Digital Media Effects on Design Pedagogy: Why Less is More

by **Murali Paranandi**
Miami University
Oxford, Ohio

Professor Turkle (2004), of the Social Studies of Science and Technology at the Massachusetts Institute of Technology, writes that contemporary information technology encourages different habits of mind. Computation is embedded everywhere in our lives, enabling anyone to use the most sophisticated technological tools and to experiment in complex and creative ways. According to her, studying and understanding the subjective consequences of this condition will be a particularly important challenge we face in the coming ten years.

With increased access to easy to use tools such as Photoshop for imaging, Sketchup, bonzai3d, and form•Z for 3D modeling, Rhino Grass Hopper for scripting and parametric modeling, Revit for Building Information Modeling, Ecotect for energy simulation, 3D printers, laser cutters, and CNC routers for fabrication etc., the current crop of architecture students is immersed in digital technology more than ever. Potential creative possibilities, seductive digital imagery, and ready to use content, easily available online, lower computing costs, direct marketing by software vendors, and urge to gain marketable skills further fuel this situation.

Google and YouTube have transformed the learning opportunities for engaging these technologies. Parametric methodologies and simulation based design, through the use of Building Information Modeling are becoming popular and appealing for their potential to produce extremely complex buildings in a cost-effective, collaborative, expeditious, and environmentally responsible manner. Relevance, appropriateness, benefits, and the impact of such approaches for academia has been explored and debated in several recent conferences and scholarly publications. It is not my intention to disregard these revolutionary approaches, but to remind us what we should not be losing in the process.

The recent rise in the popularity of digital fabrication methods adapted from manufacturing industry promotes a collapse of the gap between construction conception. These methods open up “integrated approaches” exploiting the potential for the same digital model to be used for imagining a building and for optimizing its performance and its pre and post construction lifecycle. A prominent avant-garde New York architect, a practitioner of this approach, in a recent lecture at our university, likened this approach to that of building with Lego blocks from the 3D model used for design rather than from blue prints. Recognizing this paradigm, the building industry is providing ready to use libraries of building components online. In the spirit of open source, many users are sharing their work online for others to use freely. Software vendors are designing tools, scripts, and content to smoothly integrate building components into modeling processes. It is now very easy to bring in too many details too early into the design process with just a few clicks. More over, this can be changed parametrically to study virtually infinite variations. All of this surely sounds very exciting, but it also presents new challenges and unexpected consequences for learning and design outcomes for a design student.

Social scientist Home-Dixon (2000) establishes the notion that a more complex or sophisticated solution may not be inherently a better solution. In his “ingenuity theory”, he observes that we might sometimes supply large quantities of high-quality ingenuity to address the problems around us without solving those problems. Dixon reminds us that sometimes the most effective solution might involve less and lower-quality ingenuity. So, these sophisticated tools then trap the students into creating complexity for its own sake, without regard to the problems they are intended to address.

Turkle (2009) examined use of virtual models as tools for investigation over the past twenty years in the fields of design and natural sciences, and concluded that there are gains as well as losses. She found that particularly some young designers and architects tended to use default options and confused virtual versions with real ones. Similarly, Seely’s (2004) study of digital fabrication in the architectural design process found the user-friendliness of milling machines could lead unaware students to believe that real manufacturing has the same quality. When this happens, use of the virtual causes the corrosion of original thought and stifles creativity. Virginia Tech Architecture Professor Poole (2005) explores this effect on architecture students use of digital media in studios. He attributes this to students' lack of ability to distinguish between quickness and haste. Although the students were able to rapidly produce complex forms using digital means, he observes the outcome to be hollow and lacking in essential aspects of art, architecture, and design. He blames this on pre-established limits of the software designers' imagination. In a recent conversation, I asked Professor Ubbelhode of the University of California, Berkeley, a leading expert of digital simulation tools for daylighting design, if she incorporates a simulation-based design approach in her undergraduate architecture design studios. Interestingly enough, she is reluctant to do so, because according to her Radiance used natively in Lilnex or Unix (nor Desktop or through Ecotect) is the only daylighting software they trust to be accurate, but the learning curve is quite steep and it takes three years to be able to use the software effectively and accurately. The short cuts through Ecotect have proven problematic. The question before us is not whether computers can be useful design tools, but how to make them useful in the design process. As computer technologies continue to emerge and mature, rather than looking at computers as solutions to all problems, we need to consider what they can solve and what they cannot. Remember that whether digital or analog, all models are wrong; the practical question is how wrong do they have to be to not be useful (Box, 1987).

