
Frei Otto's Pneumatic Experiments for Humanitarian Design: *The ideology and technology of lightness and adaptability.*

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Abstract

“My hope is that light, flexible architecture might bring about a new and open society.” – Frei Otto, 2003

Upon winning the 2015 Pritzker Prize, Frei Otto (1925-2015) summarized his career's desire to, *“design new types of buildings to help poor people especially following natural disasters and catastrophes.”* This was a notable divergence from the award jury's description of him as more of a thematically speculative *“...inventor, form-finder...and creator of memorable buildings and spaces.”* [1] This paper will explore the intersection of these notions about Otto's work by looking at his designs intended explicitly for humanitarian relief, recovery, or resiliency.

The intersection begins with his ideology of designing for lightness and adaptability. Although his stated desire to “build light and keep mobile” *can* be applicable for structures used in disaster relief and recovery, he intended it more broadly. In fact, Otto didn't usually associate form-finding with a specific singular functional criteria. He stated his desire was to create designs—or more specifically a process of design and construction—that could potentially improve living conditions generally. [2]

Correspondingly, he'd design speculative tension-membraned long-spans in remote locations that were intended to more broadly demonstrate expanded possibilities for “shelter” (Arctic City, 1971, Shadow in the Desert, 1972, etc.). Little doubt this work assisted in the broader efforts to incorporate tent-based membrane structures into humanitarian efforts, but he personally only had a few commissioned projects to do so (Sarabhai Tent, 1973, Hajj tents, 1981). But at the earliest stages of his career, beginning in 1955, Otto's work *was* more explicitly tied to relief and recovery efforts and the use of pneumatics.

This work was mostly speculative as pneumatics were in their earliest stages of development at the time, but Otto saw the benefits of air-inflated structures, particularly their ability to enclose spaces with lightweight and adaptable forms. He designed and provided initial engineering for a variety of structures including: Floating cities for refuge, large-scale greenhouse and agricultural operations for normally inhospitable sites, a floating tunnel bridge for flood-ravaged locations, and a flood-control dam system built with cushioned membranes and cables. [3]

Our contemporary demands for humanitarian design work related to food, water, shelter, and infrastructure suggest a re-examination of this work. Otto's sketches, writings, and physical models of this work will be compared to the broader ideological and technical experiments that defined his career. The paper will demonstrate how his pneumatic experiments become more formally-speculative and less programmatically-centered on disaster relief as Otto prioritized the resolution of technical and material considerations. These experiments legitimized the usefulness of pneumatics to an extent, but the limits of reliable membrane materials at the time and the lack of commissioned projects relegated most of the work as speculative.

References

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- [3] Otto, Frei, ed. “Tensile Structures: Design, Structure, and Calculation of Buildings of Cables, Nets, and Membranes.” MIT Press. Cambridge. 1962. ppg. 126-127