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Helix-Tower as a Case Study For Soft Structures

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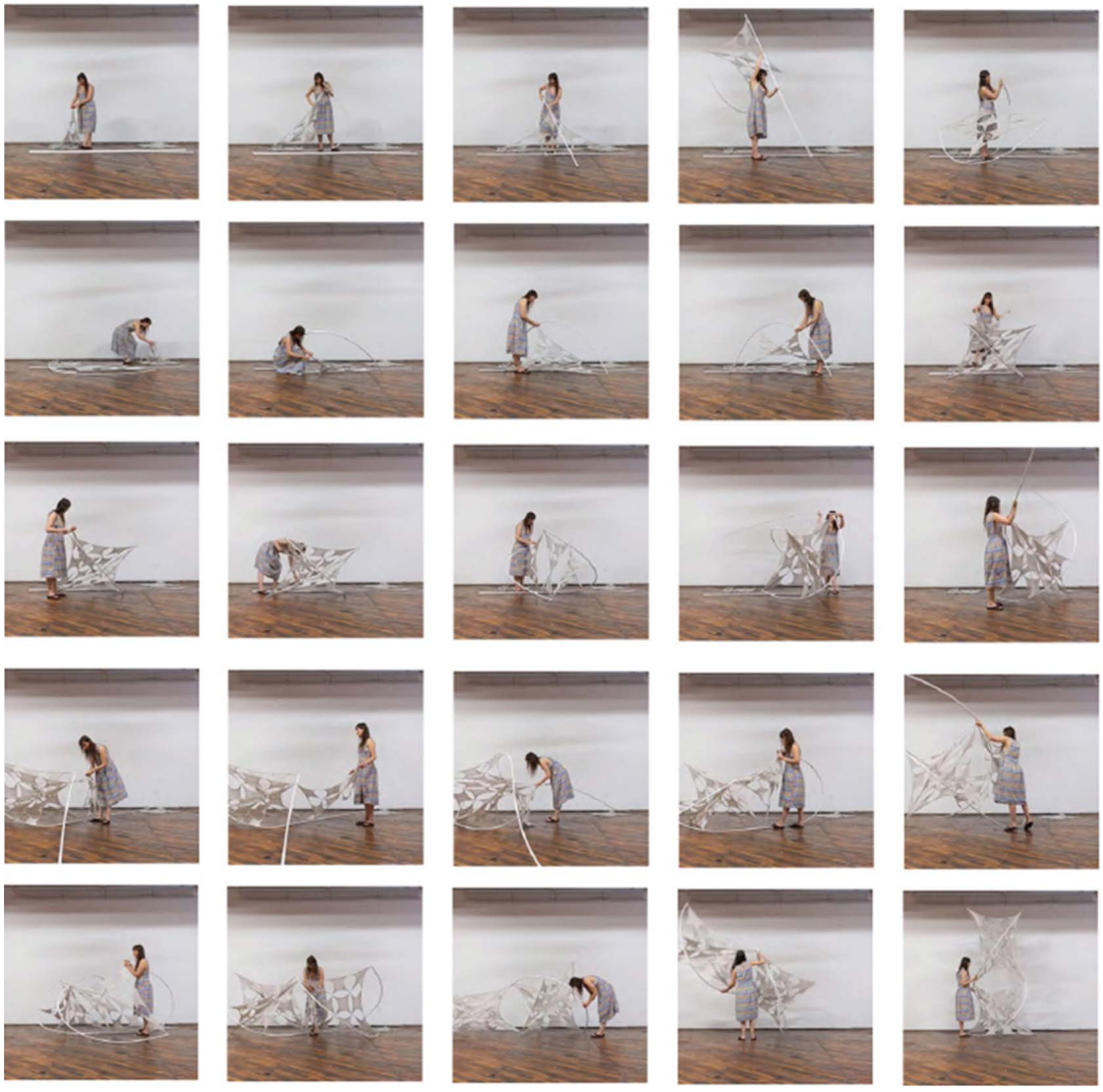

Figure 1. The lightweight structure is easy to assemble and maneuver.
Photo Credit: Virginia Melnyk

