

# MCA Student Design Competition: How Computing Helped Competing and Vice Versa

by Murali Parannadi

Project by Mark Cerney and Taryn Nye

The Department of Architecture and Interior Design at Miami University, offers an elective design studio that focuses on engaging computers into the design process at the upper level undergraduate program, which I have taught for over ten years. Here, I present a recent project by Mark Cerney and Taryn Nye (referred to as the student team here on), to illustrate the pedagogy and process involved in teaching such a studio.

During fall 2005, for a period of 6 weeks, my studio took part in the Metal Construction Association student design competition<sup>1</sup>. The competition challenged the students to use metal as the primary structural material to design an outdoor band/performance pavilion located in Washington Park, in a historic Chicago neighborhood. Stated criteria for judging included successful and creative use of metal in addressing structural, functional, environmental, and cultural needs.

The first two weeks involved literature research, site/program analysis, and sketch design culminating in a field trip to Chicago for a site visit and case studies in the use of metal. Inspired by Anish Kapoor's Cloud Gate at the Millennium Park, the student team wanted to pursue a concept that provides a kinetic experience of the park's landscape to the people. To achieve this, they came up with an idea to construct a light trap<sup>2</sup> to provide a show of color, light and shadow even when there is no event scheduled at the venue. They also wanted to submerge the pavilion into the land to shield the noise from the street level, and to make minimal visual intervention on the existing landscape of the park.

Taryn started in a very rational manner with the computer. Since the site plan provided by the competition organizers was out of date, she developed an image of site plan in Photoshop from their own research from site visit, and from google map search. She then used this as an underlay in **form•Z**, to trace the existing pathways and locate the existing trees using symbol libraries. To get a sense of scale, she started by drawing the individual programmatic spaces as boxes to represent appropriate square footage. To get a better volumetric sense, she extruded these boxes. She placed 3D scale figures on a separate layer from "people for people"<sup>3</sup> symbol library. She also setup a sequence of perspective views at the eye level, defining the keys for walkthrough animation. From this point on, these proved crucial throughout the design process, in evaluating the processional experiences of arrival, being at the event, and departure (figures 2(a), 4, and 5).

Mark, by contrast, started with an idiosyncratic study of canopy forms by nesting metal meshes and wires and placing them on a light table to observe the light and shadow patterns (figure 1). When they brought their individual explorations together, two important decisions were made to focus on their concept of creating a lighting phenomenon. First, they wanted the structure of canopies to be more like the tree forms and become lighter and transparent. Second, they decided to use the aforementioned boxy program spaces Taryn extruded in **form•Z** as they are, because their minimalist form enables them to act as blank canvases to capture the images of light filtered by the canopies.

The subsequent two weeks of the study involved building another physical model where they represented these metal trees by folding thin wire mesh into funnel like forms (figure 2(b)). This proved useful to

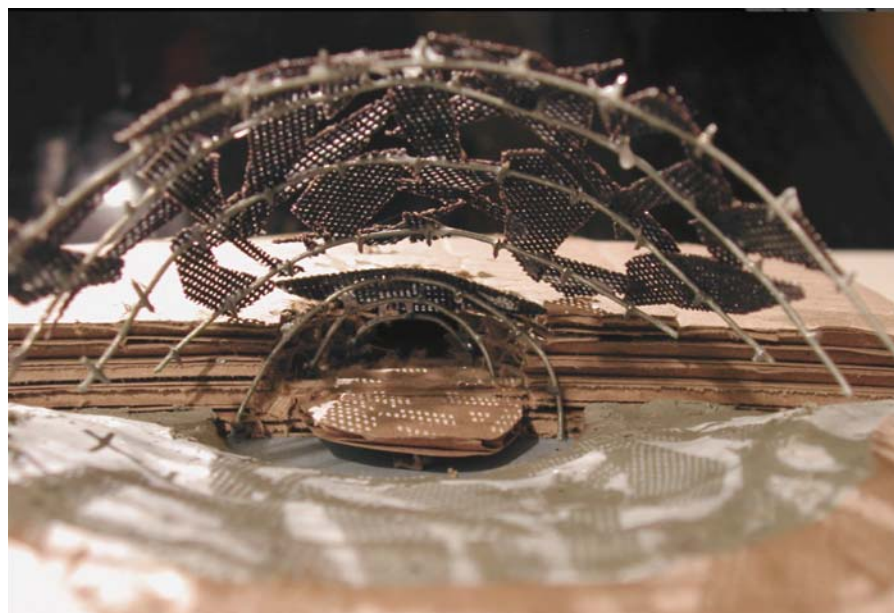


Figure 1: Early study model built with cardboard and metal wires/meshes.

