (1979), *Waterworld* (1995) and the more recent *The Book of Eli* (2009). This ad-hoc design strategy is also central to the popular ABC television series MacGyver (1985-1992). In this weekly one hour drama, the lead character was constantly faced with challenges that required improvised design solutions resulting from creative thinking and unconventional found materials.

Resourcefulness is typically a strategy found at the lower end of the economic spectrum, and the work of the Rural Studio at Auburn is particularly expressive of this. While I do not want to deny this group any Creative Heuristics that were also in play, it remains that this group of designers sought to achieve the most architecturally with the limited resources that were available to them. Whether it be dumped tires, road signs, glass bottles, wax-impregnated cardboard, or donated replacement windshields, these resources have themselves become obsolete and have found new use in an architectural application. However, Resourcefulness may also be in play independent of financial circumstances.

Since 1991, RoTo Architects has developed an approach to architectural design that welcomes uncertainty and openness. For RoTo, the final design solution is not conceived in an idealized state in which additional design energy is invested in exhaustively-thorough documentation, but rather is conceived in a comparatively loose way which allows for the joint shaping of the final solution by their conception, by other stakeholders such as the client and builder, and by the availability of new resources that were not known at the time of original project conception. While their internal office design process works to eliminate individual authorship, RoTo oftentimes achieves this with final solutions that capitalize upon the "availability of recyclable materials and skills that are within the comfort level of the builder." (Carter 23). RoTo Architects' designs for both the Sinte Gleska University in South Dakota and the Carlson-Reges residence in downtown Los Angeles express this.

The Carlson-Reges Residence design was for a couple already living in a once electric company cabling structure amidst an industrial salvage yard with an inventory accumulated over two generations. This design provided an expanded ability to publicly showcase a collection of two and three dimensional art, but without impeding upon their more private living spaces. The solution was one that incorporates many components found throughout the salvage yard, and was dependent upon the construction skills of the client / builder. While industrial steel sections were plentiful for re-use as architectural columns and beams, cylindrical gasoline tanks from the client's materials yard were also modified to serve as a second floor pool. According to Michael Rotondi, "all non-structural steel detailing [for the Carlson-Reges Residence] occurred on site in an improvisational fashion and was determined by the availability of materials and labor," (Carter 45).

For designers solving problems of need, using found objects from a generative strategy of Resourcefulness requires a suspension of the level of control typically found in professional design service. However, for those willing to entertain design solutions that are both uncertain and open at the time of conception, then the opportunity-based incorporation of a found object will achieve heightened design economy in the absence of new raw material resources and the means to deliberately process them.

Political Heuristics

When a designer chooses to incorporate a found object to signify a larger political position, whether it be in protest to a politico-socio system, or a personal position in support of a larger political context, then Political Heuristics are in play. For Charles Jencks in 1973, adhocism provided a vehicle for combating the standardization and limitation of choice by large corporations and was believed to trigger a "rebirth of a democratic mode and style, where everyone can create [their]

personal environment out of impersonal subsystems…" (Jencks and Silver 15).

For us in 2010, we find a number of designers who are incorporating found objects prompted by their respective position on environmental issues and who seek to reduce their larger design footprint for requiring new resources. These green-minded designers intentionally recycle found objects and reclaim other materials that have outlasted their original usefulness as it relates to their self-perceived role in a larger handling of waste.

While the repurposing of a found object requires the least amount of embodied energy for materials for design, this strategy oftentimes leads to solutions that have no larger holistic aesthetic agenda. When taken to an extreme, this design strategy can produce aesthetically-schizophrenic solutions that lack an overarching design vision for wholeness. However, this is perfectly acceptable for the designer using political heuristics, as the resulting aesthetic is of circumstance to the larger politically-charged act of designing with recycled and reclaimed material.

Mr. Dan Phillips is the principal of Phoenix Commotion homebuilding based in Huntsville TX and has successfully built (14) residences that incorporates found objects from a political heuristic sensibility. While Mr. Phillips will acquire approximately 80% of his construction materials from other builders' construction sites, "to him, almost anything discarded and durable is potential building material" (Murphy). Found materials already incorporated into his residences include picture frame samples for an interior ceiling, misshapen bricks, broken ceramic tiles and mirrors, wine corks, worn DVDs, and cattle bones from a nearby cattle yard. While the overall look and feel of these residences are quirky and circumstantial, they are completely code-compliant and have already proven their resale value to a more affluent audience.

For those designers using founds objects as a Political Heuristic, there is a lessened appreciation for wholeness, clarity and legibility of use, and a heightened satisfaction from knowing they have lessened the respective footprint of waste for its design field. Furthermore, the resulting aesthetic achieved is one that, however holistic or not, cannot be pre-conceived independently from working with the actual found materials at 1:1 scale.

Creative Heuristics

Whereas designers will typically first assess all of the known informative constraints in a new design problem, and then formulate a design strategy to produce solutions, the found object as a creative heuristic *"flips the script."* Instead of having information as the only basis from which design moves forward, the designer who incorporates a found object from a sensibility of creative heuristics is looking to launch a creative process in response to the fullness of a selected found object.[1]

In this instance, the designer is looking to exploit the generative potential of found objects that stem from an assessment of the found object's mechanical and/or structural

properties, and then allow that assessment to determine the program or use for a forthcoming larger design solution. If a Creative Heuristic is in play, then no longer is the final design solution in response to an articulated need. Instead, the use and function for the final design is only determined after the designer has entered into a dialogue with the properties and qualities of the found object.

For furniture designer Scott Baker, the moment of design conception occurred immediately upon viewing the found object. More specifically, Mr. Baker was browsing the only remaining publicly-accessible military aircraft salvage yard in Tucson AZ when he came upon an aileron bracket sitting amongst other components and began handling it. As he rotated it in space, he began visualizing the aileron bracket as a single support for a long shelf on a wall condition. Mr. Baker designed three new components to be made from cherry wood, and he fabricated the final Aileron shelf himself. Although the shelf was a personal endeavor for Mr. Baker's own satisfaction, it is currently on the market as a consignment piece in his art gallery, Metroform Ltd.

If we recall that found objects incorporated from a sensibility of Resourcefulness presents a means for practical solutions to address problems of necessity, then found objects incorporated from a creative heuristic sensibility either guarantee a desired condition within a larger final solution to problems not yet identified or are engaged only after the creation of the new designed object. While this generative strategy holds the most promise for creative design solutions, it also explains why it is the rarest of types. In a designer's commitment to addressing the needs of others, the pre-selection of a found object for creative action does not permit an adequate level of analytical consideration necessary in generating solutions for a constituency of users.

Fig 1. Aileron Shelf by Scott Baker.
Photo courtesy of Metroform Ltd.

Aesthetic Heuristics

A designer who decides to incorporate a found object from a sensibility of an aesthetic heuristic is one who believes a found object is either particularly beautiful or cool. In short, this

explains why designers will incorporate a found object for its own sake. In this scenario, there is believed to be larger design value in the ability for end users to read the found object, and recognize its respective origin while simultaneously appreciating its new role in a larger design solution. While it is possible within this generative strategy to allow nostalgia into one's design thinking, it can also establish the underpinnings of distinguished architectural practices such as LOT-EK in New York City and Richard Goodwin in Sydney Australia.

ARCH 597x: *"Introduction to Craft"*

Upon joining the faculty at the University of Nebraska in Fall 2005, I was surprised to find a relatively weak culture of Making when compared to those cultures from other schools of Architecture. In contrast to my experiences at UNC-Charlotte, North Carolina State University, and the University of Arizona, I had assumed that all schools of Architecture would have a developed ethic in working with, and experimenting with, "live" materials at a 1:1 scale. In light of this, I created a new 3 credit hour course titled "*Introduction to Craft,*" which is open to students of fifth year, sixth year, and PhD standing. The course examines Craft as its own creative discipline at the threshold between Fine Art and Design, and is composed of equal parts lecture, seminar and lab. While there are now other UNL faculty who also offer graduate-level electives that bolsters our culture of Making in other ways, it remains that our undergraduate curriculum is one otherwise invested in forms of representation rather than working with physical materials in an idealized state.[2] Although "*Introduction to Craft*" is a 500 level course, it effectively offers Architecture students their first curricular opportunity to consider material-based investigations in an explicit way for (16) weeks.

FOCO: "The Found Object Craft Object"

Since first seeing the Aileron shelf by Tucson designer Scott Baker in 2003, I am becoming increasingly interested in the creative heuristics that found objects provide when incorporated into a larger design problem. To this end, in Spring 2009, I issued an eight-week design project titled "FOCO: The Found Object Craft Object." My intentions were to issue an assignment in which student designers would polemically argue how found objects *ought* to be used in design, and would discover their effectiveness firsthand through the conception, development and execution of a new craft object.

Per this assignment, all FOCOs must:

01. incorporate a found object that is chosen only after careful consideration. The selection of the found object must not be circumstantial.

02. incorporate a found object that has structural or mechanical merit. Found objects with emotional value are prohibited.

03. be designed using the observable properties of the found object as a point of departure. The purpose and use of the FOCO shall be determined only *after* the found object is selected.

04. incorporate a found object that plays a performative role within the larger FOCO solution – The craft object incorporates the found object, yet the found object does not equal the craft object.

05. re-purpose the original found object within the intentional and deliberate design of a new craft object.

06. commit to a particular type of site (i.e. stands on floor, anchors to table, wall-mounted, suspended from ceiling) *without* committing to a site-specific Place.

07. recognize their role as craft objects in the 21st Century, and consider their own materiality.

Across the enrollment of (8) design students, there was a genuine enthusiasm for this assignment, as it presented an opportunity they had not yet experienced in their respective design studios. To begin, I asked the class to do some found object reconnaissance over their Spring Break in salvage yards, pawn shops, antique shops, auctions, yard sales, or their grandparents' garage. Each student was required to bring three found objects to class for discussion, and the group then took turns speculating upon the various ways in which each found object in the room could function in larger structural or mechanical applications. Found objects ultimately selected include an engine dolly, a 75-lb steel caster, a cast aluminum combustion chamber from a Mazda RX-7 rotary engine, a pair of suspension swingarms, a clutch assembly, a pair of ice skate blades, a poker chip holder, and a hand-operated apple peeler.

Since the purpose or use of the larger forthcoming FOCO was to be determined after the selection of the found object, students were dealing with a design problem in which purpose or use no longer preceded their search for design solutions. In turn, they must enter into a dialogue with the found object, assess its structural and mechanical abilities, and only then design uses for the found object. However, enthusiasm waned. To combat the group's uneasiness with the openness of this assignment, it was necessary to have a Saturday afternoon design charette in which a prolonged amount of design could occur.

Across the course enrollment, the final FOCO solutions varied widely in terms of their utility, level of found object incorporation, and overall compositional complexity.

Front-End Suspension Swingarms

Fig 2. Coffee table by John Dodson.

Mr. Dodson was attracted to both the structural and compositional qualities of these swingarms. As kinetic structural horizontal supports found in a vehicle's front suspension, these swingarms can resist considerable weight and force. Compositionally, these cast steel swingarms have several large "lightening" holes within its profile, and also features several bolted hole connections.

During preliminary design, Mr. Dodson would position the swingarms in an upright position, and it became possible to perceive the swingarms as structural supports that would allow the circular ends to become the actual bearing points for the forthcoming assemblage. Once this observation was made, the use of the FOCO was determined to be a low coffee table.

After considering some design options with a blockish symmetrical proportion, Mr. Dodson decided to elongate the proportion of the structural gesture in order to showcase the table elements that would require new construction. The structural spine was shaped from a single piece of maple, and was accentuated at both ends with walnut bearing points. Whereas one end is a modest shaped footing that comes in contact with the ground plane, the other end is a shaped connector stout enough to receive the ½" diameter bolted connections with both swingarms. Mr. Dodson subcontracted a local glass supplier to provide a shaped tempered glass profile, and this glass rests on three new rods. While these rods were conceived as appropriate attachments to the found compositional qualities of the swingarms themselves, an identical rod was used in an identical geometry and attached directly to the maple structural spine.

Engine Dolly

While Mr. Mielke produced three found objects of varying scale for consideration, he was drawn to working with his largest since this was the scale he was most comfortable. The found object is a dolly for lifting and storing pulled engines from automobiles. The dolly is essentially three pieces of tube steel butted and welded together to form "T" configurations in both plan and side elevations. The dolly meets the ground with three ¾" diameter rolling casters and interfaces with engines only through a pipe fitting that caps the top of the single vertical tube steel member. This particular dolly became obsolete when one of its small steel casters jammed, and no one took the initiative to service or repair it.

The dolly originally had a bright orange painted finish, but this finish has weathered from both heavy use and lack of care. Mr. Mielke decided early that he was interested in retaining the weathered finish quality of the dolly, and wanted to creatively contrast it with highly refined new construction.

From its side "L" profile, one will notice the composition of this dolly anticipates cantilevering the engine over its lower half. In response to this, Mr. Mielke projected regulating lines from hard material edges found on the dolly and allowed these 2d lines to act as planes to demarcate the extents of two large three dimensional volumes. Furthermore, just as a suspended engine would have airspace trapped below, then so do these volumes hover over the dolly assemblage and connect back only at the vertical support. These two persimmons-wood

volumes are physically identical to each other in overall dimensions, and both work together as saddlebags to balance the load about the high structural support arm made of steel flatstock. However, one volume is a chest of drawers with full extension glides, and the other is a single vertical drawer with adjustable shelving. To the best of my knowledge, that one small steel caster is still jammed.

Mr. Reimers won over his colleagues as soon as this 75-lb steel caster was rolled into the room. While the form and operation of this found object was similar to other casters we have seen, the immense weight of this one made it otherworldly. It was actually one from a set of four identical casters that supported an automotive sled used by body repair services to move car chassis to others places in the garage.

At a curb weight of 75 lbs., it was difficult to conceive of a complete re-purposing of the caster from its original operation. The caster could continue to roll, swivel and lock, but by convincingly making it an integral component to new forthcoming construction, it would then effectively sever itself from its original context of use.

Mr. Reimers started his process with a series of sketches of upright furniture pieces that integrated the caster as a heavyweight footing and bearing point with the ground plane. After considering the likely physical awkwardness of moving these upright pieces, the proportion of the furniture piece then became low and long. This proportion was found to offer more leverage and ease to the user, and would allow for moving the piece with less effort and greater control. After diagramming a wheelbarrow-like proportion to the FOCO, Mr. Reimers determined its purpose would be a new desk. Beyond knowing that this desk would require a prominent horizontal surface to accommodate various desk-based actions, Mr. Reimers found it difficult to explore design options without using a photograph of the caster's side profile as a point of departure for his larger design thinking.

Fig 3. Chest of Drawers by Karl Mielke.

Industrial-Scale Caster

Fig 4. A desk for a home office by Brandon Reimers.

The final desk design is characterized by two steel bases with white painted finish which are rigidly attached to an orange desk surface. Although this orange desk component appears as one piece, it was fabricated from a solid-core door and laminated plywood shapes for the downturn. Both of these pieces read as one due to several layers of bondo work and several coats of automotive-grade painted finish. While the desk surface has integrated handles for moving and repositioning the desk itself, the ironic aspect of this built design is that it is now so heavy, it requires two people to lift and steer the desk into another room.

Iceskates

Mr. Williams' found object(s) with the best creative potential was a pair of antique iceskates. These iceskates possessed a number of attractive material features including the worn leather iceskate envelope, the excessively-long cloth laces, the shaped steel iceskate blades, and their nailed connection to the underside of the skate's sole.

During preliminary design, in the pursuit of needing to re-purpose the iceskate, Mr. Williams would perceive the open shapes within the ice skate blade proper to be a handle in which the human hand would engage. This was creatively problematic first due to the uninviting sharpness of steel edges in which our hand would come in contact. Second, the found mechanical attachment of the iceskate blade attachment to the iceskate sole was still influencing Mr. Williams with regards to the means of mechanical attachment to an otherwise holistic and separate object.

Upon further evaluating the skate blades, Mr. Williams became interested in the creation of a FOCO that would become structurally co-dependent with the skateblades themselves. In order to best focus upon this compositional expectation, he was encouraged to work in a scale relatively smaller than his colleagues, and he then decided to design an occasional table.

The first iteration of this table design was drawn in marker pen, and was dismissed by the author due to its resemblance to

a woman's shoe. However, the second iteration had a changed proportion and still possessed the trait of structural co-dependence between the two found objects and the new construction. Mr. Williams began fabrication of this table by laminating a series of plywood shapes to then be shaped using electric and hand sanding methods. Once the iceskate blades were attached to the new wood construction, this assemblage served as the table base. The table surface itself was a single piece of 16 gauge sheetmetal shaped in an ovular form, and was connected to the neck of the wood base with a series of piping connections that intentionally resembled the eyelets found on the original iceskates. All steel edges at this connection were brought to align with the outer surfaces of the wood.

Conclusion

Across the course enrollment, the polemical arguments for how found objects *ought* to be used in design also varied, but otherwise reveal the impetus in which each student found the incorporation of a found object to be personally meaningful. In turn, it was an analysis of their written responses that helped to forge the four larger design strategies presented earlier in this paper.

Fig 5. An end table by Chris Williams.

[1] The decision to begin designing in this way is *itself* an act of design.
[2] These other UNL faculty include Tom Allisma, Jeff Day, Tim Hemsath and Peter Hind.

References

Carter, Brian. *ROTOBOOK*. Michigan Architecture Papers One. Ann Arbor: University of Michigan, 1996.

Jencks, Charles and Nathan Silver. *Adhocism: The Case for Improvisation*. Garden City: Anchor Press, 1973.

Murphy, Kate. "One Man's Trash…," Home & Garden Section, *The New York Times*. 02 September 2009.

Innovation, Interdisciplinarity & the Environment

Architecture seeks to transcend the mundane response of mere shelter, transforming environmentally responsive structures by imbuing them with meaning. These papers seek new and creative responses to the environment, drawing multi-scalar inspirations from adaptive and technological solutions while respecting the traditions learned through time. Each author focuses on a specific response to the environmental fabric: sustainability through time, sequestration from the elemental forces of nature, establishing the foundations necessary for creating, and technologic innovation in the human shelter interface:

Initially completed in 1621, the Ganj-Ali Khan Complex in Kerman, Iran represents the sustainability of a unique cultural expression of form and space that has adapted to man and the environment in an architectural tradition developed over a thousand years. The Green Scale Research Project evaluates and compares technological solutions to traditional and environmentally tested methods of construction with software-modeled performance.

The responsive "REdaptive Vessel" asserts a sense of permanence and establishment of home in a manner that respects the inevitability of flooding in coastal Louisiana. The University of Oklahoma's own Bruce Goff's acts of creation inspired a re-conceptualization of design approach to the mitigation of extreme natural forces of earthquake, wind and tsunami coined as Architectural/Structural Integration Design with Three "D" Strategies (ASID-3DS).

Embracing the human in the built environment is met through the tectonics of corrugated origami surfaces that respond to biometric data in "Creating a Synthetic Space between Bodies and Building." While the fundamental process of creating and sustaining the human approach to that endeavor is mined for insight in The MIT Media Lab: The Making of the Future.

Representing scale and innovation, taken together these papers seek to address, through contrast and comparison, our human response to the environment through time, technology and self-reflective observation.

+

Lee Fithian
leefithian@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Session moderator]

The MIT Media Lab: The Making of the Future

Tony Vanky
tvanky@mit.edu
SMarchS Student
The Massachusetts Institute of Technology
Department of Architecture
[Paper Presenter—Session 3B]

Abstract

The MIT Media Lab has is a unique research institute that has seen marked success in blending industry, creativity, engineering and invention in the research and envisioning of new technologies for everyday life. The Labs impact on society can be found in the creation of E-Ink, now found in e-reader devices like the Amazon Kindle, to the gaming concept used for Guitar Hero, to conceiving a model of personal, urban transportation systems. As it "invents the future", the Lab brings together engineers, artists, scientists and designers together in 30 research groups with hundreds of projects considering the future of human-computer interaction at a variety of scales.

With all of these successes, no other institution, including MIT itself, has been able to duplicate the success of the Media Lab model of teaching, making and innovating that goes beyond a pedagogical approach but transformed into a pervasive cultural identity of both technology and design. Thus, it is worth asking what factors have contributed to the continued success of the Lab and what practices can one glean by looking at the Lab through two lenses—through its structure and history and the dynamic composition and interaction of its people—in the creation of a culture of inventing and designing through the process of making

Introduction

The MIT Media Lab has is a unique research institute that has seen marked success in blending industry, creativity, engineering and invention in the research and envisioning of new technologies for everyday life. The Labs impact on society can be found in the creation of E-Ink, now found in e-reader devices like the Amazon Kindle, to the gaming concept used for Guitar Hero.[1] As it "invents the future", the Lab brings together engineers, artists, scientists and designers together in 30 research groups with hundreds of projects considering the future of human-computer interaction at a variety of scales. Beyond its research endeavors, the Lab also enrolls 138 students.

With all of these successes, no other institution including MIT itself, have been able to duplicate the success of the Media Lab model. Thus, it is worth asking what factors have contributed to the continued success of the Lab and what practices can one glean by looking at the Lab through two lenses—its distinctive institutional artifice—through its structure and history—and the dynamic composition and interaction of its people.

The Lab's foundation

The Media Lab began in the Department of Architecture, as the Architectural Machines Group in the late-1960s. Group director, Nicholas Negroponte, began the group to investigate how computer technology could aid in the production of buildings. The focus shifted in the 1980s as Negroponte argued for communication media, that in 2000 the computer, broadcast and publication industries would come together (and indeed they have).[2] As a result, the Media Lab was founded after receiving the support of then MIT president, Jerome Wiesner.

Though the focus shifted away from architecture and the architecture department, a more profound connection remains today. Kenneth Haase, former Chief Scientist of the Lab's News in the Future consortium and visiting associate professor at the Media Lab, argues that the Lab's concerns of "church and state" or the technical and the humane came from architecture. Architecture, in short, is "concerned about complex technical systems with humans among the considerations" while the Media Lab "has the same concerns but lives on a broad technological 'bleeding' edge".[3] This distinction is important as it sets the Media Lab apart from research programs around MIT. To Haase, computer scientists, mechanical engineers and other technologists will say the are concerned with people, but often only consider the human by biometric and psychometric means while architecture (and the Media Lab) also consider the aesthetic and psychological effects of a design.

The Lab also developed as a response to the Center for Advanced Visual Studies (CAVS), founded by Gyorgy Kepes. The mission was to facilitate "cooperative projects aimed at the creation of monumental scale environmental forms" and to support participating fellows in the development of "individual creative pursuits."[4] During Negroponte's time as a student and teaching at MIT CAVS brought in bright, entrepreneurial artists to the Department of Architecture and inspired many socially-oriented projects, not unlike the Media Lab today. Negroponte, however, believed in a sponsorship model that departed from CAVS and would open channels for commercialization, thus increase the impact, of the products developed at the lab. The resulting sponsorship model would later deeply connect the Lab and its researchers to industry while still strongly focusing on the creative individual.

Sponsors and industry

The Lab is also unique in that it seeks a wide and diverse range of sponsors who provide a fair level of financial stability, even in temporary downturns. Rather than sponsoring a specific

project, corporate sponsors donate money to the entire Lab, where it is shared equally among the faculty members.[5] As a result, individual lab members or research groups do not have to justify their work to the funding organizations. This allows for a degree of freedom in pursuing ideas and work. Though MIT retains all intellectual property from the Lab, sponsors receive free license of any property created by the Lab as a whole.

This structure allows the Media Lab to attract a wider diversity of companies, some of whom may not normally find benefit from traditional engineering or scientific research; companies like Hallmark Cards, Swatch AG and Plymouth Rock Studios are among the list sponsors and consortium partners.[6] Beyond the financial support, sponsor diversity contributes to the vitality of the Lab as it forces members to both discuss and learn from an ever-changing audience whose business approaches, contexts and problems vary widely. As such, thinking between the various domains necessitates greater creativity in communicating solutions, approaching problems and defining processes for a research project. Students gain practical communication skills through their discussions with visitors ranging from engineers to government officials and visitors often leave with a changed point of view (and research which they could use for their own companies).

While the sponsorship model of the Lab provides it with ample resources, it also creates tension between the research outcomes and commercial ambitions of the sponsor; this is especially true of projects that are politically or socially-focused. An anecdote shared by a recent Media Lab graduate related to a project where website users could deface, replace or edit online advertisements without destroying the page's content sparked the interest of a media conglomerate who, in the same meeting, considered ways of making it profitable (and missed the inherent irony of their discussion). Similarly, research on autism and communication technology intended to accelerate the pace of research is also being used by a sponsor in the finance sector for use on customers at branch offices. This tension between the academy and industry is present, even when the relationship is close. It also serves as an analog to the conflicts seen between industry and the emerging interconnected economy. With societal debates of network neutrality and privacy concerns, the technologically utopian view of the Media Lab also faces friction with the issues beyond the confines of MIT's campus.

The people and place

The development of this community begins with the admissions process, a unique process of talent profiling. Whereas most institutions rely on a proven record of undergraduate academic achievement, the Media Lab relies heavily on the extracurricular experiences of the applicant to understand how s/he uses their unstructured time in the pursuit of creative exploration (doing/making) and experimenting (pursuing curiosity); perhaps their activities are better evidence of entrepreneurship and performance in the classroom.[7] The aspiration of the process is to create an environment where students do not shy from crossing disciplines and research groups to create potential interdisciplinary collaborations as well as being intelligent in a conventional sense.

This difference is rooted in the Lab's distinction from most research groups where people may have a propensity of pursue a specific field of inquiry at enormous depth rather than lateral inquiry. The nature of research is such where skill sets from a variety of disciplines are required and a researcher needs openness, flexibility and willingness to move beyond the boundaries of the individual research groups and to MIT as a whole. As one example, CityCar project from the Smart Cities group has involved dozens of students from the disciplines of urban planning, architecture, mechanical engineering, computer science, electrical engineering, civil engineering, transportation design, business among many more.[8] Simply, the questions raised at the Media Lab are often too large to which one person can have all the answers and expertise.

The composition of the faculty also shares this unique blend of varied talents and willingness to work laterally between the various groups. Some have come to consider a pre-requisite of being a faculty member at the Media Lab is to be a "misfit" whose skills in psychology, design, etc would normally exclude them from consideration at traditional engineering programs. Negroponte asserts that the mark of a successful member in the Lab is "a combination of intelligence, extroversion and open-mindedness."[9] This openness toward diverse perspectives aids to minimize a risk of, as Haase puts it, "intellectual inbreeding"[10] but also opens the possibility for a sense of intellectual isolation as faculty each have distinct expertise.

Further responsibility is placed on the faculty member as they are principally in charge of the research and interests of their groups. Many professors note that the tradition of hands-off management, begun by Negroponte supported by the egalitarian funding model, has contributed massively to the Lab's creative success. Simply, the policy is to give the researchers the resources they need to do their work and leave them alone. A popular anecdote is that of new researchers sitting down with Negroponte (and now Moss) seeking some type of affirmation for their ideas only to receive neutral and unsettling responses as it was the researcher's role to direct the research, not the director's.

The Media Lab, unlike most research groups, is also a degree-granting academic department. The program in Media Arts and Sciences grants masters of science, PhDs and offers some undergraduates the opportunity to perform research in the Lab as part of the Undergraduate Research Opportunities Program (UROP). Faculty members are also hired directly by the Laboratory. The structure of an independent academic community, versus being housed within another department or as a joint center between departments, allows faculty to be beholden to and the finances to remain within the Media Lab. This allows a greater degree of research and academic freedom, as well as personal dedication, which would otherwise not be available as the politics of the institution largely remain internal.

This autonomy allows the Lab to control the type of student admitted and faculty hired. Essential to the success of the Media Lab is a diverse range of perspectives and viewpoints as mentioned previously. Negroponte contends that this broadness sets the Lab apart as generally "graduate degrees, not to mention tenure, depend upon tunneling into truths and illuminating ideas in narrow areas."[11] As the Lab is solely responsible for its admissions and hiring, it has greater power to craft the human environment. Haase argues that the Media Lab independence, versus being part of another center, allows for more "core energy" rather than "marginal energy" of the department toward its research endeavors.[12]

The Demonstration

While the Lab produces a good number of customary academic outputs such as papers and articles, the demonstration is central to the education of the student, as well as the research and design. For many students coming from an engineering background, the notion of producing compelling functioning prototype for discussion, let alone amazing visitors and sponsors, is foreign. Similarly, for some students used to the architectural or urban scales are unfamiliar with producing actual-scale, testable prototypes. The demonstration as a pedagogical tool requires ideas to come to a level of completion and resolution at a one-to-one scale. It is only at the demonstration level can the project be tested against the ambitions of the student.

Stressed Outsourced. Photo Credit: Jean-Baptiste Lebrune, Tangible Media Group.

The importance of the demonstration is codified in the culture of the Lab through Sponsor Week, which occurs once a semester. Here, success is measured by the ability for concepts to be demonstrable and for the public to understand and be awed. Indeed, such a focused outcome lends marketing success and recognition for the Lab but also gives students concrete deadlines to complete individual projects as well as prepare them for various conferences after the Week.

The process and speed of the Lab's pace has created a weakness in the demonstration model at the Lab; there is little discussion or evaluation of the project's merits.[13] Often, students move quickly on to the next project and do not spend time critiquing or evaluating the merits or issues connected with the demonstration; the question remains in many cases of how one judges the social and cultural relevance and utility of the innovation. As mentioned previously, the emphasis on thinking laterally has caused a culture that in some ways opposes going deeper into some projects. So too, some hold the belief that while the process does not provide formal criticism, the disciplinary depth of the individual offers some grounding in a particular field of interest and place concern with the pace of production. In any case, whether the concern is with process or pace, some students and professors interviewed noted, some projects simply are not going to be very good.

Learning/Doing.

Inculcated within is the notion of learning by doing—the importance of making and experimentation. A visit to the lab will stir romantic images of hackers and makers in garages than a research lab one finds in most university science and engineering departments. In most cases, students are empowered to develop their own individual projects and spend more than half of their time doing so. Through the iterative design process of making, refining and critique, the students develop new skills in programming, design or electronics through the constant refinement of their aptitudes and critical thinking abilities.

With so much freedom given to the student, one can examine the nature and development of the multidisciplinary culture of the Lab and how the individual may be empowered and developed within a design program. Students are largely free to develop their own projects for research within the banner of their home research group, though often they may collaborate with members from other groups as well as from MIT, Harvard and surrounding universities at large.

Media Lab students are required to take courses as part of their degree programs, but often attract students from across MIT and Harvard as well. In large part, the class topic and work produced in these workshop-oriented classes parallel research being conducted in the research groups. For the most part, students develop individual or group projects through the course of the semester, and rely on functioning prototypes and demonstrations of the concepts being explored. While much of what is produced is technology or engineering intensive, a typical iterative process guides the student through the various aspects, challenges and development stages of the project toward resolution—the final demonstration. Along the way, ideas are tested through creating personas, paper prototypes, animation and videos among many other methods familiar to designers to test the efficacy of their ideas and possible user scenarios.

Social Lunchbox Video Prototype, Credit: Author.

Students also build necessary skills and learn by doing both within the research group and the classes, yet the onus to pick up many of those skills falls on the individual. In Neil Gershenfeld's *How to Make (Almost) Anything* class, students are

introduced to a variety of manufacturing and fabrication processes including digital fabrication methods, electronics and circuitry and communication technology. Though the class is structured so students have a familiarity with various tools and skill-sets and is intended for a variety of expertise. Throughout the course, students are required to develop their own individual designs and machines using each week's topic. However, a majority of the learning occurs outside of the classroom as students share and seek out instructions and guides on how to realize their ideas. The class is simply meant to provide the basic introduction and aid the students in finding out how to apply and implement the technology on their own. Many students find great difficulty as the class anticipates that not all students will have both the design and technical skills required to easily succeed at every assignment. Students will collaborate and share their individual strengths toward each other's projects and many will build upon projects found on website like Instructables to make projects their own.

With such a strong cultural focus on success and performance, a question of standards arises on how to consider or appraise one's performance yet for student and professor, the metrics as nebulous. Negroponte noted that to him, the prerequisite for advancement is world fame within ones field.[14] As such, even today, the successes and weaknesses of work for both students and faculty are difficult to evaluate except on the merits of press or industrial recognition received. As a teaching method, it becomes completely subjective to assess a project and difficult to provide proper feedback and criticism. Part of the intellectual tension comes from the very asset that makes the Lab unique—its diversity. With projects collaborating with so many disciplines, what or whose standards are appropriate to evaluate a project? As well, the specific focus of each of the individual research groups within the Lab each have their own set of conditions and points of views in which they operate. At this point, the solution remains unclear yet may be necessary to improve the disciplinary rigor of the Media Lab.

Media Lab as Model (Conclusions)

Attempts have been made to duplicate the MIT Media Lab model, yet none have seen the extraordinary success of the original. In 2000, Media Lab Europe opened in Dublin as a partnership between MIT and the Government of Ireland with Media Lab Asia opening short after in 2001 in partnership with the Government of India. However, the Irish went into voluntary liquidation in 2005 with the Indian lab parting ways with the original institution in 2003. Within the United States, Calit2 at the Universities of California San Diego and Irvine as well as Design Machine Group at the University of Washington have shared in the vision of new paradigms of human-computer interaction but have not had the notoriety or perceptive impact as the Media Lab. It is undeniable that the MIT Media Lab has served as a point of inquiry for other similar programs, yet its very uniqueness makes it difficult to draw conclusions or create a template for imitation and innovation.

First, its financial and institutional resources, as well as being situated at a university like MIT have given the Lab the means to be as uncommon as it has—it has been able to afford to take risks. Secondly, the cultural identity of the lab, of which its students, faculty and legacy are part, have yielded an environment where cross-pollination, creativity and risk-taking are welcome and expected. Its focus is also broad, which has allowed the lab to adapt and grow with changes with external factors like technology, society, culture and sponsors as well as internal factors like new faculty and leadership. It is worth recognizing the influence of Negroponte and Wiesner as visionaries and powerful advocates, in addition to forming and directing the Lab's development.

Because of the complexities of the Lab's structure, attempts to copy the Media Lab model may not succeed but lessons in approaching experimentation, creativity and innovation may be found. In teaching, one can find lessons in creating a culture of creativity and experimentation within and beyond normative disciplinary boundaries. In Haase's words, "The lab, in some quiet way, is like a dynamic art piece to which you contribute; like all such pieces, sharing it promises to yield far more than we expect."[15]

---

1   Massachusetts Institute of Technology. "About the Lab | MIT Media Lab." MIT Media Lab. http://www.media.mit.edu/about/about-the-lab (accessed January 31, 2010).
2   Dillon, Dan. "Interdisciplinary Research and Education: Preliminary Perspectives from the MIT Media Laboratory," Harvard Project Zero 13 (2001), p. 7.
3   Haase, Kenneth. "Why the Media Lab works-A personal view." IBM Systems Journal, Fall 2000.
4   Finch, Elizabeth. "Center History." Center for Advanced Visual Studies. http://cavs.mit.edu/MEDIA/CenterHistory.pdf (accessed February 1, 2010).
5   Dillon, 17.
6   "Sponsor List | MIT Media Lab." MIT Media Lab. http://www.media.mit.edu/sponsorship/sponsor-list (accessed February 2, 2010).
7   Dillon, 6.
8   MIT Media Lab. "Group Information." Smart Cities. http://cities.media.mit.edu/ (accessed February 1, 2010).
9   Dillon, 10.
10 Haase, 426.
11 Negroponte, Nicholas. "Creating a Culture of Ideas." Technology Review, February 2003.
12 Dillon, 41.
13 Hasse, 421.
14 Dillon, 32.
15 Haase, 431.

References
Boyer, Ernest L., and Lee D. Mitgang. Building Community: A New Future for Architecture Education and Practice : A Special Report. San Francisco: Jossey-Bass Inc Pub, 1996.
Brand, Stewart. 1987. *The Media Lab: inventing the future at MIT*. New York, N.Y.: Viking.
"Calit2 : California Institute for Telecommunications and Information Technology." Calit2 : California Institute for Telecommunications and Information Technology. http://www.calit2.net/ (accessed January 15, 2010).
Design Studio Pedagogy: Horizons for the Future. Gateshead, UK: Urban International Press, 2007.
Dillon, Dan. "Interdisciplinary Research and Education: Preliminary Perspectives from the MIT Media Laboratory," Harvard Project Zero 13 (2001).
Finch, Elizabeth. "Center History." Center for Advanced Visual Studies. http://cavs.mit.edu/MEDIA/CenterHistory.pdf (accessed February 1, 2010).
Freedman, D. H. 2000. "Media Lab at a Crossroads". *TECHNOLOGY REVIEW -MANCHESTER NH-*. 103: 70-83.
Hassan, Robert. 2003. "The MIT Media Lab: techno dream factory or alienation as a way of life?" *Media, Culture and Society*. 25 (1): 87-106.
Haase, Kenneth. "Why the Media Lab works-A personal view." *IBM Systems Journal*, Fall 2000.

Johnson, Brian R. "[dmg]." Design Machine Group. http://dmg.caup.washington.edu/xmlSiteEngine/browsers/stylin/ (accessed February 3, 2010).

Massachusetts Institute of Technology. "About the Lab | MIT Media Lab." MIT Media Lab. http://www.media.mit.edu/about/about-the-lab (accessed January 31, 2010).

"Media Lab Europe." Media Lab Europe. http://medialabeurope.org/ (accessed January 10, 2010).

MIT Media Lab. "Group Information." Smart Cities. http://cities.media.mit.edu/ (accessed February 1, 2010).

Negroponte, Nicholas. "Creating a Culture of Ideas." *Technology Review*, February 2003.

"Sponsor List | MIT Media Lab." MIT Media Lab.

http://www.media.mit.edu/sponsorship/sponsor-list (accessed February 2, 2010).

Young, Jeffrey R. 2001. "MIT's Media Lab, a Media Darling, Seeks Global Role and New Missions". *Chronicle of Higher Education*. 48 (7): A41-A43.

Creating a Synthetic Space Between Bodies and Buildings

Angela Co
a.co@ky.edu
Instructor
The University of Kentucky
School of Architecture

Elise Co
elise@aeolab.com
Partner, Aeolab

Nikita Pashenkov
nik@aeolab.com
Partner, Aeolab

Abstract

This paper defines a research space of biometric data and actuated origami topology, with the aim of creating reciprocal relationships between biological and architectural bodies. It documents our studies on ways of hybridizing the private biological and psychological domains of the body with the shared space of our constructed environment. Putting both science and fiction in the service of architecture, we envision possible scenarios of buildings-becoming-bodies-becoming-buildings. How can biological systems be extended through the interplay of digital and physical materiality and bleed into new spatial and environmental conditions?

Historically, biometric data-gathering systems, such as fingerprint matching, retinal scans, and voice recognition, have been used in as instruments of surveillance and security in architectural applications. By switching from covert surveillance to the overt broadcasting of some of our most basic bodily mechanisms, we seek to shift the instrumentality of architecture from hierarchical control and abstract information gathering to a physical expression of the tremors, vibrations, and pulses of the physical individual.

Beyond manifesting the workings of our own bodies, what possibilities are there for inhabiting someone else's body, donning a second skin, gaining a privileged, mesmerizing, *Being-John-Malkovich*-esque perspective? And what new role can architecture play as an active participant in the experience?

Our main focus of design is a responsive architectural surface, which folds open and closed in response to breathing rhythms. We explore the tectonics of corrugated origami, utilizing lightweight folded sheet material as hinged surface structures, and the actuation of these structures with hinges and electronic hardware. Custom circuitry gathers data via on-board sensors and microprocessor, and drives actuated behavior in the form of local physical translation and/or rotation.

We are also in the process of researching other types of biometrics, including heart rate, temperature, blinking rate, and electroencephalographic frequencies. We plan to explore the possibilities of emergent form and behavior. Between biological organisms and material organizations, what new figures can emerge as part of an interactive synthetic space?

Conceptual Frameworks

Broadcasting the Body

In J. G. Ballard's short story "The Secret History of World War 3", a doddering Ronald Reagan is re-installed as the President of the United States. Though enfeebled, aged, and nearly mentally-incompetent, he—or rather his body—becomes a source of collective fixation. Updates on his vital stats begin to saturate the media channels, captivating the general public to such a degree that "Ronny's" body ultimately turns into the prime barometer for the state of the union. The President's biometric data becomes pervasive, with non-stop feeds via broadcast:

....thanks to the miracle of modern radio-telemetry, the nation's TV screens became a scoreboard registering every detail of the Presidents' physical and mental functions. His brave, if tremulous, heartbeat drew its trace along the lower edge of the screen, while above it newscasters expanded on his daily physical routines, on the twenty-eight feet he had walked in the rose garden, the calorie count of his modest lunches, the results of his latest brain-scan, read-outs of kidney, liver and lunch function....The While House staff knew that the American public was almost mesmerized by the spectacle of the President's heartbeat.[1]

In this near-future scenario, the body extends beyond its corporeal limits, shaping the politics and mindset of a nation.

A more physical form of bodily expansion can be found in the art installation *Pulse Park*, by artist Rafael Lozano-Hemmer. Set in Madison Square Park in 2008, the responsive "light sculpture" measured the systolic and diastolic heart rates via two "sensor sculptures", and translated the rhythms as sequential flashes of light that moved along a row of spotlights lining the park's perimeter. The web of strobing lights created a temporary extension of the private body into the public realm.

We seek to further explore the manifestation of corporeal vital signs by speculating on how they can literally be embodied in physical architectural materiality. We're interested primarily with biological processes which, though involuntary, may be manipulated through volitional control.

Design Process: Vehicles to Get from Here to There

Our way of working begins with Valentino Braitenburg's opening to *Vehicles: Experiments in Synthetic Psychology* — with a slight modification: the whiting-out of two words, leaving blank spaces for us to fill in:

"This is an exercise in fictional science, or science fiction, if you like that better. Not for amusement: science fiction in the service of __(noun)__. Or just __(noun)__, if you agree that fiction is part of it, always was, and always will be as long as our brains are only miniscule fragments of the universe, much too small to hold all the facts of the world but not too idle to speculate about them."[2]

This new mad-lib'd version of a classic text in the field Artificial Intelligence becomes an open framework for our own experiments in *synthetic space*, patterned after Braitenberg's investigations in synthetic psychology. Through a series of thought experiments, Braitenburg imagines several self-operating machines equipped with sensors and wheels, and by wiring the two together in a variety of ways, his vehicles exhibit increasingly complex "behavior". This behavior gets so unpredictable and yet so oddly familiar that, from a human standpoint, the fictional robots almost seem to manifest fear, aggression, love, foresight, concept formation, and free will.

Braitenberg's vehicles exhibit emergent behavior. By introducing feedback loops and real-time responsiveness to simple behavior modules (individual vehicles, which can be thought of as a relationship between sensors and motors), remarkably complex patterns arise that are neither predictable from, nor reducible to, the rules that govern the behavior of the simple, autonomous vehicles.

The Basic Behavior Module

In a similar way, we are working with a series of simple behavior modules. Our material organization pairs corrugated origami forms with a network of repeating electronic hardware units.

Corrugated origami is cellular: it has a repeating structure of folds (valleys and mountains), which also serve as hinges. Due to its cellular nature, corrugated origami patterns enable a large range of motion and impressive volumetric potential—some patterns can fold entirely flat and also expand to form enclosure-like forms.

Each "cell" of the corrugated origami pattern can be actuated, i.e. folded "open" or "closed". Actuation is through a small scissor hinge, which connects to the paper and is driven by a servo motor. The servo/hinge units are wired to a number of microcontrollers and sensors. Like Braitenberg's vehicles, this wiring is quite basic at the moment, but what we hope—we are still building all the system components—that there is a similar potential for complex behavior and form to emerge in the composite material organization.

