Digital Craft and Architectural Geometry

Edited by Carl Lostritto

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A. Owens
L. Macinnon
Matthew R. Heaton
Michael Velentzas
Forward

By Kyle Sturgeon, Director, Advanced Architecture Studios

Before diving into the beautiful production and thoughtful essays presented within this publication, I would like to put the work in the context of a few agendas that the BAC maintains—to be a highly reflective and constantly evolving institution, and to support not only the student experience but also the work of emerging design educators in our larger community. Carl Lostritto’s studio delivers on all counts.

The work of the studio was made possible by the Boston Architectural College’s EDCO Grant. Awarded to several instructors annually, the grant pairs adjunct faculty with full-time education directors to frame and conduct applied research that feeds back into our education environment in meaningful ways. This institutional initiative gives the BAC unique dexterity to infuse our courses with new methodologies, and to wrangle current agendas in design, while scaffolding the ongoing development of our community of design educators.

In this instance, Lostritto’s studio does not merely rely on 3-D printing as a static form-producing agent, but incorporates it into a complex workflow that challenges student to maneuver between analog and digital space to elicit design thinking. The value of the consciousness exhibited in each student during this workflow cannot be overstated. It has been a joy for me to see each student continue through the curriculum with a more informed and rigorous design process afforded by this experience.

More broadly, Lostritto’s studio models a new wave of inquiry and re-enacts a culture of making that is emerging in today’s Boston Architectural College. The work of the studio has created a swift sea change in our attention to the College’s fabrication resources. Building on the success of this course (and other making-centric pilot courses), we have succeeded in purchasing a CNC router, an additional laser cutter, and two 3-D printers.

Please enjoy this assemblage and continue your engagement with the BAC as we continue to usher in new ways of thinking and making after 125 years of existence within the Boston design community.
Introduction

This publication represents inquiry and research raised and conducted by a studio at the Boston Architectural College in the summer semester of 2012. The studio assumed the goal of exploring new implications that stem from the not-so-new technology of 3-D printing and its interaction with the BAC’s culture and curriculum. Four outside critics participated in regular reviews and have made scholarly contributions to this body of work. The project briefs, student work and contributions from the guests are included here in close proximity, even in some cases overlapping in their arrangement. The aim is to reflect and further the unique nature of an architectural studio: to hybridize learning, speculation and discourse such that faculty and critics are implicated in the work along with students.

By Carl Lostritto, Instructor
Course Description

This studio uses 3-D printing technology to facilitate an iterative design process and an exploration of advanced architectural geometry. An experience-oriented analysis of a local site along with isolated geometric exercises offer two parallel lines of inquiry. Site and geometry gradually convolve toward the design of a cartography museum.

A BAC Education Committee grant funds all required 3-D printing for this course using off-site 3-D printing services. Every week, each student submits a batch of models for printing. They arrive at the BAC within two weeks. Both regularity of submitted prints and the delay of off-site 3-D printing is assimilated into the pedagogy. After the models have been received, they are documented, drawn upon (and with), considered, augmented and otherwise manipulated relative to other design media.

A component of this course will inevitably involve instruction and discussion of the digital craft necessary to create mesh models suitable for 3-D printing.

Although 3-D printing is a relatively established prototyping technology, its role in design process (as a tool for research, analysis, and thinking) remains a subject of debate. 3-D printing is geometric rather than tectonic. Resulting models are materially homogeneous and are devoid of joints, connections, or seams. Leveraging this abstract quality to enable an isolated discourse on geometry and a controlled comparison of the biases of various media is the primary goal of this studio. Rigorous design of precise geometry is also on the agenda. The expected result is a formal sophistication and subtlety rarely achievable through any other design medium. Contrary to the assumption that digital media corresponds to complexity and formal exuberance, we investigate the most minimal computational actions necessary to produce uncanny forms and rich spatial conditions.

3-D printing invites a design process that maintains the potential for multiples and continually expanding possibilities. Rather than operating on a trajectory that moves towards a building at the end of the semester, the design process will be repeated. Each cycle will address multiple variations and entertain potentially drastic answers to hypothetical “what if...?” statements introduced along the way.
Exercise 1

Model a hybrid between a sphere and a plane. The sphere has a radius of two inches. The plane, given that it is a plane, has no dimensions, only orientation, axes and an origin of your choosing. This is a prompt to be considered, not a problem to be solved. Allow the enigmatic confrontation between the sphere, which, by definition, defies orientation, and the plane, which defines orientation, to manifest in emergent topologies and orders.

Make three digital models, each should be radically different from the others in terms of operational strategy and aesthetics.