Let's examine the student perception that parametric modeling improves creativity because it provides unlimited choices. Students can either create scripts graphically or download and run scripts (without having to understand how they are made) and create parametric models that are infinitely flexible. In his book "The Paradox of Choice - Why More Is Less", psychologist Schwartz (2004) of Swarthmore College, provides ample evidence that when we have too many choices, too many decisions, we are left with too little time to do what is really important. In the long run, he contends, this can lead to decision-making paralysis. According to Dixon, when the intrinsic difficulty of problems around us exceeds our cognitive ability, it produces an ingenuity gap. According to Miller's (1956) chunk theory, the human mind uses "processing 5-9 chunks (meaningful patterns)" as a tool in decision making. The problem with current Building Information Modeling systems is that they bring too much detail too early into the design process. Also, these systems are structured to facilitate "machine readability" over "cognitive readability" of design information. Their representation is structured to align with the building elements (walls, windows, doors, roofs etc.), rather than design semantics (parti, space, connectedness, enclosure etc.). In addition, the parametric nature of their representation imposes certain rules and inherent assumptions to make them "intelligent" to disallow "meaningless moves" to maintain the "integrity" of the model. This is an attempt at "fail-proofing," or "error-proofing" the design process. The problem with this approach is that it does not recognize that much of creative thinking is associative: no matter how incongruent things may seem, seeing them simultaneously, allows the mind to process and to discover connections, which is very important in generating new ideas. Failures and mistakes in this process are great learning vehicles. Fail-proofing the digital design process reinforces the standardized ways we do things.

In a recent Time magazine article Gibbs (2009) comments that newer tech-enabled toys are "overdesigned, overengineered, the product of so much imagination on the part of the toymaker that they require none from the child." Some of the newer lines of Legos, instead of challenging the kids' imagination to explore and to build something anew with simpler blocks, provide them with an inordinate number of custom pieces along with lengthy instructions for assembling a specific thing that is guaranteed to look "cool". Most of the time, these end products are so delicate that they come apart short of using Superglue – consequently, they end up becoming display trophies on a child's shelf, much like a 3D puzzle. Compared to the traditional simple Lego blocks, this limits the possibilities of reassembly, effectively discouraging iterative exploration. This is applicable to digital design media as well.

Increased choice of tools also causes an important shift in the role of a professor as an expert mentor in a studio learning environment. Feldon (2010) of the University of Virginia rightly reminds us to ask what it means to be an expert in digital media, which can change so quickly that before one has had a chance to boot up the latest software or electronic gadget, a newer version already exists. As recently as a decade ago, the professors were the experts in digital media and the students were novices. Now, in the post Google and YouTube era, the condition is reversed. It no longer makes sense to expect students to use any particular software. Therefore, it is not possible or necessary to teach students in class how to use software. This may be a blessing in a way, as it frees up more class time to focus on discussing the quality and effectiveness of design solutions. Low cost solutions are more effective in early stages of design, especially for young design students, as they provide greater explanatory return for a given amount of cognitive effort invested (Dixon, 2000). Curricula should constantly evolve in response to emerging technologies, but we need to keep constant focus on design thinking and on teaching students how to frame the right questions and how to read media outcomes (Turkle, 2004). It is just as important to teach them when not to rely on them as it is to teach them when to use digital media. This philosophy has guided the pedagogical innovation, incorporation of emerging technologies, and the evolution of our design curricula over the past decade at Miami University, resulting in the continuing success of our students at international, national, and regional design competitions.

