

Santiago Calatrava

Art

Engineering

Architecture

- Movement
- Dynamism
- Inspired by natural forms



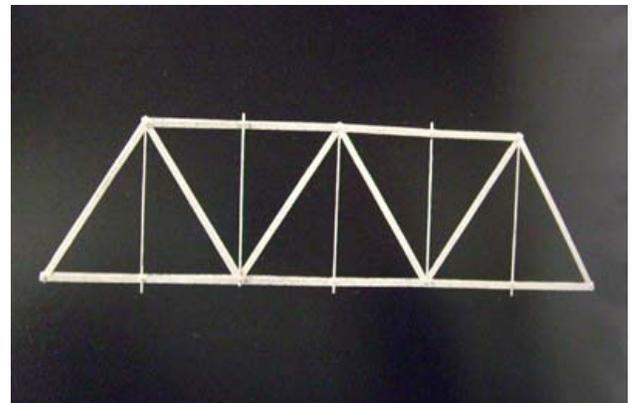
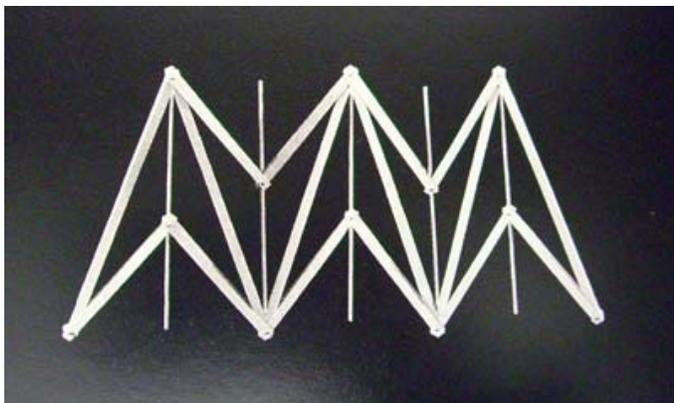
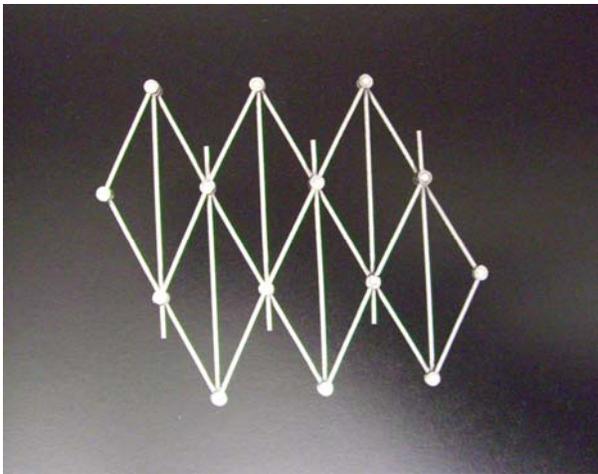
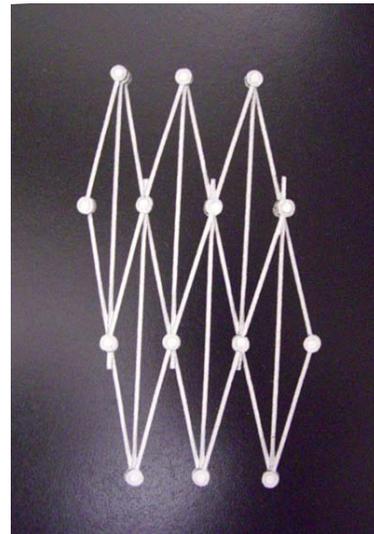
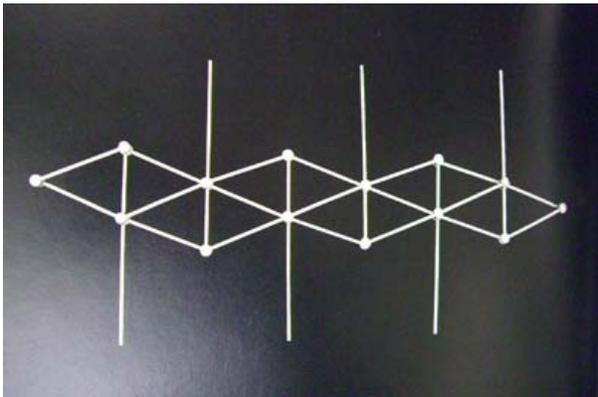
Milwaukee Art Museum