The total volume of each model may not exceed six cubic inches, which is significantly less than the total volume of a solid two-inch-radius sphere (which would be around 34 cubic inches). No element of any model may be thinner than .03 inches (a limitation of the 3-D printing process). The model must be contiguous (one piece).

Ricardo Bilonick, 1:1
Michael Ambrose was invited to participate as a critic despite his lack of proximity to the BAC. Fortunately, he was able to attend multiple reviews via video conference.

At the University of Maryland School of Architecture, Planning, and Preservation, where he is a Clinical Associate Professor of Architecture, Ambrose shepherded the architecture program out of a perpetually non-digital era and reinvigorated the studio curriculum. He has developed a reputation for designing and evolving curricula, furthering pedagogical research, and educating future educators, which make his contribution of a polemical essay all the more relevant. Ambrose’s former students are now teaching at Columbia University, Corcoran College of Art + Design, Pratt Institute, Rhode Island School of Design, and of course here at the BAC. Many, if not all, of this cadre of academics point to Ambrose as a primary motive force in our initial leap into the realm of teaching, and would identify him as one of the most successful models available of a contemporary approach to overlapping teaching, scholarship and research.

In the following essay, Ambrose begins with an assertion that “technology, geometry and computation play an ever-greater role in the conception(s) of architecture.” He continues his observation to note that architects are somehow less aware and less engaged with the meaning or implications of those cultures. All architecture is digital architecture now, and yet the discipline lacks coherent and rigorous scholarly engagement with the potential implications of digital media. However, very few of us—certainly not Ambrose—are fixated on producing the polemical digital project. We now know what we’re going to get when we ask “what is the inherently digital building look like?” and it isn’t novel. But washing our hands of the questions surrounding digital media has not served our students well. Critical dismissal of the “digital project” too easily leads to functional illiteracy in the languages technology, geometry and computation. Fittingly and refreshingly, Ambrose’s call to arms is more nuanced than that which leads to maximal divergence from traditions. Ambrose instead calls out our collective blind spot as a matter of our treatment of these cultures. He proposes an emphasis on constructing process before we construct architecture. Within that frame there is plenty of room for new “digital provocations” and a safe zone in which to explore “digital conception(s)” without resorting to digital tropes.

Ambrose’s conceptual proposal can be taken as an intellectual or theoretical proposition, but his essay can also be read for practical advice in how to teach a studio and how to approach digital media: if you’re using digital media (or, “the computer”) as a tool, you’re doing it wrong. We may have moved on from the idea of revolutionary digital architecture, but we should not accept traditional goals as given.

While other guest contributions in this publication will take the work and pedagogy of the studio and respond to it, the relationship here is somewhat the reverse. This studio is one example of Ambrose’s broad proposition. This is not a studio about new architecture that can be made thanks to 3-D printing. That a proposition would, first of all, be out of sync with technological realities. 3-D printing and associated solid modeling techniques are not new. (They’re actually quite old. Some of the key patents for 3-D printing are soon to expire, and the earliest 3-D digital modeling software could only operate on meshed solids) Instead, this is a studio aimed at investigating new conceptions of the design process; new hybrid media that are relevant given the newfound accessibility, speed and abstracted craft of 3-D printing. Put another way: the 3-D printed object was not our goal, rather the implications of holding, touching, marking on and drawing with these objects was our domain of inquiry.

—Carl Lostritto
digital provocations(s) and digital conception(s) of architecture

By Michael Ambrose

The cultures of technology, geometry and computation play an ever-greater role in the conception(s) of architecture. And yet, we seem increasingly oblivious and bound to their limitations and constraints on our work. We must be emancipated from the narrow definitions promoted through common preconceptions and misconceptions of digital design media. We must seek to demonstrate re-conceptions of what it means to be digital in the architectural design process. Primary to this task is the ability to manipulate information and computational systems and procedures as design methods that operate within and beyond the conceptualization of architecture. The task is to develop a thorough understanding of how changes in design technologies, such as animation, parametric modeling, scripting, and digital fabrication serve to provoke a reinterpretation of the design of architecture. Through the immersive engagement of the methods, techniques and processes of digital design media, several misconceptions are revealed, repaired and removed. The challenge is to understand the opportunities presented when digitally driven design process and production technologies are envisaged more comprehensively than as mere tools to fully embrace them as ways and means of thinking in and of themselves.

Architecture demands the unique ability to synthesize, hybridize, analyze and operate as a creative and mindful mediator to traverse and connect disparate concepts, technologies and cultures. During an age of ever-increasing emerging digital technologies, we are pressed to observe the transformative affects of digital design media on the discipline. Look closely and one should not see a dichotomy between the traditional and emerging paradigms; rather, the latter is a natural continuum of the former. Yet, the connection between the two requires further clarification and scholarship. The exploration of digital processes and techniques are intimately linked through a deep and long-standing architectural tradition to seek clarity of thought through simultaneous artistic and scientific examinations of the theories, processes, technologies and cultures that drive one’s architectural preoccupations.