Architectural Precedents: Actuated Surfaces

We are certainly not the first to foray into responsive architectural systems, and it helps to note certain predecessors, identifying similarities and differences. Architectural precedents for a responsive, actuated surface include Mark Goulthorpe's (dECOi) Aegis HypoSurface[3], which deforms in response to environmental electronic stimuli, such as sound, light, and movement, and Jean Nouvel's motorized shading screen in the Arab World Institute building (completed 1987).
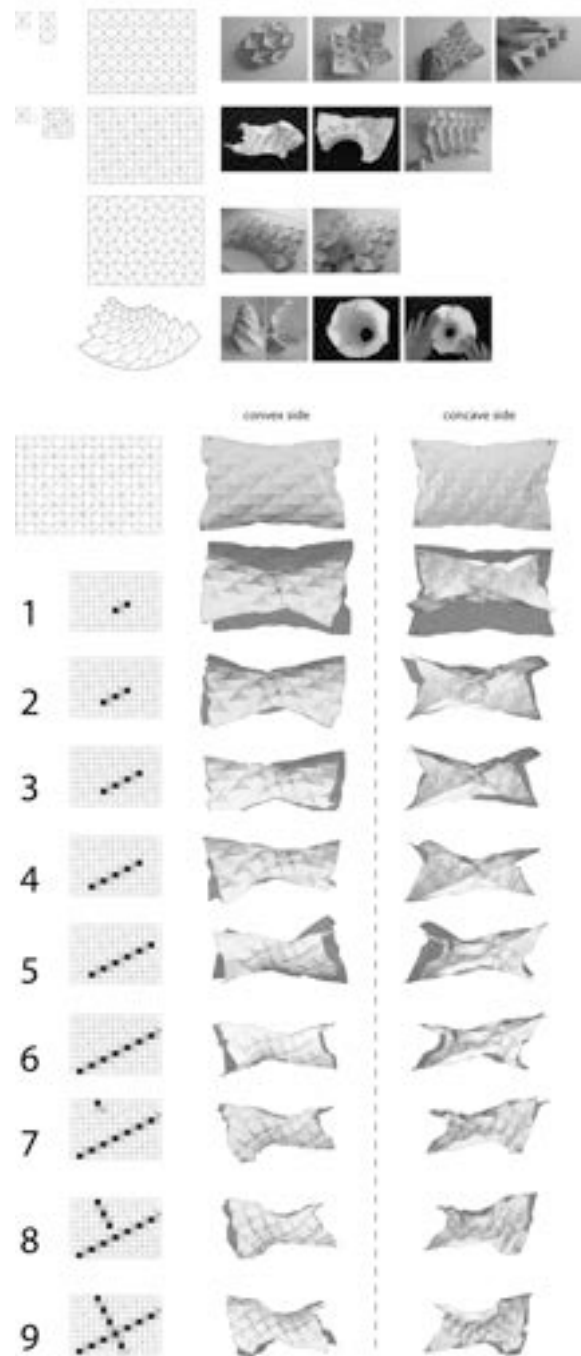
Figure 1. Selected corrugated origami patterns, and diagrams of incremental "closing"

Our research in actuating a surface topology differs in the following ways:

- We are using corrugated origami, which has specific structural and kinetic qualities inherent to the hinged folding pattern. We propose not add any separate structure to the origami topology; both Goulthorpe and Nouvel conceived of structure and kinetic mechanism as systems designed separately from the surface itself.

- Origami is flat-foldable from a single sheet or plate of material. While this is a surface characteristic, corrugated origami has the capacity to create a wide range of volumetric spaces. Both Goulthorpe's and Nouvel's actuated surfaces solely enabled surface effects—as screens whose deformations operated in shallow relief.

Prototyping the Material Organization

Corrugated Origami

Corrugated origami is module-based system, with each deformable module able to open and close. We adapt known patterns, including triangular "waterbomb", square "waterbomb", tessellated triangular patterns developed by Ron Resch[4], and helical patterns found in the phyllotaxis of plants and modeled as origami structures by Taketoshi Nojima[5] (Figure 1).

The origami forms' dynamism is a result of the folds in the paper, which act as movable hinges connecting (relatively) rigid tiled planes. The origami hinges have particular constraints for actuation. Because the origami forms are created by folding a single continuous surface, the actuation mechanism cannot be integrated as part of the topology itself; rather, the actuator mounts to the topology and the origami acts as a carrier for the actuator.

The hinges (folds) in origami have a range of motion from expanded (open) to compressed (closed). Neighboring hinges are often interdependent; if one is closed, topological constraints force others to close as well (or for others to open). Thus actuation of the forms can mean either forced expansion, or forced compression. Figure 1 shows the results of incremental compression, "closing" the hinge between two modules and the resultant deformation of the field. The operation along diagonal adjacencies results in twisting.

Actuation

Servo motors are used to actuate the corrugated origami form, with a single servo placed at each "active," or actuated, origami hinge (Figure 2).

Standard servo motors provide the positional accuracy appropriate for opening and closing a hinge (as opposed to continuous-rotation DC or stepper motors). A custom designed and fabricated fixture consists of lightweight but rigid plastic arms built onto the servo base and rotator, creating a scissors-type mechanism. Each arm mounts to adjacent faces of the origami, actuating the hinge between. Parallels slots along each arm create a "rail" that attaches to the origami surface via a loop. This mounting mechanism provides the requisite coupling, while also allowing the origami surface to slide along the axis of the rail – this flexibility is necessary as the relative position and 3D orientation of each hinge varies (Figure 3).

Figure 2. Four origami hinges actuated using servo motor fixtures.

Figure 3. Detail of servo and mounting fixture. There is no structural skeleton; the actuation system is a distributed network with each unit mounted to the surface.

The linkage actuators are driven by a custom programmable hardware board with sensor and communication capabilities. Each actuation module is a lightweight node that mounts directly to the origami surface. No extra structural skeleton is needed, as the origami supports the actuators.

Bundling sensing, communication, and actuation into self-contained modules enables distributed, scalable control structure. Power and communication wiring float point-to-point.

Communication and Emergent Behavior

The hardware module provides not only actuation, but also sensing and communication. Once multiple hardware modules are distributed across the origami topology, the relationships between each module, and also between module and data stimulus, determine the "behavior" of the overall form. The sensor/communication network configuration is thus an informational as well as literal, physical topology.

One of our goals is to provide a framework through which complex behavior can emerge through the interplay of a distributed set of simple mechanisms, rather than via a centralized program. The actuators are established as being physically distributed across the origami surface; how are they controlled, and what do they respond to?

Distributed Sensing

The most distributed system consists of modules acting completely independently of each other; in this scenario, each module is equipped with its own sensor(s) in addition to the actuator. The richness of emergent behavior depends on the variance of sensor readings from module to module; this configuration lends itself to response to ambient stimuli such as light, sound, or proximity that are locally specific. In this scheme, inter-module communication is unnecessary.

Single-point (centralized) Sensing, Distributed Topology

In the case of a single source stimulus, if each module responds to exactly the same stimulus, complex behavior may still emerge, but the range of states is limited to the range of the source stimulus.

On the assumption that greater range and variety will potentially result in more unpredictable and complex behavior, we utilize the distributed topology and overlay a configuration of how the source stimulus propagates from module to module.

If the data undergoes some transformation with each transmission, the pattern of propagation also becomes a topology with physical manifestations. Data transformations could include:

- time-shifting the data signal with each communication "hop" (from one module to the next)

- decaying the data signal with each hop

Diagrams that trace the flow of biometric data from the body (lungs, mouth) to our actuated surface prototypes are shown in Figure 4.

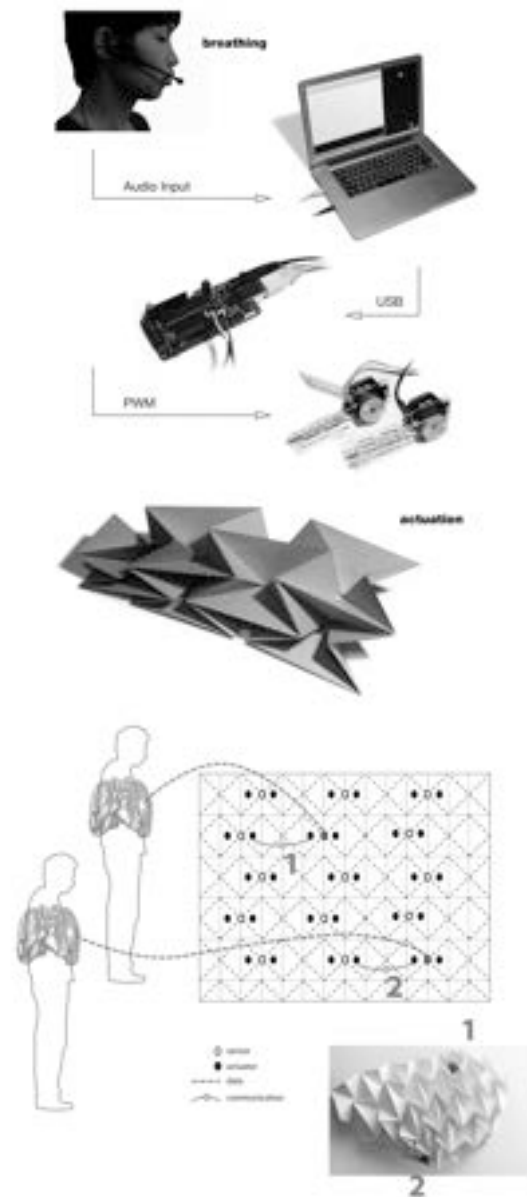Figure 4. Diagrams showing information flow from body (lungs, mouth) to architecture (actuated origami surface)

Biometric Data

We have identified and tested several technologies for collecting biometric data:

Breath – A microphone was used to sense breathing via audio signal amplitude, assuming a relatively quiet environment. Other possible technologies to be explored include piezo electric or thermistor sensing.

EEG – A basic EEG sensing module was built using open-source hardware and a signal-processing firmware developed by Aaron Bocanegra. In tests, explicit user control of the EEG signal was best achieved through contraction of facial muscles. Next steps include further research and development in processing the signals into higher-level data.

Heart rate – Wireless communication via the ANT+ protocol allowed data collection from a Garmin heart rate monitor. ANT+ is a popular open standard for low-power wireless communication (especially in health-related sensing), extending the integration potential to several off-the-shelf products by various manufacturers.

Each of these sensing technologies was tested using a PC for signal processing and communication. While the ANT+ communication and audio-amplitude detection could feasibly be implemented in firmware on a microcontroller, higher-level EEG signal processing and analysis likely require the higher computational power of a PC. In the context of larger-scale forms approaching human and building scale, the inclusion of a PC as data processing layer seems reasonable.

Conclusion

The many automata of the present age are coupled to the outside world both for the reception of impressions and for the performance of actions. They contain sense organs, effectors, and the equivalent of a nervous system to integrate the transfer of information from the one to the other. They lend themselves very well to the description in physiological terms.[6]

Our research agenda lies at the intersection of architecture, responsive design, and biometrics. After prototyping structures using paper and testing the actuation of a multiple joints, we have identified the following key issues that need to be addressed as next steps:

- Scale: this is of primary concern as we move towards a research phase of prototyping at furniture- or enclosure-scale. Having identified corrugated origami for its unique material and formal properties, how do our small paper prototypes scale to significantly larger sizes? Issues of fabrication, and maintaining the unique shape memory carried in the hinges, need to be addressed.

- Data: Having investigated, and developed interfaces to, various sensors for biometric data, the next step is to integrate data stream(s) into our actuation system.

- Behavior: Alongside physical scale, system scale must also be expanded, by increasing the number of actuation modules. We will implement a distributed communication topology, and investigate the behaviors that emerge.

This list outlines our research goals in the near future. To complement the pragmatics of this plan, we offer a series of images: thought experiments that merge the body with architecture at a variety of scales (Figure 5). These synthetic spaces between bodies and buildings are niches in which—perhaps—a new species born from a post-human subject and

a post-building architecture might evolve, along with new possibilities of sensation and agency.
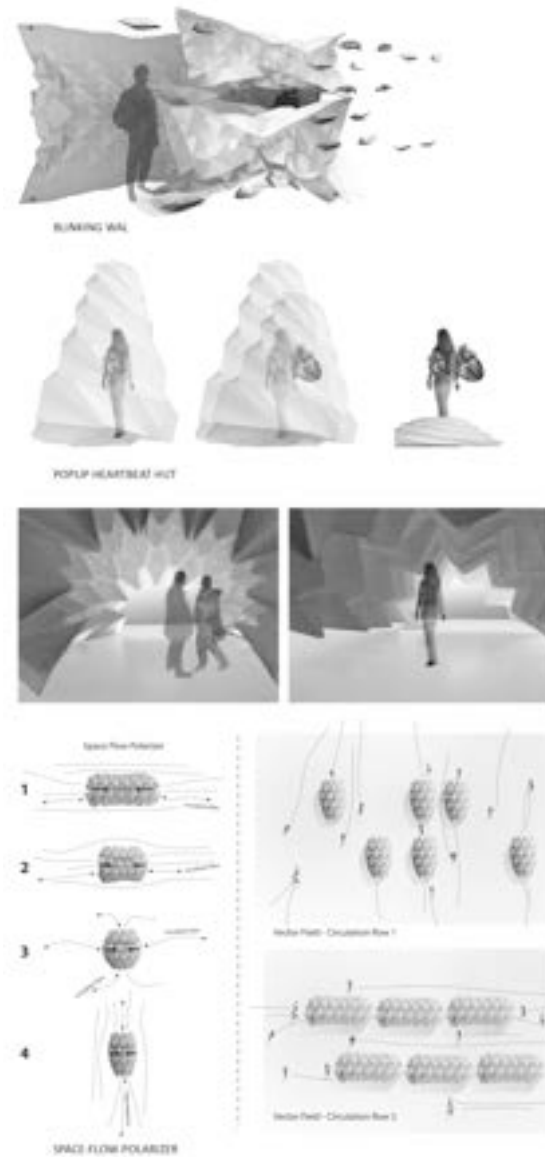
Figure 5. Thought experiments in synthetic space: buildings becoming bodies becoming buildings….

1   J.G. Ballard, "The Secret History of World War III" in *War Fever*, (New York: Farrar, Straus, and Giroux, 1990), p.26
2   Valentino Braitenburg. *Vehicles: Experiments in Synthetic Psychology*, (Cambridge, Mass: MIT Press, 1984) p.1
3   Mark Goulthorpe and dECOi, http://www.sial.rmit.edu.au/Projects/Aegis_Hyposurface.php
4   Resch, Ron. http://www.ronresch.com/
5   Taketoshi Nojima, "Origami Modeling of Functional Structures based on Organic Patterns" (Kyoto: Dept. of Engineering Science, Graduate School of Kyoto University, 2002) Retrieved from http://internetconferences.net/ipsi/files/Tokyo_N%20Origami%20Modelling%20of%20Functional%20Structure.pdf
6   Norbert Weiner, *Cybernetics*, (Cambridge: MIT Press, 1961), p.43

Unity of Being: The Hidden Manifestation of the Indoor-Outdoor Relationship in the Traditional Architecture of Iran

Dr. Khosrow Bozorgi
kbozorgi@ou.edu
Professor
The University of Oklahoma
College of Architecture

The unique sustainable architectural character of Ganj-Ali Khan Complex, which is the main focus of this paper, provides a time-space synthesis representing movement systems, generating their respective fields of gravity and consequently their own orders in urban space conception. A distinct primary, secondary, and tertiary movement system reveals the means by which these functions and their interactions result in a complex unity that marks an outstanding example of harmonic order.

Fig.1 Ganj Ali Khan Complex (Google Earth).
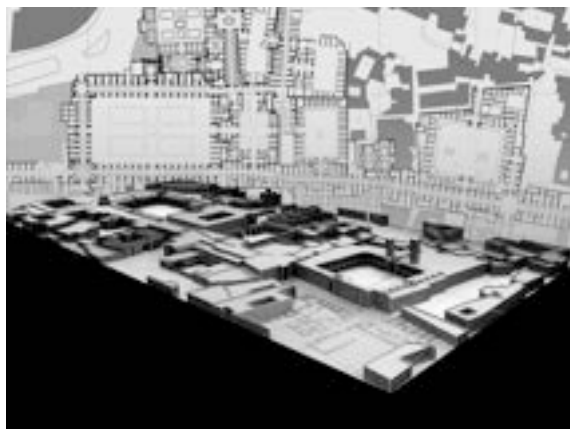
Fig. 2 Ganj Ali Khan Complex (model, built by students of 5th year, College of Architecture, University of Oklahoma, 2006).
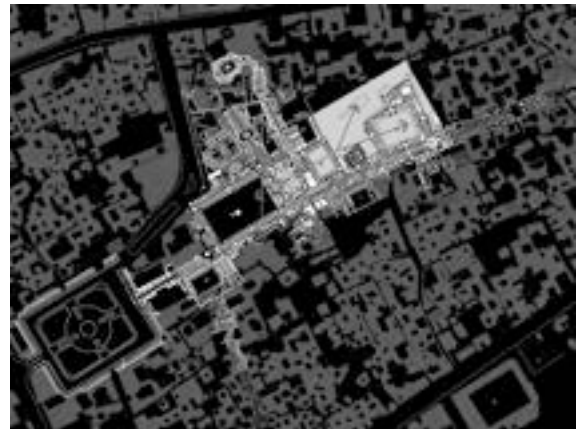
Fig. 3. Ganj Ali Khan Complex (Area Map, surveyed by Khosrow Bozorgi).

The complex was built by Ganj Ali Khan who governed Kerman, Sistan and Kandahar provinces from 1596 to 1621 under Safavid Shah Abbas I. It consists of a madrasa, caravanserai, mosque, baths, mint, cistern and shops. This complex characterizes itself in strong organic form. A walk through the Ganj-Ali Khan Complex follows an ancient thoroughfare where symmetry and rhythm are combined in motion, as in a wave. The architecture rhythm in Ganj-Ali Khan is found through time, space, and motion. The soul of the Complex is revealed as one moves between the indoors and outdoors. This unity creates a total fabric.

Kerman is the most remote of Iranian cities in the chain of cities cutting through the central plateau. In the east it is separated by the Kavir Desert from Baluchistan, now modern Afghanistan and Pakistan. Historically, the city owed its modest prosperity in Timurid and Safavid times to trade with India (1587-1629). The city fabric is made of bazaars, bathes, mosques, other public and private buildings, courtyards large and small, and paths. It appears homogeneous from the air. Kerman has one of the most extreme climates in Iran. In summer it can reach 42 degrees centigrade in July, while it can drop to below freezing in the winter. The climate naturally affects the way the Ganj-Ali Khan Complex has been planned and built.

Fig. 4. View of Ganj Ali Khan Complex (photographed by Khosrow Bozorgi).

Fig. 6. Vakil Bazaar ,Ganj Ali Khan Complex (photographed by Khosrow Bozorgi).

Fig. 5. Boroujerdi Residence, Kashan, example of court garden (photographed by Khosrow Bozorgi.).

Fig. 7. Public Bath of Vakil, Ganj Ali Khan Complex (photographed by Khosrow Bozorgi).
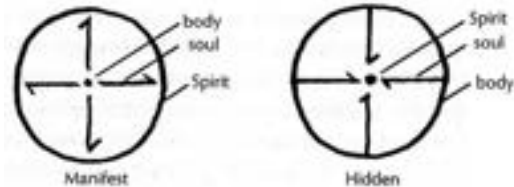
This study is important in order to understand the intellectual aspect of architectural space. Analyzing the essence of design in this historical urban complex needs the knowledge of certainty inspired by the doctrine of the spiritual path. The following diagram might to conceptualize the meaning of a unique relationship established by the dialog between inside room and outdoor court.

In spite of numerous deep transformations during the thousands of years of Iranian architectural history, similarities can still be found which are really limited by the type of building from the simplest to the most complicated structures. A courtyard (contained garden) with surrounding rooms is a

quarto-arch and the perfected courtyard becomes the quarto-portico. The quarto-arch is thus a generator of both intellectual and visual awareness. A close examination will be undertaken to reveal the cultural and ecological forces that stimulate these sustainable and environmentally correct simultaneous movement systems in Ganj-Ali Khan Complex. In order to achieve this, I will examine primary movement system-the bazaar; the secondary movement system-the residential pathways; the tertiary movement system-the impact of historical monumental buildings of the complex.

This paper also focuses on the architectural analysis of the site by investigating the intellectual awareness of the following factors that are vital for understanding the nature of the unique space conception in Ganj-Ali Khan Complex: culture, unity and plurality, interior and exterior, order and disorder, and complexity and simplicity

The study of culture throughout the historical development of traditional sustainable built environment in Iran is of paramount importance. In architecture of Ganj-Ali Khan Complex, the cultural and ecological forces that stimulated such sustainability and uniqueness in space conception should be discussed. Iranian culture, throughout its long and ancient history, has manifested itself in a variety of ways. The differing lifestyle of its many ethnic groups; the rich, shared experiences in language and literature; and a wide range of environmentally

correct approach towards architecture have continuously provided the context for the expression of culture. Iranian architectural tradition has accrued over the past thousand years a rich legacy of eternally valid responses to the perennial dictates of man and nature. These environmentally adaptive and sustainable principles are the legacy of correct, wholesome and balanced building design. The genius of such principles are that they are based upon human scale, the body's golden mean proportions, the vernacular use of appropriate construction materials, eliciting in the viewer a profound sense of the archetypal meanings of spiritual transcendence and cosmic unity. In the studying of such traditional sustainable urban settings, the impact of climate, which is an important factor of diversity, is clearly conspicuous.

Undoubtedly, one of the noblest manifestations of Iranian beliefs in the meaning of form and space is the architectural element of court garden that is the main space conception in traditional sustainable planning. A contained garden is the peak of Iranian creativity, in which the gentlest melody of nature and love of life, inspired by mysticism, is most coherently revealed. The mystical relationship with which Iranians nurture their gardens with water, trees and flowers, clearly shows that this contained plot is a sacred realm.

Once this plot of land is cultivated, the need arose to enclose it for protection from outside. Culturally and spiritually, the indoor-outdoor space relationship can be studied in the spiritual teaching of Zoroaster that also pointed to the enclosure of the court garden by seven rings of walls so as to keep out demons.

A walk through Ganj Ali Khan Complex continuously implies the unity and plurality in relationship between interior spaces and exterior court gardens. The architectural dialogue between indoor-outdoor spaces represents the unique character of desert cities. There are common structural and physical features in the layout of such cities in the *desert plateau* of Iran. The complicated and interrelated factors that have shaped historic architecture and urban form in desert regions are mostly affected by climatic. The urban form of the traditional city of Kerman is highly centralized and inward looking. Certainly, the orientation and relation to the environment has been of high importance in the planning of Kerman. The particular climatic problems caused the people of the hot, arid zone to find solutions through their settlements' architecture. Central Iran has a very large day-night temperature difference, ranging from cool to extremely hot, and the air tends to be very dry all day long. Most buildings are constructed of very thick ceramics with extremely high insulation values. Furthermore, towns centered on desert oases tend to be packed very closely together with high walls and ceiling, maximizing shade at ground level. The heat of direct sunlight is minimized with small windows that do not face the sun. The high radiation and temperature in the summer, seasonal variations from dry, hot summers to cold, dry winters, low humidity, limited water supplies and the dusty

Fig. 8. Babur's Garden, the first Moghul 'Paradise Garden', is said to have been a model for many other gardens.

Fig. 9. The architectural conception of garden reflects the "sense of place". The garden being viewed as a defined space encompassing within itself a total reflection of unity. Garden of Shazdeh, Mahan, Kerman (photographed by Khosrow Bozorgi).

Fig. 10. Walls materialize the barrier between wild, inhospitable, unbridled nature and a space set aside for a nature made by the hand of man. The concept seems sufficiently universal to define the garden generally: In Classical German language, gart meaning "enclosure" Garden of Shazdeh, Mahan, Kerman (photographed by Khosrow Bozorgi).

Fig. 11. Rooftop, Ganj Ali Khan Complex (photographed by Khosrow Bozorgi).

Fig. 12. Wind catchers, Shrine of Shah-Nimatota Vali, Mahan, Kerman (photographed by Khosrow Bozorgi).

winds are the most important factors in forming such urban structures. When studying the massing concept of Ganj-Ali Khan Complex, the significance of its planning is based on a correct response to the extreme climate of desert in winter and summer time. The use of the wind-catcher is an ancient technology to create natural air circulation and cool the inside of the complex. This traditional device along with courtyards and domes function as a natural ventilation system.

In the compact city of Kerman, the high-density and the urban structures of mixed land-use are thought to promote walking and cycling as the main modes of movement. While on an urban scale, the street appears as if carved out of a mass. In reality, the wall defining it is a thin membrane at the building scale. The concentrated urban texture diminishes penetration of dusty wind into the buildings as well as lowering the impact of heat on their surface. Covered passageways and narrow alleys with long walls in clay make the shade that provides and thermal comfort conditions in the hot summers. In addition, the buildings' orientation is in a way to avoid hot summer sun rays and stormy winds. The organic network of ways (passage, alley, cul-de-sac) has been made according to ground slope and the underground water canals called Qanat running from the base of mountains across the desert. Since water evaporates quickly on the high, dry plateau, open canal aqueducts are not as efficient as the underground method. A main shaft is sunk to the permanent subterranean water level, usually at the base of hills or mountains.

In Ganj Ali Khan Complex, the notions of complexity and simplicity are visually expressed. The structural unity is reinforced by the use of clay and mud brick as the main building material, which is found locally, reducing the heat absorption and reflecting the sunlight. This urban complex with the domes and vaults of mud and baked brick has been formed by the different levels: covered passageway, court, balcony, and roof. The roof turns into a surface, as active as any on the ground. The fluid relationship of levels animates the fabric of the complex just as the roof-scape animates the horizon with its domes, balustrades, wind towers, and steps. The Ganj- Ali Khan Complex is organically well integrated with the fabric of the City of Kerman.

The skyline of Ganj-Ali Khan Complex has been dominated by fantastic mud brick towers, giving the city an incredible urban aesthetic. These wind towers serve three fundamental functions: to ventilate basements, to provide convective cooling and to cool the interior mass of the house. These wind towers are rectangular with openings facing to catch favorable wind, even the slightest movement of air, and direct it downward into underground spaces. This model had become a part of the identity of this Complex in coping with natural forces for many centuries. Unfortunately, it now has been abandoned in modern architecture. To enter an individual house, a hierarchy moving the public from amenities, to the semi-public neighbor to the private space is created.

In Ganj-Ali Khan Complex, the idea of the unity of being can be discussed while searching for the intellectual definition of indoor-outdoor relationship as it has been manifested architecturally. Focusing on tangible sustainable organic elements of architecture, one can notice that the existence of inner courtyards or contained gardens at the core of this complex conceptualize the meaning of a unique relationship established by the dialog between the inside room and the outdoor court. The architecture of Ganj-Ali Khan characterizes itself in strong organic forms. The bazaar follows

an ancient thoroughfare where symmetry and rhythm are combined in motion, as in a wave. The rhythm is time; its place is space, and its motion the soul moving between the two, making the complex into a total fabric. The boundaries of the system which delimits space may be distributed regularly or irregularly; they may fill space in rapid succession or leave it empty for long periods of time, they may be crowded together or be spread thin; they may follow the pattern of space with certain variations or run contrary to it, creating secondary movement systems. This freedom of distribution and arrangement makes it possible for negative shapes (boundaries) to give the constant, basic form of this wave a changing, perpetually different profile. Defining the notion of the court garden is essential to this research paper while conceptualizing the unique relationship established by the dialog between inside room and outdoor court.
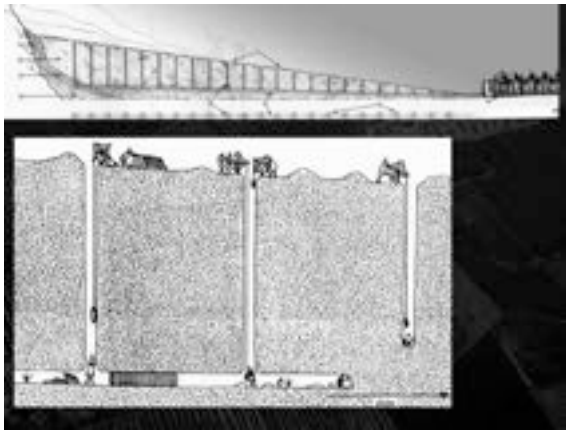

Fig. 13.   Qanat lines running from base of mountains across desert. Since water evaporates quickly on the high, dray plateau, open canals aqueducts were not as efficient as underground method. A main shaft was sunk to the permanent subterranean water level, usually at the base of hills or mountains.

The Iranian development of the Paradise Garden, a place to enjoy cultivated trees and flowers with the addition of water features such as pools and fountains, provided the foundation for Renaissance European gardens, and of the field of landscape architecture. Both the planning and finishing of interior spaces are so highly developed that they became a standard of comfort and craftsmanship in the West. Rather than influencing Europe, the design achievements of the Middle East overflowed the region's borders and contributed mightily to other homelands. Further discussion about Middle Eastern architecture is vital to our discussion in order to define its historical contribution to the West. For instance, the discussion of Iranian architecture is that of the architecture of different environments, cultures and periods. There are almost no relationships the rock architecture of the western part of the country, the wooden architecture of the North, and the mud-brick architecture of the towns on the edge of the desert. The great architectural diversity of the vast Iranian territory can probably be attributed to the existence of different climates, ethnic immigrations into Iran, and the long-lasting hegemony of non-Iranian dynasties. The impact of climate, which is an important factor of diversity, is clearly conspicuous in residential architecture. Without being influenced by official

stylistic developments, this diversity has gradually emerged in the course of time and is rooted in the geographic location. However, the diversity of official architecture has been associated with political-cultural developments, rather than climate. For example, Seljuq architecture takes shape following the same stylistic particularities in Iran, Turkey and Syria, the geographic domain of Timurid architecture involves Iran and Central Asia, and Safavid architecture is reflected in Isfahan, Qum, and other cities.

Another secondary, but significant, variable is the ethnic mobility and the quiet frequent migration of architects throughout the Middle East. This is why the work of Iranian architects can be seen from Syria to India. The massing concept of Ganj- Ali Khan Complex is neither entirely an expression of harmony and unity, nor entirely one of opposition and plurality. Rather all at once, it fluctuates between these opposed features. Introversion and the interior-exterior dialectics are among familiar subjects, but our aim, instead of pointing out to introversion in the current architectural vernacular is to indicate the interior the interior-exterior dialectics in terms of its intellectual definition and its characteristics. Another point which demands discussion in the architecture of cities neighboring the desert is the precise order of mosque plans and the sinuous disposition of streets in residential areas, which exhibits a conspicuous opposition between order and disorder in Iranian architecture. Understanding the dualism of order and disorder not only reveals the particular layout of Iranian cities, but also indicates the general tendency of the Iranian aesthetic, which can be studied even in the design of a carpet. Many western scholars and researchers have spoken of the uniformity of the Iranian architectural language by reason of its limited vocabulary. In opposition to this view, another group of researchers, particularly European travelers, have mentioned the striking diversity of Iranian architecture and decoration. It seems that this divergence derives mainly from different outlooks in regard to Iranian architecture. The truth is that Iranian architecture is highly diverse in some aspects, and uniform in other aspects. As noted by numerous European scholars and some Iranian researchers, despite the apparent complexity of Iranian structures and patterns, architecture has sometimes emerged upon very simple bases. This characteristic probably constitutes one of the wonders of Iranian architecture as well. A gradual transition of architecture from structuralism to formalism can be traced along the history of Iranian architecture, particularly from the Seljuq to the Safavid period, when the formalistic approach seems to have been prevalent. Such examples as Khaju Bridge in Isfahan attest to the existence of strong tendencies toward tectonic construction.

The present theme "The Hidden Manifestation of Indoor-Outdoor Relationship in Traditional Architecture of Iran" has establishes an intellectual and theoretical background to study sustainability. In recent decades architects and planners have been concerned about energy constraints and global warming. Designers are facing the biggest challenge of their professional careers, as their planning approaches must deal with ever changing building technology. This research is going to focus on the adaptability of a historical model that can establish new architectural principles, helping the development of a green approach towards architectural design.   Such principles are

environmentally adaptive and sustainable while seeking design solutions in a semi-arid landscape. The goal is to investigate the fundamental principles of natural vernacular air circulation along with the study of the notion of the indoor-outdoor relationship in the court architecture of the Iranian desert and find ways to integrate such criteria into the planning and design of modern buildings.

The physicality and the related traditional architectural elements of sustainability such as wind-catchers, cisterns, and covered bazaars are best communicated in a visual format; hence this project explores digitally the uniqueness of architectural characteristics of a number of buildings. This research involves an extensive photographic survey of several historical sites, yet each individual captured frame has to be surveyed and digitally drawn to explore the following overarching fundamental principles of design: symbolic vision; environmental adaptation; the paradise garden paradigm; positive space system; human scale; and geometry.

References

Ardalan, Nader. *The Sense of Unity*. The University of Chicago Press, 1973.

Bloom, Jonathan. Minaret, *Symbol of Islam*. Oxford University Press, 1989.

Blunt, Wilfrid. *Isfahan, Pearl of Persia*. New York: Stein and Day Publishers,1966.

Clark, Kenneth N. *Desert Housing*. The University of Arizona Press, 1980.

Creswell, K.A.C. *Studies in Islamic Art and Architecture*. The American University in Cairo Press, 1965.

Critchlow, Keith. *Islamic Patterns: An Analysis and Cosmological Approach*. New York: Schoken Books, 1976.

Dutz, Werner Felix. *From Pasargade To Darab*. Tehran: Farhangsara (Yassavoli) Press, 1997.

Hillenbrand, Robert. *Islamic Architecture*. New York: Columbia University Press, 1994.

Micham, Roland and Sabrina. *Coulour and Symbolism in Islamic Architecture*. New York: Thames and Hudson, 1996.

Moynihan, Elizabeth B. *Paradise As A garden*. New York: George Braziller,1979.

1978.

Shani, Raya. *The Case of the Gunbad-I 'Alawiyan' Hamedan*. Oxford University Press, 1996.

Sultanzade, Husayn. *Urban Spaces In The Historical Texture of Iran*. Tehran Municipality Press, 1991.

The Art in Structural Design for Extreme Natural Forces

Dr. I-Kwang Chang
archichang.1@ou.edu
Associate Professor
The University of Oklahoma
 College of Architecture
[Paper Presenter—Session 4B]

Sean McDow
sean_mcdow@ou.edu
MArch Student
The University of Oklahoma
College of Architecture

Abstract*

The architecture of Bruce Goff is characterized by a diversity of appearance. Each design is an assertive composition of originality responsive to the needs of the client with a conviction to create a personalized environment reflecting their aspirations. Goff's commitment for creative solutions led to both new geometric configurations which are often integrated with an expression of structure. The variety of conceptualizations of this duality are apparent in the Hopewell Baptist Church in Edmond, Oklahoma with tapered Warren trusses on the exterior defining the twelve sided plan, the use of Quonset ribs on the hemispherical Ford House in Aurora, Illinois, the cable-supported roof of the spiraling Bavinger House in Norman, Oklahoma and the innovative Japanese Pavilion of the Los Angeles, California. In all of these buildings there is a rational congruence of form, space and structure. The intent of this paper is to illustrate the potential of those idealized dimensions of expression, the continuum of form and structure, through the use of a new design concept known as "ASID-3DS". The concept involves the applications of diffusing, decoupling, and dynamic solutions in an attempt to prevent catastrophic failures due to extreme natural forces. The "ASID-3DS" is, in fact, applicable to various extreme natural forces due to earthquakes, hurricanes, tsunamis, and wildfires. Traditional construction methods have not changed much over time with materials which ultimately diminish in strength and character. Therefore it is essential to search for new and innovative methods of design and assembly in order to prevent failure. The "ASID-3DS" method aims to achieve the goal globally. While each building design and construction is force, form, function, and site dependent, each case becomes unique and demands various innovative and non-traditional structural systems.

This paper presents three conceptual designs based on three natural forces: 1) earthquake, 2) wind, 3) tsunami. The three strategies of ASID-3DS are applied respectively or jointly. The "diffusing" solution is to diffuse the forces. The "decoupling" solution involves the separation of structures that is force dependent. The "dynamic" solution searches for new materials and technology that will react kinetically in response to respective dynamic forces.

The focus of this paper is to introduce to architecture and engineering practitioners and students in understanding power of "ASID-3DS" through development of new structural systems in architecture creations which address the life safety and structural integrity issues timely and help create a timeless architecture. "ASID-3DS" is that new inspiration.

The Bavinger House, designed by Bruce Goff.
Image: Lorena McClain.

*Note: For full paper, please contact I-Kwang Chang at archichang.1@ou.edu

The Responsibility of Technology vs. the Technology of Responsibility

Aimee Buccellato
abuccellato@nd.edu
Assistant Professor
The University of Notre Dame
School of Architecture
[Paper Presenter—Session 4B]

Abstract

This paper will present the author's research in quantitative analysis of construction methods, materials, and principles of design through a select series of Case Studies involving both proposed and built projects focused on measuring, evaluating, and comparing purportedly "green" materials and methods of assembly alongside their traditional predecessors:

Energy and Knowledge Embodied: The Molino Project; Adaptive re-use of an early 20th century adobe flour mill; Bernalillo, New Mexico

Is Long Haul Preservation Preservation in the Long Run? The 900 mile journey of St. Gerard's Catholic Church from Buffalo, New York to Atlanta, Georgia

The Placebo Effect and LEED

Loyola University of Chicago's new Information Commons (LEED Silver)

Emerging Technology: The Concrete (Ana)**Log**(ue)

How modern technologies may extend or enhance the already durable qualities of traditional materials and methods.

Each Case Study involves the comparative quantitative analysis of primary building components and whole building design for each Subject Case building and allied Design Case counter-proposals, including: material properties and thermal performance; material embodied energy and embodied water; building site impact; footprint, actual and operating; and material life-cycle analysis, as related to baseline building life expectancy (100 years).

While the aim of the Case Studies is to generate specific, objective, quantifiable information, the research does not intend to advance universal outcomes or remedies, recognizing that in many cases, efforts to promote optimization and standardization – or a series of global solutions that do not necessarily take into account the distinct characteristics of location, climate, and culture – are not typically the most lasting – either culturally or ecologically – of endeavors.

By reaching beyond polemics and positions grounded largely on aesthetic premises, The Green Scale Research Project (TGSRP) intends to expand our ability to make informed design and material decisions from the outset of the design process, leading ultimately to the creation of *truly* sustainable buildings, and meanwhile seeks deeper understanding of the following related premise: What responsibility do we assign to modern technology to generate "sustainable" design solutions; how have we come to prioritize novel, advanced building technologies above immediately accessible, customary methods – and at what cost? What *is* responsible technology?

What is the Responsibility of Technology in Sustainable Design

Much of today's discourse on "green" building practices centers on the relationship between sustainability and advanced building technologies – or the perceived dependence on the latter to achieve the former. Either way, these terms have become ubiquitous, if not also synonymous, in modern architectural discourse.   But in our pursuit of high-tech optimization – in the form of "smart" building skins and "green-gizmos" soaked in embodied energy – are we overlooking materials and methods that are presently available, immediately accessible, and inherently durable and sustainable? As we advance novel technologies to generate change in the unsustainable world that we have created, are we headed towards a future of global standardization, cultural ennui - and *more* industrialization - while overlooking more immediate solutions?

If we accept that sustainability means using building systems and materials that collectively have *less* of an impact on the environment, then by principle, the use, manufacture, and implementation of these systems and materials should be of *less* consequence to the environment than any potential gains to be had in their utilization.

Before the dawn of the thermostat age, buildings were designed to perform in their environment *without the benefit of active intervention.* The orientation of a building, its materials, methods of construction, massing, scale of openings, and other bioclimatic factors were all primary design considerations before the advent of active measures. These design considerations, although not highly-technical, are not merely commemorative of an earlier, "less complicated" time, but remain central to the design of buildings that are site-specific and well-adapted to their environment. What can be gained from the study of traditional methods of construction and principles of design?

Throughout time, building traditions and systems of construction have necessarily been born out of what was

readily available: local resources, skilled labor, economics, climate, and ultimately, the combination of necessity and beauty. These methods are generally low in embodied energy, have been vetted, refined, and mastered over time, are climate and context-specific in their selection and assembly, and when executed in conjunction with fundamental principles of design, have produced some of the most enduring, efficient, practical, and beloved buildings standing today. A return to the design pragmatics of the pre-fossil-fuel and pre-thermostat age, and a renewed commitment to understanding the full impact of our design decisions – both in the present and the future - may perhaps bring us closer to finding truly responsible technology.

Methodology

In an effort to understand the broader implications of our design decisions and material and method choices, students involved in TGSRP engage in directed Case Studies of existing buildings through the quantitative analysis of that building, the Subject Case, relative to its particular site, the primary construction methods and materials employed in its execution, and any design decisions that were fundamental to its conception, if known or articulated.

This paper will present two related types of Case Studies:

Type I: High Tech/ Low Tech quantitative analysis of an existing or proposed building, the Subject Case, that has been designed and constructed using primarily novel, non-traditional materials and methods, oftentimes accompanied by claims of "greenness", sustainability, or enhanced performance, compared side-by-side with quantitative analysis of a counterproposal to that building, the Design Case, which is an alternate design and construction of the Subject Case using traditional materials, methods, and principles of design.

Type II: Alternative Construction quantitative analysis of an existing building, the Subject Case, that has been designed and constructed using traditional materials, methods, and principles of design, compared side-by-side with quantitative analysis of the Subject Case building using alternate methods of construction, including at least one contemporary mode and related materials.

Both types of study involve the dissection of the Subject Case building into primary building construction systems, assemblies, and components, and the empirical evaluation of those materials side-by-side with the dissection and empirical evaluation of the Design Case or Alternative Construction Cases. Data and analyses related to these studies used modeling and analysis programs such as Revit, Ecotect Analysis, Green Building Studio, and Athena Impact Estimator, along with manual calculations and materials databases, like the Inventory of Carbon and Energy (ICE)[1]. (See General References and Appendices for expanded data.)

TGSRP methodology differs from similar quantitative comparisons and case study-based inquiries, like those published by Robert Adam and Atelier 10[2]; the theoretical and experimental comparative studies of the performance of mass wall technologies summarized by researchers at the Oak Ridge National Laboratory[3]; and the "green" test houses built recently by the Prince's Foundation in the UK[4]. Where these studies are largely focused on comparative modeling or field experimentation to measure the thermal performance of standard building envelopes, TGSRP is focused on generating comparative data on actual buildings, particularly those that purport to be *sustainable,* in order to consider side-by-side the

broader implications of our decisions at the earliest stages of design, and the range of impact that those decisions may have when our buildings become manifest in the built world.

Today, sustainable building is more often than not described, illustrated, and executed using novel, high-tech solutions which are fundamentally at odds with the concept of sustainability. Is novel necessarily better; advanced technology necessarily more efficient, more sustainable? What are the affects of streaming innovation? Beyond the up-front costs – both monetary and resource-related – of research and design, constantly changing technology demands agile, specialized labor forces, sophisticated mechanisms and processes capable of accurately testing and evaluating new methods, and ultimately, time to respond to failure. Innovation can bring about progress, but it can also be extremely taxing on the environment and a stressor on society, potentially contributing to a loss of confidence in what we already know and the skills that we have already mastered.

Fig. 1. The Molino, March 2010. In the foreground, 4th year students in the Buccellato Studio (University of Notre Dame School of Architecture) participating in the reconstruction and stabilization efforts. Image: Author's.

Energy and Knowledge Embodied: The Molino Project

Type II: Alternate Construction

The first case considers one such mastered technology through the study of traditional earthen construction in the form of an historic adobe flour mill (c. 1907) in Bernalillo, New Mexico. "The Molino" is one of a small handful of structures of its kind that survives – in part – today; there are only two other adobe structures left in the state that, like The Molino, once stood at or over three stories tall. Stabilization and reconstruction efforts are currently underway by the town of Bernalillo to salvage and rehabilitate the remaining structure and prepare for its adapted, although yet-to-be-established re-use, by the community (Figure 1).

The Molino became the subject of a Case Study in the spring of 2010 when I traveled to Bernalillo with my undergraduate design studio to study the ancient practice of adobe construction through our assistance in the stabilization efforts and our subsequent proposals for The Molino's completion and adapted re-use.

Despite the evolution of built form in the region over the last 150 years and the advance of novel technologies, adobe arguably remains the most efficient and effective building

material for the region, due in large part to its ability to store and distribute heat gained from the sun during the day into the structure at night. Not only is mud-brick construction thermally well-suited to arid climates, like northern New Mexico, but it is made from materials that exist in abundance nearly everywhere, clay and sand. Adobe is local, low in embodied energy and one of the most democratic systems of construction: adobe structures can be built and maintained over time by communities and individuals, unlike highly technical systems which require the specialized expertise of a relative few.

The focus of this case study is to empirically evaluate the value of saving The Molino versus its demolition and the construction of a new building – of the same size and ostensibly the same function – in its stead. The Subject Case analysis quantifies the completion of the existing structure using hand-made adobe bricks as the primary wall system; compared side-by-side with separate analyses of the same building (post-demolition) constructed using two alternative materials for the primary wall systems: modern adobe block and concrete block construction. The roof system proposed for the Subject and Alternative Construction Cases is the same: engineered wood trusses sheathed with exterior grade plywood and corrugated metal; the foundation system for both Alternative Construction Cases is reinforced poured-in-place concrete, while the Design Case maintains the structure's original load-bearing river rock foundation.

