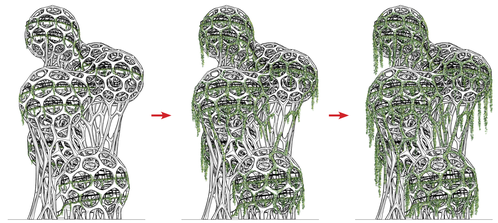
Accumulus

Silicon Valley

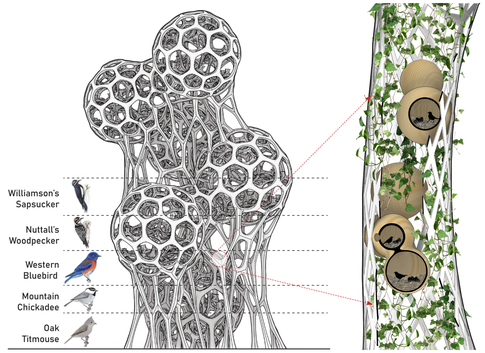
The new icon for Silicon Valley must exude the innovative nature of this place. Presenting solutions to inspire future generations of innovators such as material efficiency, integration with nature, net-zero energy and public interaction and dialogue, Accumulus establishes a new paradigm for how one might consider manifestation of future spaces. Drawing upon nature and biomimicry for inspiration in the formulation of advanced custom computational tools set and artificially intelligent solvers, the project drives towards a minimal/maximal relationship. The work is not simply a digital exercise, but a rigorous exploration between the digital and physical realms, developing systems and understanding for how the two might inform one another. The result is a system minimized in material and energy usage, while maximizing public experience and interaction. The new park at the confluence of two rivers will create both fertile seed and soil around which future development will grow. A commemoration to where Silicon Valley has come from and a beacon for where it will go next.

Site Plan

Ecology



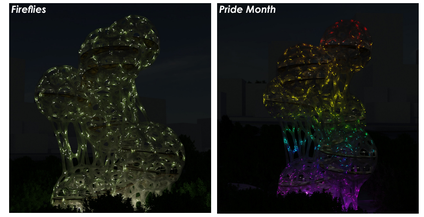
Utilizing Low-Energy Nutirient Film Technique, Local Dought-Tolerant Vines infiltrate the trellis like structure over time creating enhaced shading and biophillic spaces

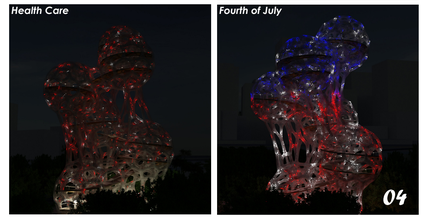


Taking advantage of the open lattice structure, small bird houses are embedded with variation in design and clustering according to local bird species requirements

Lighting Design

The lighting system for Accumulus is inherently linked to the strip-based construction of the tower and pavillion. Rather than using few large spot lights, solar-powered LED strips follow the weaving steel, when activated this creates a very unique behavior, read as a seemingly random flock of fireflies, the lights meander and twist through the night sky. In addition to the dramatic effect of the organic lighting the low wattage does not effect the local flora, fauna or wildlife. Variable in speed, brightness, density and color, the strip driven LED system present unlimited possibilities for the commemoration of holidays, events and the opportunity to interact with the public through smart phone integration.