As we explore digital design media processes and products and the cumulative effects of these technologies to re-imagine practice and education within the discipline we must seek engagement with digital conception(s) of architecture that examine representation through crafted digital exploration and development of architectural ideas. These digital conception(s) of architecture arise
from issues of design process, methods, and representations (abstract and simulation) based on computational and/or parametric cultures and environments.

Architecture finds itself at a unique moment in time where the means of production are being transformed to fundamentally rewrite or modify the existing models of education and practice within the discipline. The application of digital technologies beyond Computer Aided Architectural Design (CAAD) such as Building Information Modeling (BIM), parametric design, and digital fabrication are altering the how and what of architectural design. We must seek engagement with these digital provocation(s) of architecture that examine design representation through crafted digital exploration and development of architectural ideas. The way we make architecture is under transformation through the very digital tools and applications that define the area of digital design media. As current digital/computational modeling replaces (or displaces) digital two-dimensional drawing, just as digital drawing displaced physical drawing a generation ago, these changes are becoming increasingly more evident and perhaps more significant. The future of architecture resides in how the discipline responds to the digital provocation(s) of architecture and is transformed by digital conception(s) of architecture in the processes and products of design practice and education.
Moa Carlsson is a member of the Design and Computation Group within the MIT School of Architecture + Planning. Her prior background comprises five years of work and teaching experience in London and Vienna, since her first M.Arch. degree from the Lund Technical University, Faculty of Engineering, Sweden. Carlsson has volunteered her time to this and many computational courses as a guest critic. Members of the Design and Computation group come from radically varied geographic, cultural, and intellectual backgrounds despite a conceptual alignment and shared frames of reference, which makes Carlsson’s contribution especially resonate with the studio. Her contributing essay uses the work of the studio to develop a conception of “the design of design” that leverages the hybridization of media.

Much in Carlsson’s essay is worth highlighting. Beginning with her articulation of a “post-optimization” paradigm, which would seem on its face to contradict the very nature of computation and its corresponding capacity to build models and run simulations. We might imagine a spectrum on which optimization is on one end. On the other end we would find methodologies of “form-finding” in which “natural” laws have been allowed to play out so that relevant, curious or best conditions are happened upon by the human designer. Both extremes tend to make designers uncomfortable because they undermine the human role in design. This inquiry serves, at least, as a reminder that the relationship between design and computation requires cultivation and intellectual stewardship. Unmentioned by Carlsson in this discussion, perhaps because it is obvious, is that 3-D printing occupies an uncertain position—relative to design—in popular media and public consciousness. “What about the 3-D printed building?” is the exciting question, but it leapfrogs over a more urgent and difficult requirement of design media to produce things to think with.

Furthermore, it is useful to note that Carlsson emphasizes the constructed relationship created by some students—a kind of dialogue—between digital and physical model. This relationship is akin to the feedback loop one gets automatically between material and form when working in pre-digital or “tectonic” model. Working this way with 3-D printing allows us to return to the big picture rationale for this studio: the potential to connect the abstracted craft of the digital model with the haptic intuition of the material artifact.

Some of Carlsson’s hybrid media loops, which she calls “blends” are dependent on a key pedagogical device: the call to draw on the artifacts. This component of the studio was so successful that it almost makes debate about the contemporary role of the drawing seem moot. Perhaps drawing as a lone activity is an endangered species, but its mutant cousin, the “draw on,” is facing a resurgence.

Finally, it’s worth noting that Carlsson avoids the colloquial use of “model,” and instead references “objects” and “artifacts.” Is it because model is too specific of a term—implying fixed scale, for example? The 3-D prints are representations, but require external conditions, treatment, grammar before they can be properly deemed a model.

—Carl Lostritto
“the most important reason for going from one place to another is to see what’s in between”¹

The enterprise of design is permanently in a state of flux, evolving through processes of adjustment and mutation in reaction to the constantly changing social, technological, cultural, and economic conditions. However, at present this conceptual landscape is undergoing profound shifts that stir up radical transformations of the field. It is an exciting, but challenging, time for designers. Above all, the most important and pressing task that designers are presently facing is the redesign design itself in order to keep up with the new and evolving demands, which carry threats of both predictability and capriciousness.