see how light and transparent the metal trees can be, and the phenomenological beauty of patterns created by light filtering through. But it was not easy to control the forms of these funnels, keep them erect, and connect to one another. Also, based on their experiences with the earlier study model, they did not pursue manipulating the landform, as they considered doing so with cardboard medium to be ineffective.

So, concurrent to this, they built a digital model (figure 2(a)). They considered the Landform tool,<sup>4</sup> nurbz, and patches<sup>5</sup>, and were advised not to use any of them. Since the site was practically flat, they represented the land as a plain mesh and used the deformation tool (move mesh with profiles and path) to sculpt the landform. They constructed the seating, stage, and other program elements as simple extruded solids on separate layers and overlapped it with the landform. The metal trees were constructed using the Skin tool by sweeping a circular cross section along multiple paths. They were able to scale and move these tree forms around the site freely.

At the end of the fourth week pinup, when they presented **form•Z** rendered images along with a physical model, the critics acknowledged the strength of the concept but were not entirely convinced with the tectonics of these monolithic metal tree structures depicted in the presentation, and encouraged a more rigorous study.

With two weeks remaining for the competition deadline, the students decided to take this advice seriously and focused solely on developing the metal trees using **form•Z**.

The important aspects for modeling the tree were not only to make them to have organic forms that are unique, but to study their structural support, articulation, and fenestration/shadow formation. Upon experimentation with various ways to model the tree (figure 2(c)), they decided to represent it as a ruled surface (figure 3), as it corresponded best with their understanding of the process of fabricating it with metal.

This time, they drew the profile in section representing the structural rib. The location of the points on this profile

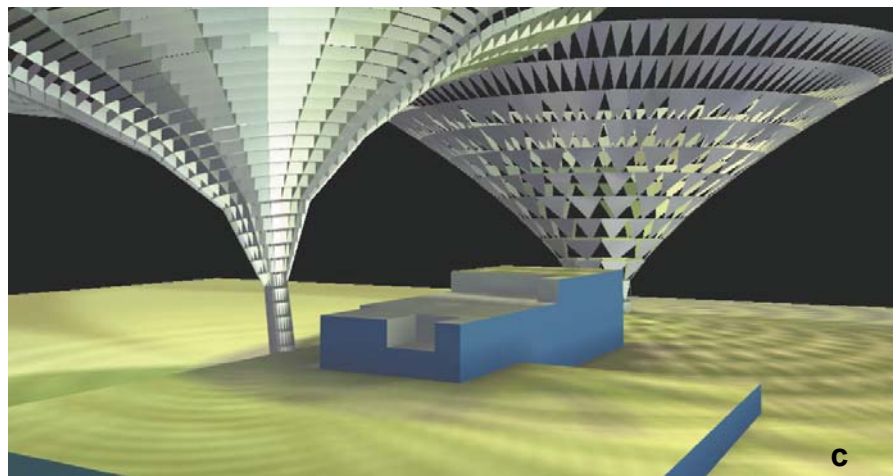


Figure 2: (a) First attempt to model the metal canopies in **form•Z**. (b) Early physical model. (c) **form•Z** model studies to identify the appropriate technique for modeling metal canopies.