The accompanying examples illustrate how Alex Fritz, a third year architecture student, dispersed a rich set of design information across media that included Pencil, Sketch book, Photoshop, Illustrator, SketchUp, and form•Z. A simple abstract 3D model was used to map and manage the connections and synergies and to put together a coherent presentation for a design solution. The choices were guided by the cost-effectiveness of the medium to expand on a specific issue that needed focused investigation. For example, in the Cultural Center project, Alex used SketchUp to model the site, as it was quite simple to import site geometry and context information from Google Earth. This transmedia approach also allowed the project to break the limitations imposed by individual software tools. For example, SketchUp did not allow for capturing the daylight qualities, so they were developed in form•Z RenderZone. This free workflow from one media to another allowed for a better focus on the problem, and resulted in a sophisticated solution that won a merit award in the Lyceum Competition (2010).

References:

1.Turkle, S. (2004). "How Computers Change the Way We Think". Jan 30 2004. Volume 50, Issue 21, p. B26.

2. Homer-Dixon, T. (2000). "INGENUITY THEORY: The Value Added of the Ingenuity Gap Concept". Ingenuity Gap. New York: Knopf.

3. Retrieved 30 June 2010: <http://www.homerdixon.com/ingenuitygap/theory.html>.

4. Turkle, S. (2009). Simulation and Its Discontents. Cambridge, Mass.: MIT Press.

5. Seely, Jennifer C. K. Digital fabrication in the architectural design process Thesis (S.M.)--Massachusetts Institute of Technology, Dept. of Architecture, 2004. p. 52. Retrieved 22 July 2010. http://dspace.mit.edu/handle/1721.1/27030.

6. Poole, S. (2007)."Pumping Up: Digital Steroids and the Design Studio". Material matters: architecture and material practice/edited by Katie Lloyd Thomas. Routledge, 2007.

7. Box, George E. P.; Norman R. Draper (1987). Empirical Model-Building and Response Surfaces. Wiley. p. 424.

8. Schwartz, B. (2004). The paradox of choice: Why more is less. New York: Ecco.

9. Miller, G. (1956). "The magical number seven, plus or minus two: Some limits on our capacity for processing information". Psychological Review, 63, pp. 81-97.

10. Gibbs, Nancy. "Forget Zhu Zhu Hamsters, Classic Toys Have Power." Time. 21 December 2009. Retrieved 28 June 2010. < http://www.time.com/time/magazine/article/0,9171,1946960,00.html#ixzz0b62oM5Vy >.

11. Feldon, D. (2010, July 20). "U.Va. professor tries to measure student achievement in science and technology fields". newsleader.com. Retrieved July 28, 2010, from http://www.newsleader.com/apps/pbcs.dll/article?AID=/201007200622/NEWS01/100720003.

12. Lyceum 2010 Competition. Retrieved 20 July 2010: http://www.lyceum-fellowship.org/currentB.html.

Murali Paranandi is an associate professor at the Department of Architecture and Interior Design at Miami University in Oxford, Ohio. He holds a B. Arch. from Jawaharlal Technological University, M. Arch. from Kent State University, and M. Arch and postgraduate certificate in CAAD from the Ohio State University. His research and teaching explore engaging digital media to enhance architectural design process. He edited "Digital Pedagogies" the first volume of joint studies journal published by AutoDesSys, Inc. Professor Paranandi's students from Miami University have won numerous awards for design excellence at regional, national, and international levels. His research work received over $300K funding support from National Science Foundation, Ohio Board of regents, Miami University, and others. He can be reached at paranam@muohio.edu.