With interest in the mutability of design, in medium and in process, this workshop provides excellent ground to investigate some of these questions. Specifically, this essay will reference the creative responses developed by the students. I will identify and explore a salient feature evident in much of the work, which I term to be “blends.” Furthermore, I will trace the emergence that follows from these hybridizations. My motivation is to celebrate and highlight this course as an example of design education characterized not by design projects, but by the project of re-forming design. Put in more specific terms, the outcomes by the workshop participants are products of a process of undulation between divergent and convergent thinking. This approach to pedagogy transcends stylistic agendas and invites students to participate in tackling some of the hardest questions designers are currently facing, even as those questions are being largely ignored by the majority of educators and practitioners.

Design as a “way of thinking” can be traced in the sciences to Herbert A. Simon’s book The Sciences of the Artificial, from 1969. According to Simon, “Everyone designs who devise courses of action aimed at changing existing situations into preferred ones.”² During the 20th century, Simon was highly influential in a multitude of fields, including among many others, cognitive science, cognitive psychology, computer science, economics and philosophy of science. In this cross disciplinary research environment, Simon developed his definition of design, which has become one of the most widely quoted and recognized. Simon saw design as a process of ‘satisficing’ rather than optimizing, which suggests that a satisfactory design
Create three models that expand upon those produced for exercise one. The total solid volume limitations remain. An added consideration is the creation of a semi-hidden space. This space will be, from some perspectives, apparent, legible, or presented. From other perspectives, it will be obscured, camouflaged, suppressed, or concealed. Also construct three models made from sheet material model corresponding to each of the three digital models.
solution may be one among many satisfactory solutions, as opposed to one singular and hypothetically-optimum solution.

In *The Sciences of the Artificial*, Simon argues that, while the natural sciences, e.g., biology, are familiar to us, most of the world around us is actually man-made, i.e. artificial. These artifacts are contingent to the goals or purposes of their designers and evolve in accordance. If the goals were different, the artifact would also be different, which, according to Simon, is the main difference between a natural and artificial phenomena; the former evolving according to given natural laws. What governs this ever changing process of new goals and subsequently new demands? If we look to technology, we find that developments have long taken place within the assumed domain of optimization, geared towards producing increased efficiency and perfection according to defined measures. These measures have however, become blurred over time. Boundaries between disciplines and constituencies have eroded or disappeared. Optimization requires one path forward, and there isn’t one. Instead, today’s technological reality facilitates a field of bifurcations forming a manifold of possibilities. In this situation, an interesting question for design emerges; if we are capable of doing nearly anything at all, how do we choose to do something in particular? Let’s investigate this implied call to “satisfice” through some of the observation from the workshop.

Drawing on artifacts – Drawing in space

After having been prompted to hybridize spherical and planar geometries, students engaged in digital modeling that resulted in inherently three-dimensional, geometrically complex and often omnidirectional constructs, which were subsequently submitted for 3-D print. After receipt of the printed artifacts, the participants were faced with the task of projecting, capturing and inventing new information about their designs by marking on those artifacts. With respect to the nature of design activity and design cognition as an essential part of human intelligence, Nigel Cross sheds light on the value of objects as he notes,

“A significant branch of designerly ways of knowing, then, is the knowledge that resides in objects. Designers are immersed in this material culture, and draw upon it as the primary source of their thinking. Designers have the ability both to ‘read’ and ‘write’ in this culture: they understand what messages objects communicate, and they can create new objects which embody new messages.”

Adhering to Cross’ approach to the objects of design and Deanna Petherbridge definition of drawing as ‘visual thinking’, let us examine the information captured by some surgical marks made by the students on to the 3-D printed artifacts.

Owens:2:3 is an intricate structure of accessible and inaccessible spaces. Studying her marked-up model, one can easily imagine the choreography of her pen as it traversed the intricacy of the volumes. The information “drawn-out” by Owens on the physical artifacts appear to fall in to one of two categories; instructive or suggestive. Besides notations of instructional text, conventions...
from architectural drawing techniques, such as the use of dashed lines to reveal hidden information and arrows to illustrate vectors of tectonic flows, were drawn. Expanding the taxonomy of the markings, Bilonick:1:1-3, also include hatches and gradient fields of color, suggestive of materiality and the wash of light over curved geometries. When observing the markings, it becomes clear that they speak both of 'things that are' and of the potential of 'things to be'. A new format of design information has emerged, positioned on a sliding scale in between the real and the imaginary. Finding new opportunities in this dimensional threshold was addressed also by Robin Evans, in the chapter titled Seeing through paper, from his publication, Architecture in its Three Geometries (1995). Evans notes:

"Ways of implying depth in two-dimensional pictures are applied to the almost flat surfaces of three-dimensional objects, but then interact with the perception of real depth to give more or less of a flutter between the real and the imaginary."