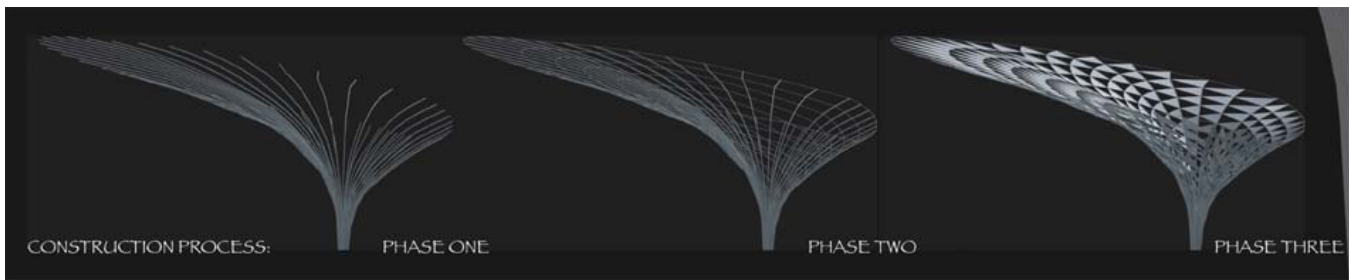


Figure 3: Construction of the metal canopies as a ruled surface.

represent where the welds would go for the lateral ties, and the metal panels. A copy of this profile was rotated in plan. Subsequently, its points were carefully moved in plan and section, guided by Fibonacci sequence<sup>6</sup>, to adjust the shape and configuration. A mesh was constructed through these profiles as a triangulated ruled surface using the C-mesh tool. Alternative faces were deleted topologically to make holes to let the light through. At this point, the Derive 2D Surface tool was used two ways on this mesh surface. The “2D Surface From Stitch” option generated paths (for axial sweep with a circle) to make the structural lateral ties, by clicking on lateral segments sequentially. “2D Surface From Selected Entities” generated independent triangular objects from all the faces, to make the aluminum panels that are to be welded to the ribs.

They used eye-level walk through animations to fine-tune the configuration of program elements, placement and the scale of metal trees, and the contour of the landform. But unfortunately, the competition format did not allow for submitting these animations. Interested reader is directed to view these animations on the accompanying DVD.

They used Photoshop to compose their three presentation boards (also available on the accompanying DVD) using images from their **form•Z** model and the physical model and shipped it off at the beginning of seventh week of the project. They were thrilled to hear the results. They garnered the top honor - the First Prize!

More on the competition jury process can be found in Marge O'Connor's “A Walk in the Park”, in the January 2006 issue of MetalMag, also available online at <http://www.metalmag.com/docs/06 link pages/06 JANUARY STORIES/ JANUARY ARCHANGLE.pdf>.

## Epilog

Despite being introduced to an array of 2D and 3D computer graphics programs in skills based graphics media courses prior to entering this studio, the students' depth of usage of computers for design is limited. Studies show that despite experience, many computer users possess minimal command knowledge<sup>7</sup>, and do not progress to an efficient use of complex computer applications<sup>8</sup>.

Most daunting thing for a design student is to represent the idea into a computable form. Computer interface is primarily command based. Getting the idea into a computable form requires translating the design intentions into specific commands. It is very helpful to have a well-articulated and succinct high concept to guide the process of negotiating the command universe. Competitions generally have clearly defined program, project/site constraints, and most important – criteria with which to evaluate the design outcome. As