Hydroscraper

A Catalytic Revitalization of Seoul's Urban Water Front

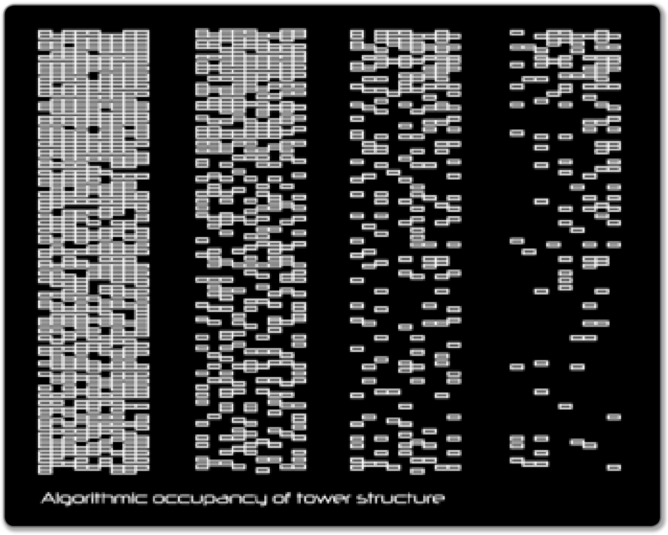
by Alex Fritz
Undergraduate
Advisor: Murali Paranandi
Department of Architecture and Interior Architecture
Miami University
Oxford, Ohio

Modeled and rendered in form•Z RenderZone.
Images composed in Adobe, Illustrator, and Photoshop.

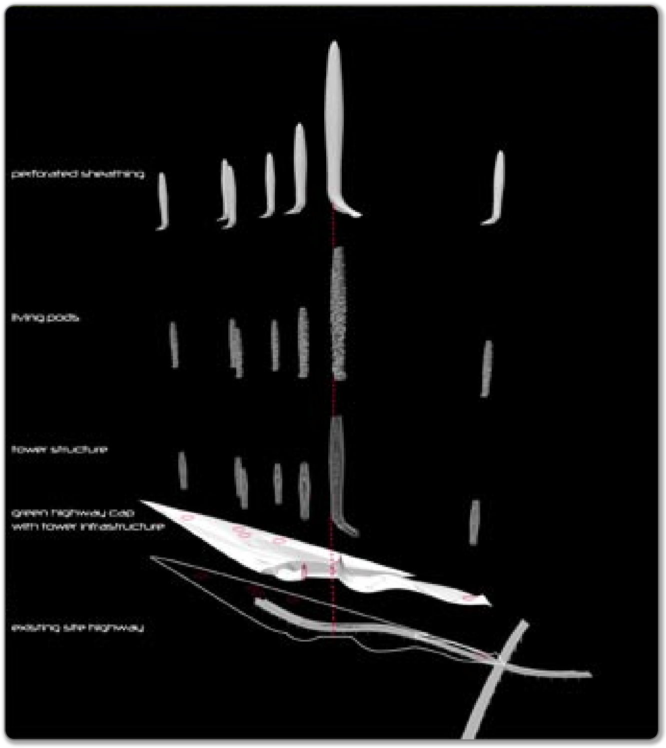
Built along the banks of the Han River, Seoul is the 8th most inhabited city in the world, with a population of over 10 million. Serving as the economic, cultural, and political center of South Korea, nearly a quarter of the nation's entire population resides in Seoul. Nearly half of South Koreans live in the conurbanation of Seoul, known as the Seoul National Capital Area, which includes the nearby port city Incheon and Gyeonggido, Seoul is quickly expanding and is now home to nearly 255,000 immigrants.