In a similar way, this work articulates a new hybrid medium for design which invites readings in multiple depths. The descriptions of students’ visual thinking are now simultaneously embodied as object and drawing, which holds potential for significant contribution to the dilemma of design in the wake of post-optimization.

Another approach that emerged during the course of the workshop involved the development of methods for drawing in space. In search of a way to navigate and assess his design outside of the digital 3-D environment, Ricardo Bilonick built a planar model using laser cutting technology. In relation to that exercise, he notes:

"The etched Plexiglas lenses gave me a chance to get inside the model and see how the forms interacted. But it still was a glass cube with a hologram of the model inside. It still didn't give me a chance to hold the exterior of the model and feel how the edges feel in your hand, nor able to really understand the deep interior activity of the three model pieces."

Similarly, finding herself overwhelmed by, "the complexity of the interior and the rigidness the boundaries” of the digital model, A. Owens built a physical model of her 3-D digital, out of planar laser-cut pieces, in order to reveal and research qualities not easily navigated in the digital environment of the computer, (Fig. 5). She notes:

"I did this by dividing the object into 25 separate sections, which I determined was enough to fully express the form, but not so many that the object became too dense to construct. After completing the model, I studied these sections, finding many interesting shapes in the geometry, but only a few that expressed the idea of the whole using only a small grouping of the pieces."

By shifting their work back and forth between digital and physical media, Owens and Bilonick found a productive dialogue for assessing certain phenomena of their designs at certain times. This transient method of problem solving in seems well suited to tackle the 'wicked' nature of design.” The process seems also to highlight the need
for an opportunistic approach, which John Dewey referred to as “flexible purposing.” In flexible purposing, one capitalizes on the emergent features appearing within a field of relationships, and is not rigidly attached to predefined aims when the possibility of better ones emerge. This is not an attempt to make design whimsical, but rather to point to its sophisticated capacity to incorporate a multitude of purposes and intents, arranged in a fluid hierarchy, into one single scheme.

Behavior as geometric manipulations

Returning again to the first exercise of the workshop, the sphere-plane hybrid, A. Owens investigated ways to model the impact objects would inflict on each other through movement. Her aim was to model the event and collision of “a plane forming to a sphere as it pushes its way through.” Owens continues, “Studying this reaction led to the process model where the plane does not just bend and form to the sphere that is violating it, but violently reacts to the interruption.” To achieve the described event, Owens developed a specialized modeling technique inside of a standard 3-D modeling software to simulate physical impact over time. By modeling change over time, Owens managed to add a time dimension to digital design, not inherent to most tools. By incorporating time, Owens could study and manipulate in detail both the digital material of her creation, and also the pseudo-physical impacts of the forces that could be applied at various times. The system provided for reciprocal feedback and reversibility, two aspects of design normally not accessible to designers.

In the studies developed by Ricardo Bilonick, the same design construct was found to behave vastly different depending on which modeling environment he was using. The main discovery by Bilonick, concerned the large differences of tolerance and accuracy, achieved in digital 3-D modeling versus in physical model building. The constraints, as experienced by Bilonick, can be classified as fixed, i.e. those outside of his control, or malleable, those possible for the designer to manipulate. On the parameters guiding his initial investigations, he notes: “I was working with a [given dimension of a] two inch radius sphere, a self-imposed 10 centimeter cube bounding box, and [the prescribed] volume limitation of 6 cubic inches.”

While digitally developing his sphere-plane hybrid, Bilonick investigated the ‘drape tool’, which can be likened to letting a sheet of fabric fall on top of one or a group of objects. He notes: “The drape tool is prepackaged ...[I] don’t know how it works, and there is a chaos-factor that [I] don’t understand yet. Like taking a hammer to the same point on ten identical pieces of ceramic, the results of the 10 strikes will produce ten different sets of shards. I understand that ceramics, glass, metal, or essentially ‘anything’ is from nature, and its natural self is part of the reason for the different results; but Rhino [Software] knows no material, it knows no gravity, it knows no strength or weakness.”

At first Bilonick attempted to adapt his design to the limitation and constraints of the technology at use, such as the minimum material thickness required for 3-D printing, which he experienced as having reductive and
uncreative influence on his work. Ultimately, Bilonick let his experiences become a phase of true discovery and surprise. Rather than using the digital tools to optimize his design construct, Bilonick set out to investigate the boundaries of information exchange and interplay between a designer and his digital and parametric tools. Through this interface, Bilonick managed to construct a productive dialogue which allowed him to slip in and out of his control, which lead to unexpected results in what he deemed appropriate amounts.