Preliminary Results

The thermal mass potential for massive wall construction in the southwest, particularly that of adobe construction, has been well-studied. In locations such as Bernalillo, New Mexico, the most effective wall assembly in terms of thermal performance is a masonry mass wall assembly where the mass wall is located in close-contact with the interior of the building (*int-mass)*, versus an assembly where insulation is added to the interior of the mass wall (*ext-mass)*, which performs significantly less effectively[5]. The insulation values of each assembly, traditional adobe construction (*int-mass)*, modern adobe construction (*ext-mass)*, and concrete block construction (*ext-mass)*, were evaluated and compared thusly:

The R-Value of the existing wall assembly (to be completed in the Design Case), 22" of adobe masonry with 2" of lime plaster applied inside and out, is approximately R-12, which meets the minimum wall R-Value for US Climate Region 5b[6] (R-11.4 c.i.). If The Molino were to be constructed anew using a modern adobe block assembly, or 14" of petroleum-stabilized adobe with an interior non-load-bearing frame wall and standard batt insulation, the aggregate assembly R-Value is 19.3 (modern adobes alone achieve only an R 6.7). Alternately, if the building were to be constructed anew using a wall assembly of reinforced concrete masonry units (grouted solid) with an interior non-load-bearing frame wall and standard insulation, the aggregate R-Value is 14.1, similar to that of the original wall construction.

Although each of the wall assemblies analyzed meet minimal thermal performance standards for the region, the broader implications of the material choices and methods involved to achieve them must be considered. If The Molino were to be razed instead of preserved, the implications – including the embodied energy of the materials used and their life-expectancy – of reconstructing a similar building are:

The total embodied energy involved in constructing a new building of the same size (3400 SF) using a modern adobe wall assembly is 51 percent greater than the total embodied energy involved in completing and re-using the existing structure (calculations include the building envelope that remains, or 70 percent of the total masonry involved in a full reconstruction). Ext-mass concrete block masonry construction – the least thermally effective wall assembly of the three – is also more intensive in total embodied energy than the modern adobe case, by 20 percent. And while each assembly system must be regularly maintained, the materials involved in routine repairs to the modern adobe and concrete block wall assemblies - cement-based mortars and plasters – are more intensive than the lime-based plaster used with traditional adobe construction[7].

Ultimately, the preservation of existing durable building stock – no matter the condition of the building – *is* large scale recycling. According to our preliminary data, completion of The Molino, using traditional methods and materials, as opposed to the construction of a new building using *modern* materials and methods would *save* – at minimum – 175 million BTU's (embodied energy for demolition alone is 53 million BTU's[8]).

Is Long Haul Preservation Preservation In the Long Run?

Type II: Alternate Construction

Preservation comes in many forms and the question of whether or not the most customary type of preservation – preservation *in situ* – is the only "valuable" type of preservation (valuable, in the same terms of the analysis performed in the first case) is the focus of the second case.

While many churches in the northeastern United States have been forced to permanently close their doors due to a decline in membership, parishes in the American southeast simultaneously struggle to physically accommodate their growing congregations. Facing just this challenge, in 2008, The Reverend Father David M. Dye, Pastor of Mary Our Queen in Atlanta, Georgia, went in search of a church for his growing congregation, and found one – in Buffalo, New York.

Our study of St. Gerard's Church involves the empirical analysis of dismantling, moving, and reconstructing an early 20th century stone church 900 miles from its original site. Taking into consideration both the material to be salvaged and its transportation, we will compare the plans underway for the church, the Subject Case, against the construction of a new church of a similar magnitude (size, materials, and methods), and the construction of the same church using contemporary masonry construction methods and materials.

The salvage and re-use of building materials and even the transport of entire buildings, like this one, is not a novel concept or practice. And while the value of conserving and preserving existing durable building stock has been studied, what has yet to be quantified are the broader impacts of "long haul preservation", particularly the energy involved; and what, if anything, is to be saved – or gained – by moving and reconstructing a structure of this scale (Figure 2).

103

Fig. 2 St. Gerard's RC Church, Buffalo, New York, September 2010. In the foreground, members of TGSRP 2010-2011 Research Team. Image: Author.

Current Analysis/ Predictions

Analysis of the Subject Case (underway) is based upon the design proposed by the Georgia-based architect, Harrison Design Associates, which centers on the deconstruction, salvage, and modified re-use of the primary exterior masonry facing material, Indiana limestone, in order to re-erect an exact replica of the church in suburban Norcross, Georgia. Unlike the original structure, which is constructed with unreinforced load-bearing composite masonry (alternating courses of 4" and 8" dressed limestone bonded with bluestone infill at the lower walls and brick at the clerestory), the facing material of the Subject Case building will be cut down to a uniform depth (approximately 4") and hung as veneer from insulated concrete forms in the reconstruction. The steel roof trusses, interior steel structural columns and beams, and copper roof, gutters, and leaders will be salvaged and recycled locally (in New York State); interior non-load bearing partitions, plasterwork, and finishes, will not be saved or transported.

The Alternate Construction Cases will use the material take-offs generated for the Subject Case to quantify the impacts of building the same church out of new materials today, using the same methods of construction and types of materials as the original structure, and alternately, building the same church out of new materials, using customary, contemporary methods of construction; in this case, insulated concrete forms clad with limestone veneer (and in a sub-case, stucco). The foundation construction assumed for all three cases is poured-in-place concrete; the roof construction is light gauge steel trusses clad with standing seam metal; and all new structural steel, relieving angles, and masonry ties will be included.

A significant focus of our study of the proposed plans for St. Gerard's concerns the energy involved in the deconstruction, modification, and transportation of the structure. The number and type of machinery involved in the deconstruction process, as well as the duration of use, will be included in our quantification of the Subject Case, along with two possible modes of transport, over land via rail and truck, and via truck alone.

Temporarily setting aside a number of qualitative considerations and the range of arguments related specifically to the treatment and preservation of sacred structures, buildings like St. Gerard's that have ceased to support active functionality are always mere moments away from total devastation, whether by fire, the elements, or vandalism. The debate can quickly turn from how to adapt, re-use, or salvage the structure and/or its valuable, durable materials to how to deposit the church – and its legacy – as landfill. Whether or not the data and analysis generated in this Case Study ultimately reveals a wash, gain, or loss (in terms of environmental impact), the question of what to do with existing, durable building stock looms large. Is there an *empirical* threshold where the "costs" involved in the salvage, transportation, and reconstruction of such structures outweigh the benefits?
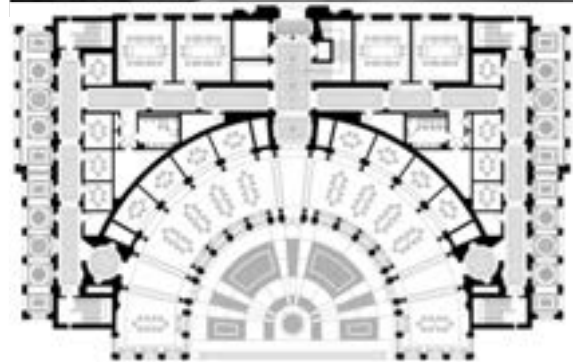

Fig. 3a. (Top) Subject Case: Loyola University of Chicago's new Klarchek Information Commons (LEED Silver). Fig. 3b. Design Case: Proposed Ground Floor Plan. Image credits: John C. Mellor.

The Placebo Effect and LEED

Type I: Hi Tech/Low Tech

Much attention today is focused on minimizing a building's operating footprint by optimizing raw energy consumption; meanwhile, the construction of hyper-efficient buildings, by virtue of their design and particular component parts, can consume exponentially more energy than what the most energy-efficient building uses annually. Novel materials, methods, and connections of assembly are unique and in many cases experimental, requiring specialized knowledge and proficiencies, and are not typically found locally. What are the *true* costs of these novel systems? As we endeavor to produce new technologies and materials that will make our buildings more efficient while at the same time attempting, ultimately, to use less energy, there emerges a significant – if often inversely-proportional – relationship between embodied energy consumption (for research and design, extraction, transport, fabrication, and construction) and a building's lifetime operating energy consumption[9].

The focus of the third Case Study is the 70,000+ SF Richard J. Klarchek Information Commons, located on the eastern shore of Lake Michigan, in the heart of Chicago's Loyola University. Our objective: to quantify the broader impacts of specific decisions made at the outset of the design process, including: building orientation, response to site, climate, and transparency, the materials used and methods employed, including assertions of advanced performance[10]; compared to an alternate design and construction of the Subject Case, using traditional principles of design, materials, and methods of construction.

In response to their client's priorities, priorities – day-lighting, transparency, thermal comfort, and efficiency, among them – the architects, Solomon Cordwell Buenz, designed a pair of 150 foot glazed façades bound by pre-cast concrete-clad "bookends"; what has been characterized as a four-storey glass box[11]. The broadest exposure of the existing, Subject Case building (Figure 3a), faces nearly due east, exploiting an (otherwise) unobstructed view of Lake Michigan.

Preliminary Results

Among the building's various novel design responses, the west-facing glass façade is a double-skin curtain wall (average assembly R-value: 4.35) designed to engage and integrate many of the building's mixed-mode operating systems; the lakefront façade is a single-skin curtain wall (average assembly R-value: 2.17).

Included in its application for LEED status were the building's novel HVAC systems and energy conservation strategies, including higher than anticipated thermal performance, despite the fact that the average R-value for over 47 percent of the building – the glass curtain walls – is 3.26. And while post-occupation energy use exceeds ASHRAE's baseline (Standard 90.1-1999), the building's *actual* energy use is still notably higher than the design model[12].

The counterproposal or Design Case (Figure 3b) evaluated is a masonry structure, self-supporting limestone and brick façades (33 and 55 percent of the total façade surface area, respectively) in front of a single wythe of structural reinforced concrete masonry (CMU). The average façade R-value for the Design Case, including punched openings (insulated glass; 13 percent of the total façade surface area), is 23.6. And while the total façade surface area of the Design Case is 10 percent greater than the total façade surface area of the Subject Case (44,605 SF: 41,034 SF) – by virtue of the proposed design's footprint (Figure 3b) – heat loss through the Subject Case's envelope is considerably greater: 462K BTU/hr versus 152K BTU/hr (calculated on a 15 degree day).

Beyond considering the thermal performance of the materials used, the estimated embodied energy (and water) involved in the execution of each Case was also studied. Due to incomplete information about the roof and floor assemblies of the Subject Case, and to maintain comparable side-by-side evaluations, our quantifications do not include the embodied energy calculations for the roof, floor, or foundation systems for either Case. Conservative assumptions were made about the use of recycled aluminum in the Subject Case (20 percent recycled: 80 percent virgin), and the quantity of stainless steel cable, fittings, and connections in the curtain wall assemblies was estimated at 1000 lbs. The embodied energy calculation for the Subject Case does not include the 6,625 feet (or 1.25 miles) of silicone sealant in the glass facades and joints between the precast panels.

While the existing façade has slightly less embodied energy than the proposed, 6027mBTU versus 6526mBTU, it is important to note two critical influences: the difference in total façade surface area between the two designs (10 percent) and the volume of brick masonry material calculated for the Design Case, which could be significantly reduced if a single wythe brick veneer construction were employed in lieu of the multi wythe self-supporting system proposed. The use of recycled brick versus virgin material would also significantly reduce the EE figure.

Our analysis of this Case Study and preliminary data suggest that there *can* exist quantifiable differences between newness and effectiveness – or that an implicit connection between the two should not necessarily be assumed. As with the Subject Case, can a building with façades composed of over 50 percent glass make credible claims about *increased* thermal performance, sustainability, and efficiency? And if so, are the ways that we currently measure and qualify sustainable and efficient design, like LEED and ASHRAE, sufficient – and do these standards necessarily lead us to the design and execution of truly sustainable buildings? At minimum, additional metrics are warranted so that the up-front and lifetime costs of the materials used and the assemblies employed – no matter how highly engineered – are included in our overall assessment of building performance; and per the intent of this research, that these factors become greater influences on the way that we set out to design truly sustainable, durable, and efficient buildings.

Emerging Technology: The Concrete (Ana)**Log**(ue)

Type II: Alternate Construction

Today there are modern technologies and materials that *may* extend, enhance, or perhaps even *exceed* the already durable qualities of traditional materials and methods. These technologies do not necessarily merit praise on their own; innovation alone does not necessarily make a better, more sustainable building. As the 18th century theorist Laugier observed, the solidity of a building – arguably its most important quality in the context of durability and sustainability

– distinctly depends on two things: the choice of material *and* its efficient use.
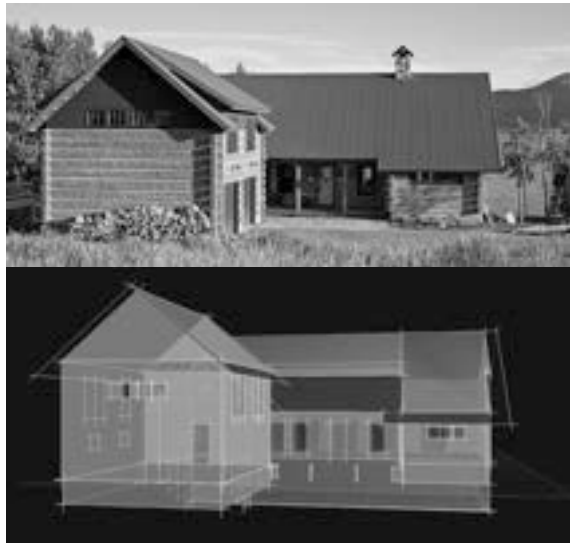

Fig. 4a (Top) Subject Case: A Residence on Henry's Lake, Idaho; Buccellato Design 2007. Image credit: J. K. Lawrence. Fig. 4b Model generated using AutoDesk Ecotect Analysis 2010.

The Subject Case building of the fourth study, a residence in northeastern Idaho made out of cast concrete logs, was just the seventh structure of its kind to be constructed out of the novel material (Figure 4a). According to the engineering and performance data published by the manufacturer, Everlogs[13], the insulated concrete composite logs won't shrink, swell or settle; they're air-tight – on an order of six times that of light wood framing (per testing by the National Center on Appropriate Technologies); are resistant to mold, rot, and insects; and achieve a three-hour (no burn) fire rating. Unlike its organic predecessor, the CIC (*core-insulation-core)* system[14] is steel reinforced to perform optimally in hurricane and seismic-prone areas (such this house which sits in a level 4 seismic zone).

While recognizing these many superior benefits, are there consequences associated with using a structural wall assembly that, despite its baseline R-19 insulation value, consists primarily of composite concrete, steel, and rigid insulation, as compared to a the construction of a similar structure using traditional timber log construction or light wood platform framing?

Preliminary Results

Evaluation of the Subject Case was based upon the primary assemblies used as built: reinforced poured-in-place concrete foundation; 8" thick steel reinforced insulated composite concrete log wall assembly with an interior, non-load-bearing 2x4 frame wall filled with Polyicynene closed-cell insulation[15] (Figure 5; A); and a cold roof constructed using engineered wood trusses insulated along the bottom chord with Polyicynene. The foundation and roof assemblies remained the same in both Alternate Construction Cases, but the two wall assemblies quantified and compared to the concrete log assembly were: 2x6 light wood or stick-frame construction, filled with standard batt insulation and clad with exterior grade plywood and stained wood clapboard (Figure 5; C); and 8" traditional timber log construction with an interior non-load-

bearing frame wall, filled with standard batt insulation (Figure 5; B) An interior frame wall assumed in both the Subject Case and this Alternative Construction Case for the purpose of securing interior finishes and running electrical and plumbing services.

In this Case, the wall assembly that involves the least embodied energy in its execution, light wood frame construction, is also the least thermally effective assembly of the three systems (see Figure 5). The alternate, traditional timber wall assembly performs marginally better thermally than the stick-framed assembly, but is percent less effective than the concrete log wall assembly. On the other hand, the embodied energy associated with the Subject Case wall assembly – which can only be estimated at this time based upon the evaluation of similar commonly-used components – is notably greater than the embodied energy of the two Alternate Construction Cases (approximately, 1.15×10^9: 9.7×10^7: 1.12×10^9 EE; CIC, timber log, and stick framing, respectively).
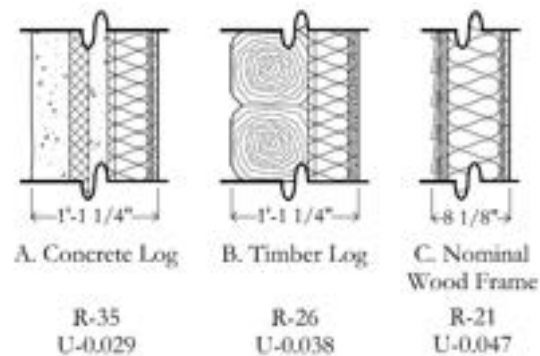
Fig. 5 Subject Case and Alternative Construction Case wall assemblies and associated R and U-Values. Image credit: Evan Possley.

Although the initially energy-intensive Subject Case requires less operating energy for heating and cooling – and therefore fossil fuels – than the Alternates, the thermal performance of the assemblies and their energy "costs" must be evaluated holistically alongside other considerations, like sourcing (a potentially significant "cost" for a traditional timber log construction, both in terms of harvesting and transportation), lifetime maintenance, and construction waste. In each of these categories, the novel material improves upon long-standing tradition: each log is cast to exact size, almost eliminating construction waste; in this case, the primary wall assembly materials were "local", traveling less than 250 miles to the job-site (as opposed to timbers which would likely have originated from Canada); and unlike their organic counterparts that need to be routinely treated, stained, and patched, the concrete logs do not require *any* subsequent treatment or chinking.

……….

For many, the emblematic goal in building design today is how to express in built form what many consider to be the Era of Sustainability, signified by novel, high tech methods and cutting-edge building technologies. Ironically, these very same materials and methods which are meant to convey a sense of progress by achieving (or, as in some cases, merely claiming) superior performance, are not necessarily the most ecologically responsible or culturally sustainable practices, and therefore, may not be the most durable nor *truly* sustainable ways of making in the long-term.

The data and analyses generated by The Green Scale Research Project, such as the four Case Studies presented in this paper, contribute quantitative analysis as an means to enhance our ability to make informed design decisions, establishing both a premise and a methodology for empirically evaluating side-by-side the full impact of our decisions on the built and natural environs, and a means for discovering *truly* responsible technology/ies.

TGSRP recognizes that individual system performance is only as good as the connections made between those systems and the treatment of the penetrations made within those systems; the durability and therefore sustainability of a building is also largely dependent upon how a building is put together. To this end, TGRSP generates a catalogue of primary connections and penetrations for the Subject and Design Cases as an additional way to evaluate and describe best practices.

Challenges and Outlook

Current modeling software limits our ability to make accurate, certifiable comparisons of as built conditions and design and material alternates germane to this research. At present time, prevailing modeling and whole building analysis software are not capable of holistically and empirically evaluating building designs at the level of an individual component or custom assembly, but only according to a very basic, limited, palette of predetermined assemblies[16]; nor are the programs able to integrate accumulated design-specific data or outcomes into a concurrent design process.

Because we are not able to validate data generated by these programs or account for incongruence between our manual calculations – which we *can* qualify – and the digital outputs, we are largely reliant upon data collected manually, and are restricted, to some degree, in our evaluation of certain material properties, like embodied energy and water, by the limitations of the databases currently available. Accordingly, our Case Studies currently focus on the evaluation of primary systems: foundation, envelope, roof, openings; and the intrinsic properties of those systems.

As the aim of The Green Scale Research Project is to evaluate and arrive at quantitative data capable of describing and influencing the broader impacts of our design decisions, the future of the research lies in the development of a dynamic modeling program that will enable the user to evaluate the use of specific materials and methods simultaneously with site-and-context-specific design decisions. Our research necessitates the ability to evaluate and compare different ways of making at the granular, rather than the macroscopic level, which is not yet supported by present technology.

1   Geoff Hammond and Craig Jones, *Inventory of Carbon & Energy (ICE), Version 1.6a.* Bath, UK: University of Bath, (2008)

2   Robert Adam, Atelier 10, et al., "Energy and Environmental Assessment: A study of the energy performance of two buildings with lightweight and heavyweight facades" in the April 2008 Executive Report (unpublished). P. 1-5, and "Sustainability and Traditional Architecture", *On Green Architecture and Urbanism* Council Report VII: The Congress for New Urbanism (Conference Proceedings) Alexandria, Virginia (2007). p. 14-15.

3   J. Kosny, T. Petrie, D. Gawin, P. Childs, A. Desjarlais, and J. Christian of the Buildings Technology Center, Oak Ridge National Laboratory, "Thermal Mass – Energy Savings Potential in Residential Buildings". http://ornl.gov/sci/roofs+walls/research/detailed_papers/thermal/index.html.

4   Ben Bolgar, "A New Culture in Building" in *On Green Architecture and Urbanism* Council Report VII: The Congress for New Urbanism. Conference Proceedings. Alexandria, Virginia (2007). p. 13.

5   Ibid., Kosny, et al.

6   ASHRAE/ANSI Standard 90.1-2007: Energy Standard for Buildings except Low-Rise Residential Buildings. Table 5.5-5 Building Envelope Requirements for Climate Zone 5(A, B, C), American Society of Heating, Refrigerating and Air Conditioning Engineers. Atlanta, Georgia (2007). p. 23.

7   Ibid., Hammond and Jones.

8   Offin, Maria. "Straw Bale Construction: Assessing and Minimizing Embodied Energy."Queen's University, 2010.

9   Canadian Wood Council, "Comparing the Environmental Effects of Building Systems: a Case Study". *Wood the Renewable Resource* No. 4 (1997).

10 Joann Gonchar, AIA, "Case Study: Loyola Information Commons". *Green Source Magazine* (2009). http://greensource.construction.com/projects/0811_LoyolaUniversity.asp.

11 Ibid., Gonchar.

12 Donald McLauchlan, P.E. and David Lavan, "Efficiency by the Book; Case Study: The Richard J. Klarchek Information Commons Building". *High Performing Buildings.* American Society of Heating, Refrigerating and Air Conditioning Engineers (2010). www.hpbmagazine.org.

13 "EverLog Systems", http://www.everlogs.com/pdfs/ELS-Brochure.pdf

14 Ibid., Kosny, et al.

15 Product specification: Icynene LD-C-50. (2010) http://www.icynene.com/assets/documents/pdfs/Products/ICYNENE-LD-C-50-Specification-Sheets-US.pdf

16 Per our use in support of this research of the following programs: Autodesk Revit 2010 and Green Building Studio: Whole Building Carbon Analysis); Ecotect Analysis 2010; Athena Impact Estimator; and per conversations and special training sessions with John Herridge, Autodesk Education Solutions Specialist for Green Building Studio and Ecotect.

Additional References

"R-Value Table: Insulation Values for Selected Materials." Colorado Department of Energy. http://www.coloradoenergy.org/ procorner/stuff/r-values.htm (accessed 6/15, 2010).

Allen, Edward and Joseph Iano, eds. *Fundamentals of Building Construction: Materials and Methods.* 5th ed. Hoboken, New Jersey: Wiley, 2009.

Building Construction Cost Data. 67th ed. Kingston, MA: RS Means Co., 2009

Ching, Francis D. K. *Building Construction Illustrated.* 4th ed. Hoboken, New Jersey: John Wiley & Sons, 2008

Construction Resource.com. "Wall Framing Calculator." http://www.construction-resource.com/calculators/stud-wall.php (accessed 7/, 2010).

Josephe A. Dempkin, AIA and The American Institute of Architects Washington, D.C., eds. *Environmental Resource Guide.* New York: John Wiley & Sons, Inc., 1998.

Lippiatt, Barbara C. *BEES 4.0: Building for Environmental and Economic Sustainability.* Gaithersburg, Maryland: National Institute of Standards and Technology, 2007.

Mazria, Edward. *The Passive Solar Energy Book.* Emmaus, PA: Rodale Press, 1979.

McHenry, Paul Graham. *Adobe and Rammed Earth Buildings, Design and Construction.* New York: John Wiley & Sons, 1984.

Technical Committe of the Log Homes Council. "The Energy Performance of Log Homes." (2003).

The Technical Staff of Cornerstones Community Partnerships. *Adobe Conservation - A Preservation Handbook.* Santa Fe: Sunstone Press, 2006.

Winkler, E. M. *Stone in Architecture, Properties, Durability.* Third ed. Berlin: Springler-Verlag,.

The REdaptive Vessel: The REbirth of Louisiana Architecture

Jessica Hester
jahester@ou.edu
BArch Student
The University of Oklahoma
College of Architecture
[Paper Presenter—Session 4B]

Abstract

The REdaptive Vessel project combines innovative flood-resistant technology, creative sustainability techniques, and economic feasibility. This tertiary concept has developed into a residence like no other. It uses insightful techniques to overcome many of the deep rooted issues that revolve around houses built in flood zones. The biggest of which is the structure's ability to overcome floods brought on by hurricanes.

Currently, houses in the New Orleans region of Louisiana use piles, or stilts to overcome hurricane flooding. As seen in the aftermath of Hurricane Katrina, this concept does not always do its due diligence in keeping the living space water tight. The piles often do not pose an issue for many families, but present many obstacles when the client is elderly or disabled. To avoid accessibility issues, there was great need to find a solution that did not involve building a one-hundred foot ramp; especially considering that water damage equivalent with that of Hurricane Katrina only comes along every fifty to one hundred years. This initialized quest to understand the reasons behind the standards set in traditional Louisiana design.

Throughout this exploration there was one constant: water vs. structure. Because it is impossible to waterproof the openings in a building, the penetrations needed to be elevated above any water that could possibly occur. To overcome this situation the house would be built on a barge. Due to the state's proximity to the Mississippi River, out-of-commission barges are not hard to come by. The plan is to REfurbish an existing barge and build the house directly on top of it. This house will then be tethered to the site creatively. If torrential rains or hurricane gales causes the neighborhood to flood, the barge bungalow will simply float its way up to safety.

The REdaptive Vessel has the potential to be a self-sustaining, off-the-grid, safe haven. It would be possible to remain in the vessel during severe weather for several weeks. The Adaptive Vessel's price tag is between $100,000 and $130,000, depending on the amount of self-sustaining equipment that the tenants would like to incorporate into the design of their home. This project has true potential to change the face of residential architecture in Louisiana and around the world.

The REdaptive Vessel

There is a profound and deep-rooted connection to tradition, culture, and lifestyle in New Orleans. This connection to things of the past is the heart of residential design in this community. The people of New Orleans depend on this association as a way to keep their heritage alive. They put great value in the way they think, design, and make their homes a space that is special and personal to them and their families.

Traditionally, homes in the New Orleans area have been built on piles. These piles range from 5 to 7 feet in height. Because this area is prone to flooding, measures have been taken to reduce the amount of possible damage to residential structures. This region is also known for its 'shotgun' style architecture. This design concept is rooted in the need for passive cooling on the extremely hot summer days that are common in the Deep South. Although this way of design is founded in the vernacular of the region, this concept is the beginning of the modern ideals of sustainability, which, so many years ago, was not an option but a requirement of the design. This is achieved by the front door and the rear door of the house aligning through a path of circulation such as a corridor or and open floor plan. In theory someone could shoot a 'shotgun' down the entire length of the house.

The traditional method of residential construction is not so different than that of today. Often houses were designed similar to the others in the neighborhood. They were typically built out of wood framing, clad with wood siding. Houses had a small foot print that was long and narrow in dimension with a roof line that was typically peaked or hipped. The front porch became an essential item on any home. This space often served as the social network of the community before Facebook or Twitter replaced the desire for human interaction.

The 'Shotgun' form of the building fits the context of the Broodmare community in which this project is located. (See fig. 1) To be able to adapt to a different site, it would not be too difficult to REevaluate the community in which the Vessel would be located. This REdaptive Vessel was designed to fit in the context of the Broodmare neighborhood which sits just outside New Orleans. This neighborhood is forward looking and optimistic. The residents are doing everything they can to

move beyond the devastation they endured and have created a plan to redeem their community after the loss of so much.

Figure 1. Traditional 'Shotgun' style housing

On the fifth anniversary of Hurricane Katrina, the mayor of New Orleans, Mitch Landrieu spoke on CNN about the rebuilding of the city. In the speech he reminded us that, "for four horrific days there was anarchy on the streets of America. The levees broke and our government failed. It is a moment in time that we should never forget and one that we should never ever ever repeat."[1] This catastrophic event opened a door to modify the traditional residential design of the New Orleans area. No longer shall we make buildings that can be so easily destroyed by the wrath of nature. A house is an extremely personal space. People spend their lives making their houses the perfect place to raise their families and enjoy the company of those who are most important to them. If they cannot trust their house to simply protect them from the weather, then what can they depend on? The architecture community has a responsibility to protect humanity and Hurricane Katrina exposed New Orleans' failure to accomplish this task.

The devastation caused in the wake of Hurricane Katrina can only begin to be repaired with the REbuilding and REnewal of the urban fabric and infrastructure. With the loss of over 1,800 lives and an estimated $75 billion in damages[2], changes must be made in the way buildings serve the people. The REdaptive Vessel is a step toward achieving these changes by REbuilding the neighborhoods in New Orleans. It is the goal of this project to solve not only the need for shelter but to strive to provide a creative solution to a rising problem. The design of this residence has developed some innovative ways to overcome constant issues that face the Parish of Orleans. The first of these unique adaptations is the ability to overcome rising waters during torrential rains that are often associated with hurricanes and the failure of local levees. This was done by the REtrofitting of an existing barge. This barge has significance not only for the pragmatic ability to overcome flood waters but also for its cultural and contextual connections. The community accredits much of its livelihood to the income that is generated through the use of the Mississippi River. Thus, the barge is deep-rooted in their many generations of hard work and success.

The REdaptive Vessel project was the outcome of an international competition. The requirements specified are at the forefront of the REbuilding issues facing many of those

affected by the 2005 hurricane. Their residential building sites are often long and narrow (See Fig. 2) with finished floor siting about 7 feet above grade and their houses are usually small allowing about 800 square feet of occupiable space. There are quite a few elderly and disabled people who live in the region most affected by the storm. Another issue to be addressed was the integration of sustainable ideas. This combination of criteria formed the starting point for the REdaptive Vessel's program.
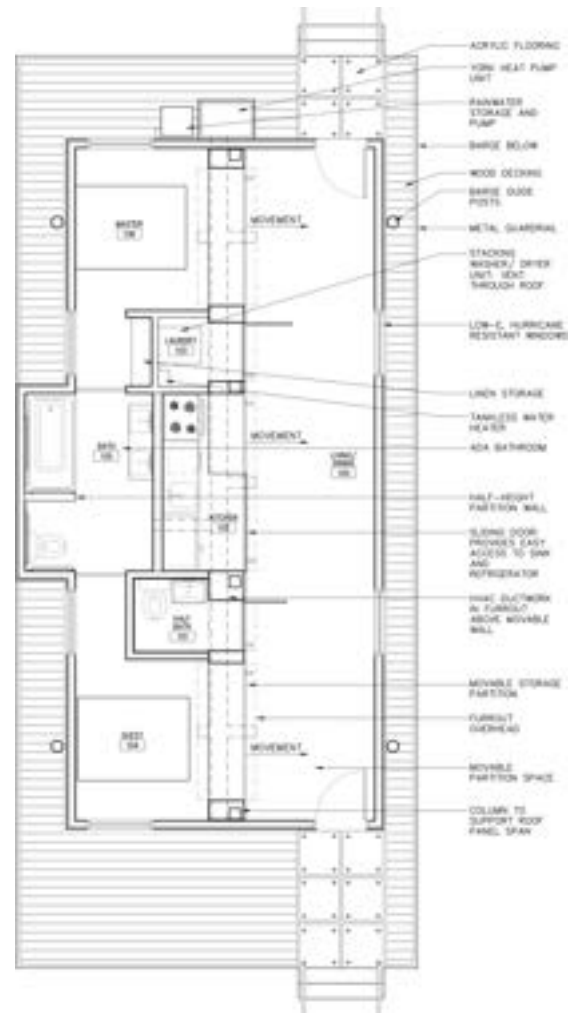
Figure 2. Floor plan of the REdaptive Vessel

The first obstacle was the ability of the building to be accessible to those with disabilities. To accomplish this while designing the house on 7-foot piles, an accessible (ADA) ramp would be approximately 150 feet long. This ramp would consume the entire back yard and leave very little open area in the front of the house. In residential design it is important to have yard space. This ramp would also limit the ability to include a front porch. Along with the ramp predicament was the simple fact that the piles did not prove to be entirely effective in the Katrina storm. With water surging to a height of 20 feet[3], there is an apparent need for versatility to respond to the catastrophe at hand. This issue created an opportunity for an alternative solution. The idea that the house should be able to rise with the water and not fight to stand against it came with the discussion to resolve the ADA issue. At this

point we began research into the precedents and solutions set by other high-risk flood zone areas. The search led to the analyzation of existing structures in the Netherlands, Africa, and Venice. We also looked at the making of the traditional houseboat. As a result, the barge became the obvious answer to creating buoyancy. The reason for this is its reasonable availability and the connection it has to the area in which the construction of the Vessel would take place.

The Vessel is designed with cylindrical shafts that run vertically along guideposts that are secured in the ground. These steel posts allow movement of the barge up with the rising of water. As the barge rises, a lock system slips into place every 18 inches. (See fig. 3) It would be improbable to think that there would be no obstacles to prevent the Vessel from returning to its 'dry land' position. The hydraulic lock system gives the Vessel the ability to remain suspended after the flood so any debris can be removed from under the structure. As is common knowledge, many items are displaced during high flood waters. This hydraulic system would allow someone from inside or from the ground the ability to maneuver the Vessel as to remove any obstructions that had made their way under the house. It would afford the tenant a simplified and less emotional clean up. Not to mention, the safety issue of no water inside the building itself, reducing the possibility of mold and mildew. Another way to mitigate this problem would be to incorporate the use of the local, skilled labor in the tradition and application of plaster. This material was applied to portions of the exterior façade. While the Vessel is in raised position, a ladder similar to that on a dock or boat will extend down in sections depending on the distance between the ground and the deck. The attachments for this ladder will be located in the back and the ladder will be stored on the back of the house. To attach the ladder to the deck all that one must do is remove the hurricane straps that hold down the ladder in its stored position and insert it into the brackets mounted on the deck surface.

Figure 3. Hydraulic Guide Post Detail

The subsequent challenge in the design of the REdaptive Vessel was the small size and the limitation this created for the footprint options. In an effort to overcome this obstacle, gravity a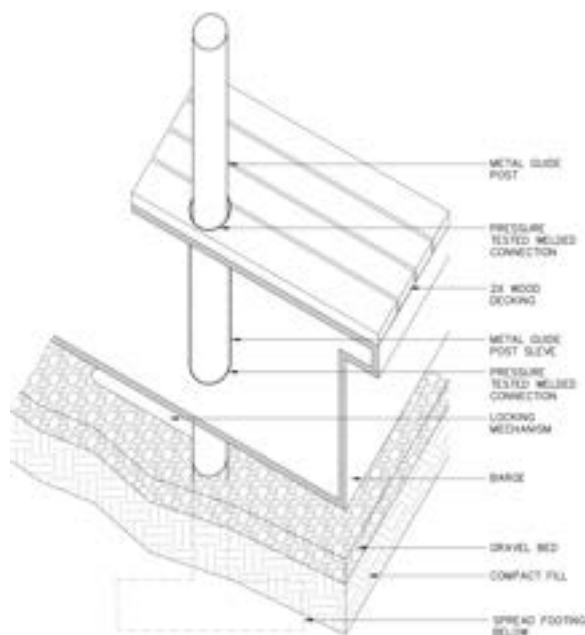ssist movable storage walls were designed. The sections of wall that are mobile are designed on suspended tracks and once a minute amount of force is applied to the walls, they move with great ease. This is caused by the counter balance located in the upper portion of the chase wall. Once the walls hits a certain horizontal point on the track it comes in contact with a mechanism similar to a soft drawer closer that absorbs the movement of the door and brings it to a smooth stop. This system is in place for both directions of travel along the track. These walls serve as a partition between the public and private spaces of the home and allow maximum usage of the living space during the day. Because these storage devices move, it allows the house to adapt to the day's activities and provide adequate space for a variety of functions from moment to moment. This core wall also serves as the mechanical, electrical and plumbing chase for the entire house. Due to its adjacency to all the rooms in the house, it is a prime location for these service items.

The third challenge was that of incorporating sustainable concepts. The home achieves the platinum requirements for LEED for Homes set forth by the United States Green Building Council. The Vessel gained a total of 128 LEED points with the possibility of several others unaccounted for. Because of this, the residence exceeds the sustainability of many other residences built on the same budget. It was not so difficult to incorporate many of the LEED ideas into the design, as it was to incorporate them while keeping the integrity of the design and staying within the $100,000 limit. In the design of the structural system we choose to use Structural Insulated Panels (SIPs) opposed to conventional construction methods. These panels provide three vital components to the green aspects of the residence's design. First, because the system is structural, there is no need to involve a structural engineer or the framing trade in the construction process. This offsets quite a bit of the extra upfront costs, liabilities, and margin of error during construction. Second, this system is fabricated at a warehouse and is then trucked to the site and assembled with the penetrations, electrical components, and fasteners already in place and accounted for. Since the house has a large majority of pre-fabricated parts, the timeline for construction will be drastically shortened. Third, the SIPs provide a high insulative R-value in both the roof and the walls. The 4-1/2" wall panel has an r-value of 28 and the 6-1/2" roof panel has an r-value of 40. This results in a smaller capacity heating and cooling system and reduced electric and gas bills. The roof is then covered with a Thermoplastic polyolefin (TPO) single-ply roofing membrane. This roof is classified as a Cool Roof according to the Cool Roof Rating Council because it has a high reflective index that creates a reduction of heat gain on the interior of the house.

Another of the sustainable design ideas that was incorporated into the project was the use of a 'rainwall' system. (See fig. 4) This is a façade system that is specifically designed for the collection and storage of rainwater. This water would be considered non-potable, and would be used in place of city water for irrigation. Although much of the site and landscape plans need very little water due to the pervious walks and native plants, the amount water collected would completely

offset the water usage for the purpose of irrigation. The remaining water collected would be used to flush the two toilets in the house. The 'rainwall' consists of three layers. The first layer is the Oriented Strand Board (OSB), which is also synonymous with the outside layer of the SIP. Attached directly to the OSB would be a waterproof membrane. Over that would be first vertical then horizontal 2"x2" Forest Stewardship Council (FSC) certified wood boards with a 2" gap between each horizontal board. The goal of the system is to allow rainfall to enter the space between boards run down the waterproof membrane and collect in a gutter like trough that runs into a collection of stacked bins located at the back of the house. These bins are specifically manufactured for the collection of rainwater and have a pumping mechanism attached.
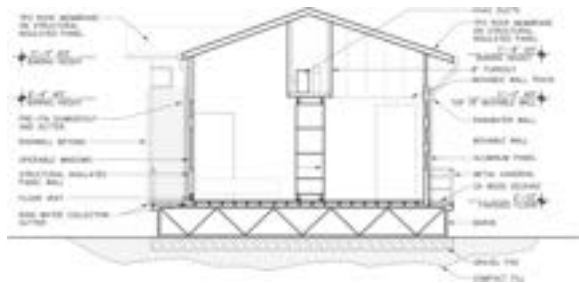

Figure 4. Latitudinal Section, Typical

The ultimate goal of the REdaptive Vessel is to create an off-the-grid safe haven in the midst of a storm. (See fig. 5) To achieve this successfully, electricity is a necessity. To meet this need, a number of solar panels would attach to the roof. These panels would send power to batteries located in the service chase. Once these batteries are fully charged the excess power would then be sold back to the city to offset the electrical costs of the tenant. This addition would also add to the base cost of the Vessel by approximately $18,000. This increase is anticipated to return on the initial investment in 8 to 15 years depending on the specifics of the panels chosen along with the aperture for mounting chosen. Another process to understand is the movement of sewage. This will be sent to an on board septic tank that would be similar to that of a recreational vehicle. Once the storm is over the tank would have to be pumped to an on-site city hook up. The sewage pumping system would be located within the barge, along with the holding tank.

Figure 5. Final Perspective of the REdaptive Vessel

The REdaptive Vessel's ability to change from city utilities to on board utilities and then for the entire structure to move vertically asks the question, "What happens to the utility connections?" As a solution to this, an automatic release mechanism would be installed. This detail would consist of several sleeved valves in which the hose connecting to the house would insert. The inserted portion would be slightly smaller than that of ground (city utility) connection. When the house began to raise the house hose would pull out of the ground connection, freeing it completely. Due to the positive pressure coming from the ground connection the valve would spring closed, sealing the pipe from water leakage. Once the hoses have been disconnected, it would only be the matter of flipping a few switches and the Vessel would be up and running again. This connection system does not require any person to be at the house when the water begins to rise and ensures that the utilities would not hinder the upward movement of the barge. As part of this system specific items in the house would be divided on breakers so that you could run specific items, such as the refrigerator, intermittently. The success of this system is vital to the overarching design.

Another important aspect of the house is the education of the residence's tenants. This house incorporates many innovative and unusual technologies that tenants would not intuitively know how to operate. For this purpose a short descriptive DVD would be made that would come with the residence along with a simple publication outlining the elements of sustainability that can be found in the home. This DVD would outline such things as the photovoltaics, rainwall, and utility connections. Operation and Maintenance manuals would also be provided for every unique and mechanical item in the Vessel. For the home to perform at its peak, it would be imperative that a continuing understanding of the best practices for living a green-life must be accomplished.

The extensive technological components that are incorporated to make the REdaptive Vessel perform as stated involve immense cost. The base price for the Vessel is currently calculated at $118,147. This price includes the barge, which allows the house to travel with the rising tide. The bulk of this cost lies in the REcommissioning of the barge and the SIPs. The barge would require slight modifications for retrofit to the house structure but at a minimal cost. In an effort to use the budget as efficiently as possible inclusions and upgrades of sustainability have been made so that a return in value would take 15 year or less. In typical situations this would be half the lifetime of the homeowner's mortgage and would be well worth it in the lifespan of the house.

The REdaptive Vessel uses what is already available and improves upon it. It breaks new ground from the making of traditional Louisianan Architecture but holds strong to the connection to the culture of the region. It provides a balance of what is needed and what is desired. It is a house that you can call home, raise your family, and make many happy memories.

Although this idea is great in theory there are some real world concerns that could cause this project to have difficulty getting off the ground. The most obvious of which is the REadaptation of the barge. Even though there are a number of abandon barges in the Mississippi River Valley who is to say that a designer could find a barge that would fit the project site and building footprint as perfectly as the barge in this project?

There is another product that would allow the house to float at a cost reduction and with much greater availability: recycled polystyrene substrate. This product would basically replace the barge in sections. The extruded foam would act as the foundation of the home and everything would be made as already planned. Polystyrene has an immense life span and provides a high insulation value and a large amount of structural strength (as long as it is not point load.)

Another point of importance lies in the systems that allow the Vessel to be off-the-grid. Although science promises that these systems would function properly in time of need, a few variables come in to play. These types of technological and mechanical systems require annual maintenance and monthly checks. If the tenants ever found themselves in need, it would be imperative that they had kept up with this routine maintenance to ensure that these systems stay in running order.

The Vessel would provide a sense of stability for the residents, knowing that it is unlikely that they would ever have to go through what they have endured just five years ago. This peace of mind is priceless and affords those involved with the vessel the opportunity to live their lives to the fullest. They now have control over their home; it no longer is an item that just sits there waiting for the hurricane gales to destroy its painted walls, wood floors, and displays of photographs. As a homeowner you can now flip a few levers and rest easy knowing that your house was designed with the intent to save itself and save lives.

This project incorporates many innovative, unusual, and undetailed ideas. There are many questions that revolve around its feasibility to perform as planned. It is important to look at this concept of the house that rises with flood water as just that, a concept. It would be amazing if the architects of this generation could look at this project as a starting point from which to create a solution to the rising problems that high winds, volumes of water, and manmade failures has led to. The residents of this house can now run into the space instead of running away from the built environment in the face of disaster. It is the duty of Architects to create buildings that humanity can rely on to provide unequivocal comfort and safety. The REdaptive Vessel's purpose is to stir the pot, to start the creative flow of making something that is not only functional, but also interesting, sustainable, and havenesque all at once.