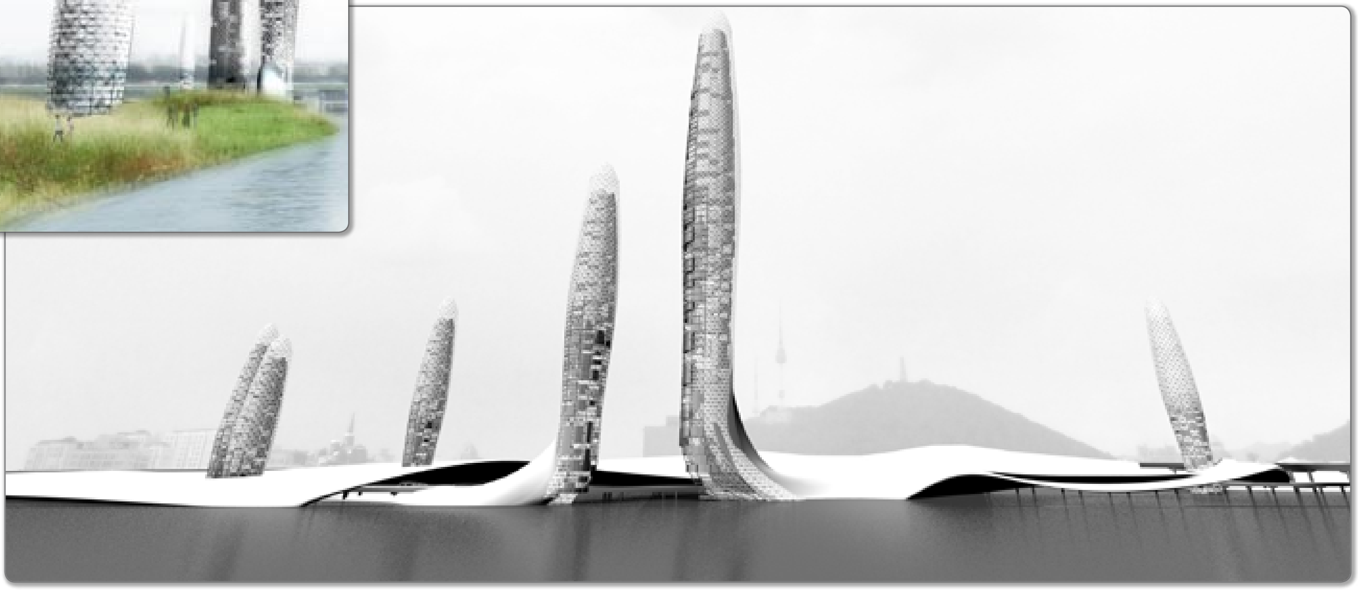
Post Korean War Seoul found itself a city of devastation and economic collapse. The city rebuilt its economy around its tradition of labor-intensive industrial exports, based around the shipbuilding industry. Industrial export remained a backbone of the economy until the late 1980s and early 1990s when South Korea began to focus on technological and electronic manufacturing. Seoul experienced a corresponding boom in construction and the building industry, rapidly expanding and modernizing. Aesthetics and architectural vigor tool a back seat to cost and production at a time when survival and physical hardship were utmost priorities. Memories of old Seoul, pre-Korean War Seoul, were quickly stamped out and replaced with monotonous residential zones and uniform high rises, all now named after such technology tycoons a Hyundai.