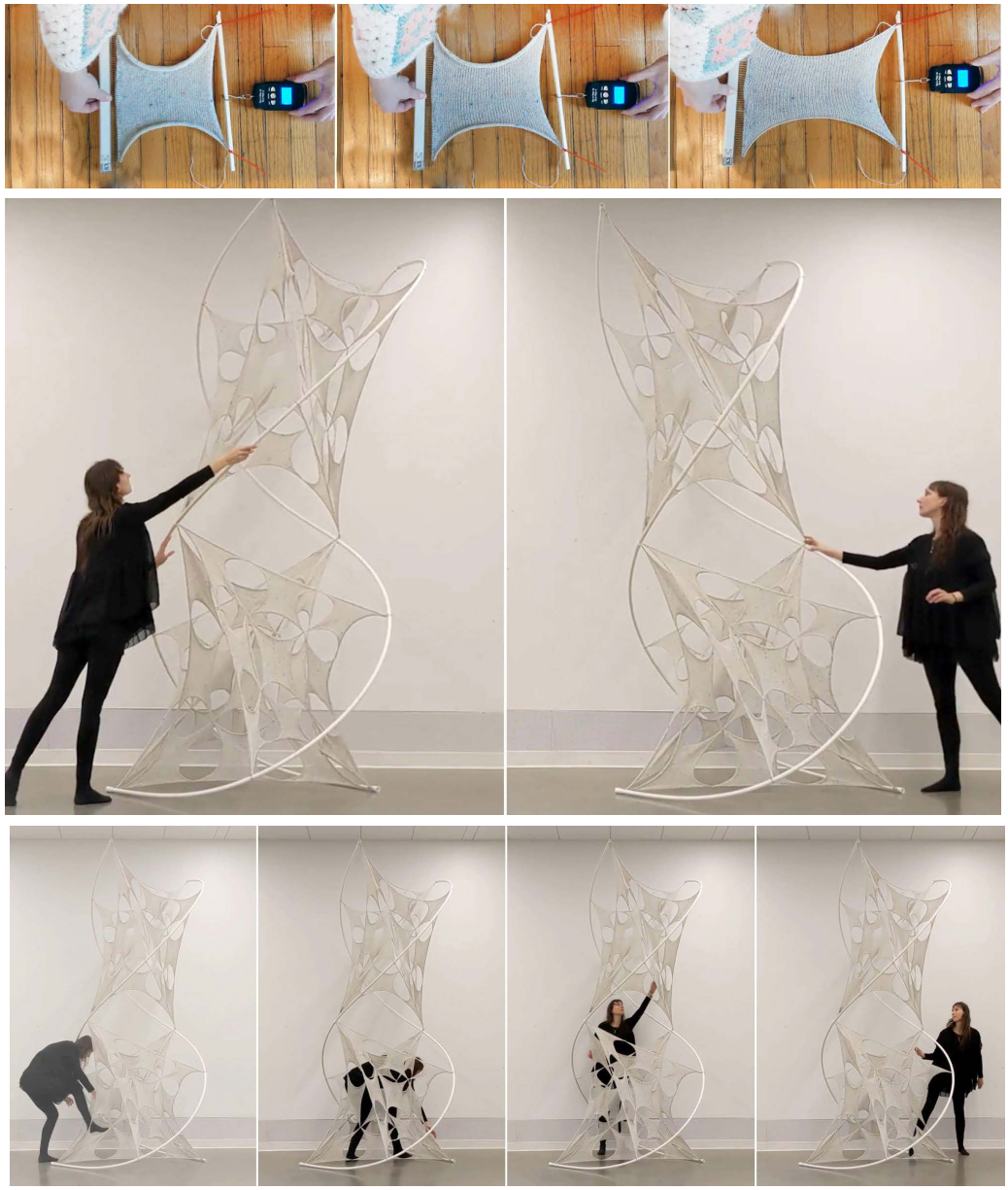

Figure 2. Studying elastic properties of knit material samples with a spring scale. Photo Credit: Virignia Melnyk.
Figure 3. Pushing and pulling on the flexible structure. Photo Credit: Virginia Melnyk.
Figure 4. Interacting with the space and inhabiting the tower. Photo Credit: Virginia Melnyk

Architecture is often recognized for its permanence and constructed from either a stereotomic or a tectonic approach (Seper, 2007). But what if architecture were to embrace possible less ridged materials? The relationship between textiles and architecture has a long history, as Gottfried Semper also wrote extensively on the topics (Semper, 2007). Furthermore, textiles were often used in architecture history, including that of indigenous lightweight and nomadic structures (Prussin, 1998). What are the possibilities for these types of lightweight and movable structures? How might they change how we perceive and interact with structures?

Knitted materials inherently have elastic properties. Combining bespoke knit materials into a tensegrity structural system provides even more flexibility. Features of tensegrity allow for a structure to be strong and light, while It also is only as strong as the materials it is made of. If the system is made from flexable materials, as in this case, the structure can flex and reverberate. Despite this ability to flex, it still has integrity and returns to its state of structural relaxation.

The Helix-Tower, built at Arts Letters and Numbers in 2021, stands upright a 9 feet (3 meters) tall. The structure is a tensegrity module using two bending active rods that helix around each other but never touch. The PVC rods are soft and flexible and easily bent to form, but have a spring back force strong enough to pull the fabric into tension and stand supporting its own weight. The textiles are made of a knit material, which has its own elastic properties allowing for more flexibility in the structure.

Weighing at less than 10 lbs. The structure was easily assembled on its side by one individual and lifted and maneuvered into its upright position. This is because another feature of tensegrity is that it is self-structuring and not dependent on gravitational forces for its structural integrity.

The structure is very porous and has large gaps within it to allow for light and wind to pass through it, as well as the human body. This creates possible interaction and inhabitation of the tower, despite its lack of enclosure. The structure is intended to be interactive, as the structure flexes and bends when users push and pull at it.

The Helix-Tower is a prototype for breaking the standards of ridged architectural expectations and offering a new way of exploring how soft flexible structures allow for the built environment to respond to the elements such as wind, as well as human

engagement. By providing a structure that is light, but still stands upright, it is recognizable as architectural experimentation exploring potential performance and interactions without being inhibited by expectations of architectural programming. Rethinking how we might live and engage. Playing with the structure and exploring the possibilities for flexible environments.

Prussin, L., & Adan, A. (1998). *African nomadic architecture: Space, place, and gende*r. Smithsonian Institution Press. Semper, G., & Mallgrave, H. F. (2007). *Style: Style in the technical and Tectonic Arts ; or, practical aesthetics*. Getty Research Inst.