This Vessel REduces, REuses, and REcycles nearly all aspects that go into making it. It combines the traditional means and methods of making with modern technologies. The REdaptive Vessel is an idea that solves a problem that should "never ever ever [be] repeate[d]."[i] Let us go forward and create that which defies all norms and make something that is wonderful and beautiful in tandem.

1 Landrieu, M. M. (2010, August 30). *New Orleans Mayor: 'Never Forget'*. Retrieved August 30, 2010, from CNN: http://www.cnn.com/video/#/video/us/2010/08/30/bts.nola.landrieu.speech.cnn?iref=allsearch
2 *Discovery Channel*. (2010, August 27). Retrieved August 30, 2010, from Surviving Katrina: Facts About Katrina: http://dsc.discovery.com/convergence/katrina/facts/facts.html
3 Handwrek, B. (2005, September 6). *Eye on the Storm: Hurricane Katrina Fast Facts*. Retrieved August 30, 2010, from National Geographic:http://news.nationalgeographic.com/news/2005/09/0906_050906_katrina_facts.html

Interpreting Architecture

These three papers serve well as interpreters in the sense that each endeavors to translate the differences between two languages; that of reproduction and that of individuation, and we can argue about which is the "foreigner" and which the "native speaker." Since the act of interpretation implies the desire or need of at least one party to understand the other, we might assume for the sake of argument that the two languages mentioned above are mutually beneficial.

Shauna Corry uses physical and archival clues to understand how the Japanese who were interned at the Topaz Camp in Utah in the early 1940s personalized the mass-produced and standardized spaces they were forced to live in, and how those spaces affected their daily lives and habits. Thomas Cline and Nick Safley examine the Bavinger House by Bruce Goff in the light of gendered, organic, and personalized contexts as an antidote to the technical and mechanistic aspects of Modernism, which were also present in Goff's work. They argue for the importance of understanding space through our emotions. The third author, Amrita Mahindroo, explores evidence of individual authorship in sculptural series to question our current relationship to technology, using two examples: Auguste Rodin's late-nineteenth-century human figures for *The Gates of Hell* and Antony Gormley's contemporary human figures as seen in such exhibitions as "Blind Light." Mahindroo also offers examples from the writing of several theorists who have been concerned with the tensions between reproduction and individual expression.

Can the language of technology and mass production be translated to serve individual needs? Can design processes that are messy and emotional, or organic and spontaneous be translated into forms that depend on technology for their dissemination? What is the role of individual authorship in our contemporary culture? All of these papers help to further the discussion of such questions.

Catherine Barrett
cjbarrett@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Session moderator]

Japanese American Internment Camp Design: Journey to Topaz

Shauna Corry
scorry@uidaho.edu
Associate Professor
The University of Idaho
Department of Architecture and Interior Design
[Paper Presenter—Session 5]

As a result of the bombing of Pearl Harbor on Dec. 7, 1941, Executive Order 9066 was issued in the interest of protecting the nation against sabotage and terrorism by Japanese immigrants. The order called for the evacuation of Americans of Japanese descent and immigrants living on the Pacific Coast to inland internment camps. This paper discusses findings from a qualitative analysis focusing on the design of one internment camp (Topaz) and the ramifications of that design on family interaction, mental health and personal identity. Numerous personal histories (Uchida, 1982; and Okubo, 1983) have detailed life in internment camps, and scholars (Taylor, Daniels, and Kitano, 1986; Beckwith, 2001; and Horiuchi, 2001) have further documented the period. However, few detailed analyses of camp records and sites in relationship to interior spaces have been conducted. Although few of the structures remain, analysis of selected existing sites, personal histories, government reports, and over 200 photographs of interior spaces and artwork provided the data set for this study. Research findings of the analysis detail how internees were affected by the built environment and the resulting changes they made to their immediate living spaces. The analysis also further documents changes to the family structure and cultural habits of the internees. The paper will not only identify negative impacts, but celebrate the internee's ability to construct meaningful artifacts that enabled them to have some control over their living spaces.

Camp Topaz

The Central Utah Relocation Center, Topaz, was one of 10 internment camps built in the interior of the United States. A total of 110,000 people of Japanese ancestry were incarcerated from March 1942 to November 1945. They included 70,000 Nisei or second generation American citizens and 40,000 Issei (immigrants) who had live in the United States for over twenty-five years (Arrington, 1997). Topaz was built in 1941-42, opened on September 11, 1942, and covered approximately 20,000 acres. The camp immediately became one of the largest cities in Utah with a peak population of 8,130 (Topaz Museum, 2002-2006). Topaz will be the focus of this paper as it is considered to be the most intact camp. Although it does not have any structures remaining, it does have foundations, pathways, and remnants of landscaping. The Topaz Museum board is actively preserving the site in an effort to create a living learning environment and is seeking status as a national landmark or monument (Beckwith, 2001).

Site:
Arrington (1997, pp. 20-21) notes the location requirements for the centers were determined by the War Relocation Authority (WRA) and were to specifically allow for: "1) large-scale agricultural or year round employment opportunities; 2)

"wide open" terrain to mitigate escape attempts and offer a buffer for strategic installations; 3) centers to be sited on federal land or land that could be purchased; and 4) access to rail transportation, and economical power and water."

The proposed site for Topaz Camp met the WRA requirements in terms of remoteness, availability of agricultural land and in rail access. The site was located in a remote desert valley in the state of Utah, approximately 16 miles from the nearest town of Delta (population 1,500), and 150 miles from Salt Lake City. The area was known for sugar beet production and other irrigated agricultural crops. Today locals still refer to the area as "the Flat" and are known to have "Hard Pan" parties on the Western desert. It is cold in the winter with temperatures reaching 30 degrees below zero and hot in the summer with highs in the 100's. The climate and altitude (4,600 above sea level) was challenge for the internees who were from the San Francisco Bay Area and used to mild coastal weather and low altitudes (Arrington, 1997; Taylor, 1993 and Verdoia, 1988). The land was bought from the Sherman Tolbert family who had farmed the site for approximately one year. Government representatives appraised the property and gave the family thirty days to move (Verdoia, 1988).

Camp Design

Design standards for the camps were developed by the Wartime Civil Control Administration (Headquarters Western Defense Command, 1942). Construction of Topaz followed the proposed layout with the administration, warehouse, hospital, and military police blocks in forefront of the site, and internee housing blocks reserved for the remaining area. Schools and churches were located in the center of the camp. Topaz consisted of 42 total blocks with 34 reserved for living quarters. Each block housed 250-300 people and was composed of 12 single story resident barracks, a central mess hall, recreation hall, combination washroom-toilet/laundry building, and an office for the block manager (Arrington, 1997 and Headquarters Western Defense Command, 1942).

Barrack Design

The footprint of a typical barrack was 20x100 and was sub-divided into five rooms or apartments that ranged in size from 16x20 to 20x25. Each room housed a family, or four or five unrelated individuals. Often two families were housed in one apartment. Each room was furnished with a heating unit (stove), cots, mattress covers, and blankets. Arrington (1997) notes, "Evacuees were required to make their own partitions, chairs, benches, tables, shelves, closets, storage chests and other furniture" (p.23).

Influence of Design on Family Interaction and Personal Identity

Numerous histories discuss the negative influence the design of the camps had on individuals and family units (Houston and Houston, 1973; Uchida, 1982; Okubo, 1983; Taylor, Daniels, and Kitano, 1986; Taylor, 1993; and Inada, 2000). The Internees noted a lack of visual and acoustical privacy in their living spaces and in the block bathrooms. Females were especially appalled with the open toilet layout. In the literature and interviews with both Topaz and Manzanar Camp internees, the breakdown of the family unit is discussed as a major negative ramification of the camp design. Arrington (1997) states, "To many Japanese, the most objectionable aspect of the entire arrangement was the denial of individual and family privacy" (p. 27). The design was based on typical military camps and significantly contributed to the lack of privacy and separation of family members.

In Final Report: Japanese Evacuation from the West Coast 1942 the design concept is articulated as follows:

"The design of temporary buildings to house the evacuees at the Relocation Centers presented a problem since no precedents for this type of housing existed. It was known, of course, that these Centers were of a temporary nature and it was expected that they would be abandoned after the war. For that reason permanent type buildings were not desired. It was essential to be as economical as possible and to avoid the excessive use of critical materials. Speed of construction was also a vital factor because it was desired to move the Japanese out of the Assembly Centers as quickly as possible . . . Theater of operations type buildings answered most of the requirements for troop shelter but were too crude for the housing of women, children and elderly persons. Normally this type of housing has no floors: toilet facilities are meager (usually pit latrines), and heating units are omitted in all except extremely cold climates. It was decided that a modified theater of operations camp could be developed which would adequately house all evacuees, young and old, male and female, and still meet fairly well the desire for speed, low cost, and restricted use of materials." (p. 264)

The design and construction decisions that were made in an effort to "speed up the process" and build as economical as possible had lasting effects for the internees. The decision to require all internees to eat a Mess Hall rather than modifying the design so families could cook in their barrack room was responsible for a major cultural change. This change in family traditions was bitterly noted by Yoshiko Uchida, a Topaz internee. Uchida remembers seeing children playing house. However, they did not "play house" in the typical pre-internment manner with children mimicking a family eating while seated at a dining table. Rather the children were, ". . . standing in line with a plate and a mess hall fork, and that became their reality" (Verdoia, 1988).

Jeanne Wakatuski Houston, a resident of Manzanar, remembers that mealtimes had always been the centerpiece of her family's day (Houston and Houston, 1973). Her family had gathered at a large wooden table and,

"He (papa) would sit at the head of this table, with Mama next to him serving and the rest of us arranged around the edges according to age, down to where Kiyo and I sat, so far away from our parents, it seemed at the time, we had our own enclosed nook inside this world. The grownups would be talking down at their end, while we two played our secret games, making eyes at each other when Papa gave the order to begin to eat, racing with chopsticks to scrape the last grain from our rice bowls, eyeing Papa to

see if he had noticed who won . . . Now in the mess halls, after a few weeks had passed, we stopped eating as a family." (pp. 25-26)

Houston believes they stopped eating as a family because her grandmother was too ill to walk to the mess hall and had to eat in the barrack, while she and her brothers and sisters preferred to eat with their friends. Sometimes her brothers attempted to eat at a number of mess halls during the dinner hour and often made a game of it. (p. 26).

Sociologists studying the camps during the occupation (Houston and Houston, 1973, p. 26) identified the breakdown of the family unit and recommended that families eat together. This recommendation was made into an edict and Houston remembers, "Most people resented this; they griped and grumbled. They were in the habit of eating with their friends. And until the mess hall system itself could be changed, not much could really be done. It was too late" (pp.26-27).

For a cultural group that valued individual privacy, the impact of living in crowded conditions was difficult at times. Toyo Suyemoto Kawakami (Kawakami, 1986), a resident of Topaz, describing her living quarters in a sonnet titled "Barracks Home" generates a clear image of the lack of acoustical privacy, ". . . sheetrock walls, transmitting every sound of neighbors' gossip or the sweep of brooms" (p.28). She further describes her family's living arrangements, and may allude to a significant problem with her brothers concerning her mother's ability to adequately supervise them:

"With eleven members, our family was larger than most, so we were assigned to the two middle rooms of a barracks in Block 4. To go from one room to the other, we had to go outside. My brothers quickly opted to occupy one of these. Mother soon became tired of going out whenever she needed to see one of them, so one day Father cut a door-sized opening between them. The first sight of our rooms was dismal - no furniture, unfinished walls and ceiling, a two-inch layer of fine dust on the floor and windowsills . . . Army cots were delivered that night giving us something to sit on. Eventually Father made a table and stools of varying heights from scrap lumber." (p. 27).

Houston (1973) also noted similar problems in Manzanar, "The cubicles we had were too small for anything you might call "living." Mama couldn't cook meals there. It was impossible to find any privacy there. We slept there and spent most of our waking hours elsewhere" (p. 28).

It is evident that the built environment when combined with ineffective social programs changed the traditions of some families. However, it is also evident that the residents of Topaz actively engaged in creating "home" with familiar artifacts and designs. Photographs and art work from the camp show exterior and interior additions such as partition walls, hand made furniture, and detailed landscaping highlighting the ways in which internees attempted to control their immediate environment and develop personal expressions of their identity. The analysis of camp living spaces revealed attempts to control visual privacy, increase comfort, and enhance function with handmade furnishings and household items such as coal shovels. Additionally, internees made concentrated attempts to show patriotism (photographs of General Eisenhower, miniature American flags, and postcards from male family members in the military); and actively engaged in creating "home" with familiar artifacts and designs, such as seashells from the coast,

and photographs and paintings of the California coast and landscape scenes from Japan.

When walking the Topaz site, one sees evidence of the internee's attempts to control their environment and develop personal expressions of their identity. Efforts to increase the function and comfort of their immediate environment are also apparent. Rock paths and garden pools are interspersed among the blocks and soaking baths can be found near one of the bathing barracks. Elaborate landscaping with wading pools and gardens is evident in a number of the camps. Horiuchi (2001) has identified the soaking bath as a symbol of community, "In less visible ways, intimate spaces, such as concrete soaking baths, or furos, were built in the latrines. In contrast to the bare, ugly army shower facilities that offered no privacy, they functioned as culturally discrete community meeting places where people could catch up on camp gossip" (p. 269).

Economic Impact

The economic impact to the depressed Millard County area was significant. Property and water rights were sold to the WRA and the construction of the camp brought a number of workers to the area. Schmerker (1999) notes, " . . . the huge influx of carpenters, electricians and plumbers overwhelmed the town of Delta, where families took in boarders when hotels filled up, and every available truck was summoned to haul building supplies to the relocation site" (p. 2). According to Arrington (1997, p.35) over a one hundred local men were hired during the construction phase, and ultimately one hundred local workers helped staff the camp at wages of $150 - $250 per month.

Because of the war there was a labor shortage in the region and Topaz proved to be an important resource for area farmers and businesses. George Corry of Sutherland hired a Japanese family, provided a farm house for their use and was able to successfully harvest sugar beets and alfalfa (C. Corry, personal communication, August 10, 2006). Amalgamated Utah-Idaho and Franklin County sugar companies recruited 230 laborers from both the Utah and Idaho camps to harvest sugar beets. Arrington (1997) notes the companies, ". . . saved enough beets to make nearly 300 million pounds of sugar" (p. 29). When internees were given day passes to Delta they purchased household items, clothing, and food. This increased the demand for a variety of goods, and area merchants began to order specialized products. Schmerker (1999) notes even a fresh fish store opened during the camp's occupation. When Topaz closed in October of 1945, laborers were hired to dismantle the camp and buildings were moved to sites within the valley. They were put to use as sheds, granaries, and homes. Additional materials were salvaged over the years, including pipes from the hospital foundation. Local men removed the cast iron pipes to sell for spending money after the camp had closed in 1946 and 1947 (C. Corry, personal communication, August 10, 2006).

In an effort to lessen the impact of the camp closing on the local economy household items were destroyed. The WRA did not want neighboring towns to be flooded with merchandise. As a result, household items including dishware, kitchen utensils, cookware and light bulbs were dumped into pits, bulldozed and buried.

Today, economic impacts are still realized with the development of the Topaz Museum and preservation of the site. Although, enhancing the economy is not a major goal for the museum board members, it is evident there will be some increase in tourism. The new museum will be located on Main Street in Delta and will include an original barrack. A goal of the museum is to create a dynamic educational experience for visitors (Beckwith, 2001). The mission of the museum is, "To preserve the Topaz internment experience during World War II; to interpret its impact on the internees, their families, and the citizens of Millard County" (Topaz Museum, 2002-2006).

Conclusion

The analysis revealed distinct interior space characteristics of public facilities (mess hall, schools, hospital, etc.) and private living quarters. It is evident the built environment, when combined with ineffective social programs, challenged and changed cultural traditions. Self-identity and cultural identity were affected both positively and negatively. This exploration of the material culture of Japanese American internment camps adds to the existing richly, textured portrait of a significant historical event. Many lessons can be learned about the effects of stress and crowding on family interaction, place identity as it relates to personal identity, and the ability of the human spirit to adapt to challenging living conditions. This unique example of individuals affecting positive change by adapting and modifying distinct design characteristics in their immediate living environments can begin to inform current discussions concerning migrant worker housing and immigration centers as related to social and cultural responsibility in design.

References

Arrington, L. J. (1997). *The pride of prejudice.* Delta: The Topaz Museum.

Beckwith, J. (2001). "Recommendation for the Topaz Internment Camp Preservation." *Report to the President: Japanese-American Internment Sites Preservation* [On-line]. Available: http//www.cr.nps.gov/history/online_books/internment/report.

Inada, L. F. (2000). *Only what we could carry: The Japanese american internment experience.* Berkeley: Heyday Books.

Horiuchi, L. (2001). *Dislocations: The built environments of Japanese american internment. In M. Makey (Ed.), Guilt by association: Essays on Japanese settlement, internment, and relocation in the rocky mountain west* (pp 255-276). Powell, WY: Western History Publications.

Houston, J. W. and Houston, J. D. (1973). *Farewell to manzanar.* Boston: Houghton Mifflin Co.

Kawakami, T. S. (1986). *Camp memories: Rough and broken shards.* In S. C. Taylor, R. Daniels and H. H. L. Kitano (Eds.), *Japanese americans: From `relocation to redress* (pp. 27-30). Salt Lake City, UT: University of Utah Press.

Okubo, M. (1983). *Citizen 13660.* Seattle: University of Washington Press.

Schmerker, J. (1999). *Utah Travel and Adventure. Topaz, Utah's internment camp* [On- line]. Available: http://www.utah.com/schmerker/1999/topaz_camp

Taylor, S. C., Daniels, R. and Kitano, H. H. L. (Eds.). (1986). *Japanese Americans: From relocation to redress*. Salt Lake City: University of Utah Press.

Taylor, S. C. (1993). *Jewel of the desert: Japanese American internment at topaz. Berkeley*: University of California Press.

Topaz Museum. (2002-2006). "Topaz: Japanese WWII Internment Camp." *Topaz Camp* [On-line]. Available: http://topazmuseum.org/topaz

Topaz Museum. (2002-2006). "Topaz: Japanese WWII Internment Camp." *Topaz Museum* [On-line]. Available: http://topazmuseum.org/museum

Uchida, Y. (1982). *Desert exile: The uprooting of a Japanese American family*. Seattle: University of Washington Press.

Verdoia, K. (Producer). (1988). *Topaz*. Salt Lake City: KUED.

Headquarters Western Defense Command and Fourth Army. (1942). *Final report: Japanese evacuation from the west coast 1942*. National Archives: Washington D.C.

Transgendered: Interpreting the Bavinger House

Thomas Cline
thomascline@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Paper Presenter—Session 5]

Nick Safley
nicksafley@yahoo.com
Adjunct Professor
The University of Oklahoma
College of Architecture
[Paper Presenter—Session 5]

Abstract

Bruce Goff's Bavinger House, completed in 1955 in Norman, Oklahoma, can be interpreted as an archetypal exemplar of organic Modernism; however, we suggest that a richer interpretation might be made if one views the house as representational of a more inclusive transgendered Modernism. The term organic Modernism, itself, is incongruous; organic is not typically an adjective that we might use to qualify the term Modernism. Modernism is not a construct that we might typically associate with the organic. Frank Lloyd Wright; however, chose to unite these terms when he stated that organic architecture was the modern ideal. Transgendered, also, appears an incongruous modifier; however, in the case of the Bavinger House, the doubly problematized term, transgendered Modernism, appears to be appropriate if we make the effort to carefully define each of the modifiers in conjunction with a hermeneutic investigation of the personal, cultural, and architectural contexts in which the house was conceived and built. This hermeneutic investigation—a means borrowed from religious studies, anthropology, and literary criticism—is a methodological reading and interpretation of a text, in this case the Bavinger House, within a particular context. Such an interpretation can be used to more sharply bracket the Bavinger House as representational of transgendered Modernism and to begin to understand it as a work that resonates with meanings that float just below the surfaces of our conscious processes.

In the Bavinger House, one can begin to read a narrative of form and detail that acts to transgender the experience of the house. This transgendering is interpreted through an exegesis that allows for mytho-symbolic understanding. From the steamy fertility of the womb/cave to the lightning-rod danger of the *penis mundi*, the Bavinger House becomes a gender variant that contradicts and dematerializes the traditional binary of specifically masculine or specifically feminine. In interpreting the Bavinger House as transgendered, one can begin to understand the adjectival modifiers "organic" and "transgendered" in relation to the categorical "Modern." In this reading, these adjectives act to modify a conception of Modernism that has traditionally marginalized history, narrative, and individual enquiry. Organic, reinterpreted as transgendered, reintroduces the historical, the narrative, and the individual and allows for the contextual reading of a normatively deviant form that does not conform to traditional architectural expression; but, rather, engages our understanding of place at a more primal level. This primal level is one that expands beyond the constructed binaries established by masculine and feminine and acts to blur the boundaries of organic and Modern into an architectural construct that addresses dualities without categorical imperative.

Outside looking out

The Bavinger House (see Fig. 1) stands right outside Norman, Oklahoma, right outside tradition, and right outside the academy. It has been praised as an example of organic Modernism, as an example of idiosyncratic voice, and as an example of great American architecture. It has; however, rarely been considered as a work worthy of scholarly inquiry. The Bavinger House is not a part of the canonical tradition of Modernism; nonetheless, we find it a significant, perhaps canonical, building in defining an American tradition. To position the house within the academy as canonical of an American tradition, we must suspend the masculine and rational presuppositions of Modernism and interpret the house from a more inclusive hermeneutic. It is a difficult interpretation. It raises issues that are still not comfortable in the mainstream of the architectural academy.

Fig. 1. The Bavinger House

How to interpret the "continuous present"

Bruce Goff, expanding upon the notions of Gertrude Stein, called for an architecture of the continuous present. He first used the term in a 1933 treatise when he described an architecture "not of the past or future, but for the continuous present."[1] In particular reference to the Bavinger House, he elaborated upon the notion of the continuous present. "I wanted to do something that had no beginning and no ending. Gertrude Stein says we begin again and again, this house

begins again and again. She talks about the sense of not being in the past, present, or future tense, but in the 'continuous present.' I was thinking in those terms."[2] Those terms, "not being in the past, present, or future," allow us a direction toward possible interpretation. This interpretation involves a hermeneutic reading of the Bavinger House as an occurrence that exists outside of the defined boundaries of architecture, and particularly, outside of the categorical boundaries of Modernism.

Our terms

In providing an interpretation that exists outside traditional boundaries, we must come to terms with our "terms." In 1954 (coincidentally during the construction of the Bavinger House), Frank Lloyd Wright brought together two seemingly incongruous terms. He stated "So here I stand before you preaching organic architecture: declaring organic architecture to be the modern ideal and the teaching so much needed if we are to see the whole of life, and to now serve the whole of life, holding no traditions essential to the great TRADITION. Nor cherishing any preconceived form fixing upon us either past, present or future…"[3] Here, Wright asserts that organic architecture is the modern ideal; that organic Modernism is the physical manifestation of Stein's continuous present. However; when we look at the constituent terms that result in organic Modernism, we find an incongruency. The two terms, in concert, stand in contrast to the notions of a continuous present. Organic, as an architectural term, is most often conceived of as curvy, perhaps bio-mimetic, and perhaps even feminine; but certainly not as the rich modifier that is grounded, inclusive, and evolutionary. Our general understanding of the term Modernism is even more problematic. Architectural Modernism is most often associated with the masculine, the monarchist, the rational, and the categorical. More often than not, architectural Modernism stands in contrast to the natural; it is exclusionary. The term organic does not appear to mollify the rational, the categorical, and the exclusionary natures of Modernism. Organic Modernism cannot define an architecture of the continuous present. In an attempt at coming to terms with the Bavinger House, the notion that it represents the continuous present, the notion that it is organic, and the notion that it is Modern, we have chosen to consider it as representational of transgendered Modernism. As transgendered and Modern, the Bavinger House can be seen to transcend the constructed boundaries established by masculine and feminine and blur the boundaries of organic and Modernism into an architectural construct that addresses dualities without categorical imperative. Transgendered Modernism can exist inclusively in the continuous present.

In choosing to look at the Bavinger house as transgendered, we again bump up against the conventions of terminology. How can architecture be transgendered unless architecture itself is gendered? As Edward Ball asked, "What could gender have to do with decorated sheds and *grands projets*?"[4] While it is outside the scope of this work to prove architecture gendered, I would suggest that Sherry Ahrentzen, in her essay "The F Word in Architecture: Feminist Analyses In/Of/For Architecture," exposes gender in architecture and that unequivocally, architectural gender is masculine. Ahrentzen further elucidates the notion of gender when she states that "Gender is not *sex*, that is, biological differences, and should not be construed as the property of individuals. Rather,

gender reflects and represents how social expectations, beliefs, and positions treat the biological characteristics of sex to form a system of values and identities."[5] She goes on to note that "gender operates when we attach to our concept of an architect or architecture our cultural constructs of a certain form of masculinity, and conversely exclude from the realm of architecture those attitudes, actions, and persons associated with feminine or female attributes."[6] Additionally, Ahrentzen constructs a definition of masculinity that is equally definitive of Modernity in that it "has come to define the universal or the superior."[7] It is here, in the conception of architecture as masculine, of Modernity as masculine, and of the organic as dismissively and inferiorly feminine, that we turn to the notion of the transgendered. Transgendered, as we conceive of it is a general term that that can be applied to conditions and constructs that are variant to the established normative binaries of masculine and feminine. A transgendered Modernism; therefore, is a form of modernism that does not prioritize the masculine, the rational, categorical dichotomy, or any particular attributes of the feminine, but rather, embraces individual idiosyncrasies, emotion, difference, and acceptance.

Methodologically, we have borrowed from the conceptual framework presented in Beatriz Colomina's work "The Split Wall: Domestic Voyeurism" as a means of launching our particular critique. Hers was a Feminist critique of the work of Adolf Loos; a reading in which she exposes the notions of power and control in what is described as a domestic setting where "the house is received as an environment, as a stage."[8] It is this reading of the house as stage, not object, which allows us to examine the Bavinger House not as an object, but rather, as an active participant in the continuous present of a transgendered Modernism. In other words, the house itself does not maintain a position of power and privilege, does not represent itself as dominantly masculine, but acts as a variant-gendered participant in the act of living. It is, perhaps, this rejection of the traditionally Modern and the acceptance of variance that makes the Bavinger House canonical within an American tradition.

Fig. 2. Light fixture created from military surplus.

The Bavinger House

In 1950, Bruce Goff was asked to design a house for Eugene and Nancy Bavinger on a piece of land that they owned just east of Norman, Oklahoma. Eugene was an art professor at the University of Oklahoma; both he and Nancy were artists who did not care for the conventional houses being built in Norman. They told Goff that they wanted "a large, open space where they could live more freely and pursue their hobby of growing indoor plants."[9] Additionally, the Bavingers wanted a house that they could build themselves with the help of students. Construction of the house began in 1950 and was completed in 1955.[10] The house, as originally built, was constructed of locally quarried sandstone, flagstone, copper cladding, plate glass, dimensional lumber, cedar trunks, glass cullet, and various military and oilfield salvage (see Fig. 2 and Fig 3).

Fig. 3. Glass cullet as ornament within interior stone spiral.

David De Long, in his text *Bruce Goff: Toward Absolute Architecture*, offers a very telling description of the Bavinger house:

A logarithmic spiral defines the shape of the enclosed area, detailed with rubble stone and irregular openings that appear as natural gaps in a stone outcropping, and dramatically profiled so that it rises gradually in height from six feet at its outer tip to over fifty feet at its central point of origin. It is firmly anchored within its setting, for it is set partly into the ground. Goff selected a natural clearing beside a shallow ravine as the site for the house, and planned the excavation of the adjoining hill to maintain a close proximity between the lower levels of the house and the stream below. He reinforced the sense of shelter by banking the excavated earth behind. Eugene Bavinger, with his sculptor's eye, carefully supervised the building of the logarithmic spiral, personally selecting individual pieces of sandstone from materials excavated on the site as well as from a nearby quarry, and placing these stones with the inset glass cullet that Goff had specified.

One approaches the house from behind (see Fig. 1), winding down the low hill to a secluded flagstone terrace beside the stream, this terrace continues inside as the lower level of the house. A pivoted door placed between angled sheets of glass leads inside (see Fig. 4), an entrance that is detailed to minimize any formal definition of line between interior and exterior space. The interior is an extraordinary water garden, and it is enhanced by changing levels, for the excavated area was purposely left uneven, and portions of exposed sandstone were incorporated into the paving. The grotto-like space that resulted defies comprehension. Paths winding between irregular planting beds and over free-form pools amplify the effect. There are no rooms in the ordinary sense, and no standard references of any sort, except for a built-in table, seat, and cooking facilities located far within the spiral.

Fig. 4. The pivoting doorway.

Circular elements that take the place of conventional rooms are suspended at different levels from the roof above. These elements are of equal size, placed so they describe a regular spiral in plan, and located in section so each is three feet above the one below (see Fig. 5). All are carpeted, or, perhaps more accurately, upholstered top and bottom. Each is constructed of plywood laid over a steel frame and suspended by metal rods from the ceiling structure above. They are connected by a spiral stair that leads up to a light-filled studio at the top, the lowest fitted with a circular banquette for lounging, the second and fourth with a bed concealed beneath the carpet, and the third and fifth left plain and designated as informal play and studio spaces. Netting draped loosely between the suspension rods provides protective enclosure without compromising the openness of the volume, and opaque curtains added to the upper four elements can be pulled for privacy, transforming the volume into a container of suspended, roofless tents. A copper-faced cylinder with wood battens is suspended independently beside each circular element, providing storage. Toilet and bathing facilities are secluded within the center of the stone spiral, on a level above the kitchen.[11]

The Bavinger House transgendered

From this description we can begin to create an argument for the Bavinger House being an exemplar of transgendered Modernism, and, as such, canonical within an American tradition. Again, we call for a definition of transgendered that allows for conditions and constructs that are variant to established normative binaries; variant to masculine and

Fig. 5. Interior composed of suspended rooms.

feminine, inside and outside, private and public, object and subject. As De Long describes, the house is simultaneously both an excavation and a tower. This excavation can be interpreted as an expression of the feminine; a womb/cave of steaming fertility. It is wet with ponds and their associated humidity; it is fertile with plants, with floating pods, and with family. This womb/cave, at the very center of its spiral, is penetrated by a steel structural rod, a *penis mundi* that enacts sexuality, expresses danger, and defines the tower that rises erect from the excavation and stands unabashedly proud above the landscape. This core that is masculine and feminine contains the wet and (electrically) hot life fluids of domesticity. This life-giving core represents the very act of copulation, the Bavinger House is neither masculine nor feminine, neither private nor public, both inside and outside, both object and subject; we have caught it in the act, a stage enacting gender variance that defies binary categorization. It is variant, yet it is also organic in its most primal sense; it represents the very act of organic origin; copulation and fertilization. It begins again and again. It is the act that precedes birth, that precedes the natural cycles of Wrights "whole of life;" it is creation acted and re-enacted in the continuous present.

Moving beyond the formal ambiguity of excavation/tower, the remainder of De Longs descriptions provide us with particular

vignettes that reinforce the gender variance of the Bavinger House. Materially, we are presented with the juxtaposition of the natural and the industrial. In most instances, the natural and industrial components stand in stark contrast; the natural represented by soft and gentle processes—the geologic gentleness of sandstone and standing water—while the industrial is represented by the most violent and aggressive of forces. Many components of the house are co-opted from military surplus; parts from World War Two era bombers used as the bath sink and as lighting fixtures, oilfield pipe used as structural components, glass cullet used as ornamentation. These items are the embodiment of the masculine, the violent, the industrial hegemony of Modernism. These stand in contrast to the domestic, while simultaneously completing the blurred domesticity of lived experience.

As De Long noted, one approaches the house from behind; it does not cohere to accepted standards of decorum. Is it coy, is it shy, is it just indifferent to convention? Whichever it is, it certainly is variant to our expectation of suburban domesticity. We approach its sinuous back and gently sweep to the right, down the stairs, past the cullet encrusted roof buttress, descending to the flagstone terrace, and are presented with a view of the pond and landscape beyond. It is here that roles are reversed; one has their back to the front of the Bavinger House. When one turns to face the house, one is faced with another ambiguity. At first glance there is no door, it is parallel to our gaze and thus dematerialized. This dematerialization of the door is interesting, but only in knowing that there really is no there there; the formal natures of domestic separation and privacy normally represented by the door and the front façade have been marginalized. Having approached from the sinuous, stone, material rear of the house one is now confronted with a glass wall. It appears, at first glance, to be thoroughly Modern; modern in the sense of the Farnsworth House. But in looking, in thinking, in engaging this glass wall, one begins to dematerialize. When you look in, you see out. The flagstone of the patio uninterrupted penetrates and becomes the interior; however, the interior doesn't cohere to the conventional interior. One cannot help but see the outside; the interior walls are the exterior walls. There is no differentiation in the stone. This interior that is exterior wall is also dripping with plants and flooded with light from the continuous skylight that removes the roof from the wall. Again, we are faced with a variant; the roof and the walls do not meet. This cannot be an inside; therefore, perhaps, one cannot still be outside. This ambiguity of inside and outside reinforces the variant gendering of the Bavinger House. The apparent modernism of the entry is emasculated, it no longer holds the privilege of the Modern façade. It is not a definitive, categorical separator of individual space, but rather, it acts to blur the reality of our experience.

Once one actually makes it to the door, they are faced with another transgendering, another variance to the normative. A "normative" residential door opens in, it is inviting, it pulls away the barrier to entry, it generously invites participation in the domesticity of the home, of the family. A door that opens outwardly is aggressive, non-inviting, non-residential, and certainly not generous. The front door of the Bavinger House, atypically, paradoxically, does both. This large wooden door pivots; it opens both outwardly and inwardly, predominantly outwardly. This; however, makes some sense in theorizing that the Bavinger House is not working to be dichotomous; the inside is not inside, the outside is not outside; the door can

swing both ways, and by pivoting, it does. While the action of the door physically enacts its variance, this variance is reinforced by the visual/tactile ambiguity of the door knob/pull. There are two knobs here, the first is a typical residential lockset; it serves a practical purpose. It allows the door to be locked and unlocked; it is the one nod to security and separation implied by residential façade. The second; however, acts both as ornament and as pull. This second knob/pull, both in and out, is anything but conventional; it consists of two Dutch oven lids applied to the walnut door. The Dutch oven coheres to our transgendering interpretation of the house. A Dutch oven is domestic, yet, it is not. There is an implied femininity in the notion of a Dutch oven being a domestic cooking implement, yet the Dutch oven is not particularly domestic and not particularly feminine in an American mythology. It resonates with cowboy campfires, Boy Scouts, guys getting away from enacted domesticity. This representation of domesticity as ambiguity compliments and complicates understanding of the house; it is removed further and further, again and again, from the normative. The Bavinger House firmly establishes itself as a gender variant, non-normative addition to the tradition of American architecture, and that's before one even makes it to what might be termed inside.

As we saw from the outside, there is no inside. Once one enters through the door, they simultaneously move outside again. There is no clear differentiation; the ceiling/roof does not engage the wall, sunlight streams in, the ceiling/roof acts as canopy just as the trees outside act as canopy to the terrace. As noted before, the interior wall is no different than the idea of the exterior wall; physically they differ only in that inside there are planters, programmatically significant inside and unnecessary outside. This wall, defining a logarithmic spiral, acts to define space, but the space defined does not cohere. It bleeds, it slips, it slides, it penetrates, it interpenetrates, and then, then it floats, it rises, it burns away like a mist. It is a stage, it encourages the gaze, yet it is not static in its set. It doesn't separate the viewer from the viewed. The Bavinger House is variant in that participation is truly participatory; there is no *voyeur* and no *regardeur*, no subject and no object. Again we recall the ambiguity of the continuous present and think of it in relation to a negated conditional. The act of living is not compartmentalized, not categorical, but rather, natural, fluid, adaptive.

As an initial impression, this impression that the Bavinger House is non-normative, is transgendered, we can accept the house as a type. But, that type is not Cartesian, is not categorical, is not masculine. In saying that it isn't masculine, our binary nature encourages an assumption of the feminine. Again, the Bavinger House is not that. It is neither masculine nor feminine; it does not cohere to a binary conditional. It is transgendered. It is ambiguous. It is variant to the normative. We hold that this variance is an eloquent expression of American architecture. This American architecture is not, and cannot be, truly homogenous. Conceptually, it must be variant, ambiguous, and ever changing as it responds to our culture, our landscape, and our strivings. It lives in a continuous present. It is the idea of the continuous present of variance that accords the Bavinger House admittance to the canon. It is the yen to the Farnsworth House yang; or is it the other way around?

1   Bruce Goff,, "Thoughts on Housing as Architecture, Prepared for Alfonso Iannelli and his Associates" (unpublished manuscript, October 28, 1933: 11 pages), not paginated.
2   Paul Heyer, *Architects on Architecture; New Directions in America* (New York: Van Nostrand Reinhold, 1966), 71.
3   Frank Lloyd Wright, *The Natural House* (New York: Bramhall House, 1954), 3.
4   Edward Ball, "Building to a Climax: Or, Sex is in the Details." *Villiage Voice Supplimnt 111* (1992), 27.
5   Sherry Ahrentzen, "The F Word in Architecture: Feminist Analyses In/Of/For Architecture," in *Reconstructing Architecture: Critical Discourses and Social Practices*, ed. Thomas A. Dutton and Lian Hurst Mann, (Minneapolis: University of Minnesota Press, 1996), 72.
6   Ahrentzen, "The F Word in Architecture," 73.
7   *Ibid.*
8   Beatriz Colomina, "The Split Wall: Domestic Voyeurism," in *Sexuality and Space*, ed. Beatriz Colomina, (Princeton: Princeton Architectural Press, 1992), 85.
9   David De Long, *Bruce Goff: Toward Absolute Architecture* (New York: Architectural History Foundation, 1988), 106.
10 *Ibid.*
11 *Ibid.*, 107-109.

All photographs by Thomas Cline.

Of the Same Hand

Amrita Mahindroo
amahin@mit.edu
SMarchS Student
The Massachusetts Institute of Technology
Department of Architecture
[Paper Presenter]

History has shown us that the most promising leaps in evolution are those which are demonstrative of a certain incongruity, and it is these which are often pregnant with possibilities of a future generation of outcomes which bear little or almost no resemblance to their parent states.

Throughout history the works of numerous artists and architects have shown a signature, as if to say, 'they come from the same hand', regardless of the multitude of hands the idea is drawn, communicated and then finally realized by. The continuity of the hand is more often as a result of the greater intellectual project. It is through the exploration of an idea, or abstract theoretical agenda over the course of multiple projects that the series develops, thus becoming an integral part of the exploratory process of design. The series, as identified in this paper, assumes two distinct branches, the first and perhaps most obvious, is the one in which there is a consistency of a formal or aesthetic language between projects. The second and more interesting series is that in which projects bear no obvious stylistic resemblance to one another, they are more importantly, able to explore a singular theme to its broadest capacity through different techniques pertinent to the context of each project. This paper is an exploration of the friction between the ambitions to negotiate the ever-changing contextual circumstances for and from which works are conceived and the artistic need for identifiable authorship. It will seek to illustrate how technology has changed the nature of continuity of the 'hand' through history, transitioning from the skilled hand of technique prior to modernization, to the hand of abstraction through the 20th century, leading to questions of its present ambiguity in the age of digital design.

The Hand

In 1880 Auguste Rodin received the commission for the 'Gates of Hell' (fig.1) from Edmund Turquet, for a portal to a museum of decorative arts, which was ultimately never built. The piece was a depiction of a scene from Dante Alighieri's 'The Inferno'[1]. Indicative of remarkable heterogeneity and craftsmanship, the gates are in fact a compilation of 180 clones of two or three figures which have been repeatedly reconfigured into a new narrative giving each a unique identity in the overall work. Rodin worked on the piece over the course of 4 decades, and from it came some of his most recognized sculptures, such as 'The Thinker' and 'The Kiss'. The gates in essence became the testing ground for many of Rodin's ideas, finally materializing as themselves a culmination of his body of work.

Rodin saw the end of an era where the expressive nature of the work of art was defined by the skilled hand of the artist. The dramatic changes in techniques of production which followed the

Fig. 1. The Gates of Hell, Auguste Rodin

industrial revolution slowly edged their way into the arts via the applied arts and industrial design, ultimately exchanging the skilled hand for the precision and efficiencies offered by new technologies. The romantic notions of the hand crafted or handmade were largely undermined in the early 20th century with modernisms affinity for abstraction, the beginnings of which were already becoming apparent in the work of Rodin, and some of his students, such as Antoine Bourdelle. The value of a contemporary work of art is measured primarily by its conceptual rigour. The series today can very rarely be justified as pure explorations of technique, as was the case in an earlier age. This need for abstraction requires that the works which emerge from a series, demonstrate constant reinvention or mutation so that the conceptual lineage is seen to progress in its physical form across the body of work.

The Dynamic Type

Quatremere de Quincy, an architectural theorist of the enlightenment period, wrote extensively on the subject of architectural mutations. His underlying argument lies in the distinction between the model and the type, in his work *Dictionnaire Historique d'Architecture;*

'The word 'type' represents not so much the image of a thing to be copied or perfectly imitated as the idea of an element that must itself serve as the rule for the model...The model, understood in terms of the practical execution of art, is an object that must be repeated such as it is; type, on the contrary, is an object according to which one can conceive works that do not resemble one another at all.' [2]

The type thus provides the source through which a formal language evolves, allowing for the development of a series without compromising the creative independence of the individual oeuvre. Whilst traditional 20th century reading of the type has been most closely linked to the idea of formal composition, its contemporary resurgence should be under more dynamic pretences, as identified by Detlif Mertin's in his essay titled 'Same Difference'. In his study of Mies van de Rohe's idea of modularity, Mertin's makes an analogous reference to Goethe's theories on biological forms, which allow the parent theme to remain an abstract notion, read only through the sophistication of each unique response;

'Consider a selection of leaves from the field buttercup (Ranunculus acris), arranged from the bottom of the stem to the top. Despite its extensive range, the series nevertheless gives the impression of an overall unity. No one leaf however suffices as a measure or model for all the others. Rather their unity remains implied, contingent on the progression and transformation of the series, on what Goethe called the metamorphosis of the plant – 'the process by which the same organ presents itself to us in manifold forms'. This unity remains open to the possibility that a new form will take its place among the others and inflect the series.' [3]

The model on the other hand implies an established aesthetic or formal grammar, which today is closely related to the aesthetic continuities which result from technique based explorations of form. Technique is defined as specific a way of carrying out a particular task[4]. It is pre-established and implies a mechanical methodology with an emphasis on skill. Art theorist Susan Langer stresses that the artist's ability to weave layers of meaning into the exercise of crafting comes from the cultivation of a greater ambition of expressing ideologies beyond the inanimate object, thus distinguishing between artistic expression and the mere crafting of expressive forms. [5]

Antony Gormley

It is for this reason that the type has to be thought of as more than a device for generating a formal or aesthetic language. The idea of an individualized contextual response and the development of an overarching architectural language are almost completely at opposing ends of the game. That which constitutes the context of a work, is highly specific and more importantly an externally controlled factor, it cannot be, and rarely is controlled by the author who is required to work within and simultaneously create anew its definition. The dynamic type therefore needs to generate works which demonstrate autonomy in each context, however can be continually identified as building on a thesis, as seen in the works of British Artist Antony Gormley.

Fig.2. *Field for the British Isles, 1993, Antony Gormley.*

In his retrospective exhibition titled 'Blind Light', held at the Hayward Gallery in London in 2007, Gormley showcased a collection of works on the broad theme of the human form in space. Each piece offered the potential to be read both as an individual oeuvre and as part of a series, tailoring itself to its environment whilst retaining its integrity as a whole.

His earlier explorations of the theme resulted in 'Field for the British Isles' (fig.2) which comprised of 40 000 handmade terracotta figures created in collaboration with the local communities of the British Isles in 1993. Gormley requested simply that each figure be between 10 and 20cm high and have two eyes, the rest was at the discretion of the hands that produced them. Gormley's exploration has as much to do with the community that produced them as it does with his own intellectual project, of how reflective the configuration of the human figure is of a society at a specific moment in time.