Perspective Images

01. Tower Street View

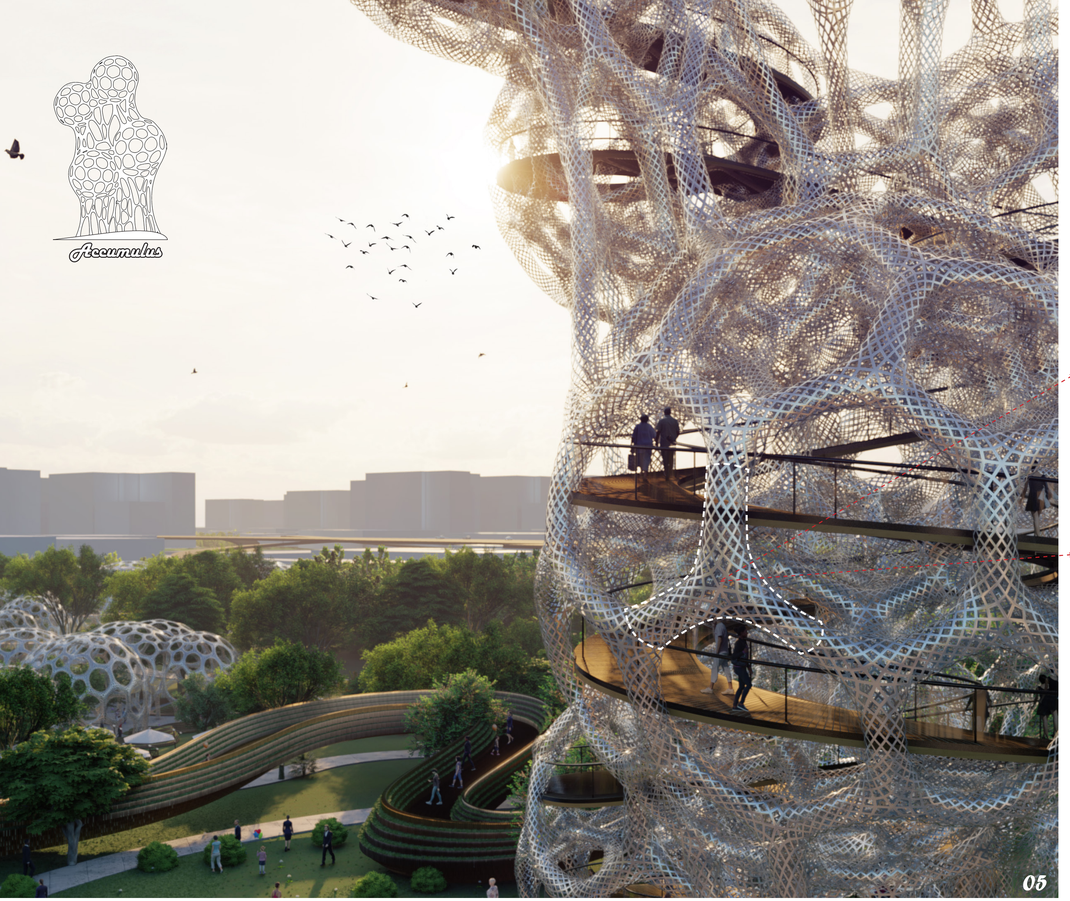
02. Ground Pavilion

03. Tower Interior View

04. Night Lighting Effect

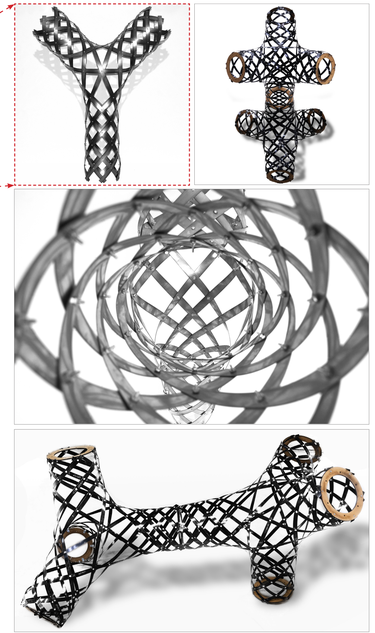
05. Tower Overlooking the landscape

06. Park Overview



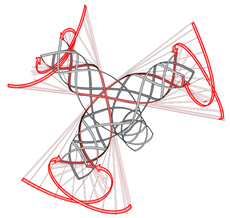
Material Tactics

Through rigorous prototyping, both digitally and physically, steel, in particular tempered chromium steel alloy, was selected as the proposed material of choice. As an infinitely recyclable material, the structures will be produced from reconstituted scrap steel. Understanding that most all steel is produced in coils before stamping, cutting, folding and punching, the project will take advantage of this state with the most minimal of interventions through precise algorithmically determined hole-punches. Utilizing Bending-Active Structural logics the components take advantage of the elastic deformation to create a dynamic equilibrium between woven members. As tempered steel strip flexes in only the planar axis advanced computational simulation and artificial intelligence tools are used to ensure the straightness of each strip as it wraps the minimal surface form of the structural members.