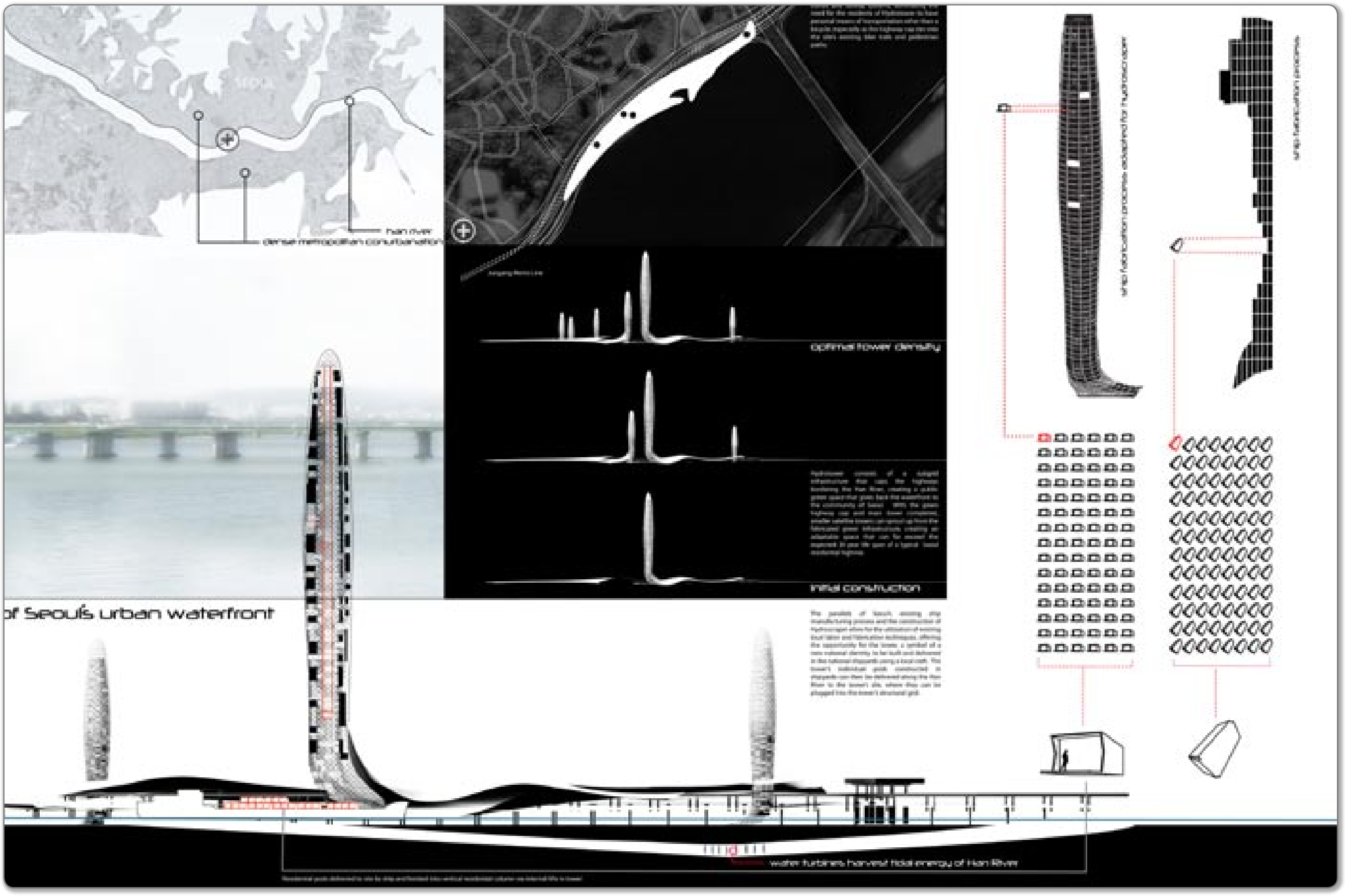
The riverfront has been lost in favor of constructing mass transit super highways, and once intimate bike paths have been replaced with a system of concrete causeways and tunnels. Seoul is a city of hyperdensity with 30 percent of total building floor area in Seoul in 2000 occupied by high rise residential apartments. Between 1960 and 1980, it was calculated that on average a 20 story apartment had to be built every day to keep up with growing necessity for housing. Every 30 years it is accepted that apartment buildings will have to be razed and to be replaced by a larger, more accommodating construction.



In order to eliminate building waste and construct only what is to be occupied, Hyrdotower proposes a building system that will only plug units into the tower's grid on an as needed basis. The towers are not intended to ever be fully occupied, but rather to have pods constantly reorganizing and rearranging within the structural grid of the tower. Spaces not occupied by pods can be filled by vertical gardens for the existing community and allow for greater air circulation and light filtration throughout the construct.