His retrospective exhibition took this idea to a new level of complexity as he discarded any consistencies of aesthetic language to explore the theme in a broader sense, expanding the study of his context (that being the society within which his works were exhibited) well beyond the walls of the gallery, to the parapets of the building itself, and as far afield as the surrounding area in his piece titled Event Horizon (fig. 3) Gormley strategically placed human scale bronze clones on bridges, and the inaccessible rooftops of various buildings, all facing the gallery. The unprepared observer, sees a man precariously

Fig 3. *Event Horizon, 2007, Antony Gormley.*

perched on a parapet; perhaps protesting or making an artistic statement or perhaps ready to take his life, incurring strangely overwhelming emotions of both awe and fear, until one understands what they are seeing is a narrative constructed around Gormley's own observations of societal behavior toward these issues.

The works that followed were of a similarly dynamic nature each creating an independent yet unified discourse around the theme of the peripheral space around the body. Gormley's thesis that the figure is present only as a consequence of its surrounding environment is seen in every piece, from the analogous models in allotment, where the form of the body is abstracted into concrete sarcophagi or the embryonically suspended figures in 'Matrices and explosions' (fig.4) held in tension in a net of stainless steel cables, to the purely abstract in Blind Light (fig.5) where the inanimate figure is substituted by the observer's body as they move through the volumes designed to heighten one's own experience of the peripheral space defined by their own body. There is never a more intense sensation of being both alone and surrounded by the unseen figures within a thick white cloud. From the exterior the artwork is constantly reconfiguring itself, as the dark silhouettes of the figures which occupy the volume, surface time and again from the boundary-less white fog.

In his observations, art critic David Leader, articulates how Gormley's works are constantly challenging the peripheries of the physical form.

> Gormley speaks of his fascination with "negotiating and renegotiating the edge, in terms of whether it's within or without". Edges, he says, are "the relation between something and nothing", and they "both define and release us".[6]
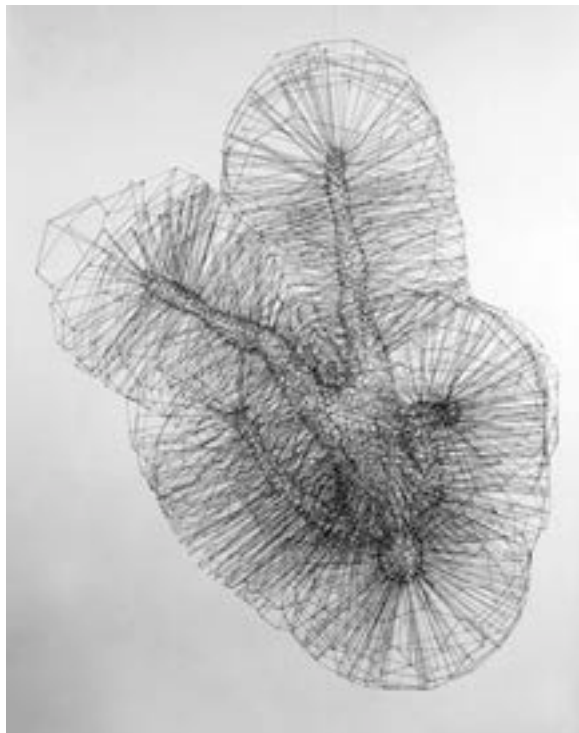

Fig 4. *Matrices and Explosions, 2007*, Antony Gormley.

Gormley's works show no firm aesthetic thread; his version of the 'dynamic type' emerges as an abstract idea which becomes the rule for his explorations across various medium, materialization techniques (both from the trained and untrained hand) and contextual surrounds. The emphasis here is that the open work is as much the outcome of a contextual dialogue as it is the development of a thesis. His work allows for an evolution which has far greater elasticity than the formal evolution of a predetermined aesthetic agenda. Whilst in recent times context has been discarded as a false parameter through which to measure the success or relevance of a project, even in its temporality one might consider context a rich vessel of information that provides the linguistic palette for the exploration of unique outcomes. It is of great value to think of the body of work as having an ideological certitude that allows a confident departure from palette, line, profile, and above all technique, ultimately allowing for a greater freedom of expression.

Fig 5. *Blind Light, 2007*, Antony Gormley.

Copyright

Gormley's bronze clones strategically positioned across central London are not so far removed from Rodin's figures in the Gate's of Hell. Both demonstrate the possibilities of perceived variation in the unit due to evolving context. In giving each 'clone' a new identity through a constructed contextual narrative, Rodin was able to exploit the technologies of reproduction available to him. Ultimately it was his skill at choreographing the work to layer meaning into each individual figure that allowed the work to transcend the 'disenchantment' associated with each figure's reproducibility, and to extend it to the layered and complex work of art, which it came to be recognized as. In the words of Rosalind Krauss,

> 'The gates themselves are another example of the modular working of Rodin's imagination, with the same figure compulsively repeated, repositioned, recoupled, recombined. If bronze casting is that end of the sculptural spectrum which is inherently multiple, the forming of the figurative originals is, we would have thought at the other end – the pole consecrated to uniqueness. But Rodin's working procedures force the fact of reproduction to traverse the full length of this spectrum.'[7]

In her reading of Rodin's work Rosalind Krauss makes a marked reference to Walter Benjamin's seminal essay on 'The Work of Art in the Age of Mechanical Reproducibility'. Benjamin raises critical concerns in an age where technological reproducibility

reduces the work of art from its earlier associations with aura (that which inspires awe) as the originality of the work becomes obscured by its consistent reproduction. She argues however that because the gates were stylistically autonomous from the techniques associated with bronze casting, they were sealed with a copyright, and hence able to transcend the philosophical tribulations associated with reproduction. The evolution of his works were wholly defined by the nuances and imperfections of his own stylistic techniques and furthermore by his own ideological thesis. It is perhaps to this end that Rodin had little difficulty in handing over the rights of his works to the French Government allowing for their re-casting. He acknowledged the arrival of a new age in which the skilled hand of the artist was losing its relevance, allowing that which he had produced (and was subsequently reproduced) to be infinitely tied to his own hand and to the time in which they were conceived, therefore beyond the need for the original[8].

The Hand in the Digital Age

What then becomes of the hand in the digital age? Our contemporary infatuations with technique, as seen in many a digital landscape, demonstrate a shift from the abstract to the analogue, through forms which represent through tectonics the technological instruments facilitating their conception. Digital techniques have opened great doors in the realm of design over the last decade, exhibiting extraordinary potential for the conception of complex forms and geometries with remarkable ease. They are however in the realm of the skilled hand. Whilst it can be argued that the objective of digital techniques in form finding is to allow for the emergence of unexpected results and new types, their disconnection with environmental parameters and contextual implications gives them a remarkable homogeneity as a consequence of their introspective nature. The dangers of allowing technique the role of both philosophy and tool jeopardizes the criticality of the work, regressing into a craft based mode of thinking and allowing the type to transition into what Quatremere de Quincy refers to as a model, defined by an aesthetic language. Whilst it is undoubtedly important to maintain the relevance of these techniques as a means to an end, it should be noted that techniques, in being contemporary are by nature temporary and almost entirely dependent on the technologies which permit them and supersede them with equal diligence. Their role is foremost to create the bridges between the development of a formal language and new technologies, both as an extension of the mind and the hand as it oscillates between the distant poles of the mind's eye and the material realization of a project, they cannot however be substituted for the training required for the mind to tailor a response to varying environmental circumstances, which inform the building of an ideological thesis.

Works, whose evolution depends on the evolution of technology, open themselves up to a greater risk of imitation. Some of the greatest protagonists of such thinking, for whom the body of work is the result of pursuing a stylistic agenda through digital techniques, have spurred future generations of referential forms in the works of other designers and furthermore endorsed these techniques through pedagogical models where the master-class assumes an earlier apprenticeship approach to teaching design, breeding entire future generations of similar designers.

In an age where technique based explorations of form develop a measurable arbitrariness, it leaves continuum in formal language at a dead end. The dogmatic pursuit of an aesthetic language through new digital techniques has resulted in a certain homogeneity of forms which leaves much of what we see as open to reproduction because of their apparent modes of conception. The ability to transcend the aesthetic limitations of the technology of a time, comes from an ambition to represent ideas outside of the techniques which can be attributed to their materialisation, as seen in the figures of both Rodin and Gormley. In an age in which technological reproducibility reduces the mysticism associated with not only the material but now also the conceptual origins of the work, it needs to be substantiated through a continuously evolving aesthetic, and its consistencies need to come through an ideological channel, a channel which will perhaps surmount our own digital adolescence, and push it in the direction where the extraordinary breadth of techniques we so introspectively use will be engaged to make connections between social, cultural and environmental factors. Somewhere in this union lie the next generation of types, we need only challenge the existing.

'It is constantly becoming other in order to remain itself. Its identity is founded precisely on the potency to be otherwise, demanding that the visible form be superseded again and again in an endless production of sameness and difference.'[9]

---

[1] Le Normand-Romain, Antoinette (1999). *Rodin: The Gates of Hell*. Paris: Musee Rodin, 2002.

[2] Antoine Quatremere de Quincy, 'Type', quoted in Aldo Rossi, The Architecture of the City, trans. Diane Ghirardo and Joan Ockman (Cambridge, Mass: MIT Press, 1982), p.40 Passage originally published in Quatremere de Quincy, Dictionnaire historique d'architecture, vol. 2 (Paris: n.p., 1832)

[3] Mertins, D. 'Same Difference', Published in Phylogensis, FOA's Ark Foreign office architects, Actar, 2003.pg 278

[4] Definition of Technique, Oxford English Dictionnary, 2009.

[5] Langer, S. ' Feeling and Form', published in Aesthetics a Comprehensive Anthology, ed. Steven M. Cahn and Aaron Meskin, Blackwell Publishing, Malden MA, 2008, pg. 325

[6] Leader,D. 'Antony Gormley; Drawing in Space' Published in Making Space, by Baltic Centre of Contemporary Art, Gateshead 2004.

[7] Krauss, R. 'The Originality of the Avant-Garde and Other Modernist Myths', MIT Press, Cambridge 1985.pg 154

[8] Krauss, R. 'The Originality of the Avant-Garde and Other Modernist Myths', MIT Press, Cambridge 1985.pg 154

[9] Mertins, D. 'Same Difference', Published in Phylogensis, FOA's Ark Foreign office architects, Actar, 2003.pg 278

Image Credits

Fig.1 *Auguste Rodin, 'The Gates of Hell', Musee Rodin, Paris, 1917.*
Author of Photograph: Andreas Witzel
Source: Wikimedia Commons

Fig. 2 *Field for the British Isles, 1993, Antony Gormley*
Author of Photograph: Matt Gorecki
Source: icommons

Fig. 3 *Event Horizon, 2007,*
Antony Gormley
Hayward Gallery London

Fig.4 *Matrices and Explosions, 2007*
Antony Gormley
Hayward Gallery London
Source: Synaptic

Fig.5 *Blind Light, 2007*
Antony Gormley
Hayward Gallery London
Source: Stephen White
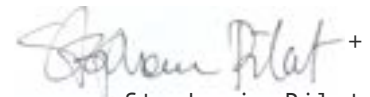
History Reframed

In the last few decades scholars have challenged the canon of architectural history from feminist, post-colonialist, and innumerable other perspectives. This critique has motivated a productive reconsideration of how we select and evaluate projects to discuss. The canon as we once knew it has begun to disintegrate; it is no longer western-centric or even necessarily chronologically taught. The papers that follow are part of the legacy of this reconsideration.

Nathan Richardson, for example, argues that studies of the design process be incorporated into surveys of architectural history in order to better illustrate how architects experiment through design. Moreover, as a result of this prying open of the canon, we are now learning more about the many talented designers whose work was previously marginalized.

The Roman born architect Lina Bo Bardi is one of these often overlooked figures who is now finally gaining recognition outside of Brazil. While Catherine Veikos and co-authors Gabriela Campagnol and Stephen Caffey share an interest in the work of Lina Bo Bardi, they focus on different aspects of her work. Veikos sheds light on Bo Bardi's interest in the handmade and everyday, in popular and peasant aesthetics and in the ways in which architects can serve society.

Campagnol and Caffey, in contrast, focus their attention on Bo Bardi's unconventional design for the Museo de Arte de São Paolo (MASP), a stark and monumental project, which upended the relationships between viewers and works of art and undermined any sense of a chronological development in art. Together the pair of papers on Bo Bardi's work resists any singular or reductivist reading of her legacy.

+

Stephanie Pilat
spilat@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Session moderator]

Reconstructing the Historical Narrative: Wagner and a Volumetric Approach

Nathan Richardson
nathan.richardson@okstate.edu
Assistant Professor
Oklahoma State University
School of Architecture
[Paper Presenter—Session 6]

Abstract

The crafting of a historical narrative defines the window in which history is viewed; it articulates that which is in view, out of view, and how the view is organized. Though many may experience this view through a different lens, the manner in which the narrative is constructed—the window and its frame—are of profound importance. This paper considers the objectification of the historical survey which is broad as a function of *space-time*, but narrow as one considers the full complexity of architectural projects and practice. This is demonstrated through a reading of the overall aim articulated by authors of key survey texts and, more specifically, their treatment of Otto Wagner. This approach to understanding the current construct of architectural history is intended to account for both a broad and detailed view of the narrative. This brief analysis supports the claim that the common narrative crafted in architectural history is largely singular in its treatment. The emphasis is too often placed on that which has been *made*, not on the process of *making*.

In lieu of this sequential and narrow view of historical artifacts alone, this paper proposes a revised construct of history which affords historians the opportunity to convey a truer and more relevant meta-narrative. The proposed reconstruction is composed of a system of intersecting surveys, incorporating the important role *place*, *process*, and *product* play in shaping architecture as we know and experience it. These narratives exist as a function of a given historical case or the historical survey in its entirety. *Place* is a function of the temporal, physical, and cultural environment of a particular time and space. This particular component of architectural history is, of course, already well represented in key texts. It remains as one essential component of understanding and teaching architectural history. The substantive modification to the proposed construct is primarily exhibited in the other two narratives. *Process* is a function of the people who play a role in realizing a given building and the manner in which they produce it, from concept to completion. *Product* is a function of the theoretical and practical components of a given process in a particular place. In short, there are many products that function as input and output in the creation of architecture. As this framework is extended across the timeline, it effectively illustrates the potential for a system of numerous intersecting narratives that tell a more complete story of *making* architecture. The common emphasis on a selective design history is valuable, but largely singular and under-serving students and the profession; it reinforces a narrow conception of architectural practice through the objectification of an otherwise rich and complex historical meta-narrative.

The Current Construct of Architectural History

A Broad View

The current historical narrative as articulated in survey texts places extraordinary emphasis on that which has been *made*, the *artifact*, the *product*. In contrast little attention is dedicated toward *making*, the *activity*, the *process*. One need only review the aim articulated by authors of key survey texts to understand their limitations in scope. David Watkin, in *The Rise of Architectural History* articulates the three primary components of architectural history as practical, historical, and aesthetic.[1] This view is naturally manifested in *A History of Western Architecture* by Watkin.[2] Though this framework conveys holism, all three components are principally concerned with understanding and explaining the physical qualities of architecture. This view or some slight variation of it is embedded in most presentations of the historical survey. A further review of texts reveals slight variations on the same basic model. *Sir Banister Fletcher's A History of Architecture* identifies a presentation method requiring styles and periods to be considered with respect to influence, character, typical examples, comparable analysis of principal features, and bibliographic sources.[3] *Buildings Across Time*, while settling on an arguably more accurate title, provides "…extensive descriptive narrative leavened with critical analysis."[4] As stated in the introduction, "…it is necessary to enter the mind of the architect and to suspend modern biases so that we can evaluate the work as the product of a particular time and place."[5] Here too, the emphasis is on the built product as a function of time and place. Furthermore, it is a presentation largely centered on the architect's perspective. Alternatively, *A Global History of Architecture* discards the "lens of the nation-state…" in favor of architecture as a "cultural production" with a focus on patronage, use, meaning, and symbolism.[6] In *A History of Architecture: Settings and Rituals*, Kostof acknowledges the inherent compromise and "…tries to reconcile the traditional grand canon of monuments with a broader, more embracing view of the built environment…"[7] This is admirable, as the book attempts to present a more expansive history of building, including both the "high" and "low" culture of architecture and vernacular. As Kostof explains, "I wanted to tell a story—the epic story of humans taking possession of the land and shaping communities through the act of building."[8] Even this enlarged lens however, is principally concerned with the physical product of building design and construction. Of course, it would be folly to fault a historian for attempting to tell a particular, even selective story. However, it seems that architectural history as an academic discipline has long embraced a multiplicity of largely similar meta-narratives. Consider the following statement of

purpose incorporated in *Architecture: from Pre-History to Post-Modernism* by Trachtenberg and Hyman:

> This book centers on monumental architecture as the visual art that is the most sensitive powerful touchstone of the cultural process. While we anchor architecture in its worldly background, we have not stressed the 'social' history of art in which external socio-economic factors lead. Nor have we lingered on the history of architectural patronage…we do not treat the history of the architectural profession or the building trades. Significant as these subjects are…[9]

This acknowledgement of other significant subjects and their potential, yet omitted role in the history of architecture is natural and noteworthy. One can't fault a historian for focusing their academic scope on a specific text to a manageable scale, but should this be the case for most treatments of architectural history? If so—as it seems to be—the same targeted narrative takes shape again and again, replicating itself with only slight variations from text to text. As a result, the profession of architecture lacks a coherent structure for exploring the full depth and breadth of its role in history and the factors which shape the production of the built environment. It seems evident that this emphasis on the physical qualities of architectural design throughout history only serves to reinforce a similar emphasis in contemporary practice.
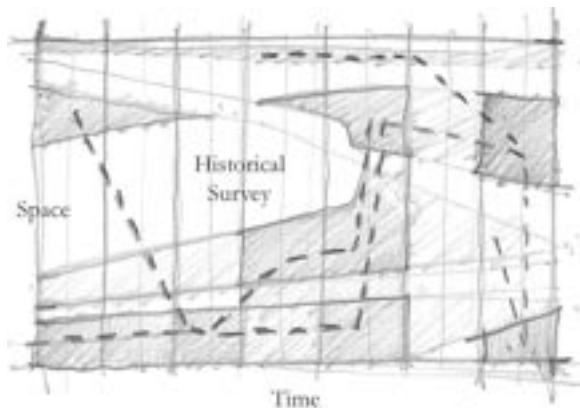

Fig. 1. Historical Survey as a Function of Time and Space

A Detailed View

Perhaps architectural history's roots in the history of art, while valuable from certain perspectives, is largely flawed given the complex and expansive nature of building design and construction. It is particularly evident as one considers Otto Wagner, his present position in the survey, and his potential role in a reconstructed narrative. For instance, Wagner was often involved in the creation of architecture as a visionary, speculator, designer, contractor, and operator.[10] Majolika Haus (No. 40 Linke Wienzeile) is the most prominent work in which he operated in this expanded capacity. While Wager isn't entirely unique in this regard, he is one of the most prolific and likely cases worth mentioning in the context of a historical survey. Yet, his full story doesn't fit the conventional script, and so he is commonly cast in the "visionary designer creates an object which expresses an architectural theory" mold. Consider the treatment of Wagner and Majolika Haus in the following texts. In the *History of Architecture: Settings & Rituals*, Wagner is credited as one of three men to "…have been

assigned the most prominent place in the formulation of a new twentieth-century idiom."[11] The idiom, referenced here, primarily alludes to the physical characteristics of Wagner's work, as a function of design theory. Despite the "prominent place" Wagner is ascribed, a fairly cursory description of his work is presented by Kostof. In *Sir Banister Fletcher's A History of Architecture*, Majolika Haus is described as "…a six-storey tile-faced façade punctuated by regularly-spaced rectangular window openings reminiscent of Schinkel's Feilner House….Here, however, in a deliberate conflict with the generally severe rectangular forms, intricate coloured curvilinear patterning expands across the tile-facing…"[12] In four other volumes, Wagner gets somewhere between a paragraph and a page as part of the narrative, without a mention of Majolika Haus or any other of his apartment projects.[13] *A Concise History of Western Architecture*, by Furneaux Jordan is simply too concise to mention Wagner at all.[14] In *A History of Western Architecture*, Watkin includes a significant discussion of Wagner, but only as an architect in the purest sense of the term. He describes the Majolika Haus as a "lyrical…apartment block of 1898 faced in ceramic tiles decorated with coloured plant forms which flow vivaciously across the façade…"[15] Even in Hitchcock's *Architecture: Nineteenth and Twentieth Centuries*, where one might expect to find a more full rendering of Wagner's activities due to the limitations in the scope of the survey (Majolika Haus is also prominently featured on the cover), the script is largely set by convention.

> Wagner's so-called Majolika Haus, a block of flats at 40 Linke Wienzeile built in 1898-9, is much more distinguished and original…Although the ironwork of the balconies is here and there curvilinear in detail and the faience plaques that completely cover the wall are decorated with great swooping patterns of highly colorful flowers, the architetectonic elements of the façade are nevertheless very crisp, flat, and rectangular.[16]

One must not conclude that this argument holds these particular presentations of history or Wagner and his work as incorrect or faulty. A cursory treatment or omission of any given architect, work, or storyline is a reasonable part of defining practical limits of exploration. These texts do however, begin to illustrate how frequently historical narratives tend to replicate some slight variation of a largely similar story. In such a story, form, design, and theory are central and the process of creating the architecture or the broader range of forces that inform it are cast aside entirely. A more comprehensive range of issues is warranted in order to inform a more complete and relevant reading of history.

A Volumetric Approach

In order to reconstruct the components and methods of presenting architectural history, one must first visualize the narrative in its current form. Consider the emphasis on the passage of time and geographic places, identified as space in Figure 1.[17] As one seeks to understand and explain the artifacts, buildings are organized with respect to time and location, similarities and trends are identified, and a meta-narrative is crafted out of multiple narratives throughout time. This diagram (Fig. 1) illustrates the primary implication of current surveys in identifying similar characteristics in buildings of a given time or location, and grouping similar works with respect to style (represented by shaded geometries). The meta-narrative drawn from the inter-

relationships of such groupings over time is illustrated by dashed lines. This leads to the common story of the development of architectural theory throughout various regions, cultures, and nations. Naturally, as one moves across the timeline, particular places become more or less relevant in supporting the meta-narrative and, as a result, receive more or less attention.

However, this representation lacks an expression of supporting evidence as a key component of the narrative. One can certainly imagine the role supporting evidence plays in setting the meta-narrative, but in order to move towards a volumetric approach, consider the following. Part of establishing the history of architecture, is explaining why certain buildings take their particular form or expression. In order to illustrate this aspect of history in its current construct, it is necessary to incorporate a diagrammatic third dimension. That third dimension is largely related to influences of a theoretical or practical nature (see Fig. 2).

The influence of issues such as materials, technology, or structure is represented below the primary plane, whereas influence such as art, culture, or religion is represented above the primary plane. This theory and practice dyad gives shape and form to the common historical narrative (illustrated by the undulating plane in the horizontal direction). This model best represents the forces at play in the current construction of the historical narrative. There are a few primary problems with this approach. First, it is still largely centered on explaining the physical product from the architect's lens. Second, it accounts for a limited range of factors that serve to explain the built environment. Third, it is largely formed at the hand of a given historian, based on their selective reading of history. One can certainly see how such a framework would operate sufficiently, particularly for the arts, in which the process of creating the art is relatively compressed (i.e. fewer actors, more limited palette of materials, shorter time frame from conception to completion, fewer external forces acting on the process and product). Architecture, by necessity, is distinct from art in the complexity of production. This representation of the existing construct (Fig. 2) however, begins to give shape to an alternate approach. One way to integrate these issues in a comprehensive framework is to reorganize them as a function of *place, process,* and *product* (see Fig. 3). First, the emphasis on space and time as two distinct dimensions is unnecessary. It is the combination of space and time (along with other factors) which begins to define a place. As a result, the proposed reconstruction dispenses with the space-time distinction, illustrating them along the same continuum as a function of *place*. Second, a more complete reading of production is conceived as *process*. Third, the full range of *products* which drive and are derived from the making of architecture are illustrated. One could consider products along this continuum as those of the mind, identified near the top and those of the hand, identified near the bottom.

Given the reconstructed volume of history as presented above, one can begin to see how a diverse range of intersecting narratives can shape a more complete history of architecture. While a near infinite number of current and yet-unwritten texts might fulfill the intent of this reconstruction, a couple examples should suffice for illustrative purposes. Consider Kostof's *The Architect: Chapters in the History of the Profession.* This "historical survey" begins to tell a valuable additional narrative, partially represented by the vertical plane identified as the

"History of Process" in Figure 3. In the volume, Kostof discusses the aim of the work.
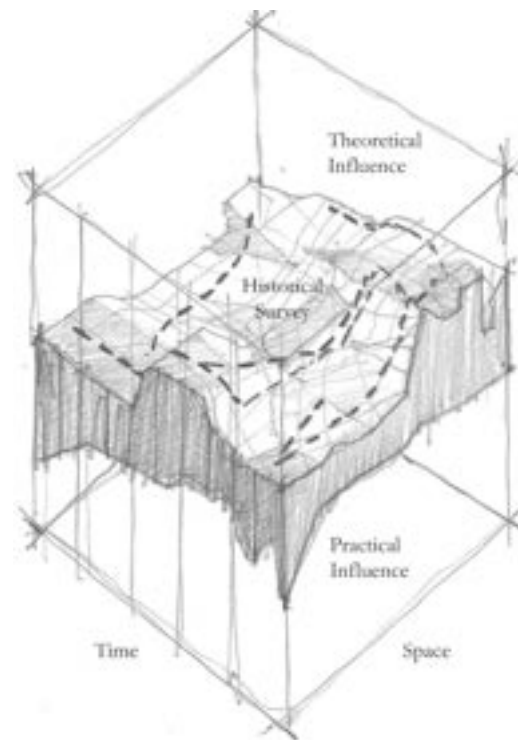
Fig. 2. Historical Survey as a Function of Time, Space, and Influence

> The history of architecture in [the twentieth] century has tended to be centered primarily around the product of architecture. It is interested in architects, in the main, only as the makers of this product. The education and training of the architect at different times and in different cultural worlds, the *process* of architectural practice, the structure of the profession and the social standing of the architect— such topics have been of secondary importance. Yet, their bearing on the understanding of the canon of past monuments that is the handiwork and charge of architectural historians is undeniable. As pertinent as the history of the profession is to those who carry on its traditions, it should equally be a constituent concern of the general study of architectural history.[18]

Another text that begins to inform the history of process, and cover certain forms of practice excluded by Kostof, is *The Image of the Architect* by Andrew Saint. In this work, Saint identifies the various manifestations of the architect, embracing a broader definition of the architect. As Saint explains,

> We are at present in the midst of a widespread transformation of 'architectural history', with its emphasis on aesthetics, design and authorship, into 'building history', which has broader social and economic preoccupations. This book attempts to contribute to the debate on this transition. The realities of architectural practice, past and present, have often been hidden from those entering upon

an architectural career; and the conflict between those realities and the ideals of creativity fostered in schools is, I believe, something which students of architecture should appreciate, ponder and debate.[19]

Fig. 3. Reconstructed Meta-Narrative

Saint investigates varying models of the architect as hero and genius, professional, businessman, gentleman, and entrepreneur, thus supplementing voids left unrepresented in Kostof's more narrow treatment of practice. One can imagine how the current historical survey of architecture could be greatly enhanced by such complementary surveys covering the history of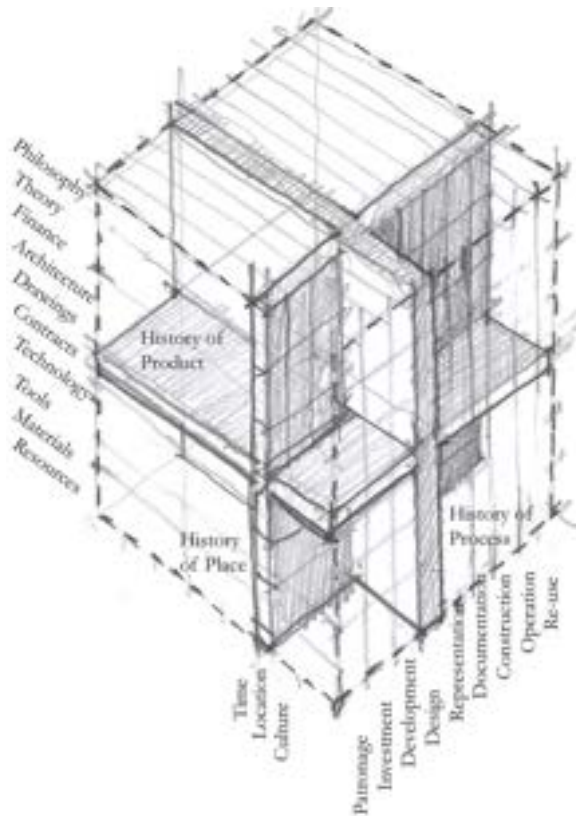 process. In the same diagrammatic orientation, a set of histories focused on patronage, real estate investment, development, finance, construction, management, and even redevelopment could function in a similarly valuable way. Furthermore, imagine additional surveys along the horizontal plane as illustrated in Figure 3. While the current history of architecture largely organizes itself as such, consider the relevance of complementary histories in philosophy, real estate finance, land-use policy, and construction contracts, for instance. These represent largely existent topics of history, that haven't found a clearly structured place in the historical survey. Finally, imagine a broad survey of a particular place, which fully conveys the corresponding elements and activities that comprise the creation of architecture in its full complexity. This vertical plane in the perpendicular direction, begins to ground the prior two surveys in a particular setting. This survey could be positioned to present a more contemporary reflection of the production of architecture, or set at some defining point in time more distant in the historical survey. Naturally, a series of such surveys could more effectively

illustrate numerous trends in the process of creating architectural products. While one can't reasonably strive to understand or convey the entire volume of history through an infinite set of intersecting surveys, it is evident that even three distinct surveys would begin to give form to the full volume. Furthermore, it does so in a more measurable way. Once the volume is introduced via three primary surveys, subsequent surveys add more definition and depth to ones understanding of architectural history in its entirety.

Having established how such surveys could function on a broad scale, it seems relatively simple to imagine how one could build a volumetric survey beginning with individual artifacts—from the ground up, so to speak. Imagine what impact a broader reading of Wagner's Majolika Haus could have on the profession's understanding of history—and current practice, by extension—if the full story were more commonly told. Instead of primarily exploring artifacts as a function of design theory, one could expand the narrative, describing the full process and products that actors on a given project employed. Figure 4, for instance, could exist at the very intersection of the primary planes illustrated in Figure 3. While it deals with similar issues, they are connected to a specific piece of work, not the survey in its entirety. Instead of focusing on the formal qualities of the architecture and the theories that informed them from the architect's perspective, one could expand the frame, creating a broader story of *making*. As in Majolika Haus, one could present the project from beginning to end, discussing Wagner's role in conceiving, financing, constructing, and operating the building. In addition to architectural theory, economics, finance, documentation, construction, and leasing could be addressed. A similar approach could be used for many historical artifacts, regardless of the architect's scope of participation. Doing so, for even a select few buildings as a part of the standard historical survey, would begin to define the larger volume, encompassing a broad range of actors and issues inherent in the production of architecture.
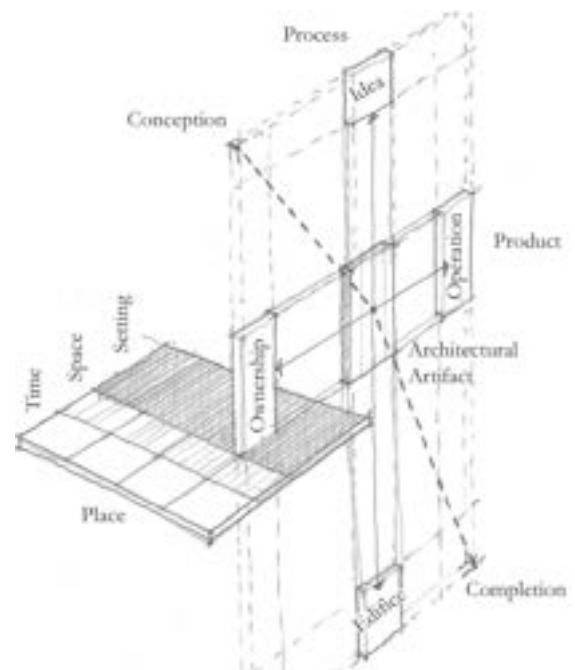

Fig. 4. Architectural Artifacts: Expanding the Narrative

Conclusion

If such a reconstruction of the historical meta-narrative is so appropriate, then why hasn't it been implemented in a largely similar form? First, one may fairly argue that the model is simply too expansive to operate within the reasonable limits of a given text or course. This wouldn't necessarily be true for a selection of historical artifacts, a series of history courses, a range of survey texts, or as a component of graduate studies. Still, the definition of a broader volume as a function of three discreet surveys largely accounts for the necessary balance of depth and breadth which reality necessitates. Furthermore, the model could organize the architectural explorations of a more expansive intelligentsia, thereby providing a framework for those students, faculty, and practitioners that choose to deviate from the conventional script. Second, one might argue that the survey, as it's largely structured in architectural history, is centered on the most appropriate and relevant information. For instance, though it might be interesting to note that Wagner functioned well beyond the standard scope of architectural services, it isn't the most important part of his work in the context of architectural history and is, therefore, necessarily omitted. This may be true for many historians, but it is a value-laden decision. The decision should be (and often is) acknowledged. However, there are likely unintended consequences that must be considered. At some point, if architectural history becomes such a singular exploration of form and design theory, it shouldn't be a surprise that students may struggle to embrace a more complex reality as they enter the practice of architecture. Finally, one might argue that this conception of architectural history is effectively existent and the information, texts, and courses available. In theory this may be true, but this author hasn't discovered such a structure to be existent or reasonably accessible in practice. This author is no historian. His desire to understand architecture as an art form is great, but not eclipsed by his desire to understand architecture as a product of many other socio-economic factors. This is, by necessity, an architectural history "problem". It must be considered, explored, and addressed in some meaningful fashion, for those students, professors, and practitioners that desire to gain a more expansive and relevant understanding of architecture and its *making*.

1   David Watkin, *The Rise of Architectural History* (London: The Architectural Press, 1980) preface.
2   David Watkin, *A History of Western Architecture* (London: Barrie & Jenkins, 1986).
3   J.C. Palmes, ed., *Sir Banister Fletcher's A History of Architecture*, 18th ed. (New York: Charles Scribner's Sons, 1975) preface.
4   Michael Fazio, Marian Moffett and Lawrence Wodenhouse, *Buildings Across Time*, 3rd ed. (Boston: McGraw Hill, 2009) preface.
5   Ibid., introduction.
6   Francis Ching, Mark Jarzombek and Virramaditya Prakash, *A Global History of Architecture* (Hoboken, NJ: Wiley & Sons, 2007) preface.
7   Spiro Kostof and Greg Castillo, *A History of Architecture: Settings and Rituals*, 2nd ed. (Oxford: Oxford University Press, 1995) preface.
8   Ibid. See also Chapter 1.
9   Marvin Trachtenberg and Isabelle Hyman, *Architecture: From Prehistory to Post-Modernism*, 1st ed. (The Netherlands: Harry N. Abrams, 1986) p 41.
10 Residenz Verlag Salzburg, *Otto Wagner, 1841-1918* (New York: Rizzoli, 1964). August Sarnitz, *Otto Wagner, 1841-1918: Forerunner of Modern Architecture (Koln: Taschen, 2005).* Iain Boyd Whyte, *Otto Wagner, Vienna 1841-1918: Designs for Architecture* (Oxford: Museum of Modern Art, 1985).
11 Spiro Kostof and Greg Castillo, *A History of Architecture: Settings and Rituals*, p 686.
12 J.C. Palmes, ed., *Sir Banister Fletcher's A History of Architecture*, p 1199.
13 Bill Risebero, *The Story of Western Architecture*, p 230. Michael Fazio, Marian Moffett and Lawrence Wodenhouse, *Buildings Across Time*, p 437-438, Francis Ching, Mark Jarzombek and Virramaditya Prakash, *A Global History of Architecture,* p 657. Marvin Trachtenberg and Isabelle Hyman, *Architecture: From Prehistory to Post-Modernity,* p 492.
14 R. Furneaux Jordan *A Concise History of Western Architecture* (Great Britain: Harcourt Brace Jovanovich, 1976).
15 David Watkin, A *History of Western Architecture,* p 474.
16 Henry-Russell Hitchcock, *Architecture: Nineteenth and Twentieth Centuries*, 4th ed. (New Haven: Yale University Press, 1987) p 403-404.
17 The term space here is used to signify the focus on a particular region or location as a distinct component from the role of time.
18 Spiro Kostof, ed., *The Architect: Chapters in the History of the Profession* (New York: Oxford University Press, 1977) p vii.
19 Andrew Saint, *The Image of the Architect* (New Haven: Yale University Press, 1983) p ix.

Surface Effects: Lina Bo Bardi's SESC-Pompéia

Cathrine Veikos
veikos@exchange.upenn.edu
Assistant Professor
University of Pennsylvania
School of Design
[Paper Presenter—Session 6]

Abstract

"Lina wanted Brazil to become an industry based on the abilities to be found in the hands of the people, in the eyes of people with creativity."

-Darcy Ribeiro[1]

Amongst the many Italian émigrés to Brazil in the period after World War II, the architect, Lina Bo Bardi (1914-1992) most expressively manifests the tensions inherent in the assimilation of vernacular material traditions with modernism in her works and writing. The result of this practice is evident in the material surfaces of her built work, where the use of unfinished concrete, roughly–finished mortar, rough or plaster-coated masonry is dominant. Bo Bardi's Social Service for Commerce Building- Pompéia, (SESC-Pompéia), in São Paulo, Brazil (1977-1986), with its hand-made furnishings and signage, heterogeneous pavers and carefully designed garden plots, walls with indexical markings, colorful murals, inscriptions, and hand-placed pebbles and stones, is especially paradigmatic. An abandoned factory transformed into a leisure and sports center, it represents a unique alternative, both to the machine-based aesthetics of European modernism, and to the lyrical formal freedom of her better-known Brazilian contemporary, Oscar Niemeyer.

To begin with the hand is to stress the tactile and material dimension of architecture rather than the conceptual and intellectual one; to pay attention to the way architecture is made and how it achieves its expression. In her writing, Bo Bardi alludes to the little-known German philosopher, Conrad Fiedler, advancing his theory of "pure visibility" as a way of giving epistemological value to aesthetic cognition. According to Fiedler, artists and scientists see the world in different, but equally important ways. In a period when arguments for the systematic industrialization of architecture were dominant, she elaborated on the possibility of a "new humanism." Whenever she discussed architecture theory, she was explicit about doing away with its dialectical relation to practice: "…the elaboration of theory may originate from practice and be its consequence."[2]

A student of the Italian architectural discourses of the '30s and '40s which advocated the reconciliation of Rationalism and *Mediterraneità* (in the magazine Q*uadrante,* for example), Bo Bardi cultivated her understanding of the vernacular in Brazil, attentive to the resourcefulness, roughness and ingenuity of the poorest Brazilians. At SESC, at the São Paulo Museum of Art (MASP) and as director of the Museum of Modern Art of Bahia (MAM-BA), Bo Bardi designed and mounted many exhibitions of the objects produced by the people of the Northeast region. The exhibitions were provocations, putting

emphasis on the value of the everyday objects as "artifacts of civilization," as *art* that was authentic, because it was made by hand and connected to life. She elaborated a theory for architecture out of their practice. Following the terminology of the nuanced Italian architectural discourses, the Roman school's "architettura minore" [minor architecture] and its Milanese counterpoint, "architettura rurale" (rural architecture), advanced by Giuseppe Pagano in *La Casabella,* she termed her approach, "arquitetura pobre" (poor architecture). Using her adopted language, Portuguese; she relied on it to describe many of her projects, including the SESC-Pompéia: "The initial idea for restoring the so-called complex was one of 'Poor Architecture,' poor, not in the sense of indigence, but in the sense of the hand-made, great dignity expressed with humble means."[3]

Drawing and Writing

Lina Bo became an architect in the difficult years surrounding the Second World War. She completed her education in Rome at the Scuola superiore di archittera di Roma [College of Advanced Architecture] in 1939, under the Fascist regime of Benito Mussolini. She quickly found apprenticeships with the favored and consequently, prolific architect, Marcello Piacentini (1881-1960), who had been her Professor and Dean of the School. Soon, dismayed by the ecleticism of the monumentality of Piacentini's work, "…I do big perspectives in pen, with Roman horses […], veils and lots of other things; all for E-42, naturally,"[4] she jumped at the opportunity to move to Milan with a classmate, Carlo Pagani (1913-?). In the 1930s, as Bo began her professional career, a rich architectural discourse with multiple and nuanced positions concerning the political potency of architecture was evidenced in architectural magazines and journals, especially, *La Casabella, Quadrante, Lo Stile, Domus and Architettura.* The Italian vernacular, referred to as "architettura minore" (Minor architecture) by the Roman school, Bo's professors, Piacentini and Giovanni Giovanoni (1873-1947), was criticized as historist by Giuseppe Pagano (1896-1945), architect and editor of *La Casabella.* His polemical rebuttal to the prevailing historical eclectism that characterized *Architettura,* the magazine of the Fascist syndicate of Architects, led by Piacentini, was "architettura rurale" (rural architecture) interpreted as practical and pure. The first and most potent critique of Piacentini however, came from the journalist and art critic, Pietro Maria Bardi (1900-1999). He and Lina Bo would marry in 1946, but she wrote that she admired him since she "…was a bobby-soxer" as the "greatest Italian journalist," the main protagonist for modern architecture in Italy, author of the polemical *Tavola degli Orrori*

[Table of Horrors] which ridiculed the Neo-Classicism and Ecleticism of the "Official Style."[5] His magazine, *Quadrante*, advocated for the reconciliation of functionalism and the natural forms of *Mediterraneità*, calling for a new morality in architecture that would represent the patriarchal benevolence of the Fascist State. He also contributed articles to and consulted with architect, Gio Ponti (1891-1979) on the character and content of the new magazine, *Lo Stile: nella casa e nell'arredamento* [Style: Home and Furnishing] he founded in 1941.

Lina Bo wrote articles, did drawings and projects for the office of Gio Ponti from a studio she shared at 12 via Gésu, in Milan, with Pagani, and the architecture office of Luigi Claudio Olivieri, Renato Angeli, and Carlo De Carli. She contributed her architectural work and writing, done in collaboration with Pagani, to *Lo Stile*. An idea for turning a small fruit crate into a baby's bassinet was one of Lina Bo's first recognized published works, a drawing and short article signed with Pagani in the magazine, *Grazia*.[6] (Fig. 1)

It is interesting to note that Ponti wrote an article titled, "Case Semplici per la vita sana" [Simple homes for healthy Living] and included coverage by *Gruppo 7* architect, Piero Bottoni (1903-1973), of "A Great work of Rural Building: the reconstruction of 13,000 homes for Peasants in Hungary"[7] in *Lo Stile*. P.M. Bardi, too, although with a different agenda, published "La Casa Rurale"[8] in *Quadrante,* and promoted the schemes for rural housing by engineer and inventor, Gaetano Ciocca (1882-1966), whose work would later appear as a pedagogical example in a text by Lina Bo Bardi. Certainly, it overstates the point to say that the valuation of rural architectures and hand-made solutions to practical problems of life found in the pages of architectural magazines between 1933-1946 were the major influence on the approach that Bo Bardi took in her later architectural work, or on design of the SESC-Pompeia. It has been argued by many Brazilian scholars[9] that her journeys into the Brazilian Northeast were more definitive, but this Italian groundwork reveals that it may have been more recognition than discovery for Bo Bardi.

Built by Hand

On the very first page of her thesis of 1957, *Propaedeutic Contribution to the Teaching of Architecture Theory,* Bo Bardi establishes two principles that will serve as criteria for her Theory of Architecture: 1) materials express ideas, and 2) Architecture…is a *projection* of civilised man in the world, an artifact of human intelligence. To introduce the nature of theory, practice and design, and their inter-relation to students, she reproduces the allegories from Cesare Ripa's *Iconologia* of 1625, and inspires the ambitious to find their description:

"Theory is concerned with reason and the operations of the intellect; Practice with the operations and movements of the senses…the former contemplates the highest causes, the latter investigates the lowest effects. So that one is the summit and the other is the foundation of the whole fabric of human discourse."[10]

Re-calibrating the relationship between theory and practice, she eliminates the hierarchical duality implicit in the statement, and concludes in her characteristically willfull manner, that "theory is nothing more than a foundation for architectural problem-solving, a synonym for practice."[11] That the creation and investigation of effects would be the foundation of a theory of architecture is the stimulus to an interpretation of

Fig. 1. Watercolor signed Bo e Pagani, *Grazia,* 1941, p.31. Reprinted in Bardi, Lina Bo. *Lina Bo Bardi.* Lina Bo and P.M. Bardi Institute, Edizioni Charta: Milan, 1994. p. 28.