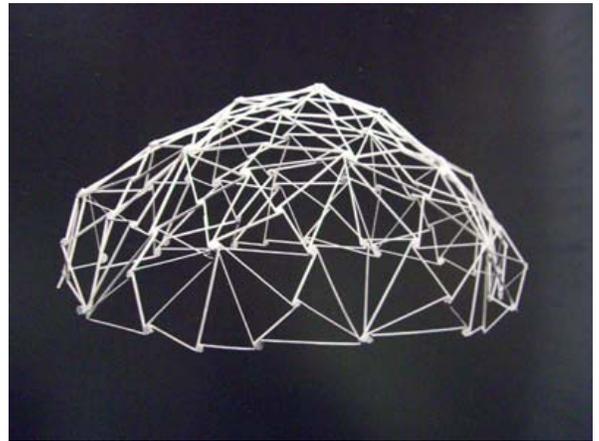
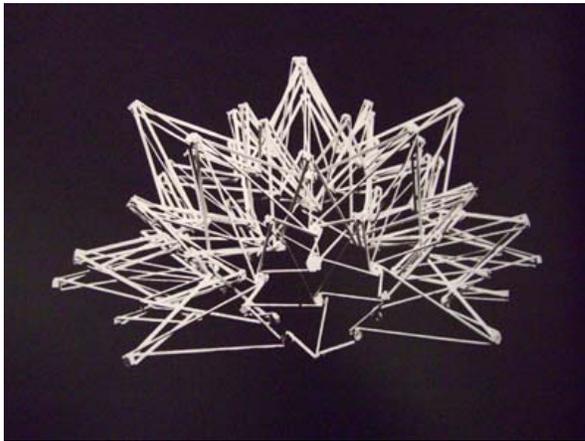
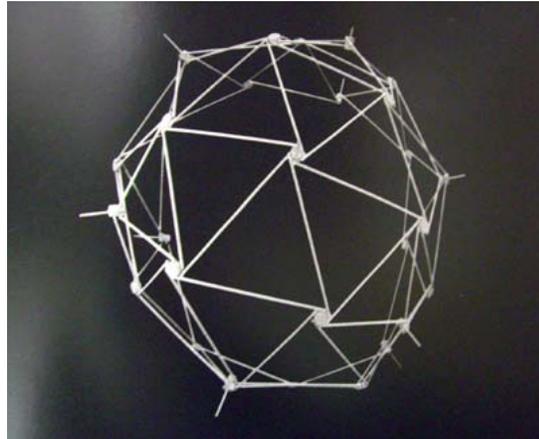
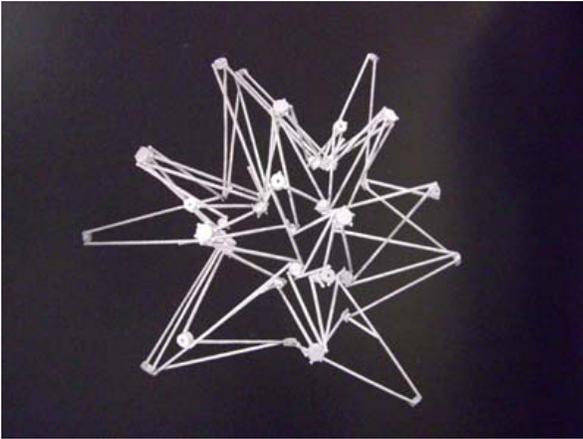
Santiago Calatrava was born in Valencia, Spain, 1951. He attended primary and secondary schools in Valencia, as well as from age 8 the Arts and Crafts School where he learned drawing and painting. His post secondary education was at Escuela Tecnica Superior de Arquitectura, Valencia, where he earned an under-graduate degree in architecture and a post-graduate degree in urbanism. His interest in the mathematics of certain great historical works of architecture and the draw of the Swiss engineering tradition took him to the Federal Institute of Technology (ETH), Zurich, to study civil engineering. During his time at ETH he completed his doctoral dissertation, "On the Foldability of Frames", '70-'81 (1, 3).