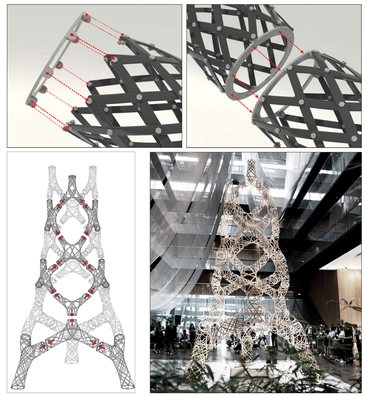
Assembly Strategies

Responding to contemporary trends in construction and fabrication, assembly strategies rely on a hybridized formation of digital and analog processes. As the computationally determined holes require absolute precision, they are produced through anautomated process by simply feeding steel coils through a robotic punching, labeling and cutting machine. Counter to convention, the assembly instructions are embedded within the material itself, holes are labeled to coincide with there matching partner, and simple analog mechanisms are used to over come the torsional strength of the steel. End rings cap individual components creating triangulation and rigidity throughout the diagrid form as well as developing a secure moment of connection between components, while maintaining material continuity through the structural lines.



← *Steel Component Prototypes*

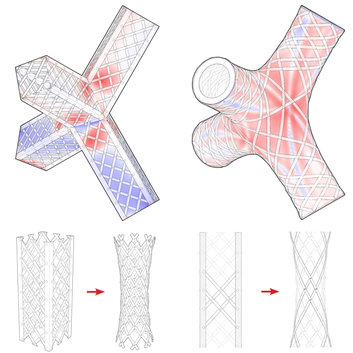
23 ft Woven Structure Built in Bamboo ↓



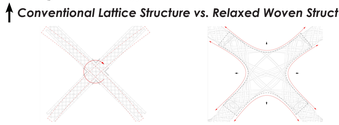
Structural Efficiency

Inspired by efficient vernacular structures which maximize material efficiency through flexure, this system further looks to nature to define efficient form. Biomimetic in behavior AND form, the system finds the pathways of least resistance in defining the distribution of material, formal strategies and expresive ambiguities. Where conventional steel lattices rely on massive cutting and welding, this systems ability to maintain material continuity and transpose the connective element to the mid point of structural lines drastically reduces the dependence on fasteners for strength.

As Le Ricolais once said "The art of structure is where to place holes." In the case of this structure, the holes emerge through the woven assembly. As opposed to conventional box lattice structures, the material runs along the force lines of the minimal surfaces as found through Finite Element Analysis. As the strips are form finding, triangulation emerges within the diagrid structure, embedding further rigidity. The woven strip technique presents an efficient low cost way of fabricating the highly efficient minimal surface geometries without any wasted material.



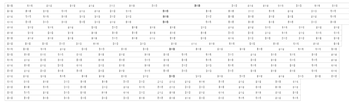
↑ *Conventional Lattice Structure vs. Relaxed Woven Structure*



Conventional box truss requires reinforcement plates to combat moment forces, whereas the minimal surface of the diagrid structure naturally opposes the moment through its manifold monocoque structure.

Production Approach

The combination of computational simulation and physical prototyping creates a feedback loop that enables precise prediction of material behavior to maximize strength and material efficiency. Through material testing of bamboo, wood, and metals, steel was selected for its high structural integrity and infinite recyclability. This project looks to its most widely produced form as its starting point: the humble steel strip. While construction of traditional steel structures requires repetitive cutting and welding operations, Accumulus uses precise robotic processes to punch holes as determined by the digital simulation. These strips are then simply woven together to create a doubly curved monocoque shell that is much better suited to distribute torsional loads than conventional steel lattice structures.



↑ *Strips Fabrication Guide Used for Prototyping*

Vertical Circulation