Lina Bo Bardi's work which re-conceptualizes surface as constitutive.[12] Such an interpretation is supported not only by the work itself, whose restrained formal character highlights its expressive material surfaces, but by the recurring themes Bo Bardi elaborates in much of her writing and teaching. History is also critical. Modernism is part of history, and we are part of history as we make it, in the present. The way that she undoes the dialectic between history and modernism repeats the virtuosity of the theory-practice conflation, but is a topic for another project.[13]

In her preparatory notes and lectures for courses at the Faculty of Architecture and Urbanism, Federal University of São Paulo (FAU/USP), and the Visual Arts School of the Federal University of Bahia, she insists on the cultivation of a "consciência do arquiteto"[14] an architectural consciousness that is aesthetic, technical and ethical. In her thesis, she characterizes the development of Architecture as increasingly due to the fusion of art and science. The fusion, she says, helps to achieve harmonious solutions to aesthetic ideals while concurrently providing the certainty that comes with the progress of scientific research. Nonetheless, the "consciousness" of the artist and the scientist are distinct, as described by the "great critic Fiedler":

"…He who does not contemplate the world with the interest of the artist, if he at all feels the desire to take notice of the appearances of objects, attempts but to investigate the conditions of their origins. Only with difficulty, however, will he come to understand that there is a need of *visually comprehending appearances as such,* independently of knowledge of their origins."[15]

In an article published in Bruno Zevi's magazine, *L'Architettura*, she reiterates the lesson of Fieldler, saying that only examination, comprehension and vigilence are important for the construction of an architectural consciuousness; that "visible traces of accidents of construction, of revisions, of errors corrected or not, anti-perfectionism in architectural realization, in short, are valid."[16] The essential artistic substance is evident only to a cultivated sensibility, a capacity to understand the work as a product and an element of the entire cultural life.

By the Hand of the Brazilian People

In an essay published in 1976, Bo Bardi calls for a re-assessment of so-called "low" or "popular" Brazilian art: "even if it is considered poor in the eyes of high culture."[17] Her effort to visibly manifest the value of this work, as an artifact of the richness of "Northeast Civilisation" is recorded in a series of major exhibitions which she designed and curated, in collaboration with anthropologists, experts in theater, Brazilian writers and the artists themselves. In the beginning, she included these hand-made objects in the exhibitions of the first Museum of Art of São Paulo.[18] In glass vitrines, she and P.M. Bardi displayed changing exhibitions of religious "ex-votos," tools and utensils next to Olivetti typewriters and American whiskey bottles.[19]

The exhibition "Bahia no Ibirapuera" mounted under the marquee in Ibirapuera Park on the occasion of the 5th São Paulo Biennale, in 1959, provoked the contemporary international display of "high art" with the authentic impulse to art of the Brazilian people, and of all people; the poetry of everyday life. In the catalog accompanying the exihibit, Bo Bardi and Martim Gonçalves, director of the School of the Theater of Bahia (ETUB), begin by evoking surrealist poet, Lautréamont, "La poésie doit être faire part tous, non par un." [Poetry must be done by all, not by one]. The parting words are both invitation and provocation, from Adolphe Appia, "soyons artistes, nous le pouvons"[let us be artists, we can do it].[20] Designed with architectural, theater, and lighting expertise, the exhibition is particularly striking for the setting it creates for the art. The sensorial is activated materially in every respect. Although only black and white photos remain, the notes and watercolors by Bo Bardi suffice to recreate the ambience. Shimmering light-colored material is stretched across the ceiling to form airy folds, and lit from above to create a luminous horizontal plane. Dried eucalyptus leaves are strewn on the ground for a dark and pungent counterpoint. Supports for wooden easels hit the covered ground in cones of poured concrete, which are decorated with shells and stones. This experiment is in evidence again in Bo Bardi's House for Valéria Cirell (1958) where all the exterior surfaces of the house are embedded with shells, pebbles bits of toys and ceramic plates, and fragments of bottle glass.

Seemingly guarded by a gathering of headdresses, the exhibition unfolds in a series of angled walls covered with tapestries and objects. A traditionally leather-clad "vaquiero" [Brazilian cowboy], "faces-off" with two Baroque sculptures in painted wood. These have a perfectly square and highly textured "gilded wall" as a background, reminiscent of the gold-filled Portuguese Baroque churches in Salvador, Bahia. A whitewashed brick wall, perpendicular to the hall, is lined with rows of ex-votos and creates a space for an auditorium behind.

At the time Bo Bardi made her associations with the emerging avant-garde in the Northeast, what is known as the "Golden Age of Brazil" (1955-1962) was well under way: the music of *Bossa Nova*, an industrial Boom, positive social change under Juscelino Kubitschek, including financial assistance for the under-developed "Northeast Triangle." The Superintendencia para o Desenveolvimento de Nordeste (SUDENE) [Superintendency for the Development of the Northeast] was created on the basis of Keynsian economist Celso Furtado's "Operation Northeast."[21] The United States pledged to help provide technology and capital in the hopes that this would quell the growth of peasant leagues in the area that might be swayed towards Communism. Martim Goncalves, supports his theatre projects at ETUB with grants from the Rockefeller Foundation. Lina Bo Bardi is invited in April of 1958 by the director of the School of the Beaux Arts at the University of Bahia, Mendonca Filho, to give two lectures. She speaks about space and the necessity for the "humanization" of architecture.[22]

Bo Bardi becomes a creative protagonist in Salvador de Bahia in the hopeful and dynamic years before the military coup of 1964. She teaches and directs the Museu de Arte Moderna da Bahia (MAM/BA) [Museum of Modern Art of Bahia] by invitation of the governor of Bahia, Juracy Magalhães, and does architectural work, including a major project for the restoration of a complex of abandoned buildings around a 16th century Sugar Mill, including a slave quarters, and nobleman's residence that had, through the years, been used as a snuff factory, cocoa factory, waterfront warehouse, and marine barracks. The "Exposição Nordeste" [Northeastern Civilisation] of 1963, inaugurates the gallery space of the "Solar d'Unhão," into which Bo Bardi dropped an exquisite wooden spiral stair. Under her direction, the new "Museum of Popular Art," projects three more exhibitions in this series, each to highlight a particular culture of Brazil. Sadly, these and other ambitions, such as the Project for a School of Artisan (rather than Industrial) Design, the Center for the Study of Artisanal Work (CETA) are halted by the military coup of March, 1964. Continuing to direct the Museums under censorship was not possible, nor was teaching, as the political beliefs she shared with some architectural collegues, including Vilanova Artigas, Paulo Mendes da Rocha, and Maitre Jean had already led to their dismissal from FAU/USP.

Re-located to São Paulo, Bo Bardi mounted the important exhibition, "À Mão do povo brasileiro" [By the Hand of the Brazilian People] in 1969 at MASP working with theater director, Jose Celso Martinez Correa. She continued her scenographic work, designing costumes and sets for the play, "Nella giungla delle citta" [In the Jungle of the Cities], by Bertold Brecht (1921-22). Though this period is often regarded as an interruption of her career, and an intense personal disappointment of her ambitions to develop an "artisanal industry" from what she saw as Brazil's authentic national culture, Bo Bardiused it to synthesize her experiences and invested her next major project, the SESC- Pompéia, with all the hope that she had lost in the Northeast. All the surfaces of the huge urban complex are infused with it. (Fig.2)

Fig. 2 Lina Bo Bardi. "Drawing of a Possible Future for SESC-Pompèia" Lina Bo and P.M. Bardi Institute.

SESC- Pompèia

"The great surfaces of reinforced concrete are pierced with irregular holes which replace windows, at the same time ensuring the unity of the walls and a magic lighting of the five double floors. Roughly brutal details, pop inserts, fragments of colored tile, the collage blend together to reinforce the differences, without pity… an extraordinary assembly of fragments, virtuously avoiding any aspect of Kitsch. Without intellectual arrogance it provides a model of an agreeable environment, full of humanity and poetic fantasy. It also reflects the personality of the author, her youthful training in the atmosphere of Milanese design, and then a persistent and painful plunge in the enigmatic world of Brazil." - Bruno Zevi[23]

The Social Services for Commerce Building - Pompéia, (SESC-Pompéia), 1977-1982/1986, is Bo Bardi's largest project. The SESC Program is regional, with centers for sports and leisure facilities built at the expense of business owners to serve working communities of roughly 15,000 people. The site is almost 180,000 square feet, and exists in a dense and erstwhile industrial urban area. The site was partially occupied by a 1938 building constructed in brick on the British Factory model by Mauser Bros. Ltd. The factory had been closed and the building left abandoned, a near ruin. Lina recalls her first visits to the site, in 1976, when she encountered the

building's reinforced concrete structure, reminiscent of the systems of the great mid-19th century engineering pioneer, François Hennebique (1842-1921). She decided that the shell should be preserved, leaving the unfinished material surfaces untouched—also, she said, the Saturday morning crowd of mothers and children, rain leaking through cracked tiles, kids splashing water around—she decided that this too should be preserved: with all the happiness. (Fig. 3) Her decision not to demolish the building and give herself the freedom to accommodate the almost 250,000 square feet of programmed area on an empty site, is a demonstration of her desire to challenge the dominant paradigm of modernism; she maintained continuity with the past, but without re-creating it. Her mission, clear from the iconography she created for the new institution, was to subvert the past. The factory that once produced black smoke, would now produce flowers, the workers (displaced to the city from rural Brazil) who spent their days in toil would now swim, play soccer, read in the library, learn how to build and play a guitar, watch plays, be challenged by provocative exhibits and enjoy time with friends in the café.
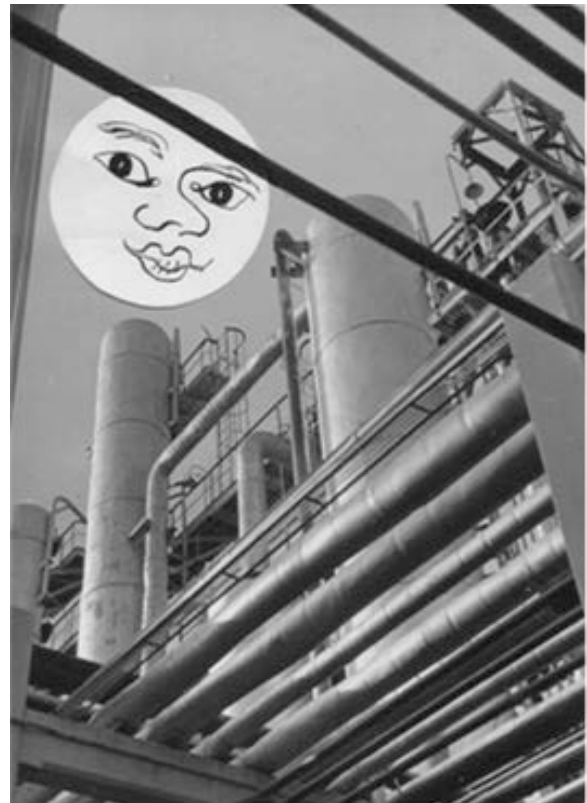

Fig. 3. Collage on Photo. Lina Bo Bardi. From the archive at the MASP Library, Habitat Folder.

The team produced hundreds of drawings for the set of construction documents for the project, including details for all sorts of wall treatments, paving materials and patterns, indoor and outdoor furniture, signage, doors, windows, detailed plans for planting, including intimate flower gardens,

Fig. 4. Sign at SESC-Pompéia Entrance to Cafeteria. Photo by C. Veikos, 2005.

medicinal gardens, wall gardens, and roof gardens.[24] There are notes on the drawings that indicate the Latin and common names of plants and flowers and exactly where on the site they are to be planted. The fauna selection takes into account color, scent, growth of time and season and use. The paving blocks, their dimension and where and whether moss would grow between them is indicated. Each surface participates in the creation of a dynamic atmosphere, which was intended to produce an anticipated effect on the visitor. But for all this attention to detail, much was altered by the viccicitudes of construction process. Against common expectation, this did not detract from the work, but gave it the 'humanity" Bo Bardi often discussed in her writings. Although there is no evidence that she knew it, Umberto Eco's 1962 book, *Opera Aperta* outlines a very similar phenomenon. SESC- Pompéia was very much an "Open Work" in the sense Eco describes.

The spaces and surfaces Bo Bardi designs for the SESC-Pompéia, promote the creation of collective fantasies. This is achieved in no small part by the process of construction Bo Bardi undertook. During construction, she set up an office *in situ*. This was not uncommon at the time, however, the quality and level of engagement with the construction workers was unprecedented. The collective, including Bo Bardi, the young architecture graduates, André Vainer and Marcelo Carvalho Ferraz and the construction workers followed the work on site and discussed construction details and building methods and opportunities. A retrospective film of Bo Bardi's work captures an interview with the workman responsible for the design and construction of the signage for the cafeteria.[25] He recalls how Bo Bardi invited him to carve any foods, fruits, or vegetables he chose to fill the shelves of the small frame that would be the sign. He said he refused at first, because he did not have any training, and did not know how to carve in wood. Bo Bardi insisted, and so he made his attempts, ultimately completing the work with great satisfaction. (Fig. 4) After ten years, he was still employed at the institution he helped to construct, and proud to see his work each day. This example demonstrates the power of the physical and tangible relationships that people have with the things they make themselves, and when these things are part of the physical environment, how they can maintain powerful relationships,

and bring happiness to people. Indexical markings exist on the concrete walls Bo Bardi added to give measure to the space of the library within the free plan of the preserved, but "gutted" factory. Each is identical in size and material, but the surfaces are reverse-etched or inscribed. Sometimes the traces look like accidents of construction, impressions of cracked or dirty plywood, a leaf or other debris, caught in the formwork. Others are arabesques, willful arcs that measure the sweep of an arm across the surface of the wood forms, leaving a bumpy relief and shadow line on an otherwise smooth concrete surface.

The most emphatic of these expressions, and the most visible, is part of the later, new construction on the site, completed in 1986. A concrete water tower looks as if it was built by stacking pre-cast barrels. Each seam is not crisp and smooth, but a ruffle of concrete that leaves a raggedy shadow. (Fig.5) The concrete ruffle is an excess, uncured material that leaked, perhaps straining the burlap bag that was used to plug up the bottom of the formwork. Or maybe, it was done on purpose. After all, it is aesthetically quite striking... and so with many aspects of the complex, surprise, humor, mysteries abound, and are enlivened by use.

Running through the middle of the site, a long narrow ribbon of land, considered unsuitable for construction, is called the *Aguas Pretas* stream on the drawings. Bo Bardi built a large wooden deck across it and built a "waterfall" next to it, to be used as collective shower. On either side, she built two vertical concrete towers to house the swimming pool and gymnasia on one side and locker rooms on the other. She connected the towers with elevated walkways that fly across the *Aguas Pretas* stream, reminiscent of the stairs and walkways of a

Fig. 5 SESC- Pompéia. View of water tower , locker room tower and elevated walkways to gymnasium tower. Photo by A. Ryba, 2005.

1940s housing project in Rome, by Giovannoni.[26] On a recent visit, the coincidence of a karate tournament for children under age five and a rainstorm produced a clamour of screaming kids, running from the locker room tower to to the gymnasia, crossing the walkways on every floor, a flurry of white against the darkening wet surface of the concrete. If I had seen it on a sunny day, photos show that the wooden deck is ideal as a boardwalk, and with the adjacent shower, enough like the seaside to promote disrobing to reveal fashionable beachwear…right in the middle of the city.

Bo Bardi liked to say that Brazil was blessed with two great riches: the land and the people. She put her belief in the hand-made artistry of the Northeast to work at SESC- Pompéia, giving the people who were building it the opportunity and the challenge to "be artists."

"We added a few small things, she said modestly of the project, "… a little water, a fireplace."

Just before she left Italy, Lina Bo worked together with Pagani and Zevi on a weekly magazine called "A". In the wake of the war, the sole topic was reconstruction; Architecture, not as an end, but as an instrument to understand and change life. The first issue pledged:

"We must go back to the beginning, to the letter A, to build a happy life for everyone. We try to create in every man and woman the awareness of what a house and a city is, to make everyone recognize the problems of construction, so that everyone, and not just the technicians, participates."[27]

In the SESC Pompéia, Lina Bo Bardi made good on her pledge.

[1] Bardi, Lina Bo. *Times of Rudeness: Design at an Impasse.* Lina Bo and P.M. Bardi Institute, São Paulo, 1994. English language supplement, p.16.

[2] Bardi, Lina Bo. *Contribuição Propedeutica ao Ensino da Teoria da Arquitetura,* Habitat Ltd.: São Paulo, 1957. p. 29 (my translation).

[3] Bardi, Lina Bo. *Lina Bo Bardi.* Lina Bo and P.M. Bardi Institute, Edizioni Charta: Milan, 1994. p. 220.

[4] Lina Bo, from a letter to Carlo Pagani, Sep. 26, 1939. Noted in "Interview with Lina Bo Bardi" Olivia de Oliveira, 27 September 1991, published in Oliveira, Olivia (ed.). "Lina Bo Bardi: Built Work" 2G no. 23/24, 2003. p.231.

[5] Bardi, Lina Bo. *Lina Bo Bardi.* Lina Bo and P.M. Bardi Institute, Edizioni Charta: Milan, 1994. p. 12.

[6] "Interview with Lina Bo Bardi" Olivia de Oliveira, 27 September 1991, published in Oliveira, Olivia (ed.). "Lina Bo Bardi: Built Work" 2G no. 23/24, (2003): 240.

[7] "Una Grandiosa opera di Edilizia Rurale: Riconstruzione di 13,000 Case per contadini in Ungheria" Piero Bottoni. *Lo Stile,* no. 4, April, 194. p. 12-19.

[8] Gaetano Ciocca, "La Casa Rurale" [The Rural House], *Quadrante* n. 22, Feb. 1935.

[9] De Riserio, Antonio. Avant-Garde in Bahia, Lina Bo and P.M. Bardi Institute, 1995.

[10] Cesare Ripa, *Iconologia*, Padua, 1625, p.255ff, 666ff, cited in D.J. Gordon, "Poet and Architect: The intellectual Setting of the Quarrel between Ben Johnson and Inigo Jones," Journal of the Warburg & Courtauld Institutes, Vol. 12, 1949, p. 167.

[11] Bardi, Lina Bo. "The Theory and Philosophy of Architecture," 1958. Reproduced and translated in Oliveira, Olivia (ed.). "Lina Bo Bardi: Built Work" 2G no. 23/24, 2003. p. 211.

[12] Veikos, Cathrine, "To Enter the Work: Ambient Art" Journal of Architecture Education, (JAE) Special Issue: Installation Art, Vol. 59 (4), Blackwell Publishing, 2006. p. 71-80; and Cathrine Veikos and Renee Cheng, "The Sheer Opacity of Contemporary Enclosure," Journal of Architectural Education, (JAE), Special Issue: Surface, Vol. 57:2, (MIT Press, 2003) p. 11-17.

[13] Veikos, Cathrine. *Lina Bo Bardi: Architecture Theory,* forthcoming publication.

[14] The word, "consciência" in Portuguese can be translated as both "consciousness" and "conscience" in English. Bo Bardi intends the ambiguity and implies both meanings.

[15] Fiedler, Conrad, quoted in Bardi, Lina Bo. *Contribuição Propedeutica ao Ensino da Teoria da Arquitetura,* Habitat Ltd.: São Paulo, 1957. p.21. (my emphasis).

[16] Bardi, Lina Bo. "On Architectural Linguistics" *L'Architettura,* n. 226, August, 1974. Reproduced and translated in Oliveira, Olivia (ed.). "Lina Bo Bardi: Built Work" 2G no. 23/24, 2003. p.218.

[17] Bardi, Lina Bo. "Ambient Planning. Design at an impasse" in *Malasartes,* 1976. Reproduced and translated in Oliveira, Olivia (ed.). "Lina Bo Bardi: Built Work" 2G no. 23/24, 2003. p.223.

[18] Before she designed the MASP on Paulista Avenue, the Museum of Art of São Paulo was located in the *Diários dos Associados* Building. Bo Bardi designed the interiors and exhibitions.

[19] "Vitrinas das Formas," Habitat, n. 1. Oct.-Dec. 1950. p. 35.

[20] Bardi, Lina Bo. *Lina Bo Bardi.* Lina Bo and P.M. Bardi Institute, Edizioni Charta: Milan, 1994. p. 134.

[21] Furtado, Celso. The Economic Growth of Brazil, 1959.

[22] Oliveira, Olivia. *Subtle substances, The architecture of Lina Bo Bardi.* Barcelona: Gustavo Gili, 2006. Oliveira's bibliography lists a manuscript for a conference on April 18, 1958 and three manuscripts for lectures on Aug 11, 13, 18, 1958 at the School of the Beaux Arts in Bahia. Also, on August 19, 1958, a manuscript for a lecture, "Conferencia sobre arquitetura e engeharia: arte e tecnica" [Conference on architecture and engineering: art and technique] at the Polytechnique. [Conference on architecture and engineering art and technics

[23] Bruno Zevi, *L'Expresso*, Rome, May 1987.

[24] The drawings, preserved in the archive of the library of FAU/USP, were generously made accessible to me by the architect and Professor, Paulo Bruna.

[25] "Lina BoBardi," Documentary film. Aurélio Michiles and Isa Grinspum Ferraz, Lina Bo and P.M. Bardi Institute, 1993.

[26] Lina Bo, "Casa a nuclei abitavi in Roma" *Lo Stile,* Milan, n.31, July 1943, p. 15-20.

[27] Bo, Pagani, Zevi, "A", no. 1, 1946. Reproduced in Bardi, Lina Bo. *Lina Bo Bardi.* Lina Bo and P.M. Bardi Institute, Edizioni Charta: Milan, 1994. p. 30.

Pepper the Walls with Bullets:
Lina Bo Bardi's Museu de Arte de São Paulo

Gabriela Campagnol
campagnol@gmail.com
Assistant Professor
Texas A&M
Department of Architecture
[Paper Presenter—Session 6]

Stephen Caffey
scaffey@archmail.tamu.edu
Assistant Professor
Texas A&M
Department of Architecture
[Paper Author]

Abstract

Recent commercial initiatives at MASP – São Paulo Art Museum – have drawn the world's attention once again to the genius of Roman-born Brazilian architect Lina Bo Bardi. Designed in 1957, MASP flouted European museological and museographical conventions. In the dissolution of structural, temporal and hierarchical boundaries, Bardi's expressive architectonic forms and revolutionary exhibition schemes allowed space to manifest as a substantive property. Within the thickness of the space, paintings attached to glass stelae hovered in a state of veneration, as objects liberated completely from the tyranny of scholarly text. This collaborative paper interrogates the intersections and interstices between the building as object and the objects within, with both experienced through "reactions of curiosity and investigation" aroused by the fully realized desire for affective freedom and the "conquest of nothing." By tracing the museum's development from conception through its first full permanent collection exhibition, the paper examines the philosophical, theoretical, practical and formal elements of what John Cage termed "the architecture of freedom." The paper then situates the museum and its collections within broader discourses of de/colonization, in order to demonstrate the degrees to which Bardi's gestures redefined notions of space and form within and beyond the context of the museum as mausoleum, archive and treasury. The paper concludes with an interpretative synthesis of principles of spatiality as codified by Deleuze, Merleau-Ponty, Lotman, et al., as their tenets complicate and enrich our reading of MASP and its objects as architectural interjection. The paper also debates the incongruent modifications that Lina's original project has suffered over the last 15 years.

Lina Bo Bardi in Brazil

The foundation of a new art museum brought the Roman-born architect Lina Bo Bardi to Brazil.[1] In 1947 her husband, the Italian journalist, art critic and promoter Pietro Maria Bardi, was invited by the publisher and entrepreneur Francisco de Assis Chateaubriand to found and operate an art museum in Brazil, either in Rio or São Paulo, which would house a collection of European and Brazilian art. According to Lina, "I much preferred Rio, but the money was in São Paulo. I told Pietro that I wanted to stay, that I had re-encountered the hopes of the nights during the war. Thus we remained in Brazil."[2] The private, non-profit art museum opened its doors in October of 1947 in a one-thousand-square-meter room in an existing building at 7 de Abril Street in downtown São Paulo, location of the headquarters of the Diários Associados (Associated Press), owned by Chateaubriand. Lina Bo Bardi was placed in charge of the museological and museographical designs.

Lina's curatorial vision challenged the configuration of a museum as an "intellectual mausoleum", with its suffocating "cupolas and monumental staircases." Lina envisioned instead a space within which to provide an atmosphere, a conduit intended to create in the visitor a state of mental preparedness for understanding the work of art; "in this sense no distinction is made between an old or a modern work of art. With the same objective, the work of art is not located following a chronological criterion but it is presented almost deliberately so as to produce shock, to awaken reactions of curiosity and investigation."[3] In the Abril Street location the paintings were detached from the walls, mounted on a neutral background, and held by metal pipes fixed on the ceiling and floor. "The criteria governing the internal architecture of the museum were restricted to solutions of 'flexibility,' to the possibility of transforming the ambience, together with strict economy that is in keeping with our times.(…) Picture frames were also eliminated (when they were not authentic to their times) and replaced with neutral bands."[4] The idea for a new kind of museum had first manifested earlier in that same year, in Lina's work for an art museum in Rio de Janeiro: "The new museums should open their door, and let pure air and new light in. (…) To establish contact between past life and the present. In this sense the new museums, having understood their function in the contemporary world, have found to exert it, and are farther ahead than the most progressive of educational institutions".[5] In keeping with what would be the generously collaborative approach that would define her professional career, São Paulo Art Museum (MASP) was a product of three personalities: Chateaubriand, the underwriter; Pietro Maria Bardi, the head curator and director; and Lina Bo Bardi, the designer. Between 1953 and 1957, the main collection of MASP went on tour to countries such as France, Germany, Belgium, England, Italy and the United States (at New York's Metropolitan Museum of Art in 1957).[6]

Make the Decision/Make the Connection

> I was looking for simple architecture, one that could communicate that which in the past was known as 'monumental', that is, in the sense of collective", of "civic dignity'.[7]

The location chosen for the permanent home of the MASP collection was a parcel of land bounded by a major thoroughfare on one side (Avenida Paulista), a public park and forested valley on another and Avenida 9 de Julho, which runs through a tunnel before intersecting Avenida Paulista. The acreage donated by Joaquim Eugênio de Lima—the engineer whose contracting company built Avenida Paulista—included a belvedere that offered park visitors a view of the city. That prospect, which made the site such an attractive choice for the construction, also proved the greatest challenge and inspiration to the young architect. As part of the terms of the donation, Lima stipulated that no building erected on the site could obstruct any part of the view from the park.

Fig. 1 – Arial view of MASP at Paulista Avenue, São Paulo.

When devising her solution, Lina considered her personal encounters with the site as well as the role played by the location in São Paulo's cultural history. One day in early 1950s, while passing by the Avenida Paulista, Lina had noticed the belvedere and inquired about its future. An employee of the City Hall kindly informed Lina that the buildings on the site would be replaced with something that Brazil needed urgently. "Ah! What is lacking in Brazil? Public restrooms! We are going to do two big restrooms: one on the left, underground, for men and another on the right, for women. That's when I decided I was going to do a museum in that place."[8] Until 1957 the site had served as the political center of the city, the Trianon, where politicians launched their candidacies, the social and cultural elite held their banquets and celebrations, grand balls were staged and the city's inhabitants could enjoy the sun on one of the few terraces devoted to that purpose. When Lina saw the Trianon had been demolished in 1957, she made her decision: "that was the only one, the only place where the São Paulo Art Museum could be built…a decent place with a good image, popular with Paulistanos—ideal for the first art museum in Latin America."[9]

Despite her conviction, Lina had to face a number of realities. She was determined to locate MASP on the Trianon site, but "there was no money; there were no newspapers, there was nothing. I had been working with Chateaubriand, with Pietro,

in the Diários Associados. But Chateaubriand was in England as ambassador, Pietro in France, and here I was alone."[10] Undaunted, Lina arranged a meeting with Edmundo Monteiro, factotum of the Diários at the time, and persuaded him to offer São Paulo Mayor Adhemar de Barros support from Diários Associados in his campaign for the Presidency of Republic. De Barros would have access to twenty-three newspapers, radio stations and television channels throughout the country in exchange for the construction, funded by the municipal government, of a museum that would be conceded to MASP to house Latin America' largest art collection. Lina recalled, "Edmund liked the idea and asked me to do a sketch that same night to go see the mayor the next day. (…) Exciting! He [the mayor] agreed without even looking at the drawing, and asked us to talk with his secretaries."[11] Lina's personal determination would prove key to the realization of MASP.

Conceived as a free plan, the current MASP was designed and built between 1957 and 1968 (Figure 1). The building divided into parts: the lower level located beneath Avenida Paulista and the upper level divided by the grand belvedere. The lower level was comprised of a civic hall with two auditoriums, library, restaurant and storage. The superior part of the building was comprised of two levels, with five meters of lateral cantilevered space extending out over Avenida Paulista on the one side and overlooking Anhangabaú Valley on the other. The first above-ground floor of the structure housed administration, storage and temporary exhibition area. The second floor was devoted entirely to the pinacoteca. At the street level, a plaza opened beneath the entire length of the building, with the base of the first floor serving as a sort of ceiling for the plaza (Figure 2).

One of the many distinguishing features of the structure is the span: at the time the largest in the world.

> I'm ashamed to say that the São Paulo Art Museum has the largest span in the world! It is eighty meters in length. I never wanted to make the largest span in the world, but there was the land donation that imposed it as a condition for its use the maintenance of the belvedere overlooking São Paulo. If I had constructed a building with columns and eliminated the belvedere, the land would return to the heirs.[12]

The span was a product of Lina's realization that the challenges presented by "no columns, seventy meters of light, [and] 8 meters of ceiling height" could only be solved with pre-stressed concrete. Lina chose a pre-stressed concrete structural system designed and patented by engineer José Carlos Figueiredo Ferraz, who had expressed admiration for the project. "I went looking for him: 'Do you want to work for free on a public project that will be of great cultural importance to São Paulo? I work for free, only the draftsmen will be paid." Ferraz agreed. The construction contractor had already been chosen through a competitive bidding process. Work began in 1960.[13]

Make It Simple/Make It Float

> Concrete as it comes from the forms, the lack of finish, may shock a whole group of people.[14]

Immediately following the MASP proposal, Lina visited the north of Brazil to design the Modern Art Museum of Bahia in

Salvador. While spending time away from the elite circles of São Paulo, Lina rededicated herself to the values of simplicity, accessibility and what she came to term "Poor Architecture"— poor not because of its use of inexpensive local materials or low quality, but poor because of its simplicity, clarity and lack of pretense. During that period, Lina also wrote extensively about the relationships between architecture and culture with an emphasis on the folk and the local rather than the more rarified and esoteric issues associated with mid-century Modernism. As Lina characterized it, "by means of a popular experiment I arrived at what might be called Poor Architecture. …I feel that in the São Paulo Art Museum I eliminated all the cultural snobbery so dearly beloved by the intellectuals (and today's architects), opting for direct, raw solutions."[15] As Esther da Costa Meyer observes, Lina left the concrete rough, covered the floors with black industrial rubber, exposed the air ducts and plumbing—all of which combined to create a building more suitable to collective experience than to private use.[16]

Fig. 2 – Void beneath the suspended box that houses the pinacoteca filled with concert-goers.

Though distinctive, Lina's decision to levitate MASP to allow for an unobstructed view of the city from the park was neither a matter of artistic choice (she had to preserve the view) nor an idea generated specifically for the São Paulo site. The concept of a box-like building suspended from the ground by reinforced concrete C beams was already proposed in her 1951 design for a Museum on the Seashore in São Vicente. This museum (never built) was conceived as a box enclosed on the three sides, with the façade facing the ocean cover with glass. Five C beams, measuring twenty meters from end to end and twenty meters apart, held the building aloft.[17] In one of Lina's early watercolor perspective sketches for MASP, she translated the design for the seaside museum into a box suspended from six C beams—a plan abandoned because of its repetitive disruption of the belvedere.[18]

Make It Transparent/Make It Free

Other preparatory studies demonstrate that Lina's earliest conception of the suspended box made no provision for transparency. Instead, Lina conceived the space as a box with opaque sides (with or without a Corbusian ribbon window on the first floor, depending upon the stage of conceptualization) and only settled on the glass façades with light sheds later in the process. Once transparency (exterior and interior) had asserted itself at MASP, it assumed a determinative role in the formal and philosophical content of the structure, the site and the exhibition scheme for the paintings in the collection.[19] Transparency had assumed an increasingly important role in industrial and domestic architecture from the 1910s, beginning with Peter Behrens's Turbine Factory, Walter Gropius's Fagus and Bauhaus buildings, and Ludwig Mies van der Rohe's Tugendhat House in Brno. As Renato Anelli observes, "MASP shows no resemblance to the spiral museums of Le Corbusier and Frank Lloyd Wright. Transparency comes clearly through Mies Van Der Rohe, with her 'Museum for a Small Town' (1942), and studies for the 'Museum on the Seashore' (1951)."[20] Lina's MASP, however, qualifies as one of the earliest transparent spaces intended for collective use by the general public.[21]

When American avant-garde poet and musician John Cage came to São Paulo, while riding along Avenida Paulista he asked the driver to stop the car in front of MASP. He got out of the car and walked from side to of the belvedere to the other, raised his arms and exclaimed: "It is an architecture of freedom!"[22] Having grown accustomed to receiving for "the world's largest free span", Lina welcomed Cage's characterization, which communicated "what I meant when I designed MASP: the museum was a "nothing, a search for freedom, the elimination of obstacles, the ability to be free."[23] In Italy, the crushing weight of Antiquity and the Renaissance set limits and preconditions on Modern architecture that simply did not exist in São Paulo. In Brazil, Lina "had the freedom to build a completely new building."[24] Anelli notes that Lina's design for MASP was

> far from being a formalistic whim of the author[;] the glass facades of MASP expand the space of the pinacoteca to the city. The transparency of the façades and the supports establish continuity between art work and daily life….[25]

Transparent façades dissolve the false boundaries between high/fine art and daily life, awakening in the uninitiated viewer "a natural consciousness." The transparency of MASP thus articulated Lina's belief that "to acquire consciousness is to politicize oneself."[26] MASP was the most fully realized and thus the most potent of Lina's built *manifesti*—a call to arms for the Paulistano masses to wrench art from its funerary associations to connect to art through the clear, free, natural light of daily life.

The Exhibition Scheme for MASP

> …a painting is born in a free space—that is on an easel—its original state can best be evoked when exhibited on tempered plate glass fixed on a concrete base, rather than against an opaque wall.[27]

Within the contextual confines of Creating_Making, Lina's pinacoteca installation for MASP hovers in the space above the underscore. This is the space of neither/nor, of liminality, of becoming, of transition, of dissolution, of absence, of suspension, of the pause, of silence, of the void. Through the

execution of Lina's vision, the exhibition space took on a substantive quality comparable to American composer John Cage's *4' 33"*, performed by a full orchestra as four minutes and thirty-three seconds of complete silence.[28] In Cage's three movements of instrumental and vocal silence, the random, ambient noise of the music hall and its occupants serves as content, with each performance and each recording of the work dramatically different from all others. Similarly, Lina's installation at MASP rejects the institutionally sanctioned (and ever-contentious) dialogue between painting and wall, replacing that artificial and superficial dialogue with a series of glancing encounters with other viewers. In the MASP pinacoteca, silence equaled presence and absence supplied the sound.

Numerous artists and curators (including Lina) had questioned the institutional rigidity of museal practice before MASP opened its doors to the Brazilian public in 1968. However, few succeeded in completely liberating the museum from its function as a treasury-reliquary-mausoleum conceived to address, valorize and reassure cultural elites. As Olivia de Oliveira notes, Lina "dechristianized" the museum experience, making all works equally accessible to both the uninitiated and "the ordained" by "removing the 'aura' from the pictures."[29] Lina contested the traditional valuation of paintings as luxury goods and precious objects, preferring instead to present them as the products of artistic labor, as "trivial items" linked to quotidian life.[30] In Lina's curatorial calculus, the installation became—in senses literal and figurative—a destabilized field of cultural production.[31]

Fig. 3. Lina Bo Bardi with one of the glass and concrete supports on the second floor of MASP during construction.

In the mind of the "jealous conservative with his old-fashioned, academic beliefs," the exhibition scheme at MASP was an act tantamount to desecration. For innovator Lina, however, with her "futuristic background and visionary ideas," the revolutionary approach to the display of the paintings was the only option for a museum that "belongs to the people."[32] Through MASP Lina articulated a number of the aesthetic, curatorial and political impulses that informed her work as architect, artist and activist. As a member of the Communist Party, Lina held in marked disdain monarchical and capitalist socioeconomic hierarchies; this disdain permeated Lina's consciousness, driving her decisions at all levels of the design process.[33] Corollary to this perspective was Lina's collectivist approach to aesthetic decision-making and curatorial expression. Over a period of twenty years Lina conversed with colleagues in the fields of architecture and design and

consulted with Pietro-Maria as she crystallized the ideas that would manifest as the radical MASP strategy. While working with Gió Ponti in Milan in the 1930s, Lina had actively engaged in the emerging polemics of exhibition practice, a mode of expression which provided most young modern architects their only opportunity to present their work to the public.[34] Most influential in Lina's process was Franco Albini, whose designs for Scipione & Black and White Exhibitions at Milan's Pinacoteca di Brera in 1941 presented paintings on individual stands that allowed viewers the full 360-degree visual access most often afforded freestanding sculpture.[35]

As individual brushstrokes comprise a painting, Lina's work with the MASP collection qualifies as a single, expansive artistic gesture—a work of installation art as much as a curatorial policy. When affixed to their respective glass and concrete supports, the paintings served as discrete "markings" within the broader work. A photograph of Lina seated next to Vincent van Gogh's *The Schoolboy (Camille Roulin)* on the MASP construction site demonstrates the point (Figure 3). In formal terms, four elements comprise each component gesture. A cast concrete base (40x40 cm) supported a 5/8-inch tempered glass panel with four holes, to which was secured a single painting. As would be the case if the works were hung on a wall, viewers had full access to the "content side"—the obverse in the case of Lina's glass easel. On the reverse side of the support appeared labels, the smallest of which approximated conventional museum wall text panels, the largest roughly matching the dimensions of the object displayed. At their most spare, the labels identified artist, title, medium and dimensions of the work. Some labels of this size allowed the viewer to see most of the back side of the work. More text-intensive labels, which included explanatory "reproductions, engravings, maps, graphics and documents," completely obscured the backs of some works.[36] Lina expressed confidence that her "design of a panel-easel in the MASP art gallery is an important contribution to international museum management." To quantify her success, Lina cited the ratio of the thousands of visitors who visited MASP each weekend to the "dozen complaints" she had received about the exhibition scheme.[37]

Make Mayhem/Create Proximity

Once she had attached the paintings to their glass easels, Lina arranged them in the MASP second-floor exhibition room in an irregular grid pattern, all facing toward the entrance to the space and presented at "eye level" so that the viewer could always see multiple works placed at varying distances (Figure 4). However, no viewpoint allowed a MASP visitor to see all of the works at once; nor did any position permit the viewer to see only one of the paintings. As Shuman Basar notes, "the glass supports disappeared at a distance, giving the impression that the paintings were hovering in magical, liberated suspense: an orchestration of dogged rationality bordering on the (poetically) pathological."[38] The resulting assemblage reads as a single work of art, the whole of which could only be experienced by moving through and around the individual components. And just as viewers who looked through Marcel Duchamp's *The Bride Stripped Bare by Her Bachelors, Even (The Large Glass)* (1915-23) to see other viewers on the other side of the work experienced the disorientation of a chance encounter, each visit to MASP would have emerged as a different permutation of chance elements.[39]

Fig. 4 – View of the pinacoteca installation.

Lina and Pietro-Maria chose the presentation sequences for each of the rows of paintings; the intent was an emphatic "leveling" of the objects. This was achieved by rejecting such conventions as chronology, attribution, artistic movement, artist oeuvre, national identity, medium, size, market value, art-historical significance and geographical origin. The MASP installation made no distinctions between Brazilian vanguard painter Flávio Rezende de Carvalho's *Sleeping Nude* (1932), Pierre-August Renoir's *Pink and Blue* (1881) and van Gogh's *Schoolboy*. Lina's "crystal easels" created a perception of simultaneity across the movements and periods represented by collection, and an unusually free course of reception for the visitor.[40] With her carefully scattered glass stele, Lina disfigured time and deranged space, insinuating the art of the past into an "eternal present," concretizing André Malraux's "imaginary museum" in one grand, wild, fanciful provocation.[41]

Make Time Collide/Make Space Porous

Perhaps more than any other institution of its kind, Lina's MASP invites a sort of rhizomorphic sampling of twentieth-century theory and criticism.[42] Writing about the work of another architect, Stephen Holl, Shima Mohajeri articulates a series of points that one might reasonably apply to the experience of Lina's fenestrations of space and time. Invoking philosopher Maurice Merleau-Ponty, Mohajeri suggests Holl's *Experiments in Porosity*

> bring in the idea of spatial depth infused with time. The porous layers in space indicate the simultaneity of presence where [the] body moves through depth in time. That is when the body experiences the event of time and space in its continuity. The spatial porosity is a method for destabilizing the outlines and limits while displacing them back and forth in-between spaces. This continual closing and opening of space provides a room for the body to discover its own visibility among the invisibles created by the empty voids. Thus, the porosity in space will appear as a result of an uninterrupted flow of interpenetrated events within the spatial depth.[43]

In the MASP pinacoteca, one moved in and around and through and between the phenomenological field and the dematerialized temporal and spatial boundaries of the transparent floating box hovering above the void.

Rather than experiencing the museum as a sedentary space striated by paintings hung wall-to-wall and floor-to-ceiling (as

was the practice prior to the late nineteenth century) or by linear constructs of chronology, the uninitiated viewer gazed at the objects on display, never able to see the object and its mediating, filtering label at the same time.[44] The resulting disconnection deterritorialized the works, separating them from their semiotic systems, effectively and affectively and neutralizing the semiospheric authority of such classifications as Renaissance, Baroque, Romanticism, French, Italian, etc.[45] Through this catalyzing mechanism of performative (dis)engagement, the novice viewer who might have been otherwise alienated by the aura of each discrete expression of Euro-imperialist academic hegemony in the MASP collection welcomed and was welcomed by each work as a product of artistic labor. Conversely, the strategy intentionally alienated those among the ordained who had been conditioned by the institutional mandates of European museological and museographical convention to seek disciplinary reassurance through the ritual privileging of wall label text.[46] Lina's installation allowed both the uninitiated and the (willing) ordained a smooth, nomadic space within which to "restrain from all usual doing and prizing, knowing and looking, in order to linger within the truth that is happening in the work," rectifying and revivifying the "vital relationship" between viewer and object.[47] Thus Lina provided the perfect environment within which viewers from various backgrounds and with various degrees of exposure to the fine arts could become the guardians of her installation.[48]

Conclusion

Creat Conformity

> It is difficult and painful to visualize all the countless paintings on countless walls in countless rooms, halls and museums waiting to move back into space where they can again vibrate, breathe as it were.[49]

In 1996, four years after Lina's death, the glass easels in the pinacoteca were replaced with painted plaster walls in order to halt and prevent further damage to the paintings caused by exposure to light and the bowing of the floor. In 2003, the Brazilian Institute for National Historic and Artistic Heritage (IPHAN) registered MASP as a national heritage. In the report for the listing, IPHAN suggested (without mandating) that the MASP curators preserve Lina's installation scheme. The curators permanently removed the glass panels, citing a number of justifications for the decision. Those justifications range from the impracticality of using glass easels for displaying tapestries and other such large works to reasserting the primacy of the painting-wall dialogue in response to Lina's "intolerant" and "authoritarian" intervention.[50]

Architect Aldo van Eyck understood the genius of Lina's MASP installation. Writing in 1997, five years after Lina's death and shortly after painted walls were installed to permanently replace Lina's glass easels, van Eyck commented on MASP and its collection as a series of conjoined conditions:

> it is at the same time both large and small, few and many, near and far, simple and complex, open and closed; it will furthermore always be both part and whole and embrace both unity and diversity.