Calatrava was intrigued with structures found in nature, particularly moving structures. His dissertation research explored questions about "modeling the movement of parts of complete structures and representation of intricate curved surfaces" (3). He broke the problem into two components:

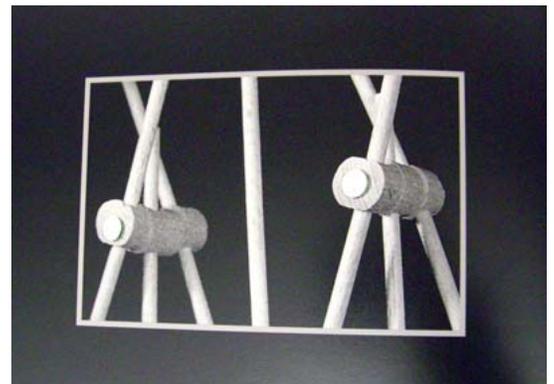
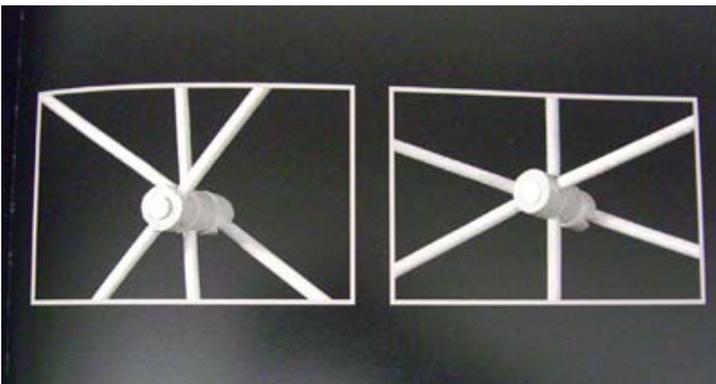
- Modeling geometrical transformation of 3 dimensional frames into more compact arrangements
- Articulating the mechanical connectors in the joints required for the sequential transformation, abstracting aspects of strength of materials (3)

Example: Modeling geometrical transformation of 3 dimensional frames into more compact arrangements (small scale, wood)





Example: Articulating the mechanical connectors in the joints (small scale, wood)

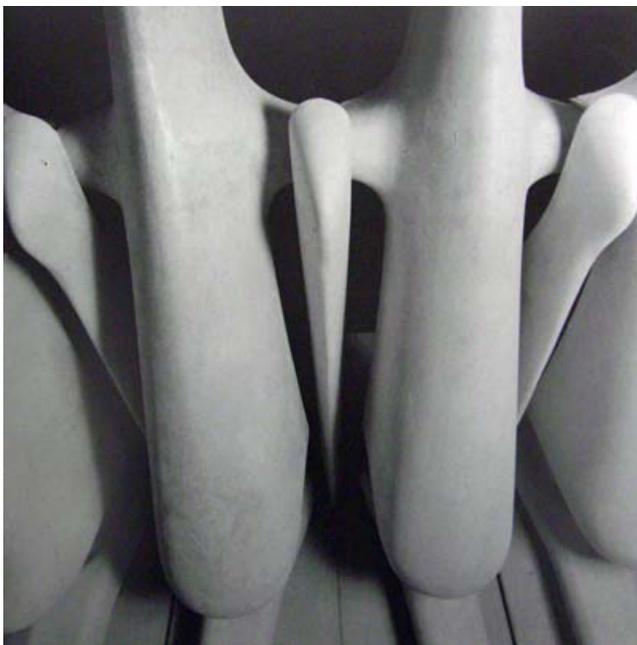


In his dissertation, these examples and many others are accompanied by extensive mathematical explanations and equations.

Bones and Skeletal Systems

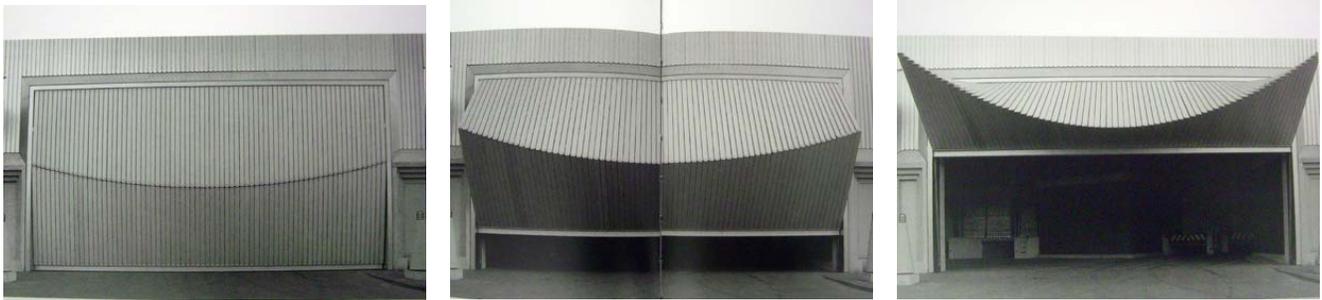
The first 10 years of Calatrava's practice were spent working in Zurich. Harbison, in Creatures from the Mind of the Engineer, explains Calatrava's work in Zurich as "the desire to express and understand structure with skeletal clarity and the desire to create enormous and impinging creatures.. caters to intellect, senses and emotion at once.. neither cold.. nor lurid" (2).