It is exciting to view the list of creative responses developed by the students in reaction to the deliberately ambiguous brief. The potential for contribution to the formation of new design pedagogy is immense. In particular, while acknowledging that design, and how we design, is changing, the workshop has provided a series of examples of how design can be used, not to solve problems but to formulate and ask new questions and to challenge assumptions. By allowing new opportunities to emerge from technology enhanced processes, and by inventing possibilities to observe changes of design artifacts and goals over time, creativity can be redefined as process of invention and projection rather than ability in fixed potions. Learning to adapt in ways which positively changes one’s course or changes the environment in which we act seems the biggest opportunity and challenge at hand. Having in detail observed the approaches developed by the students, is seems likely that the radical transformations to the field, hold great potential for equally radical results. Let’s let time show, what these expected ‘unexpected’ results can bring.

Notes
Program

Boston Museum of Cartography

Entrance/Reception/Ticketing (200-300 SF): Space for an information/donation/ticketing desk (staffed by one person) and a threshold to control access, coat room.

Shop (400-600 SF): Selling of map prints, literature, folios (staffed by one person); must have public access. Public “frontage” is considered an advantage.

Permanent collection (1,200-1,400 SF): Includes one historic globe (one of first crafted in America) and a collection of 35 historic and contemporary maps and “cartographic art.” Indirect natural light is required.

Temporary exhibits (500-700 SF): Will house small shows from local educational institutions and artists. Indirect natural light is required.

Curator’s office (250 SF): Office space for head curator and assistant curator

Storage and Staging (500 SF): Must be adjacent to Curator’s office and temporary exhibit space

Bathrooms (400-600 SF): Either part of addition or connection to existing core

Site
Marie Law Adams is a founding partner of Landing Studio and a lecturer at the Northeastern University School of Architecture. Landing Studio designs architecture, industrial infrastructure, and landscapes with a principal focus on developing design tactics for positively integrating active global industries and infrastructures into their local contexts. Adams influenced the course of the studio as a guest critic, but her contribution here is of meant to further the discourse rather than respond to the work directly. Landing Studio recently completed a project that overlaps technically and conceptually with the content of the studio. A narrative of that project’s formation follows. At their cores both share an ethos of geometry.

—Carl Lostritto

Icebreaker House

By Marie Law Adams
The Icebreaker House derives its name from the vessels that carve the lines of the shipping channels through frozen lake waters, drawing a traversable vector across the otherwise undelineated surface. A network of evenly distributed light beacons dot the irregular contour where land meets water, circumscribing all of the lake shores with a geometrically articulated boundary of navigation. The site of this proposal occurs at the convergence of Lakes Michigan and Huron, between two illuminated outcroppings.

The site sits on the edge of the narrowest gap between the upper and lower peninsulas of Michigan. A major infrastructural monument spanning between the peninsulas, the Mackinaw Bridge, is located to the northeast, its presence on the horizon setting a diagonal axis of orientation.

Across the length of the parcel, the sloping ground transitions from grasses to rock, sand to water, and to the thickened horizon of land emerging again, miles away on the opposite side of the lake; initiating a second axis of spatial extension. In contrast, a dense wood of dark evergreen punctuated by occasional birches encloses two edges of the narrow parcel.
The architectural geometry is calibrated through simple formal orientations and volumetric relationships that engage the spaces of the interior with the underlying spatial organization of the site. The house is comprised of two identical rectangular volumes. One is oriented directly north across the variegated shore, and the other is inclined twenty-five degrees northeast, towards the bridge.

The intersection and overlap between the volumes generates a solid utility core at the center of the structure that initiates a spiraling sequence of living spaces around the architectures’ edges. Alignments and views to the landscape are framed between the bounding edges of the internal core, and the enclosure walls.

The intersection of the volumes results in a fractured roof plane, each section independently inclined to shed heavy winter snow. In the interior, the inclined roofs have the effect of shaping each room into a wedge shaped volume that expands and condenses the spaces towards specific views. Additional openings positioned near the apex of the tilted stratum draw in additional light from above the tree line and orient views to the sky and tree canopy.

The spiraling sequence continues up a flight of stairs, carving between bedrooms and looping back through a void to the lower level. The highest space culminates in an expanded view, where one can make out the regional geography of lakes converging. The recognizable form of the landscape creates an awareness of one’s place in geographic context at the northern tip of the state and the heart of the Great Lakes.
Create three models that expand upon the prior six. Volume restrictions remain. However, in a shift from the context of the previous exercises, these models may be considered as scalar representations that correspond to forms in your building design. Consider the form of circulation. How can this form manifest as both threshold and figure?