149

Lina's anti-museum, the "museum beyond the limits," has been reduced to a simple, closed and partial enclosure, no longer complex, open and diverse, no longer the "marvelous exception to the wrong rules" that govern exhibition practices worldwide.[51] Few reminders of Lina's "uncompromising…simultaneous solidarity with people, art and architecture" remain.[52] Today Lina's vision survives in the memories of the thousands of Paulistanos who wandered through the kaleidoscopic space and in works by such artists as Vik Muniz and Mirjam Thomann (Figure 5).[53]
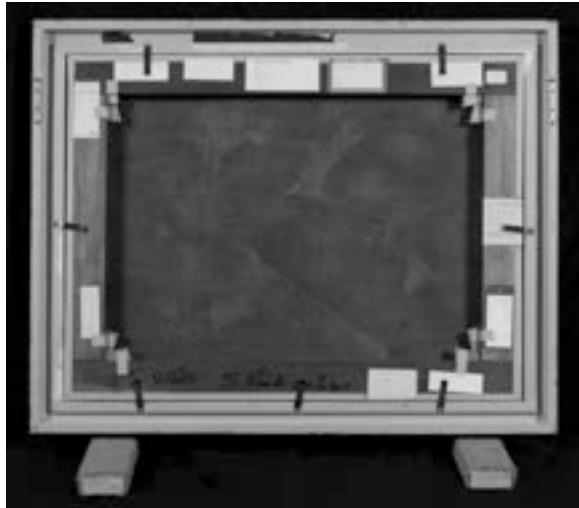

Figure 5. Vik Muniz, *São Paulo, after Tarsila do Amaral* (2010). Wood, cloth, tape, labels, hardware, carpet. 112.24 x 100.49 x 6.35 cm. Galeria Fortes Vilaça, São Paulo.

In the suspended box above the void, one can experience the last vestiges of the pinacoteca installation in the form of two replicas of Lina's concrete and glass supports, which are used to separate the kitchen from the checkout line in the MASP restaurant.[54] Lina's characterization of the museum as the "conquest of nothing" takes on a particular poignancy in the effacement of her curatorial presence by the irresistible homogenizing forces of globalization.[55]

Acknowledgments

1 A number of excellent recently published scholarly articles have discussed Lina Bo Bardi's design for the Museum of Art São Paulo. See especially Zeuler Lima, "Preservation as Confrontation: The Works of Lina Bo Bardi," *Future Anterior* 2:2 (Winter 2005): 25-33; Cathrine Veikos, "To Enter the Work: Ambient Art," *Journal of Architectural Education* 59:4 (2006): 71-80; Alexander Miyoshi, "Museografias do MASP," in *I Encontro de História da Arte do IFCH* (Campinas: Unicamp, 2006), revisão historiográfica *O Estado da Questão* (Campinas: IFCH, 2006), 1:52-60; and "O edifício do MASP como sujeito de estudo," *Arquitextos/Architexts* 07.084 (May 2007) accessed August 30, 2010 <http://www.vitruvius.com.br/revistas/read/arquitextos/07.084/245>; Carlos Eduardo Comas, "Lina 3x2¹," *Arqtexto* 14 (2009): 146-189; and Renato L. S. Anelli, "Museu

2 Lina Bo Bardi, *Lina Bo Bardi* (São Paulo: Instituto Lina Bo e P. M. Bardi; Milan; Charta, 1994), 12.

3 Ibid, p.46.

4 Ibid.

5 Ibid, p. 43.

6 See the following exhibition catalogues: *Chefs-d'oeuvre du Musée d'art de São-Paulo: Octobre 1953-Janvier 1954* (Paris: Musées nationaux, 1953); *Paintings from the São Paulo Museum: The Metropolitan Museum of Art, March 21 - May 5, 1957* (New York: Metropolitan Museum of Art, 1957); An Exhibition of One Hundred Paintings from the São Paulo Museum of Art, October 8-November 17, 1957, the Toledo Museum of Art (Toledo: Toledo Museum of Art, 1957); and Masterpieces from the São Paulo Museum of Art : at the Tate Gallery (London: The Arts Council of Great Britain, 1954).

7 Bardi, *Lina Bo Bardi*, 100.

8 Lina Bo Bardi, *Lina por Escrito*, eds. Silvina Rubino and Marina Grinover (São Paulo: Cosac Naify, 2009), 174

9 Ibid., 122-123.

10 Ibid., 175.

11 Ibid.

12 Ibid, 174.

13 Ibid, 125.

14 Bardi, *Lina Bo Bardi*, 100.

15 Bardi, *Lina Bo Bardi*, 100.

16 Esther da Costa Meyer, "After the Flood: Lina Bo Bardi's Glass House," *Harvard Design Review* 16 (Winter/Spring 2002) accessed August 30, 2010, accessed August 30 2010 http://www.gsd.harvard.edu/research/publications/hdm/back/16 decosta_meyer.html.

17 Bardi, *Lina Bo Bardi*, 93.

18 Olivia de Oliveira, *Subtle Substances: The Architecture of Lina Bo Bardi* (Barcelona: Editorial Gustavo Gili, 2006), 262.

19 Oliveira, *Subtle Subtances*, 327; and Bardi, *Lina Bo Bardi*, 101.

20 Anelli, Renato L. S. "O Museu de Arte de São Paulo: O museu transparente e a dessacralização da arte," *Arquitextos/Architexts* 112 (September 2009): 112.01-112.10 accessed August 30, 2010 http://www.vitruvius.com.br/revistas/read/arquitextos/10.112/22

21 The idea of employing glass as a transparent support can be seen as early as 1948 in the shelves for an Art and Architecture Studio Palma designed by Lina with the architect Giancarlo Palanti. Transparency as a concept was further explored by Lina in her own house, the Glass House, built in São Paulo in 1951.

22 Cláudio Cavalcanti, *MASP: A cor da paixão pela arte* (São Paulo: Glasurit do Brasil, 1990), 90.

23 Bardi *Lina por Escrito*, 16.

24 Renato L. S. Anelli, "Gosto Moderno/ Modern Taste: Exhibition Design and Design Exhibition," *Arqtexto* 14 (2009): 92-109, 104.

25 Ibid.

26 Anelli, "Gosto Moderno," referencing Lina Bo Bardi, "Explicações sobre o Museu de Arte," *O Estado de São Paulo* (5 April 1970).

27 Henry A. LaFarge, ed., *Museum of Art São Paulo* (New York: Newsweek, 1978), p. 163.

28 A number of sources note the comparison between Lina's MASP and Cage's music. See, e.g, Oliveira, *Subtle Substances*, 259.

29 For a discussion of the aura of the artwork, see Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," first published in 1936.

30 Oliveira, *Subtle Substances*, 276, quoting Bardi, "Explicações sobre o Museu de Arte."

31 See Pierre Bourdieu, *The Field of Cultural Production* (New York: Columbia University Press, 1993).

32 Pietro Maria Bardi, Introduction to ed. Henry A. LaFarge, *Museum of Art São Paulo* (New York: Newsweek, 1978), 9-15, 9; Oliveira, *Subtle Substances*, 276, quoting Lina, "Explicações," 1970.

33 "I have designed a few homes, but only for people [with] whom I am acquainted and that I am fond of. I have a horror of designing homes for madams where an insipid conversation is apt to arise about the swimming pool or the color of the curtains…I have done mostly public works, always collectively. I would very much like to design popular homes and I have done several studies on the

subject, but for the time being that does not seem to be possible."
Bardi, *Lina Bo Bardi*, 117.

[34] Stephen Leet, Franco Albini (New York: Princeton Architectural Press, 1991), 21-43, 21.

[35] For a description of Franco Albini's exhibition practices, see Leet, *Franco Albini*, and Oliveira, *Subtle Substances*, 286.

[36] See LaFarge, ed., *Museum of Art São Paulo*, 163.

[37] Bardi, *Lina Bo Bardi*, 100.

[38] See Shuman Basar, "Whitewash: The Role of the Modern Gallery Setting as a Site of Artistic, Architectural and Curatorial Adventure," Platform – Modern Painters (April 2005): 98-101, 100.

[39] For other references to Duchamp in the context of Lina's work, see Veikos, "To Enter the Work."

[40] Anelli, "O Museu de Arte de São Paulo," 102.

[41] See André Malraux, *Le Musée imaginaire* (Paris: Éditions Gallimard, 1965), mentioned in Carlos Eduardo Comas, "Lina 3x2¹," *Arqtexto* 14 (2009):146-189, 168.

[42] For a discussion of the principles of the rhizomorphic that one might reasonably apply to Lina's MASP installation, see Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987), 3-25.

[43] Shima Mohajeri, "The Time of Place in Architecture: The Simultaneity of Spatial Depth and Steven Holl's Design Method," paper delivered at International Merleau-Ponty Circle Conference, Mississippi State Unversity, 9 September 2009, 6. See Maurice Merleau-Ponty, *Phenomenology of Perception*, trans. Colin Smith (New York: The Humanities Press, 1962). See also Steven Holl, *Experiments in Porosity* (Buffalo: Buffalo Books, 2005)

[44] See Deleuze and Guattari, *A Thousand Plateaus*, 474-500. For a summary discussion of the gaze, filtering, discipline and desire in the specific context of the museum, see Valerie Casey, "The Museum Effect: Gazing from Object to Performance in the Contemporary Cultural-History Museum," paper delivered at the 2003 at the The Seventh International Cultural Heritage Informatics Meeting, Ecole du Louvre, Paris accessed August 30, 2010 http://www.valcasey.com/ thesis/thesis_effect.html. See also Norman Bryson, "The Gaze in the Expanded Field," in Hal Foster, ed., *Vision and Visuality* (Seattle: Bay Press, 1988); Jacques Lacan "What is a Picture?" ed., Jacques-Alain Miller, *The Four Fundamental Concepts of Psychoanalysis* (New York: Norton, 1978); and Michel Foucault, *Discipline & Punish: The Birth of the Prison* (New York: Vintage Books, 1979).

[45] See Juri Lotman, "On the Semiosphere," trans. Wilma Clark, *Sign Systems Studies* 33:1 (2005): 205-229, 213, 217; and Gilles Deleuze and Félix Guattari, *Anti-Oedipus*, trans. Robert Hurley, Mark Seem and Helen R. Lane (New York: Viking, 1977).

[46] See n. 43 above.

[47] See Martin Heidegger, *Poetry, Language, Thought*, trans. Albert Hofstadter (New York: Harper & Row, 1971), 66; and Theodor Adorno, "Valéry Proust Museum," in *Prisms*, trans. Samuel and Shierry Weber (Cambridge: MIT Press, 1982), 173-186.

[48] Heidegger, *Poetry, Language, Thought*, 66.

[49] Aldo van Eyck, "A Superlative Gift," in *São Paulo Art Museum* (São Paulo, Instituto Lina Bo e P.M. Bardi, 1997) n.p.

[50] Alexander Miyoshi, "A Evolução da Museologia do MASP no último decênio (1986-1998)," in Miyoshi, *I Encontro de História da Arte do IFCH*. See also: "Masp tombado não exige uso de cavaletes" (MASP registered does not require the use of easels), *Folha de São Paulo* (19 December 2003).

[51] Oliveira, *Subtle Substances*, 262; van Eyck, , "Superlative Gift."

[52] Van Eyck, "Superlative Gift." For the idea of social space see Henri Lefebvre, *The Production of Space*, (Walden: Wiley-Blackwell, 1991).

[53] See Mirjam Thomann accessed August 30, 2010 http://www.bambifoundation.com/projects/2010/ aufstellung.html.

[54] Fernanda Mena, "Projeto de Lina Bo Bardi vira divisória no restaurante do Masp," *Folha de São Paulo* (28 April 2010).

[55] Marcelo Carvalho Ferraz, "Uma idéia de museu," quoting Lina.

Creating_Making Forum Poster Session Abstracts

Please contact poster authors for more information. Contact, as well as biographical, information is available beginning on p. 168.

Celebrating Process: Wabi-Sabi

Jennifer Barker, Megan Hoover,
Jenna Thompson
University of Memphis

The Japanese aesthetic of Wabi-Sabi believes "in the fundamental uncontrollability of nature" (Koren, 2008, p. 27), in which "people adapt to nature", and in the "organic organization of form" (p. 27) which lies in the "aesthetic appreciation of the evanescence of life" (p. 54). This concept of Wabi-Sabi was carried into the design for a classroom screening device. The design for the screen celebrates the act of making and its integral relationship to creativity. Acknowledging the concept that process and creativity are reciprocal, the designers choose bio-plastic, a sustainable, biodegradable, nontoxic material that is fabricated from heating gelatin, glycerin, and water. Due to the fluidity of the material and its natural ability to absorb and evaporate relative to its surroundings, there remains a necessity to adjust the design as it is made.

When beginning the design process, questions arise concerning the aesthetics and construction of the screen. What colors would be used? What materials would be used? What pattern would the individual panels of bio-plastic make? How would the screen be supported? Would the framework be light or heavy? How would the screen wrap the corner? Colors are chosen from the Wabi-Sabi idea that "once-bright saturated colors fade into muddy earth tones or the smoky hues of dawn and dusk" (p. 71). The colors chosen, various shades of orange, brown, and the natural color of the bio-plastic, are in tune with the philosophical ideals of Wabi-Sabi. Concerning the Wabi-Sabi aesthetics of the individual panels of bio-plastic, materials used in the panels "are usually made from materials not far removed from their original condition within, or upon, the earth and are rich in raw texture and rough tactile sensation" (68). Reeds, rice, and shredded paper are used to compliment the "raw texture and rough tactile surface" (68). Additionally hemp is used to bind panels together. In response to the nature of the bio-plastic, which when it dries is light in weight, a delicate system of slight cables and small hooks are used to hang the screen from the ceiling.

The material choice and design process substantiate the Wabi-Sabi notion of evolving and devolving, an aspect that says objects are always in a state of transition. The bio-plastic material has the potential to return to the earth; therefore, the design responds to its transitory nature by being flexible and adaptive. In this way, the material and the process are cyclical.

References
Koren, L. (2008). *Wabi-Sabi: For artists, designers, poets & philosophers*. Point Reyes, CA: Imperfect Publishing.

Concrete: Texture, Utility, Strength, Beauty

Megan Hoover / Fabiana Vazquez
University of Memphis

Concrete is a building material that is seen everyday on sidewalks, building exteriors, structural supports, and in several other utilizations. In these applications one can witness the various textures, utility, strength, and beauty that concrete exhibits. However, how often does one look past the finished product to stop and recognize the amount of time, effort, and planning that goes into making such concrete elements and surfaces? Generally, most do not realize the importance of the design and construction of formwork when looking at the finished concrete product. In order to further students' understanding of the process behind concrete design, a design project was generated to allow students to explore concrete designs, including the formwork that they would not normally consider.

This project focuses on the process of creating the formwork and surface textures to achieve the various qualities exhibited by concrete. Students were given four guidelines: one eighty pound bag of concrete, two voids or reveals cast into the concrete, three different surface textures or treatments, and a four inch module to which the project must be designed and constructed.

Through this process, students learn the importance of effectively designing and constructing forms to achieve their desired finished design. In doing this project, students were exposed to the process that is present when concrete is poured in larger projects. Students learn the importance of formwork in their designs and that the design and construction of the formwork is as important as the execution of the actual pouring of the concrete and the desired design of the finished project. The forms also have to respond to the project parameters in that they have to contain the surface textures that will be present in the finished product and successfully accommodate the eighty-pound bag of concrete.

As students explore concrete and the various factors and elements that are present during the design and construction of the concrete formwork, they discover the importance of the process. The detailing and planning that is involved in designing the formwork for a successfully completed concrete piece is as important, if not more important, than the pouring and mixing of the concrete. Through this exercise, students were able to work with and understand the process of concrete design. This hands-on experience allowed students the opportunity to understand and appreciate this process and how it applies to their future design projects, both in school and in professional practice.

Desoto Recycling Zone: Catalyst for Community Involvement

Sherry Bryan, Jennifer Barker, Michael Chisamore, Megan Hoover, Colby Mitchell, Jenna Thompson and Benjamin Vega
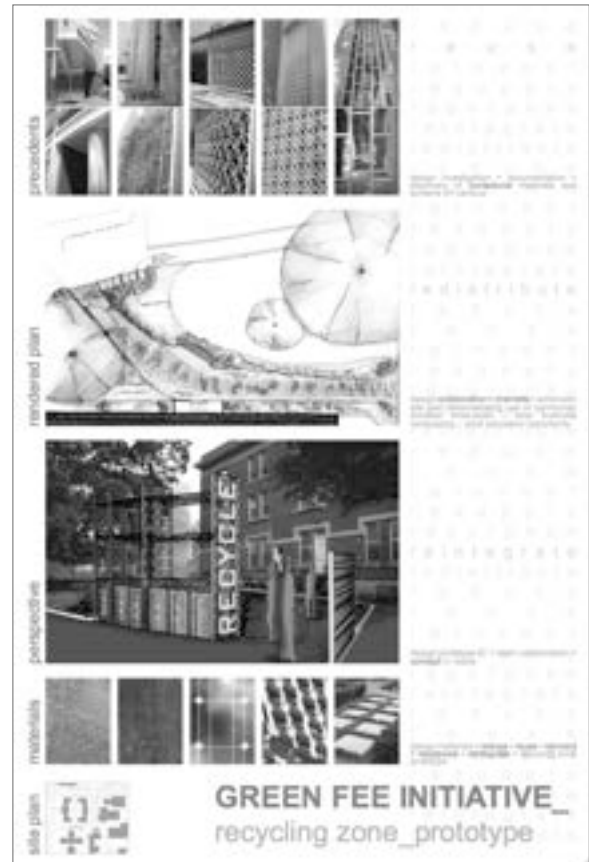University of Memphis

Sustainable design offers unique opportunities for fostering deeper engagement and a sense of ownership by diverse groups in a community. The broad reach of sustainability both in scope and effect on the wider community, allows it to act as a catalyst that spurs creative thinking. People come to the project with a sense of shared purpose, and becoming part of the team, bring unique abilities and connections that allow the project to develop and grow. Since its inception, the Recycling Zone project on Desoto Avenue at the University of Memphis has been a collaborative effort deriving its energy and finding its direction from the people involved.

The project started as an attempt to salvage a well traveled area of campus suffering from neglect, while moving recycling out of the forgotten service areas of campus and into the public realm. The site, located on a major campus entrance, provides an opportunity to reclaim green space from black-top and promote sustainability where students will traverse regularly.

The first sessions of the design team brought together architecture students and faculty with various skills and approaches to design. More importantly the participants brought connections to the larger campus and city community. Through the connections of one participant, a *brise soleil* from a downtown county government building was donated to be repurposed as the main construction material. Contacts with local landscape professionals specializing in xeriscaping expanded the project to include a walkway path where elements of sustainable plantings can be utilized as educational opportunities to the public and also serve as a demonstration for future ground-cover improvements.

As the project moves through design development more students will leave their mark on the design. The Building Technology class will be forming and implementing sustainable bench seating. Groups both in the Department of Architecture and across campus will be designing and fabricating aspects of the permeable paver system. Individuals from programs across campus have volunteered to participate in the construction scheduled for this spring.

A shared sense that design affects the greater whole has created a community across the campus and the city. How a recycling zone is designed and the message it conveys has greater implications about sustainability and its perception within the community. Each connection and each participant in the web of design is integral to the success of the whole.

GREEN FEE INITIATIVE_
recycling zone_prototype

Forming Space: A First-Year Exploration in Generating Design Through Folding

Sherry Bryan, Jennifer Barker, Chere Boiron, and Benjamin Vega
University of Memphis

To help first-year students consider the dynamics of form and its reciprocal relationship with space, a generative design project was formed which focused on manipulating a 2-d plane into a 3-d object. Students were first given three pre-determined projects to practice in class: one that involved cutting and placing; one that involved cutting and threading; and one that involved folding only. Students were then asked to develop a construct utilizing any of the methods previously investigated in class which spoke to the principles of form, space, and order and the corresponding elements. Students were given a minimum (8" x 8") and maximum (12" x 12") size for their construct. They were encouraged to use paper, or paper-based products, that supported their design. Additionally, they were instructed to be conscious of the material's thickness. Above all, the material and corresponding manipulations had to stay intact, such that, should the form be deconstructed it could again be seen as a plane. Supplementary connections were limited to discreet, well-placed clear tape. After the model was finished, students were instructed to photograph it under different light sources in order to capture shade, shadow, pattern, and visual texture. In each image, they were to show qualities of form and space that defined their exploration and concept.

Students articulated that this project helped them to understand form and space and created in them an ability to translate thought into action. One student summed it up as the following:

> As a result of the folding plane assignment, our class' understanding of form, space, and order has improved. This was our first attempt at designing our own space, so it was interesting to see how things turned out. I believe that the end result of the projects showed how each individual thinks. It is very interesting how a relatively small group of people can see the same space in so many different ways. On a personal note, the project gave me a new found appreciation of concept and how it can be incorporated into designing a space.

This folding project was one of a series of quick manipulative studies that focused students' attention on problem-solving through object play. Such play increases an individual's ability to learn skills that can be transferred and applied to investigating all types of design-oriented projects. It is the hope of the instructors that learning the skill and practicing it often facilitates quick and transformative growth on the part of the student.

Ghost Lab 11 & 12: Ghost Stories

Nick Nepveux / Megan Carrithers
The University of Kansas

This poster tells the story of Ghost Lab, a two week Design-Build internship taught in the Master-Builder tradition by architect, Brian MacKay-Lyons at his family farm in the rural village of Upper Kingsburg on the coast of Nova Scotia. Bringing together all parts of the trade: students, teachers, architects, builders, engineers; we all join together for one week of design and one week of build to gain an experience of a lifetime. The story will be told by two very different participants of the two most recent Ghost Labs, one male PhD student, and one female MArch student. Despite our differences we both agree with Robert McCarter when he writes, "The Ghost project allows the understanding that architecture has its own disciplinary tradition and ordering principles, unique unto itself, in its capacity to make place, to give identity, to construct community, and to shape experience—all through the understanding that we only <u>know</u> what we <u>make</u>" (our emphasis).[1]

The things learned and gained from the Ghost Lab experience can be difficult to summarize and shares a certain ambiguity with the town motto given to Salinas, California by a reporter in John Steinbeck's "There's Always Something to Do in Salina." The reporter bluntly tells us, "Salinas is," in response Steinbeck tells us, 'I don't know what that means but there is no doubt of its compelling tone."[2]

Ghost <u>is</u>… many things and each participant comes away with their own view of what it offers. For some it's a chance to learn from a respected and talented architect, for others it's a chance to make something real or full-scale for the first time in their life, and others come for a fresh perspective on architectural education. The thing we had in common is that all of us – students, teachers, architects, and critics – gathered in response to a gap in the institution that is architectural education.

Ghost's world approximates a time before the enlightened Pevsner informed us that cathedrals are big "A" architecture and a bicycle shed is a building, at Ghost they are both/and, each of Brian's sheds are architecture as well. Ghost simulates a world of architecture with a little "a," where architect and builder are not the same person, but constantly move closer to sharing a common knowledge through making and through a relationship of communication and respect.

---

[1] McCarter, Robert. "The Thought of Construction" in Ghost: Building an Architectural Vision. New York: Princeton Press, 2008.

[2] Steinbeck, John. America and Americans and selected non-fiction. New York: Penguin Group, 2002. p. 5.

Hand Created_Hand Made

Nathan Krug
The University of Nebraska

Although Sukkot was originally an agricultural holiday like Passover and Shavuot, the Bible (Leviticus 23:42-43) ascribes historical significance to it by stating its purpose: "You shall live in booths seven days in order that future generations may know that I made the Israelite people live in booths when I brought them out of the land of Egypt..." The sukkot (booths) that Jews build today are reminders of that forty-year sojourn in the desert on the way to the Promised Land.
-from *The Jewish Book of Why* by Alfred J. Kolatch.

Project Description
Shalom, and welcome to the Sukkah Project™.

Since 5757 (1996) we have provided sturdy, affordable, easytobuild Sukkah Kits to families, schools & congregations throughout North America.

Browse our website to learn about our unique Wood-Frame & Tubular Sukkah Kits and the other items we offer for Sukkot observance: • Bamboo Sukkah Roof Mats (S'chach)
  • Original weatherproof Sukkah Banners
  • Decorative Fruit & Veggies
  • Etrog / Lulav Sets imported from Israel
  …and more

Be sure to visit our Sukkah Gallery filled with customer photos showing the variety of ways a beautiful sukkah can be built with our kits.

And visit the Customer Comments page to read customer feedback about the Sukkah Project™ kits.

b'Shalom!
Judith & Steve Henry Herman

Whether you refer to the Holiday as Sukkot, Succos, Succot, Succoth, Sukkoth, or Feast of Tabernacles...we can provide the finest, most affordable kits for building a sukkah, (or a succah, sukka, or succa) perfect for your family, school or congregation.

Readings:
Students shall download, read, and prepare talking points for assigned readings:
• *Sukkos through the Ages from the Jewish Festivals; history and observance* by Hayyim Schauss.
• Sukkot, Shemini Atzeret, and Simchat Tora from the *Jewish Book of Why* by Alfred J. Kolatch.

Site:
There is no specific site - this is after all a structure that by its very nature is "mobile." You do have the choice of allowing your design to "stand alone," or to develop as a "lean to."

Requirements:
Your final Sukkah will be presented exclusively through the use of a single basswood model at ½" = 1' scale. The model will be predominately monochromatic.
The model shall be largely monochromatic. Materials other than basswood are encouraged as long as their final appearance "blends" rather than "contrasts" with the basswood chroma. The form and material properties of your Sukkah can effectively be represented without using the actual proposed material.

Considering the ½" = 1'-0" scale of the presentation model, resolution of joinery will be readily apparent. Also, note that fine craftsmanship will be an effective requirement for communication of your design in model form.

The extents of your model base shall be 12" wide, 38" long, by 3 ½" deep. All finished surfaces of the model should be constructed with maple or birch plywood.

In Search of Traditional Sustainable Green Built Environment

Dr. Khosrow Bozorgi
The University of Oklahoma

In recent decades architects and planners have been concerned about energy constraints and global warming. Designers are facing the biggest challenge of their professional careers overwhelming their planning approaches to dealing with building technology. This research project is going to focus on the adaptability of a historical model that can establish new architectural principles, helping the development of a green approach towards architectural design. Such principles are environmentally adaptive and sustainable while seeking design solutions in a semi-arid landscape. The goal is to investigate the fundamental principles of natural vernacular air circulation along with the study of the notion of the indoor-outdoor relationship in the court architecture of the desert and find ways to integrate such criteria into the planning and design of modern buildings. Iranian architectural tradition has accrued over the past thousand years a rich legacy of eternally valid responses to the perennial dictates of man and nature. These environmentally adaptive and sustainable principles are the legacy of correct, wholesome and balanced building design. The genius of such principles are based upon human scale, the body's golden mean proportions, the vernacular use of appropriate construction materials, eliciting in the viewer a profound sense of the archetypal meanings of spiritual transcendence and cosmic unity. In the studying of such traditional sustainable urban settings, the impact of climate, which is an important factor of diversity, is clearly conspicuous. The physicality and the related traditional architectural elements of sustainability such as wind-catchers, cisterns, and covered bazaars are best communicated in a visual format; hence this project explores digitally the uniqueness of architectural characteristics of a number of buildings. This research involves an extensive photographic survey of several historical sites, yet each individual captured frame has to be surveyed and digitally drawn to explore the following overarching fundamental principles of design: symbolic vision; environmental adaptation; the paradise garden paradigm; positive space system; human scale; and geometry.

Making Opportunities

Awilda Rodriguez / Jeanne Homer
Oklahoma State University

In the fourth year design studio, students were assigned a project that served as an introduction to a semester in which integrated systems are emphasized: structure, materials, and space. The students were required to create an assemblage of plastic bottles they collected over the break using mechanical connections. In the act of making, they could not ignore the constraints of construction, materials, and connections.

The time constraint of four days and the issues involved in engaging all 32 students forced the students to immediately consider the realities of making. Some students emerged as leaders, and they chose to tackle one large form versus several separate smaller ones, and this decision had a significant impact on the design. Their traditional linear process of conceptual drawings, followed by plans, then models, then elevations would not be possible. Instead, they did rough sketches on the board so that the entire class could interact. They determined a general direction, then proceeded to divide the class to achieve tasks that needed to happen right away, such as organizing the bottles by size, shape, and color.

The students soon realized that they did not have enough bottles, a constraint set by themselves, and that the bottles were different. The students discovered that the concept for the design would not work. Usually, the studio environment does not offer an outlet for students to test their designs and discover design shortcomings. Often the limitations of a specific production process or the inherent characteristics of a material that could drive important design decisions are not part of the design equation. In this project, once they embraced the materials in front of them, the design was adjusted. For example, the design issue of texture became less about fractal repetition and more about composed pattern that was rooted in the bottles they had at their disposal.

The process of making in the school courtyard created opportunities for interaction with other faculty and students. These spontaneous critiques pushed them toward their final solution of creating a statement about the life of a plastic bottle.

Throughout the project, students struggled with creativity in constraint. It was important to introduce the idea that constraints can actually promote and reveal creativity, versus solely being perceived as limiting it. Iterative experimentation, discovery of conceptual errors, and the modification thereafter can lead to an unconceived outcome which is an important part of the student's experiential learning.

Synesthetic Artifacts: Re-imagining metaphors between artifact, materials, and functionality through a kit-of-parts anthology

Anthony Cricchio
The University of Oklahoma

Synesthesia is a crossing of one sense into another through stimulation. The cross modal occurrences that happen within a synesthete open a broad range of conceptual links between the senses. Although strong synesthesia only occurs in a small fraction of society, we all have an inherent weak synesthesia that directs our abilities in everyday life. An example of weak synesthesia is the inherent property with the association of light colors with high tones and dark colors with low tones. As architects, we design architecture to capture both our physical senses (sight, sound, touch, smell) and the incognizant sense of space. The basic interconnection of the physical senses and the sense of space has long been broken down into parts of study in basic architectural design. This compartmentalization and process actually conflicts with our inherent process to conceptualize and reconnect associations between the senses through metaphoric conceptualization. Kit-of-parts projects are a way of exploring the connections between different architectural conceptualizations and expressions by focusing on a concept though an architectural vocabulary, in a sense an architectural synesthesia.

The basis of exploration is based on Metaphor Theory which states that metaphors are grounded in everyday experiences and are conceptual in nature. The exploration studied form through a series of stages. The first stage began with the analyzation of three "Artifacts". The artifacts as described below were studied as a series of parts. The stage acted as the generation point. The second stage reassembled and explored new architectural artifacts through a series of metaphoric conceptualizations. The metaphoric conceptualizations are the programmatic qualities or "rules" which defined the architectural artifact. An example of a metaphoric conceptualization would be a definition as "the space tastes loud," or "the small whisper feels big." The final stage applied the explorations into a redefined architectural artifact. The artifacts were modeled first as literal digital models, and then broken down into a series of parts. The parts were categorized as objects, attachments, or concepts. The expressions of the artifacts went through a series of synesthetic manipulations that explored the reinterpretation of its conceptual entity. The final part of the process re-defined the new architectural artifact as a product, referring back to the original idea of an artifact.

The intent of the project was to have the student explore conceptual ideas through a process which develops an alternative design problem solving methodology. The generation, exploration, and final application process explored by the student becomes the future framework for the next phase of the competition studio.

Techtonic Momento

Anthony Cricchio
The University of Oklahoma

*Tectonic: of or pertaining to building or construction; constructive;
               architectural*

Memento: a reminder of past events

As architects, we design architecture to capture both our physical senses (sight, sound, touch, smell) and the incognizant sense of space. The basic interconnection of the physical senses and the sense of space has long been broken down into parts of study in basic architectural design. This compartmentalization and process actually conflicts with our inherent process to conceptualize and reconnect associations between the senses. Most design students use their senses to explore basic design concepts through beginning academic design exercises without much thought. The students use metaphoric conceptualization as a way of grasping complex issues and associating them with tangible thoughts and ideas. To capture this innate property of metaphoric conceptualization, along with students' senses, leads to enhanced learning opportunities. It also may lead to the possibility of understanding why some students have an intuitive sense of design while others do not. The following project suggests a pedagogical approach in teaching where a reintroduction of a basic architectural design program can invoke an upper level design student to think both in advanced spatial and a-spatial architectures. The project was developed to provoke thought into complementary issues that would be explored in the more complex architectural program. The students were given only one week to complete the assignment.

Biographical Information

Dean of the OU College of Architecture

Dr. Charles Graham
cwgraham@ou.eduDean
University of Oklahoma
College of Architecture
+
In 2008, Dr. Charles W. Graham joined the college as Dean. Graham's career in higher education began in 1978 at the University of Texas at San Antonio where he helped start the architecture and interior design programs. Dean Graham came to OU from Texas A&M University where he worked for 25 years. He is a founding member of the National Consortium of Housing Research Centers, a consortium of universities and research labs that conduct worldwide housing research. Graham earned his Bachelor's degree in Architecture from Texas Tech University, Master of Arts degree in Environmental Management from the University of Texas at San Antonio and a Doctor of Philosophy in Urban and Regional Science from Texas A&M University.

Chairman of the Bruce Goff Chair of Creative Architecture Series

Prof. Hans Butzer
butzer@ou.edu
Mabrey Presidential Professor of Architecture and Urban Design
University of Oklahoma
College of Architecture
+
Hans is Mabrey Presidential Professor of Architecture and Urban Design at the University of Oklahoma in Norman, where his teaching and research focus on sustainability as an extension of ethics, efficiency, community and design. He is also committee chairman of the Bruce Goff Chair of Creative Architecture Lecture Series.

Together with his wife/partner Torrey, Hans is best known as the co-designer of the internationally acclaimed Oklahoma City National Memorial. He and Torrey joined Oklahoma native Jeremy Gardner and formed the architecture practice Butzer+Gardner Architects, an Oklahoma City-based architecture and urban design practice where Hans is co-director.

His built work has received regional and national awards from the American Institute of Architects, the American Society of Landscape Architects, the Boston Society of Architects, and the Boston Society of Landscape Architects. It was included in TIME Magazine's Top Ten Best Designs of 2000 and has been published throughout North America and Europe. His work has also won or placed in over 10 graphics/design competitions in both the United States and Germany.

Hans is licensed to practice architecture in Oklahoma and Germany. He holds a Bachelor of Architecture with High Honors from the University of Texas at Austin, and a Master of Architecture from Harvard University's Graduate School of Design. Hans is also a LEED Accredited Professional. Today, Hans and Torrey reside in downtown Oklahoma City with their three children.

Creating_Making Forum Administrator

Angela Person
a@ou.edu
PhD Student
University of Oklahoma
+
Angela is a second-year PhD student in the Department of Geography. She received a BS in environmental design from the University of Oklahoma and an MA in museum studies, also from OU. Angela has worked at the Smithsonian Institution in Washington, D.C. for the past two summers. Recently, she co-authored the paper, "Transilient minds: An historical-anthropological approach to first year architecture studio," which was presented at the 2009 *Transilient Boundaries in/of architecture* conference in Edinburgh, Scotland. The paper has since been published in the *Edinburgh Architecture Research* journal (2010). She also presented the paper, "Critical and Hermeneutic Inquiry: A Feminist Approach to Architectural Discourse" at the *2010 International Conference on Architectural Research* in Washington, D.C., and the project, "El pilar de sustentabilidad: Toward Latin American sustainability," at the 2010 *Association of Collegiate Schools of Architecture* conference in New Orleans, LA. Angela has twice been awarded the OU Women's Studies program's Betty Baum and Norman Hirschfield Award. Currently, she is studying how varying types of public spaces—and their architecture—help constitute their communities' cultural identities. Angela is mother to Nora Lucía, an energetic and inquisitive four-year-old.

Peer review panelists & session moderators

Catherine Barrett
cjbarrett@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Peer review panelist & Session moderator]
+
Catherine Barrett is a licensed architect who ran her own practice in Seattle, Washington for fifteen years and taught design studios and sketching in the Department of Architecture at the University of Washington. In June 2010 she received her PhD from the Division of Art History at the University of Washington for a monograph of the medieval town of Cordes in southern France. She is currently an Assistant Professor in the College of Architecture at the University of Oklahoma.

Dave Boeck
dlb@ou.edu
Associate Professor
The University of Oklahoma College of Architecture
[Session moderator]
+
David L. Boeck received a Bachelor of Environmental Design and both a Bachelor and Master of Architecture from the University of Oklahoma. He is an Associate Professor of Architecture at the University of Oklahoma in the Division of Architecture focusing on integrating Universal Design Principles into all projects, along with the concepts of sustainability. He has also integrated a multi-disciplinary and collaborative approach to studio organization and project development and as written and presented numerous papers addressing the importance of using a collaborative approach to studio project development as a pedagogical tool for student learning, making the students ready to fit into the professional office environment when they graduate. His firm involvement has included principal/owner in David L. Boeck, Architect, partner in Robison-Boeck Architects, and currently principal/owner in DLB Architects, PC. His architectural practice focuses on designing sustainable environments. The nature of this sustainability involves designing projects that are not just energy efficient, but that are also comfortable, and accessible, to all user groups. His project experience includes residential, ecclesiastical, commercial/ retail, educational, and civic facility designs.

Daniel Butko
butko@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Peer review panelist & Session moderator]
+
Daniel Butko attended the University of Florida for both Bachelor of Design and Master of Architecture degrees. Daniel is currently an Assistant Professor of Architecture at the University of Oklahoma. He is a registered architect in Kansas and Oklahoma with NCARB certification and LEED accreditation. Notable awards are the 2005RobertBradford Newman Award for excellence in acoustical research and the 1993 Walt Disney Dreamers and Doers Award that recognizes creativity and constancy. Previous employers include JE Dunn Construction, HOK Sport (currently Populous), Kansas State University, and the University of Florida.

Anthony Cricchio
anthony.cricchio@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Session moderator + Poster Presenter]
+
Professor Cricchio holds a BS in Architecture (1993) and a MArch (1995) from the University of Texas at Arlington. He has practiced in the Dallas/Fort Worth area with Corgan Associates as well as teaching at the University of Texas at Arlington and at Oklahoma State University. Professor Cricchio is a registered architect and is NCARB certified. He believes that teaching architecture is an extension of his own inquisitive nature and is evident in his pedagogical approach to the design studio. A combination of practical applications and conceptual problem solving, Professor Cricchio has been recognized with several significant prizes including the Beck Professional Award for the 2005 Ken Roberts Memorial Delineation Competition, finalist in the 2003 Braun Prize Competition, and Honorable Mention in the 2001 UIA Water and Architecture Competition. Professor Cricchio teaches in the design studio and is involved with the integration of computers with the design process.

Dr. Eren Erdener
e-erdener@ou.edu
Professor
The University of Oklahoma College of Architecture
[Session moderator]
+
Eren Erdener, Ph.D. is a faculty member at the University of Oklahoma, College of Architecture. His teaching areas are architectural and urban design, facility management, programming, and research methods. His research areas are: qualitative and quantitative methods of the built-environment evaluation, development of utilization metrics, and teaching methods. He has many scholarly articles published both in national and international journals and worked as the regional editor of the U.K. based Facilities journal.

Lee Fithian
leefithian@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Session moderator]
+
Lee A. Fithian is an Assistant Professor in the College of Architecture at the University of Oklahoma in Norman, Oklahoma. With a background in architecture, engineering, and computer science, Lee's focus is on creating true social, environmental and economic sustainability in the built environment while transferring that design knowledge to future Architects through the Graduate Studio. Lee serves on University, State and National boards by bringing a transformative perspective on sustainability in the built environment to the profession. Lee is a practicing Architect, a Certified Planner, and LEED Accredited Professional.

Kemal Gokturk
sgokturk@scad.edu
CNC Prototyping Manager
Savannah College of Art and Design
[Peer review panelist]
+
Initially set on a course of Architecture with six years of study and practice, Kemal Gokturk diverged from this path upon discovering his love for the more intimately scaled building of furniture. While earning a BFA in Furniture design from the Savannah College of Art and Design, Kemal worked in antique restoration and subsequently progressed to exhibiting unique works in exhibitions as widespread as New York, Paris and Milan. The processes of his personal work have expanded from a foundation in fine craft to incorporate more advanced techniques utilizing computer modeling and machining, and he has presented on the topic of computer aided design and CNC fabrication on more than a few occasions. Currently, Kemal serves as the coordinator for CNC operations at the Savannah College of Art and Design prototyping concepts stemming from an array of disciplines including Industrial Design, Furniture Design, Sculpture, Jewelry, and even some Architecture.

Nick Harm
nharm@ou.edu
Associate Professor
The University of Oklahoma College of Architecture
[Peer review panelist]
+
Nick Harm, AIA, is associate professor and director of the Division of Architecture within the University of Oklahoma College of Architecture. Originally hailing from Nebraska, he holds B.S. and M.S. degrees in Architectural Studies from the University of Nebraska. His broad professional experience includes design work across the U.S. and Saudi Arabia, including residential, hospital, religious, and landscape projects. Currently, his areas of focus are human aspects of design, architectural photography, and experimentation with non-traditional materials. Nick is also owner/operator of Running Bird Vineyard, located just outside Norman, OK.

Jonathan Hils
hils@ou.edu
Associate Professor
The University of Oklahoma
School of Art & Art History
[Peer review panelist]
+

A native of New Hampshire, Jonathan W. Hils is an Associate Professor of sculpture at the University of Oklahoma. He received his BFA degree from Georgia State University (1997) and his MFA from Tulane University (1999). Before coming to the University of Oklahoma, Mr. Hils served as an adjunct instructor (drawing and sculpture), studio manager, and technician at the College of Charleston School of the Arts in South Carolina. The recipient of the 2005 Oklahoma Visual Art Coalition Fellowship (OVAC) for outstanding creative work in the visual arts, Hils' work is represented in several private and corporate collections including the Hyatt Corporation, Four Seasons, the John Michael Kohler Arts Center, and Equity West Partners. He has shown extensively across the U.S. in solo and group exhibitions. He was also selected for a John Michael Kohler Arts Center Arts/Industry artist residency in 2005. He has been a visiting artist and lecturer at San Jose State University, the University of Wyoming, Appalachian State University, Longwood University, the College of Charleston, Renmin University (China), Wichita State University, and Brevard College.

Kelly Hutzell
kellyh@andrew.cmu.edu
Assistant Teaching Professor
Carnegie Mellon University School of Architecture
[Peer review panelist]
+

Kelly Hutzell, AIA, LEED AP is an Assistant Teaching Professor of Architecture at Carnegie Mellon University. She holds joint appointments between the Pittsburgh, Pennsylvania and Doha, Qatar campuses. In addition to teaching, Kelly is a senior associate at over,under, a Boston-based multi-disciplinary design firm. Prior to her involvement with over,under, Kelly practiced in firms that specialize in urban design, cultural, and institutional projects, including Schwartz/Silver and Machado and Silvetti Associates. Her work, research and teaching focus on architecture and urban design of the public realm. Recent publications include articles in Bringing the World into Culture (ASB-VUB Press) and Al Manakh: Gulf Continued (Stiching Archis).

Lisa Iwamoto
lisa@iwamotoscott.com
Associate Professor of Architecture
College of Environmental Design University of California—Berkeley
[Peer review panelist]
+

Lisa Iwamoto teaches design studios and graduate seminars. Her research focuses on digital fabrication and material technologies for architecture, and includes development of the CAD/CAM lab in the Department of Architecture. Her book, Digital Fabrications: Architectural and Material Techniques will be published Spring 2009 by Princeton Architectural Press as part of their series Architecture Briefs. Iwamoto received her Master of Architecture degree with distinction from Harvard University where she was recipient of the Faculty Design Award, and a BS degree in Structural Engineering from the University of Colorado. She has taught previously at the University of Michigan and at Harvard. Iwamoto is principal of IwamotoScott Architecture, a practice formed in partnership with Craig Scott. Committed to pursuing architecture as a form of applied design research, it engages in projects at multiple scales and in a variety of contexts consisting of full-scale fabrications, museum installations and exhibitions, theoretical proposals, competitions and commissioned design projects. IwamotoScott's recent projects include: Voussoir Cloud, SCIArc Gallery, Los Angeles; ORDOS100; Hydronet; REEF, PS1 Young Architects Program 2007; and Jellyfish House for the Vitra Design Museum's exhibition OPEN HOUSE.

