The Rules of Engagement

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Inspiration

Sometimes you find yourself on a long flight, staring out the window. It's at this moment that you begin to notice the engine, not just for the sheer size and power of the machine, but also for the way it is built. You notice the construction of each panel of the engine, from the seams to the connections. What a beautifully efficient and artfully crafted machine. You open your laptop and begin to model the engine. You work with a NURBS-based modeling program as the organic nature of the NURBS curve works well with any design that must take into account a streamlined profile.

You begin by drawing profile curves. Each curve does not take any sort of manufacturing logic into account, instead focusing on the character of the profile shape. The engine cover is symmetrical along the axis of the intake, and can be built using nothing more than one profile shape revolved around an axis. Building the other bits and pieces requires some careful study and guesswork as you cannot get out and look. However, as you further study the engine and your model, you start to notice something: The Control Points you used to generate the profile shape of the curve have generated a series of isocurves on the model surface that very closely resemble the panel seams of the actual engine!

This is not a coincidence but based (in part) on a level of efficiency in both modeling / drafting an engine as well as the actual fabrication: The control points used for drawing the initial profile curve show up as isocurves when the revolved surface is generated. In this respect, the isocurve surface reflects the information programmed into the initial profile curves. This is not the case with typical triangulation, which is more concerned with the type and degree of curvature rather than the history of the information used for the surface.

These thoughts are the basis for "The Rules of Engagement": An experimentation and investigation into the usage and exploitation of the representational qualities of NURBS surface geometry as method and logic for the design of architectural spaces. By embedding architectural programmatic information into the initial profile curves, all of the "rules" needed to articulate the project are reflected in the resultant surfaces. In this way, a conceptual "design pipe-line" is established, connecting fundamental ideas of architecture to that of representational craft, allowing the computational geometry of the building to "wear" its identity.

Development

For a first experiment, a small corner site was chosen, approximately 14'-0" wide by 64'-0" deep, surrounded by two buildings that create a small alcove on the back of the site. A 3'-0" module was superimposed on the site. The dimension of the module was determined based on the minimum width required for a public door. This module served as the set of guides for the manipulation of profile NURBS curves. The initial module was then sub-divided to produce a tertiary 1'-8" module, a dimension akin to the "comfortable" width of the average person.

The program for this experiment was a zone for group and private reflection, a respite from the hustle and bustle of the city surrounding the site. Four sequential spaces were required for the reflection zone including: Entry, Group Reflection, Private Reflection, and Literal (Buffer) Reflection. Markers along the major module increments were placed to reinforce the locations of the potential NURBS curves.

Given the limited space of the site, articulating each programmatic area through partitions was out of the question as it would have created a series of claustrophobic spaces. Instead, a series of "dents" and "curves" were determined to be the best way to spatially denote changes in program. The organic nature of the NURBS curves was exploited as a method for articulating soft spatial changes without compartmentalizing the overall volume.

Six NURBS curves were drawn out on the ground plane in a process akin to the building of a boat. Each curve contained the same number of Control Points with each point located at the intersection of two modules. Deviations in the direction of a curve notated changes in program, with the degree of deviation notating the amount of change from programmatic condition to programmatic condition.

In traditional boatbuilding, the profiles of members that would give the boat shape and structure were drawn out on the ground, full size. These profile lines served as the templates for the actual pieces of the boat. Once cut, each piece was then lifted and rotated into 3-D space, arranged along a keel. This system of rules and logic was applied to the Reflection Zone, though the "keel" is more figural, in this case having a relationship to the concept of wrapping more than the typical NURBS loft.

The profile curves that articulated changes in programmatic spaces were then connection sequentially from bottom to top through a process of sweeping. The resultant shell not only defined the programmatic articulation, but also generated the rules for determining the locations of apertures, each of which would use the resulting surface isocurves as a set of edges for apertures. These apertures reflect the parameters used in generating the initial NURBS curves.

As we can see from the referenced Control Points on the ground plane, a triangulated shell does not take into account the information embedded into the initial profile NURBS curves. The spirit of the design was muddied by a triangulated efficiency.

The final interior and exterior NURBS profiles have been swept following the rules set forth earlier, and the apertures in the street side elevation have been placed as well, each using the surface isocurves as a method for determining the size and location. The rules of engagement have determined every step of this methodology, but it is the author who sets up the overall design early in the investigational process.