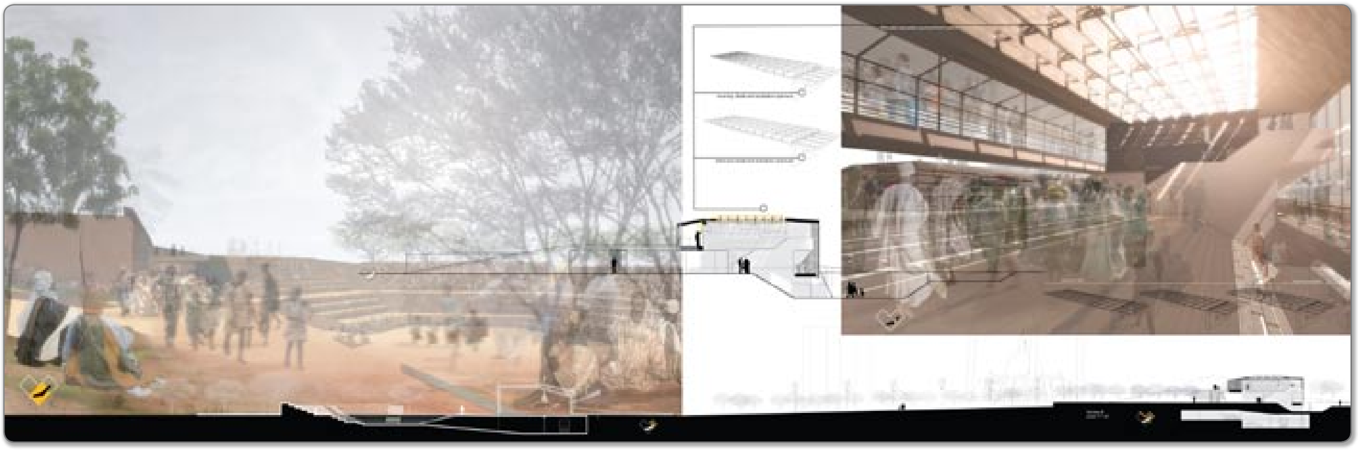



han river
dense metropolitan conurbation
optimal tower density
initial construction
of Seoul's urban waterfront
ship fabrication process adapted for hydroscraper
ship fabrication process
water turbines harvest tidal energy of Han River

Abuja National Cultural Center

by **Alex Fritz**
Undergraduate
Advisor: Murali Paranandi
Department of Architecture
and Interior Architecture
Miami University
Oxford, Ohio

Modeled in Sketchup and form•Z, rendered in form•Z RenderZone, Images and presentation composed in Photoshop and Illustrator.



African vernacular architecture is an inherently sustainable construction assembled by local craftsmen using locally available, low embodied-energy materials. This project generates a similar ideology, utilizing site-specific and low maintenance sustainable vernacular materials that simultaneously involve feelings of a universal familiarity, appealing to both a deeply rooted, diverse local population as well as a global influx of assorted nationalities.

The project consists of a unifying transverse wood screening, a series of rammed earth enclosures beneath the screen and communal circulation paths and bridges that penetrate and interweave the two entities. The wood screen shelters the building's inhabitants from harsh climatic properties while still granting views of the surrounding landscape and allowing for passive natural ventilation. The monumental rammed earth enclosed spaces provide thermal mass to buffer the occupants from the salient temperature fluctuations of Abuja are aligned to funnel the site's circulation towards an axis that offers views directly to Abuja's Aso Rock. Site lines of Aso Rock also spill into the amphitheater grounding the performance spaces of the cultural center in its rich context.

So as not to encroach on the present use of the site by locals, the Friday Market is encouraged to overflow onto the cultural center's grounds through its open landscape and shaded groves of trees. The Friday Market weaves a rich cultural fabric into the site and through its integrated presence, the Cultural Center will attract much of the market's life through its extensions of shaded circulation and its curious, semi-transparent presence.