Stephanie Liner
stephanie.liner@gmail.com
Artist
New York City, NY
[Peer review panelist]
+

While growing up in Charlotte, North Carolina and Georgia, Stephanie developed an interest in antique furniture and traditional pattern design. These communities and interests have played a part in the physical and conceptual components of her work. Stephanie began an apprenticeship with a traditional European style upholstery shop (The Straight Thread) in Madison, Wisconsin. There she learned to build forms and do upholstery. Through travel abroad and doing research into decorative floral patterns, she gained an understanding of that history and its impact on our culture's decorative interiors. Stephanie has been making work and delving into the connection between these decorative interiors, sexuality, gender, and architecture for the past ten years, earning a Bachelors of Art and Design from North Carolina State University, College of Design and an MFA and MA from University of Wisconsin- Madison. Stephanie is now an artist living in New York City. Recently, her work has involved using specific types of fabric, sewing techniques, and upholstery to create vehicles for human interaction.

Emily Moss
mosse@newschool.edu
Assistant Professor of Core Studies
School of Design Strategies
Parsons the New School for Design
[Peer review panelist]
+

Emily Moss grew up in the afterschool art programs of Manhattan's 1960s-era Lower East Side. She studied literature at Yale University as an undergraduate and attended the Graduate School of Design at Harvard University, where she received her Masters in Architecture with honors in design. She divides her professional life between construction projects and teaching. She is full-time faculty at Parsons The New School for Design, where she teaches in both the architecture/interior design department and in foundation. She is a registered architect in New York State, and is currently completing several   townhouse additions/renovations in Brooklyn.

Stephanie Pilat
spilat@ou.edu
Assistant Professor
The University of Oklahoma College of Architecture
[Peer review panelist & Session moderator]
+

Stephanie Zeier Pilat is a designer and architectural historian whose work and practice examines points of intersection between aesthetics, politics, and architecture. Professor Pilat holds a Ph.D. and Master of Sciences in architectural history and theory from the University of Michigan as well as a professional degree in architecture from the University of Cincinnati. She is the recipient of Fulbright fellowship and a Rome prize from the American Academy and has presented her research in venues across the United States and abroad. Professor Pilat specializes in twentieth-century architecture, social housing, and Italian architecture. Professor Pilat is also a founding partner of Reconstruct Design, a practice committed to social entrepreneurship and environmental stewardship.

Fred Schmidt
fschmidt@fsb-ae.com
Principal and Director of Architecture
Frankfurt - Short – Bruza Associates
[Peer review panelist]
+

Fred Schmidt grew up as a military dependent, and spent his childhood in Japan, France, Spain, and the United States. For the past 35 years, he has lived in Norman, OK, where he graduated from the University of Oklahoma with a Bachelor of Architecture. In 1993, Fred was inducted into the AIA College of Fellows, and, ten years later, in 2003, he was awarded the "Oklahoman of the Year" award for his role as Chief Architect of the Oklahoma State Capitol Dome Design Build Team. He is past president of both the Oklahoma AIA and the Oklahoma Architectural Foundation, as well as past chair of the AIA National Environmental Education Committee. Additionally, Fred now serves as president of the University of Oklahoma Division of Architecture's Professional Advisory Board. Fred believes that, "As architects, we are the stewards of the built environment and must be diligent in creating public awareness of the positive virtues of a quality built environment and of the value of the architect's role and contribution to that environment.

Randall Teal
rteal@uidaho.edu
Assistang Professor
The University of Idaho
College of Art and Architecture
[Peer Review Panelist]
+

Randall Teal is an Assistant Professor of Architecture at the University of Idaho. His pedagogical and research interests are in design fundamentals and architectural theory with a significant influence from Continental thought. His writing focuses primarily on understanding and promoting situated dialogue between creative processes and the built environment. Recent publications include "Immaterial Structures: Encountering the Extra-Ordinary in the Everyday," in *JAE: The Journal of Architectural Education 62*, No. 2 and "Placing the Fourfold: Topology as Environmental Design," in *Footprint: Delft School of Design Journal 3*.

Creating_Making Forum presenters

Jennifer Barker
Jlbrker1@memphis.edu
Adjunct Professor
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Jennifer Barker is an Adjunct Professor of Architecture at the University of Memphis and currently teaches a section of the Fundamentals of Design course. She earned her Master of Architecture degree from the University of Memphis and her Bachelor of Architecture from the University of Tennessee, Knoxville. Currently she is pursuing a Doctor of Education in Higher and Adult Education, with an intention to continue teaching design courses at the university level. The research for the doctoral degree is anticipatory of such teaching by focusing on retention of and focused learning for entering first-year design students. Specifically, what interests Jennifer the most is trying to increase the spatial capacity for learning while developing students as critical thinkers to maximize initial learning (thereby better preparing students for the rigorous curriculum to follow).

Dr. Khosrow Bozorgi
kbozorgi@ou.edu
Professor
The University of Oklahoma
College of Architecture
[Paper and Poster Presenter]
+
Dr. Khosrow Bozorgi was originally educated at the National University of Iran, where he received his B.Arch. and M.Arch. degrees. During the 1980s, he received his Master of Science and Ph.D. degrees in Architecture from University of Pennsylvania, Philadelphia. He has taught architecture for more than 25 years at all levels both undergraduate and graduate. His primary teaching area is advanced architecture/urban design), Western/ Middle Eastern architecture, and urban design theories. Dr. Bozorgi is the Ph.D. coordinator responsible for developing the first doctoral Program for the College of Architecture at the University of Oklahoma. Dr. Bozorgi also developed a similar program for Tehran University in 1992. He has 25 years of professional experience as project designer working with large international architectural firms in United States, Europe, and the Middle East. He has been continuously visible at the national and international level in obtaining support for his scholarly work as evidenced by funding from major external agencies, research/publications, architectural consulting, public lectures, and professional research projects.

Edward Becker
egbecker@calpoly.edu
BArch Student
California Polytechnic
Architecture Department
[Paper Presenter]
+
Edward Becker is a 5th year undergraduate architecture student at California Polytechnic and recently resided in Copenhagen, Denmark while his research project "Digital Fabrication in Denmark: As tool and craftsman" was being conducted. In September, he returned to Cal Poly in order to complete his thesis and oversee the production of a line of chairs designed as part of his current Danish research project.

Sherry Bryan
sbrynhgg@memphis.edu
Associate Professor
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Professor Sherry Bryan is Director of the Architecture Program and Coordinator of Graduate Studies for the University of Memphis Department of Architecture. She also currently serves as Interim Director of the Interior Design Program in the Department. Sherry earned a professional Master of Architecture degree from Virginia Tech and also holds a Master of Science degree from the University of Memphis. Sherry has over twenty-five years of experience and has taught a wide variety of courses ranging from first year fundamentals studios to graduate-level design studios and seminars. During her tenure she has received a number of awards including Academic Advisor of the Year from the University of Memphis. She serves as advisor to the University of Memphis chapter of the American Institute of Architecture Students and is liaison to the Memphis Chapter of the AIA.

Aimee Buccellato
abuccellato@nd.edu
Assistant Professor
The University of Notre Dame
School of Architecture
[Paper Presenter]
+

Professor Buccellato's practice, including published built-work, research, and writing, is focused on advancing the study of sustainable design and building technology with particular emphasis on quantifying the inherently durable and sustainable characteristics of traditional materials, methods, and principles of design. In addition to teaching Introduction to Building Technology I, Professor Buccellato teaches upper-level undergraduate and graduate studios, and engages both undergraduates and graduate students in directed studies as part her Green Scale Research Project. Alongside this research, Professor Buccellato works with faculty in the departments of computer science, mechanical and electrical engineering to optimize the integration of computational waste heat – an enormous, underutilized passive heat source – in buildings, and will present a paper on the topic at the upcoming 2011 ASHRAE Winter Conference. Professor Buccellato is also a member of the Steering Committee for one of the University's prestigious Strategic Research Initiatives, the development of a near-site indoor/ outdoor experimental facility to support critical environmental change research and education.

Stephen Caffey
scaffey@archmail.tamu.edu
Assistant Professor
Texas A&M
Department of Architecture
[Paper Presenter]
+

With the support of a two-year Samuel H. Kress Foundation dissertation fellowship at the Courtauld Institute in London and a summer residency at the Terra Foundation for American Art, Giverny, Stephen Caffey earned the PhD in Art History from the University of Texas at Austin in 2008. He joined the faculty of the Department of Architecture at Texas A&M University as an Assistant Professor of Art and Architectural History later that year, and became a faculty affiliate of the TAMU American Studies program in 2010. His current research projects include the history and science of visual and spatial literacies; visual cultures of empire and identity; the aesthetics of sustainability; climate-responsive features of historic vernacular architecture in South, Central and Western Asia; the role of artists' residencies in the development of contemporary American art; and an interactive digital reconstruction of Vauxhall Pleasure Gardens circa 1764.

Gabriela Campagnol
campagnol@gmail.com
Assistant Professor
Texas A&M
Department of Architecture
[Paper Presenter]
+

Gabriela Campagnol, from Brazil, has been an architect and urban planner since 1999. In 2004, her master research "Industrial and Agricultural settlements," was published with grant funding from FAPESP (The State of São Paulo Research Foundation). This book was awarded honorable mention in the 7th Young Architects National Award the following year. She earned a PhD in History and Theory of Architecture and Urban Planning from the University of São Paulo, Brazil, in 2008. She joined the Department of Architecture at Texas A&M University as an Assistant Professor of Design and Architectural History in that same year. Her current research projects include the architecture and planning of sugar settlements; sugar industrial heritage; and re-use of the industrial past: architecture, heritage and sustainability.

Megan Carrithers
mcarrithers@ku.edu
MArch Student
The University of Kansas
School of Architecture, Design, and Planning
[Poster Presenter]
+

Megan Finnesy is a second year student in the MArch program at the University of Kansas School of Architecture. During her final year, she intends to study under Dan Rockhill's design-build studio, Studio 804. Her pursuit of graduate studies was driven by her ambition to build upon her current foundation of design knowledge through further study of sustainable building methods that encourage environmental stewardship. Finnesy believe sthat design-build methods of architecture allow for the process of design to better serve the community, the environment, and the economy. Finnesy has a Bachelors of Science in Interior Design from Kansas State University. This past summer, she participated in Ghost Lab 12, a two week design-build program taught in the master-builder tradition by Canadian architect, Brian MacKay-Lyons. During her undergraduate studies, she was a teaching assistant for first year Interior Design studios, and she is currently a GTA for Site Planning under Donna Luckey at the University of Kansas.

Dr. I-Kwang Chang
archichang.1@ou.edu
Associate Professor
The University of Oklahoma
College of Architecture
[Paper Presenter]
+
Dr. I-Kwang Chang teaches structures in the College of Architecture at OU. He practiced structural design for years and taught structural courses at the California State University, San Jose (Civil) and University of Notre Dame (Architecture) prior to OU. His main research interests are: Innovative structural systems for earthquake/wind/flood/fire protection for residential and low-rise buildings; Innovative seismic protection for historic buildings; Innovative "design-build" construction; and Innovative structural design for earthquake induced sloshing protection for liquid storage tanks. While at Notre Dame he joined Professor Robert Amico leading four students participated the Rehousing Hollywood student Design Competition sponsored by AIA Research and Federal Emergency Management Agency in 1997. Their team won the first prize. The test was to generate high-density, low-rise prototypical designs for replacement-housing communities through the integration of conceptual design with technical imperatives. The sites selected were in Hollywood, CA, where the 1994 Northridge earthquake struck.

Michael Chisamore
mkchsmre@memphis.edu
Assistant Professor
Director, FedEX Institute for Sustainable Design
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Professor Michael Chisamore earned a Master of Architecture from Virginia Tech and a Bachelor of Professional Studies in Architecture from SUNY Buffalo. Michael practiced architecture in Elmira and Rochester, New York for 8 years and taught at Alfred State College for 7 years prior to his appointment to the University of Memphis, Department of Architecture in 2009. At Memphis he is the Director of the FedEx Institute Center for Sustainable Design and teaches Advanced Environmental Systems, Experiential Drawing, Introduction to Architecture, and Design Studios at both the graduate and undergraduate level.

Thomas Cline
thomascline@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Paper Presenter & Session Co-moderator]
+
After completing a Bachelor of Architecture at Auburn University, several years of architectural practice, and an MFA in Furniture Design from the Savannah College of Art and Design, Thomas is now an Assistant Professor in the College of Architecture at the University of Oklahoma. As the Beginning Design Coordinator, his teaching is grounded in the belief that design is a product of human imagination and intuition, and as such, articulates how we understand and exist in the world. His current work focuses on the use of contemporary feminist and post-colonialist methodologies to counter a contemporary design discourse that marginalizes history, precedent, particular identity, and ontological ways of knowing.

Angela Co
a.co@ky.edu
Instructor
The University of Kentucky
School of Architecture
[Paper Presenter]
+
Angela Co is a LEED-accredited designer and an educator. She is the founder and principal of Studio Co, an architectural initiative in pursuit of possible worlds through critical inquiry into our natural and constructed ones. Her research into speculative architectural artifacts and their effects on space, bodies, and behavior includes a collaboration with Aeolab on the Weather-Making Balloon media installation and nomadic pavilion, which has been exhibited at the Eyebeam Art and Technology Atelier in New York City. Outside of Studio Co, she has worked on theoretical and built projects with Bernard Tschumi Architects and Asymptote Architecture. Co holds a Master of Architecture Degree from Columbia University's GSAPP, where she was awarded an Honorary Design Award and the Loewenfish Memorial Prize for Design Excellence, and dual Bachelor Degrees in Architecture and Computers Science from the University of Pennsylvania. She has taught design at Columbia University, the University of Pennsylvania, and is currently an Instructor at the University of Kentucky.

Elise Co
elise@aeolab.com
Partner, Aeolab
[Paper Presenter]
+
Elise Co is a media artist and founding partner of Aeolab, a design and technology consulting firm in Los Angeles. Co holds a Master of Science degree in Media Arts and Sciences and a Bachelor of Science in architecture from MIT. She is a former Professor of New Media at the Hochschule für Gestaltung und Kunst in Basel, Switzerland, where she taught courses in interaction design and physical computing. Her work has been shown internationally, including at the Museum of Modern Art NY, SIGGRAPH, IMRF Tokyo, Cooper Union, and the New York Art Directors Club. She was recently selected as an Artist in Residence for Extending Creativity in Digital Media at the Anderson Ranch Art Center in Snowmass, Colorado.

Shauna Corry
scorry@uidaho.edu
Associate Professor
The University of Idaho
Department of Architecture and Interior Design
[Paper Presenter]
+
Shauna Corry is an associate professor and Interior Design Program Coordinator in the Department of Architecture and Interior Design at the University of Idaho. Her research interests include environment and behavior, universal design and social/cultural responsibility in design. Dr. Corry earned a Interdisciplinary PhD from Washington State University with emphasis areas in architecture, interior design, anthropology and sociology. She has taught at the University of Idaho for 9 years and previously taught at North Dakota State University where she served as Facility Management Program Coordinator.

Chris Cosper
ccosper@caad.msstate.edu
Adjunct Instructor
Mississippi State University
College of Architecture and Design
[Paper Presenter]
+
A 1994 graduate of the Mississippi State University School of Architecture, Chris has more than 15 years of experience with design and construction in Mississippi. His work (while a partner at Pryor & Morrow Architects) includes the Bowen Hall Renovation at MSU and the Marks-Rothenberg Renovation in downtown Meridian. His recent work includes a new office building for the Starkville Electric Department, a project which is scheduled to be LEED certified. As an adjunct instructor, Chris has taught first through fourth year design studios, the Active Building Systems course, an Electrical Systems Course, and a Construction Document and Detailing course for Interior Design. As the assistant director of the Educational Design Institute, Chris is working with school districts across the state to improve school facilities.

Anthony Cricchio
anthony.cricchio@ou.edu
Assistant Professor
The University of Oklahoma
College of Architecture
[Poster Presenter]
+
Professor Cricchio holds a BS in Architecture (1993) and a MArch (1995) from the University of Texas at Arlington. He has practiced in the Dallas/Fort Worth area with Corgan Associates as well as teaching at the University of Texas at Arlington and at Oklahoma State University. Professor Cricchio is a registered architect and is NCARB certified. He believes that teaching architecture is an extension of his own inquisitive nature and is evident in his pedagogical approach to the design studio. A combination of practical applications and conceptual problem solving, Professor Cricchio has been recognized with several significant prizes including the Beck Professional Award for the 2005 Ken Roberts Memorial Delineation Competition, finalist in the 2003 Braun Prize Competition, and Honorable Mention in the 2001 UIA Water and Architecture Competition. Professor Cricchio teaches in the design studio and is involved with the integration of computers with the design process.

Chere Doiron
cdoiron@memphis.edu
Assistant Professor of Interior Design
The University of Memphis
Department of Architecture
[Poster Presenter]
+

Chere Labbe Doiron practiced interior design in Southwest Louisiana after receiving her Bachelor of Fine Arts Degree from the University of Louisiana at Lafayette. Returning to graduate school, she received her Master of Fine Arts degree from the University of Memphis in 2004, and taught for 3 years in NE Ohio. Chere believes that good design has the power to create and transform place to the benefit of all. Academically, her most rewarding work and the subject of her beginning research surrounds the development of creativity with students through the design process. An artist as well, she finds beauty in unusual places and small things documenting these experiences through painting and photography.

Chris Ford
Cford4@unl.edu
Steward Professor of Sustainable Design
The University of Nebraska—Lincoln
College of Architecture
[Paper Presenter]
+

Upon graduating from North Carolina State University in 1998, Chris joined the New York office of Richard Meier & Partners where he assisted the design development of several international competition entries and commissions. The majority of Chris' tenure was spent in assisting the execution of the 173 / 176 Perry Street residential towers located on Manhattan's west side. Chris also worked for Rick Joy Architects and Rob Paulus Architects in Tucson AZ as both an architectural project manager and construction manager. While an Associate with RPA, Chris was also an Adjunct Lecturer at the University of Arizona, School of Architecture. In Fall 2005, Chris joined the University of Nebraska College of Architecture where he regularly teaches design studios at both undergraduate and graduate levels. Chris teaches a required elective for all 3rd year students titled "Design Process," and has offered his graduate level elective, "Introduction to Craft," each Spring semester since 2006.

David Fortin
david.fortin@montana.edu
Assistant Professor
Montana State University
School of Architecture
[Paper Presenter]
+

David Fortin is a registered architect in the province of Alberta in Canada. He teaches design studio and architectural history at Montana State University where he is currently researching the dynamics of global urban growth as it relates to informal communities. Working with colleagues at the Jomo Kenyatta University of Agriculture and Technology in Kenya and students and colleagues at MSU, the team is developing sustainable design strategies for housing in Nairobi that specifically interrogate perceived distinctions between rural and urban conditions. Ultimately interested in the evolution of the notion of home, David's research interests extend to the crossovers between architecture and science-fiction. He is currently completing a book titled Architecture and Science-Fiction Film: Philip K. Dick and the Spectacle of Home, as well as a chapter on Dick and the modern city for a forthcoming publication on literature and architecture.

Jessica Hester
jahester@ou.edu
BArch Student
The University of Oklahoma
College of Architecture
[Paper Presenter]
+

Jessica Hester graduated with honors from Putnam City High School in 2005. She is a fifth-year Architecture Student at the University of Oklahoma. She is expected to graduate in May 2011 with a professional degree in Architecture. She is highly involved in the student chapter of the American Institute of Architects, Freedom By Design, Architecture for Humanity Dallas/Fort Worth and the National Architecture Accreditation Board with which she has participated in the accreditation of the architecture programs at the University of Detroit Mercy, Southern University Baton Rouge, and the Frank Lloyd Wright School of Architecture. She is an Accredited Professional of the United State's Green Building Council's Leadership in Environmental Design program. She has received multiple academic awards including an AIAS Presidential award, The President's and Dean's Honor Rolls, and the Backus Payne Leadership Scholarship.

Jeanne Homer
Jeanne.homer@okstate.edu
Associate Professor
Oklahoma State University
School of Architecture
[Poster Presenter]
+

Professor Homer received her Bachelor of Science from the University of Illinois at Champaign-Urbana and her Master of Architecture at Arizona State University in Tempe. She has been a practicing architect in Chicago and Phoenix, having received her professional registration in Illinois in 1998. While she was practicing in Chicago and Phoenix, she taught at the Art Institute of Chicago and Arizona State University. Professor Homer received the 2007 ACSA/ AIAS New Faculty Teaching Award and the 2006 Halliburton Excellent Young Teacher Award.

Megan Hoover
BArch Student
The University of Memphis
Department of Architecture
[Poster Presenter]
+

Megan Hoover is a second year undergraduate architecture student at the University of Memphis. She is an honors student and vice president of the American Institute of Architecture Students. Megan is excited and interested in sustainable design and hopes to carry innovative sustainable design ideas into her professional career. Upon graduation, Megan plans to pursue a Master of Architecture degree.

Brian Kelly
criticalframe@hotmail.com
Visiting Professor
The University of Nebraska—Lincoln
College of Architecture
[Paper Presenter]
+

Brian M. Kelly, RA is a Visiting Professor of Architecture at the University of Nebraska at Lincoln College of Architecture. His previous teaching experience includes Drury University's Hammons School of Architecture in Springfield, MO and California Polytechnic State University at San Luis Obispo. Prior to joining the faculty at UNL, Brian served as lead designer in the office of Randy Brown Architects, designing several award-winning projects of various types and scales. In addition to teaching, he has also recently started his own office focusing on smaller scale architectural projects, objects and graphics. Brian's teaching focus is in the areas of beginning design, architectural representation theory and the craft of making. His student work has been featured in academic journals and his professional work has been published internationally.

Nathan Krug
nkrug@unlnotes.unl.edu
Associate Professor
The University of Nebraska—Lincoln
College of Architecture
[Poster Presenter]
+

Nathan Krug's time in academia has covered twenty-nine years, where he has attained tenure at two universities while maintaining a professional practice to enable the realization of the principles and ideas central to his teaching. Both educational and professional experiences have provided a balance of theoretical, social, and technical knowledge permitting me to teach a wide range of subjects within the professional curriculum. As part of the "Land Grant Triad," a mission that includes teaching, research / creative activities, and service, Krug's actions center around a holistic approach to architecture; an approach that results in built forms appropriate and even necessary within their context. It is Krug's goal to help students to develop the tools necessary to creatively solve problems. In architectural education this encompasses exploration and formulation of a process enabling one to merge the technical with the artistic, the pragmatic with the theoretical, the push for innovation with the comfort of proven success.

Amrita Mahindroo
amahin@mit.edu
SMarchS Student
The Massachusetts Institute of Technology
Department of Architecture
[Paper Presenter]
+

Amrita Mahindroo is a graduate student in the SMarchS Program in Architecture and Urbanism at Massachusetts Institute of Technology. She received her B.Arch with Honours from the University of Melbourne in 2005, and has since practiced in London and Paris, as Project Architect for Buckley Gray Yeoman and Shigeru Ban Architects Europe. She has presented her research through lectures at the Branded City Conference at UCLA in 2009 and at the NCBDS Conference at UNC Charlotte in 2010, and is interested in the relationship between society and technology in shaping the built environment.

Sean McDow
sean_mcdow@ou.edu
MArch Student
The University of Oklahoma
College of Architecture
[Paper Presenter]
+

Sean McDow received his bachelor's degree from the University of Oklahoma in Environmental Design. He is continuing his education at the University of Oklahoma, working toward a Masters of Architecture degree. Sean McDow has a strong interest in structural design that developed while working with Dr. Chang as his teaching assistant. Currently he is continuing to expand on this interest with his thesis that involves structural designing issues as they relate to the extreme conditions brought about by tornado activity. It is his hope that the research done through his thesis will one day lead to new technologies that might prevent structural failure under extreme conditions.

Matthew Mindrup
mmindrup@maryu.marywood.edu
Assistant Professor
Marywood University
School of Architecture
[Paper Presenter]
+

Born in St. Louis, Missouri, Matthew Mindrup spent his childhood in State College, Pennsylvania. Having felt the call to take up the profession of architecture, he enrolled at the Pennsylvania State University where he completed degrees in both architecture and philosophy. After 3 years of professional internship, Matthew undertook graduate study and earned a Masters of Architecture at the University of Pennsylvania where he fostered a deep interest in the history of architectural theory and representation. In 2007, Matthew completed a Ph.D. in Architecture and Design at Virginia Tech University on the physical and metaphysical coalition of two architectural models assembled by Kurt Schwitters in the early 1920s. Matthew's ongoing research in the history and theory of architectural design locates and projects the implications that models have in the design process. He has presented some of this research at conferences while other parts have been published in JAE, SIAJ and became the focus of a conference session that he co-chaired at the 2009 ACSA annual meting in Portland, OR.

Colby Mitchell
ccmtchll@memphis.edu
BFA-Arch Student
The University of Memphis
Department of Architecture
[Poster Presenter]
+

Colby C. Mitchell is currently a fourth year architecture honors student at the University of Memphis. He entered the architecture program in the summer of 2006, immediately getting involved in student activities such as the downtown chalk arts festival, receiving 1st place in the freestyle design. He is involved in several student organizations within the architecture program including Alpha Rho Chi, Construction Specifications Institute for Students and the National Organization of Minority Architects for Students, holding the position of Vice President in CSI-S. He has also been involved in other campus organizations, holding the office of president for the Empowered Men of Color minority student organization in 2007. Over his four years, he has produced a broad array of design projects including a sustainable residence, a warehouse, and a bank that was nominated for the program's first design excellence award. He has also enrolled in the Intern Development Program and plans on attending graduate school in the fall of 2011.

David Nepveux
nepveux@ku.edu
PhD Student
The University of Kansas
School of Architecture, Design, and Planning
[Poster Presenter]
+

David (Nick) Nepveux is currently in his 2nd year of the PhD program at the University of Kansas School of Architecture. Nepveux's research is centered on the relationship between the pedagogy of design-build studios and the more traditional studio method, and design-builds' effects on the architectural philosophies of the students who participate. Nepveux has a BArch and a minor in architectural history from Oklahoma State University. He has three years experience in all phases of building design and construction at DWL Architects and Planners in Phoenix, Arizona. Last summer, he participated in Ghost Lab 11, a two week design-build program hosted by the Canadian architect Brian McKay-Lyons. Nepveux has been a guest jury member at Kansas State University, the Frank Lloyd Wright School of Architecture, and Arizona State University. He is a GTA and has taught first year architecture and architectural engineering design studios, and is currently team-teaching a 3rd year design-build studio with Nils Gore at the University of Kansas.

Ernest Ng
Ernest.ng.hh@gmail.com
Visiting Assistant Professor
Mississippi State University
College of Architecture and Design
[Paper Presenter]
+

Ernest Ng graduated from State University of New York (SUNY) at Buffalo, with a Master of Architecture degree, conferred with an award distinction in overall design excellence for the graduating year of 2009 and the Henry Adams merit award. Prior to his graduate studies in Buffalo, he spent three years in professional practice at Steven Holl Architects in New York City. Ernest studied at the National University of Singapore where he received his B.A. in Architecture and has also spent a year of study abroad at Carnegie Mellon University, Pittsburgh, as part of a M.Arch program from National University of Singapore. He is currently a visiting assistant professor at Mississippi State University, College of Architecture, Art & Design, teaching a materials survey course and undergraduate studios.

Nikita Pashenkov
nik@aeolab.com
Partner, Aeolab
[Paper Presenter]
+

Nikita Pashenkov was born in the former Soviet Union, lived in USA since 1991, and in Japan between 2003-2004. He earned a Bachelor- Degree with Honors from Architecture School at Princeton University and Master of Science from MIT. He has worked as a researcher with Aesthetics & Computation Group at the MIT Media Laboratory and later at GK Tech Inc, a branch of the Japanese industrial design conglomerate GK Design Group. In 2005 Pashenkov co-founded Aeolab, a design and technology firm in Los Angeles. His work investigates the intersection between design, programming and electronics technology and has been featured in exhibitions at MoMA (New York), Institute of Contemporary Art (London), Eyebeam Atelier (New York), and Ginza Gallery (Tokyo).

Santiago Pérez
perez.sr01@gmail.com
Assistant Professer
University of Arkansas
Fay Jones School of Architecture
[Paper Presenter]
+

Santiago R. Pérez is an Assistant Professor and 21st Century Chair in Integrated Practice at the University of Arkansas, Fay Jones School of Architecture. He is currently developing new teaching and research initiatives related to "Craft + Advanced Digital Fabrication in Architecture." Previously, Pérez served as an Assistant Professor of Architecture at the University of Houston, where he developed large-scale fabrication projects at the university's Keeland Design Center. Professor Pérez has published and lectured widely on the influence of craft and digital fabrication on design and architecture, including recent talks at University of Oregon and the Contemporary Arts Center in Houston, TX. His forthcoming essay, "The Ecology of Making," will be published in Matter: Material Processes in Architectural Production, while other recent publications include "Crafting Complexity," in Acadia Silicon + Skin (2008) and "Towards a New Tactility," in the Material Matters proceedings (2008). Pérez received a Master of Architecture with Distinction from the Harvard Graduate School of Design and the Tamaki Fellowship, as a researcher in residence in the office of Tadao Ando in Osaka, and the AMORPHE office in Tokyo, headed by Kiyoshi Sey Takeyama.

Seung Ra
Seung.ra@okstate.edu
Assistant Professor
Oklahoma State University
School of Architecture
[Paper Presenter]
+

Seung Ra is an Assistant Professor of Architecture at Oklahoma State University School of Architecture. His current research and design practice focuses on culture, technology, and progressive approaches to the interdisciplinary study of architecture and urban design. He has presented and exhibited his research and theoretical works throughout the U.S., Germany, Singapore, China, Brazil, and Spain. Professor Ra holds a Bachelor of Architecture from Oklahoma State University and post-professional Master's degree from Columbia University. He taught at the New York Institute of Technology and as a BIG12 Faculty Fellow, he visited at the University of Nebraska at Lincoln. Prior to his teaching and research at OSU, he worked on a wide range of projects at Studio Daniel Libeskind, Friedrich St.Florian Architects, and Kohn Pederson Fox.

Nathan Richardson
nathan.richardson@okstate.edu
Assistant Professor
Oklahoma State University
School of Architecture
[Paper Presenter]
+

Assistant Professor Nathan Richardson teaches design and real estate at the Oklahoma State University School of Architecture. Prior to joining OSU in the fall of 2009, Nathan received his Master of Design Studies with Distinction from the Harvard University Graduate School of Design. In 2003, Nathan received his Bachelor of Architecture, Magna cum Laude, from Oklahoma State University. His current scholarship and consulting activities are centered on the production of architecture as an art, science, and real estate enterprise. Of particular interest is the role of speculation, valuation, and innovation in design, finance, and architectural practice. Prior to studying at Harvard, he worked for three years at Cutler Anderson Architects in Seattle, Washington, working on a number of residential and commercial projects in the United States and abroad.

Awilda Rodriguez
awilda@okstate.edu
Assistant Professor
Oklahoma State University
School of Architecture
[Poster Presenter]
+

Professor Rodriguez received her Master of Architecture and Bachelor of Science in Design degrees, from Arizona State University with a concentration in computer applications. After working in Phoenix, Arizona for ADP/Flour Daniels and The Orcutt and Winslow Partnership, she pursued postgraduate studies in multimedia technologies. Her professional work encompassed a wide range of projects, including educational, healthcare, hotel/resort facilities. She served on the Board of Directors for the Arizona Central Chapter of the AIA during the period 1997-98. Professor Rodriguez taught for five years as an adjunct professor at ASU, and in the fall of 2009 she joined the Oklahoma State University School of Architecture as a full-time faculty member.

Nick Safley
nicksafley@yahoo.com
Adjunct Professor
The University of Oklahoma
College of Architecture
[Paper Presenter]
+

Nick Safley is a recent graduate of The University of Oklahoma College of Architecture and a life long resident of Norman. He is an instructor in the first year studio at OU; a position intended to introduce the perspectives of recent graduates into beginning design pedagogy. Nick has worked in Oklahoma City for bg design collaborative and in Los Angeles for Roto Architecture. He is currently constructing the physical component of the exhibition "Bruce Goff: A Creative Mind." In his spare time he carries the lightest possible loads on the most interesting trails.

Irina Solovyova
Irina.solovyova@utsa.edu
Assistant Professor
University of Texas –San Antonio
College of Architecture
[Paper Presenter]
+

Irina Solovyova is an Assistant Professor in Interior Design Program at the University of Texas at San Antonio, where she teaches interior design and foundation courses. She was born in Russia where she received Master's or Architecture from Volgograd State Architectural and Engineering University. She holds Ph.D. in Architecture from Texas A&M University. Irina's research area of interest is emotional component of memory as related to design, influence of autobiographical experiences of designers on the product and process of design, and design pedagogy.

Jennifer Thompson
jlthmps5@memphis.edu
Adjunct Professor
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Jennifer "Jenna" Thompson is a LEED accredited Adjunct Professor of Architecture at the University of Memphis. She earned a Master of Architecture Degree from the University of Memphis and both a Bachelor of Architecture degree and a Bachelor of Interior Architecture degree from Auburn University. Jenna is currently pursuing a Doctor of Education in Higher and Adult Education at the University of Memphis.
While at Auburn, Jenna encapsulated sustainable design in every project, the most notable of which is her extensive research of biodegradable plastics in interior design applications. This research yielded Jenna the distinguished Auburn University Undergraduate Research Fellowship Grant, which is awarded to only 20 students per year for the entire University, and the 2006 AIAS Student Research Honors Award. Her passion for creating awareness and action to social issues of environmental stewardship permeates her philosophy of design, adult education and teaching methodology.

Gregory Thomson
thomsong@uwm.edu
Assistant Professor
The University of Wisconsin—Milwaukee
Department of Architecture
[Paper Presenter]
+
Assistant Professor Gregory Thomson holds a BA (English Literature) from Carleton College, and MArch and MS diplomas from the University of Oregon. His work has been published and exhibited at the American and International Solar Energy Society and the USGBC annual conferences. He has served on the Technical Review Committee of the American Solar Energy Society and is a manuscript reviewer for Solar Energy and Automation in Construction. He is the first faculty member in the Department of Architecture to receive a competitive UW – Milwaukee Research Growth Initiative grant. He and a team of collaborators won international design competitions held by the USGBC Emerging Green Builders and the Boston Society of Architects. Working in the AEC field for almost 20 years, he has been a builder of custom and prefabricated assemblies, a practicing architect, and an academic. Most recently he has been the PI for the UWM Solar Decathlon project.

Tony Vanky
tvanky@mit.edu
SMarchS Student
The Massachusetts Institute of Technology
Department of Architecture
[Paper Presenter]
+
Tony P. Vanky is researching urban computing and urban design as a Master of Science of Architectural Studies candidate at the Massachusetts Institute of Technology. Prior to MIT, Tony has served as a director on the board of the Association of Collegiate Schools of Architecture and the Vice President of the American Institute of Architecture Students where he specialized in issues of education, innovation processes and professional development.

Fabiana Vazquez
fvazquez@memphis.edu
BFA-Arch Student
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Fabiana Vazquez is a second year undergraduate architecture student at the University of Memphis. She is involved with AIAS, CSI students, and Alpha Rho Chi Professional Fraternity of Architecture and Allied Arts. She is currently interested in learning more about sustainability and concrete designs. She is inspired by architects such as Peter Gluck and Zaha Hadid, as well as the ZeroEnergy Architecture Firm in Boston, MA. After receiving her Bachelor degree, Ms. Vazquez plans to continue on to the graduate program at the University of Memphis to receive her Masters in Architecture. Her biggest ambition is to travel to Spain to study designs created by Antoni Gaudi and Frank Gehry.

Benjamin Vega
bavega@memphis.edu
BFA-Arch Student
The University of Memphis
Department of Architecture
[Poster Presenter]
+
Ben Vega is a first year architecture student at the University of Memphis. He is in the honors program currently working alongside faculty and upper classmen on the Green Fee Initiative Project. His architectural interests include green technologies and their uses within sustainable design. Before coming to the University of Memphis for Architecture, Ben was at the University of Tennessee at Chattanooga seeking a Biology/ Chemistry double major. During his time at the school, Ben worked with the Biology department in a research study of the evolution of the plant genus plumus. He hopes to incorporate this knowledge of biology into his understanding of sustainable design.

Cathrine Veikos
veikos@exchange.upenn.edu
Assistant Professor
University of Pennsylvania
School of Design
[Paper Presenter]
+
Cathrine Veikos, AIA, is an Assistant Professor at the University of Pennsylvania School of Design. Her research addresses the relations between drawing and building, materials and media-based techniques in art and architectural practice. Her current project examines these themes in the work of architect, Lina Bo Bardi (1914-1992). Articles on this research and on the phenomenon "Sheer Opacity" have been published in the Journal of Architectural Education. Cathrine Veikos teaches design studios and advanced seminars and is the Coordinator of the Second-year Design Studio and the three-semester Visual Studies sequence in the Graduate Program. She worked professionally in the offices of Roland Simounet and Jean-Paul Viguier, in Paris, and for Bruce Graham at SOM Chicago before becoming a principal of atelier4Architecture (a4A), an international firm she co-founded. She was recently honored with a Cass Gilbert Fellowship at the University of Minnesota College of Architecture and Landscape Architecture, a Rotch Traveling Studio Scholarship, and an award from the Graham Foundation for the Advancement of the Arts. Cathrine has an M.A. from Barnard College-Columbia University and an M.Arch from Harvard University.

Andrzej Zarzycki
andrzej.zarzycki@njit.edu
Assistant Professor
New Jersey Institute of Technology
College of Architecture and Design
[Paper Presenter]
+
Andrzej Zarzycki is a designer and educator who employs digital tools to create experiential technology teaching into the New Jersey Institute of Technology (NJIT). His research focuses onmedia based environments as well as validation methodologies of generative designs through building performance analysis and simulation tools. Professor Zarzycki presently teaches courses in building sciences, computational simulations as well as design studio. Since 1996, he was part of the Architecture, Representation and Computation group at MIT. While there, he produced video presentations of Unbuilt Monuments for MOCA, Siggraph and other venues. Prior teaching experience includes computational design at Rhode Island School of Design (RISD) Interior Architecture Department. Andrzej Zarzycki 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.

The University of Oklahoma
College of Architecture

Mission.

The mission of the College of Architecture at the University of Oklahoma is to provide its students with a dynamic professional education in architecture, construction science, interior design, landscape architecture and regional and city planning through a variety of undergraduate and graduate programs in interdisciplinary, collaborative settings emphasizing excellence in education, research, and service to the community.

Vision.

The College of Architecture at the University of Oklahoma aspires to provide the world with leaders prepared to advance their professions, improve their communities, and contribute to a global society. Their success will be reflected in the national rankings of the disciplines according to third party assessments.

Online.

http://www.ou.edu/architecture

By phone.

(405) 325-0311

In person.

Gould Hall
660 Parrington Oval
Norman, OK 73019-3003

The University of Oklahoma

Overview.

Created by the Oklahoma Territorial Legislature in 1890, the University of Oklahoma is a doctoral degree-granting research university serving the educational, cultural, economic and health-care needs of the state, region and nation. The Norman campus serves as home to all of the university's academic programs except health-related fields. Both the Norman and Health Sciences Center colleges offer programs at the Schusterman Center, the site of OU-Tulsa. The OU Health Sciences Center, which is located in Oklahoma City, is one of only four comprehensive academic health centers in the nation with seven professional colleges. OU enrolls more than 30,000 students, has more than 2,400 full-time faculty members, and has 21 colleges offering 163 majors at the baccalaureate level, 166 majors at the master's level, 81 majors at the doctoral level, 27 majors at the doctoral professional level, and 26 graduate certificates. The university's annual operating budget is $1.5 billion. More information about The University of Oklahoma is available online at <www.ou.edu>.

Equal Opportunity.

This University in compliance with all applicable federal and state laws and regulations does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, political beliefs, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid and educational services.

Leadership.

Oklahoma Regents for Higher Education
Glen D. Johnson, Chancellor
Joseph L. Parker Jr., Chairman
Julie Carson, Vice Chairman
Marlin "Ike" Glass Jr., Secretary
James D. "Jimmy" Harrel, Assistant Secretary
John Massey
William Stuart Price
Toney Stricklin
Michael C. Turpen
Ronald H. White, M.D.

University of Oklahoma Board of Regents
John M. Bell, M.D., Chairman
Leslie J. Rainbolt-Forbes, M.D., Vice Chairman
Richard R. Dunning
Tom Clark
Jon R. Stuart
Max Weitzenhoffer
Clayton I. Bennett
Chris A. Purcell, Vice President for University Governance; Executive Secretary of the Board of Regents governing the University of Oklahoma, Cameron University and State University; and Secretary of OU, CU and RSU

University of Oklahoma Executive Officers
David L. Boren, President
Nancy L. Mergler, Senior Vice President and Provost, Norman campus
Dewayne Andrews, M.D., Senior Vice President and Provost, Health Sciences Center, and Executive Dean, College of Medicine
Gerard P. Clancy, M.D., President, OU-Tulsa
Anil Gollahalli, Vice President of the University of Oklahoma and General Counsel to the Board of Regents of the University of Oklahoma governing the University of Oklahoma, Cameron University and Rogers State University
Chris A. Purcell, Executive Secretary of the University of Oklahoma Board of Regents, Vice President for University Governance, and Secretary of the University of Oklahoma, of Cameron University and of Rogers State University
Nicholas S. Hathaway, Executive Vice President and Vice President of Administration and Finance
Catherine F. Bishop, Vice President for Public Affairs
Joseph R. Castiglione Sr., Vice President for Intercollegiate Athletics Programs and Director of Athletics
Kelvin Droegemeier, Vice President for Research, Norman campus
Loretta Early, Chief Information Officer and University Vice President for Information Technology (Interim)
Tripp Hall, Vice President for University Development
Matthew Hamilton, Vice President for Enrollment and Student Financial Services and Registrar
Joseph Harroz Jr., University Vice President and Dean, College of Law
Danny Hilliard, Vice President for Governmental Relations
John Iandolo, Vice President for Research, Health Sciences Center
Jerry Jensen, Interim University Equal Opportunity Officer
Clive Mander, Director of Internal Audit
Berrien Moore III, Vice President for Weather and Climate Programs and Dean, College of Atmospheric and Geographic Sciences

University of Oklahoma Executive Officers <continued>

James P. Pappas, Vice President for University Outreach and Dean, College of Liberal Studies

Guy Patton, President, OU Foundation

Daniel W. Pullin, University Vice President for Strategic Planning and Economic Development; Chairman, Center for the Creation of Economic Wealth; and Regulator, Office of the Regulator

Kenneth Rowe, Vice President for Administration and Finance, Health Sciences Center

Shad Satterthwaite, University Equal Opportunity Officer

Clarke Stroud, University Vice President for Student Affairs and Dean of Students

Norman Campus Deans

Charles W. Graham, College of Architecture

Paul B. Bell Jr., College of Arts and Sciences (and Vice Provost for Instruction)

Berrien Moore III, College of Atmospheric and Geographic Sciences, and Vice President for Weather and Climate Programs

Kenneth R. Evans, Michael F. Price College of Business

Larry Grillot, Mewbourne College of Earth and Energy

Gregg A. Garn, Jeannine Rainbolt College of Education (Interim)

Thomas L. Landers, College of Engineering

Rich Taylor, Weitzenhoffer Family College of Fine Arts

T.H. Lee Williams, Graduate College

Norman Campus Deans <continued>

David Ray, Joe C. and Carole Kerr McClendon Honors College

Zach Messitte, College of International Studies

Joe Foote, Gaylord College of Journalism and Mass Communication

Joseph Harroz Jr., College of Law, and University Vice President

James P. Pappas, College of Liberal Studies (and Vice President for University Outreach)

Douglas Gaffin, University College

Sul H. Lee, University Libraries

Health Sciences Center Deans

Kevin Rudeen, College of Allied Health

Stephen K. Young, D.D.S., College of Dentistry

Dewayne Andrews, M.D., Executive Dean, College of Medicine (and Senior Vice President and Provost, OU Health Sciences Center)

Lazelle Benefield, College of Nursing

JoLaine Reierson Draugalis, Ph.D., College of Pharmacy

Gary Raskob, College of Public Health

James J. Tomasek, Graduate College

Tulsa Deans

F. Daniel Duffy, M.D., School of Community Medicine, Tulsa

William O. Ray, Associate Vice President for Academic Affairs, Tulsa

THE UNIVERSITY OF OKLAHOMA
COLLEGE OF ARCHITECTURE
< ou.edu/architecture >

PROCEEDINGS OF THE
2010 CREATING_MAKING FORUM

THE UNIVERSITY OF OKLAHOMA
COLLEGE OF ARCHITECTURE / DIVISION OF ARCHITECTURE

< ou.edu/architecture >