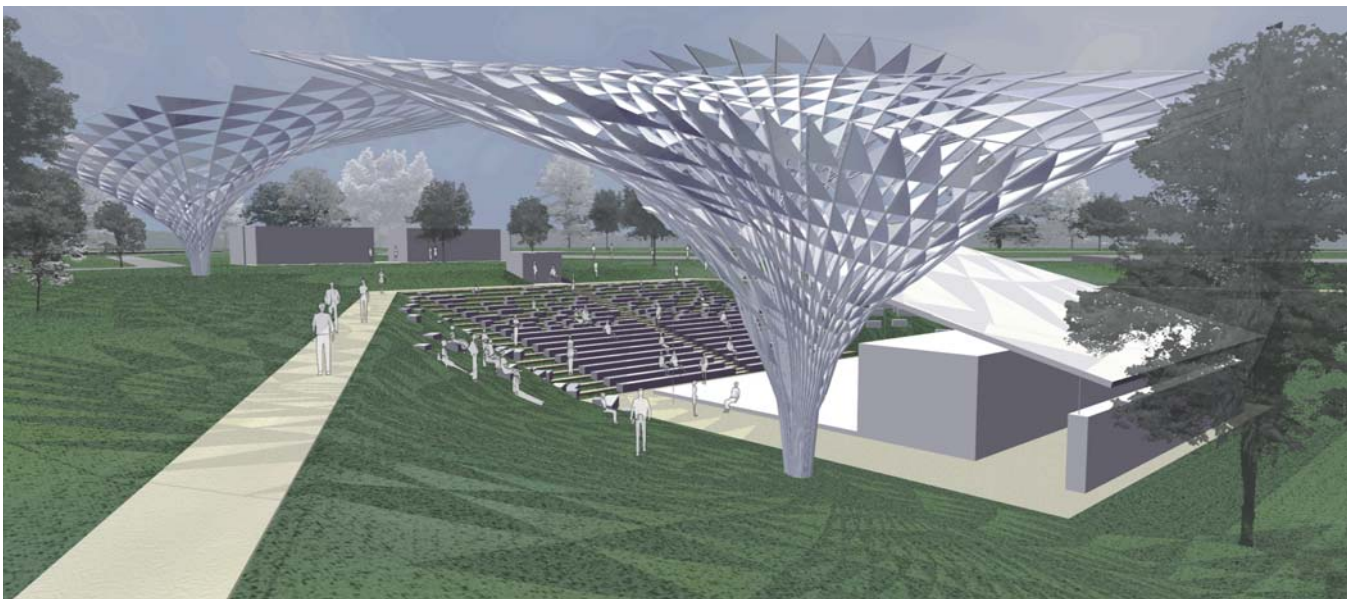


Figure 4: An eye level view from one of the pathways of the park.

suggested by Alvin Toffler, thinking about “big things” while doing “small things”, can make the “small things” go in the right direction.

One of the first readings<sup>9</sup> in the studio studies the role competitions played on the success of SHoP architects. This motivates students to develop a focus by carefully distilling their conceptual intent into a few important things that really matter. Once these ingredients have been identified, it is generally possible to have an open discussion in the studio about how computers may or may not help investigate these. At these discussions, as well as during desk critics, students need direction in matching their design semantics to specific features that exist in the specific software programs we have at hand. More importantly, in a parametric manner that allows further study and iterative exploration and experimentation of the ideas in 3D. After all, the competitions encourage experimentation and taking risks.

Requiring the students in studio courses to present their mode of inquiry as part of their reviews, along with the design content, the process of engaging the computer becomes the subject of discussion during the critiques. These discussions become very important in helping the students find the functionality in the computer to execute a strategy. As it turns out, each student’s investigation ends up being focused on one or two specific features of the program. It is extremely important to create an open environment where these processes are exposed, discussed, and critiqued so that everyone involved learns.