This prompt is designed to pose a particular implicit challenge. While circulation has loomed as one of the primary challenges required if the results of previous exercises where to be translated into architecture, Exercise 3 prohibits the consideration of circulation as a secondary formal system. The task instead is to adapt or otherwise revisit the previous forms so that they may function as circulation.
The following is an interview conducted by Marek Hnizda of Ricardo Bilonick, a student in this course. Hnizda lives and practices in Washington, DC, where he operates rakusak, which designs and produces functional artifacts. He co-chairs the AIA|DC Design Excellence Committee and participates regularly in academic reviews. Hnizda was able to visit the studio on multiple occasions including one in-person visit early in the semester, before the first formal review. As a result, Hnizda’s welcome input was able to significantly affect the path of the course. He was a staunch advocate of marking on the artifacts, and was certainly responsible for raising the profile of that component of the pedagogy including its eventual prominence in the exercises that followed his first visit.

This interview was conducted in January of 2013, well after the course had been completed and both participants enjoyed the benefit of reflection and distance. It has been edited here only as space limitations require, and for clarity. Thanks are owed to Ricardo Bilonick for his willingness to participate in this endeavor. This interview was not part of the studio, and we relied totally on Bilonick’s eagerness to volunteer his time in furthering the discourse initiated during the semester. I’m thankful that Bilonick was able to speak candidly, professionally and publicly about his experience.

As an instructor, the ability to observe related discourse from the outside is a rare indulgence. I’m inclined to mine this discussion on multiple levels, but will restrain myself from excessively polluting the content of their dialogue. On the broadest level, Hnizda and Bilonick are both clearly interested in a reflection not only on the product of the studio, but Bilonick’s personal state of mind including is reaction to various aspects of the pedagogy.

I can’t help but note, because of my perspective as a teacher, some of the terminology used by Bilonick. First, I’m fascinated by the apparent conflation between “knowledge” with the verbalization of intention or the articulation of that knowledge. From my only cursory understanding of contemporary linguistic and cognitive theory, I can assume, for the sake of this discussion, that such a relationship is certainly valid. I have no criticism of that condition, but it is nonetheless one of many potential openings into an interrogation of a studio culture (especially important at our school, which does not sustain a studio environment in the conventional sense) that relies heavily on presentation and discussion rather than faculty-engaged work sessions. As a result, it may be too easy for us to undermine the intuitive or artistic knowledge that comes out of simply an attention to one’s own intuitive making. I’m fascinated and skeptical, for example, that it’s ever possible to “stop thinking.” It may be possible (and productive), however, to stop thinking verbally and instead think kinetically. But then of course we have a rather absurd problem. After a week apart, the faculty asks the student to, “tell me about your non-verbal thinking…”

At a time when many serious computational thinkers are claiming a shift from representation to simulation—as though representation was merely communication and its inherent imperfections some kind of conceit—I’m pleased that this topic is present in this interview. Bilonick does talk of “showing” and “conveying,” and at least implies the pre-existing presence of an idea before representation.

Slightly surprising, but telling and also quite astute, is Bilonick’s description of some digital modeling as “loose.” It’s not always obvious from the “outside” looking into digital media that rigor in craft can be so easily abandoned yet still produce a plethora of enticing products. Bilonick’s awareness of this was the first step in working toward rigorous an increasingly abstract craft.

Finally, I’ll point out Bilonick’s reference to speed, and the slowness of drawing on the models compared to the fast—and I presume, procedurally fixed—technique that characterized some of his digital modeling. This relates to an implicit commentary regarding authorship and Bilonick’s individual role in the work of this studio. Bilonick’s ability to frame his own engagement from a third person perspective is a testament to his confidence as a student and aptitude for self-criticism. Although Bilonick is an exceptional example, regular inquiry on the part of students with respect to one’s own role in academia is something that is commonplace the BAC. It is not possible here to get “lost” in one’s own world.

—Carl Lostritto
Reflecting on the Studio Experience

Marek Hnizda: Thinking about the project and your process in particular, what do you see as the most significant process-driving component: site, program, pedagogical statement, other?

Ricardo Bilonick: This was the least vocational studio I’ve taken, as we focused less on problem solving and more on form as the motive force. In addition, time constraints—especially given the need to produce versions of models via an off-site 3-D printing service—ended up being a significant factor, I’m accustomed to a much slower pace. However, after revisiting this project after the course completion, I can see in my work, even despite aesthetic flaws, it was always executed with reason.

H: Can you elaborate a bit more about what you mean by “with reason”? What reasoning tactics did you use? Were they provided?

B: Architecture can be thought of as simple problem solving, and that is how my previous studios have been driven—we need to incorporate certain building elements while we design. When I say “with reason” I mean that I constructed a series of tasks to be solved. I think that in past projects I found that as long as I answered the questions and the problem was solved, the program was satisfied and a building would come together. This studio was different; it was form driven at first. And given the pace of the course, the building came rather late in the process. Of course, by this point in my education, some concerns are automatic—the tendency to contextualize form with respect to sun, wind, and climate—but dealing with forms in isolation, and then again with concerns of aesthetics in isolation, it was a unique experience to me. I don’t want to downplay it; it was fun actually, and maybe our school is lacking in the artistic side of architecture.

H: In your writing done throughout the studio, you note: “the site can metaphorically be seen as a valve.” In what other aspects did this metaphor drive the decision making of your process?

B: The building as a valve stemmed from the study of the site and how the neighborhood used the site and the stairs. The existing and substantially undersized urban stair was heavily trafficked but never thought of as a destination. It only served to get people up and down, quickly. The museum could act as a civic appendage to slow the urban users down. The wide stair promoted interaction with fellow users and provided a destination.
H: In retrospect, what was one moment, over the course of the studio or your project, when something significant happened, a breakthrough, a shift or a unique method of problem solving?

B: Slowing people down was an initial goal. A unique breakthrough emerged out of geometry studies, between generation one and two. I had given myself a set of instructions for building geometries. I should have known that a rigid set of instructions would yield a predictable model. However, in the second generation I was looser in my instruction set, and the result was much more elegant. The initial resultant model was a study of the projection of a sphere onto a plane. I extruded that form, and then removed components. When everything lined up on center, a die-like form emerged. For the second generation I used the same rules but shifted elements off center, this created wonderful woven looking sheets. The breakthrough was that I didn’t need to be so rigid with my rules. I was so concerned that if I didn’t have a reason for how something was made that it was not valid, but it turned out that the loosely instructed models were the most elegant and valuable.

H: During physical modeling, which basic function deemed most useful, which was most difficult? Was this similar to the manipulation that took place using digital modeling?

B: There is a speed associated with digital modeling... digital ‘anything’ for that matter. With speed comes carelessness. I often see rendered Revit models, for example, without thought about what exactly they are trying to say or show. They press render and come back later. By actually drawing the model, assembling a collage, a view of the model, or physically building the model, it slows the process down significantly. You may intentionally highlight some components, and subconsciously minimize others.

I had made a physical model that I could have done several ways, but I wanted to highlight the intersections of the cone elements rather than its elegant exterior surfaces. I had to remind myself what it was I was trying to show.

There is also a reality of building physical models that may not occur with modeling digitally. I constructed the conical shapes as ribs using contour lines. I hadn’t considered how I might go about separating the ribs from each other. I essentially had a handful of loose rings. I had to introduce a spine to hold it all together.

H: How did the variety of model modes complement each other? Where you able to oscillate between different modes?

B: Architecture is art, but also reality: this is what it looks like... and this is how it can be built. The value of using Rhinoceros Software as a digital tool was only brought to reality with the physical modeling. Eventually, these things we joyously created digitally need to be built physically. The intermediate step between computer and physical modeling was the 3-D printing. Tumbling the digital model is great for understanding the model, but it’s still a 2-D image. The 3-D printing represents reality: allowing you to hold, look through, cut, or break the model to find weak points. The physically constructed modeling took uniform talc and glue shapes and combined them into both structure and form.

One anecdote from the conversation between digital and physical modeling was the discovery of gravity. I made a conical digital model and it “floated” without neither up nor down. After physically building the same model by hand and once the glue set, I put it on the table and it toppled over. It was the first time I had realized the center of gravity of the model may not be automatically in my favor. Ironically, the 3-D printed version of the same model did stand upright. The density of material and uniformity throughout the model, anchored it to the desk.

H: When did you stop asking questions about the resolution of your process?

B: I am embarrassed to admit that I often don’t know what I am doing when I am doing it. There is a gestation period that must occur for me to understand my actions. But, there was a transition when it came time to think about actual inhabitable space and the unique conditions of the site, I took a moment to learn from the site and program in particular and draw out tools to steer the design of the museum.

H: Could this process have another resolution? Can your architectural manifestation be reconstructed elsewhere successfully? How much of this design is site or program specific?

B: I could see my process leading to an infinite set solutions; it was not deterministic. Even if I repeated the process with the same set of parameters we were asked to use, I would have found a new solution. However, I do not think I could use my building design in the same way anywhere else. This site was so crucial. I can imagine the next version of my process would be developed further using the site as data points, not as interpreted conditions. At that point I could plug in different site data and create a new building. But that would be like pressing ctrl+P and hoping the formula works.

Our site was too unique to replicate the design elsewhere. With the streets crossing at different levels the design was geared toward a vertical passageway. That typology type is not new, but the temporal nature of the site lends itself to need a public stair that functions differently at different times of day.
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