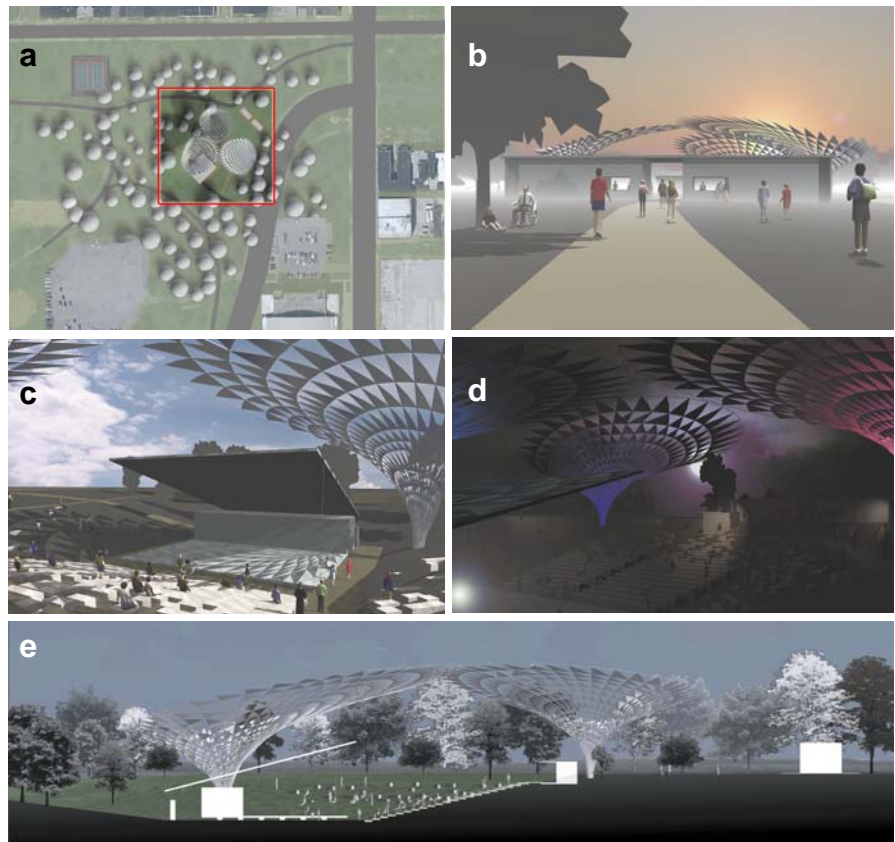


Figure 5: (a) Site plan showing path ways and context. (b) Entry point with ticketing/concessions. (c and d) Lighting effects during day and night. (e) Longitudinal section showing landform manipulation.

## Notes

- [1] Competition brief and the winning entries can be viewed at <http://www.metalconstruction.org/>. Accessed: February 19, 2007.
- [2] Inspired by Ball and Noguees' Maximilian's Schell installation. <http://www.emanate.org/schell.htm/>. Accessed: February 19, 2007.
- [3] Purchased for academic use from <http://www.peopleforpeople.com/>. Accessed: February 19, 2007.
- [4] These tools are designed to extrude 3D landforms as stepped, or triangulated, or mesh forms from a set of valid contour lines and site outline. This method requires one to think about 3D landforms in terms of contours. While this tool can be extremely helpful when dealing with very specific information to build very precise land forms, it becomes inefficient when the form is still ambiguous.
- [5] NURBS require thinking about 3D form as surface interpolated by defining cross sections. Patches work by defining boundaries of an area and are manipulated by pulling and pushing points on

the surface. While these result in fluid looking form with relatively little effort, precision and control is not easily accommodated.

[6] Although possible, staying pure to the Fibonacci was not their main concern at this stage. Overall, they were more rigorous about it in section, by spacing the lateral ties at  $z$ ,  $z$ ,  $2z$ ,  $3z$ ,  $5z$ ,  $8z$ ,  $13z$  heights. In plan, articulating the canopies and the distribution of spaces took precedence over Fibonacci.

[7] For example, Microsoft office user “experience team” research found that out of roughly 1400 built-in commands, five commands (Paste, Save, Copy, Undo, and Bold) account for 32% of usage of Word 2003 and that use of other than the top 10 commands was strikingly rare. <http://blogs.msdn.com/jensenh/archive/2005/11/07/489864.aspx> Accessed: February 19, 2007.

[8] Bhavnani, S.K., and John, B.E. “The Strategic Use of Complex Computer Systems”. *Human-Computer Interaction* 15 (2000), 107-137

[9] Kellogg, Craig. SHoP [interview]. *Competitions 2000 Fall*, v.10, n.3, p.44-[55], ISSN 1058-6539.



**Murali Paranandi** is an associate professor and coordinator for computer studies at the Department of Architecture and Interior Design at Miami University in Oxford, Ohio. He earned 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 intersect with the engaging digital media in concert with traditional media for architectural design. His research work in digital pedagogy received funding support from National Science Foundation, Miami University, and others. Professor Paranandi’s students from Miami University have won a total of five **form•Z** Joint Study Program Awards of distinction in the categories of architecture (2000), interior design (2004, 2006), and animation (2005); and honorable mention in architecture (2002). During 2005-06 year, his students won four prizes representing a total of \$34,500 cash awarded, including two first prizes, in Metal Construction Association, and Association of Collegiate Schools of Architecture (ACSA) design competitions. *Photo by Vishnu Paranandi.*