The inspiration for many, if not all of Calatrava's projects can be found in nature and in the machines and structures of nature. Forms resembling bones and skeletal systems are often in the structure of his work (2).



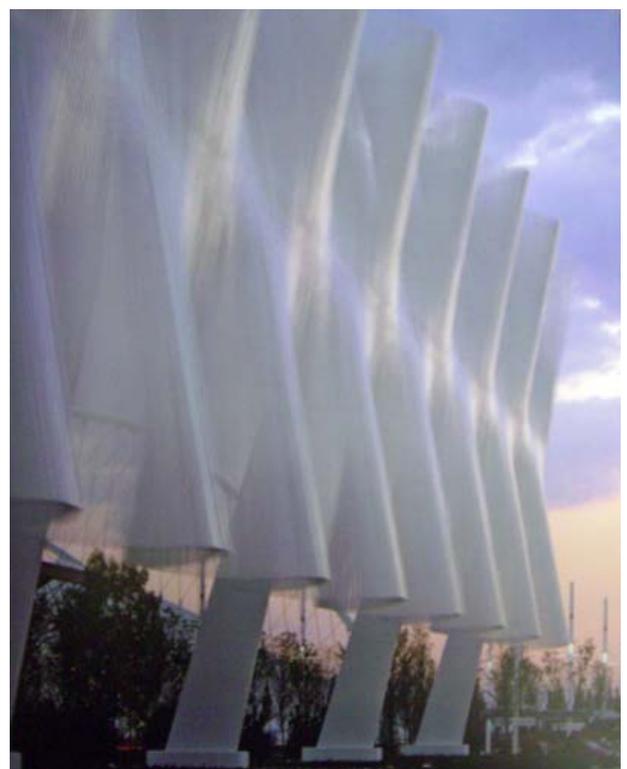
Concrete Pavillion, Swiss Building Fair, Basel, 1989.

Many early works in Zurich were canopy or roof structures, such as the remarkable yet simple Ernstings Warehouse, 1983-1985.



Waves

Wave forms recur in Calatrava's work. Early wave forms were experimental models, then mid sized public art installations, then the roof of the winery for Bodega & Bebidas at San Sebastian, Spain, then a huge installation "the Nations Wall" at the Athens Olympics. The art installations are moving sculptures. These wave forms are constructed with a series of straight members that rotate at the center of each member causing the wave to undulate.

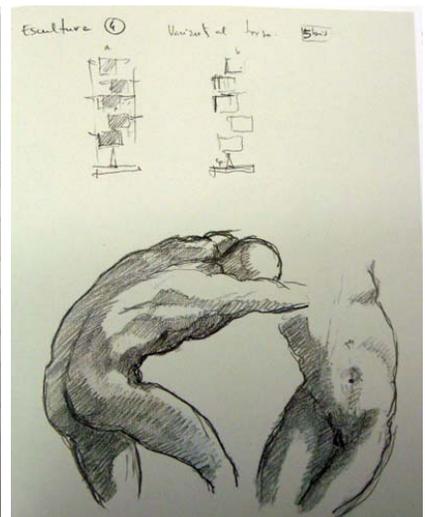
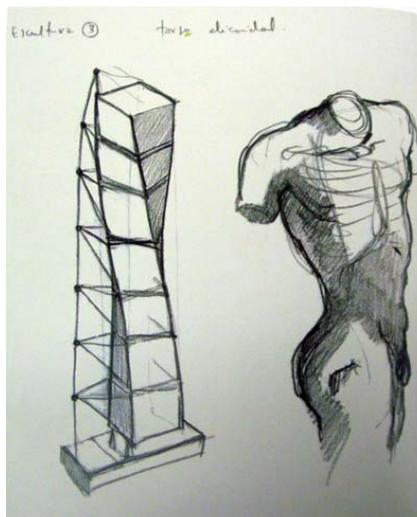


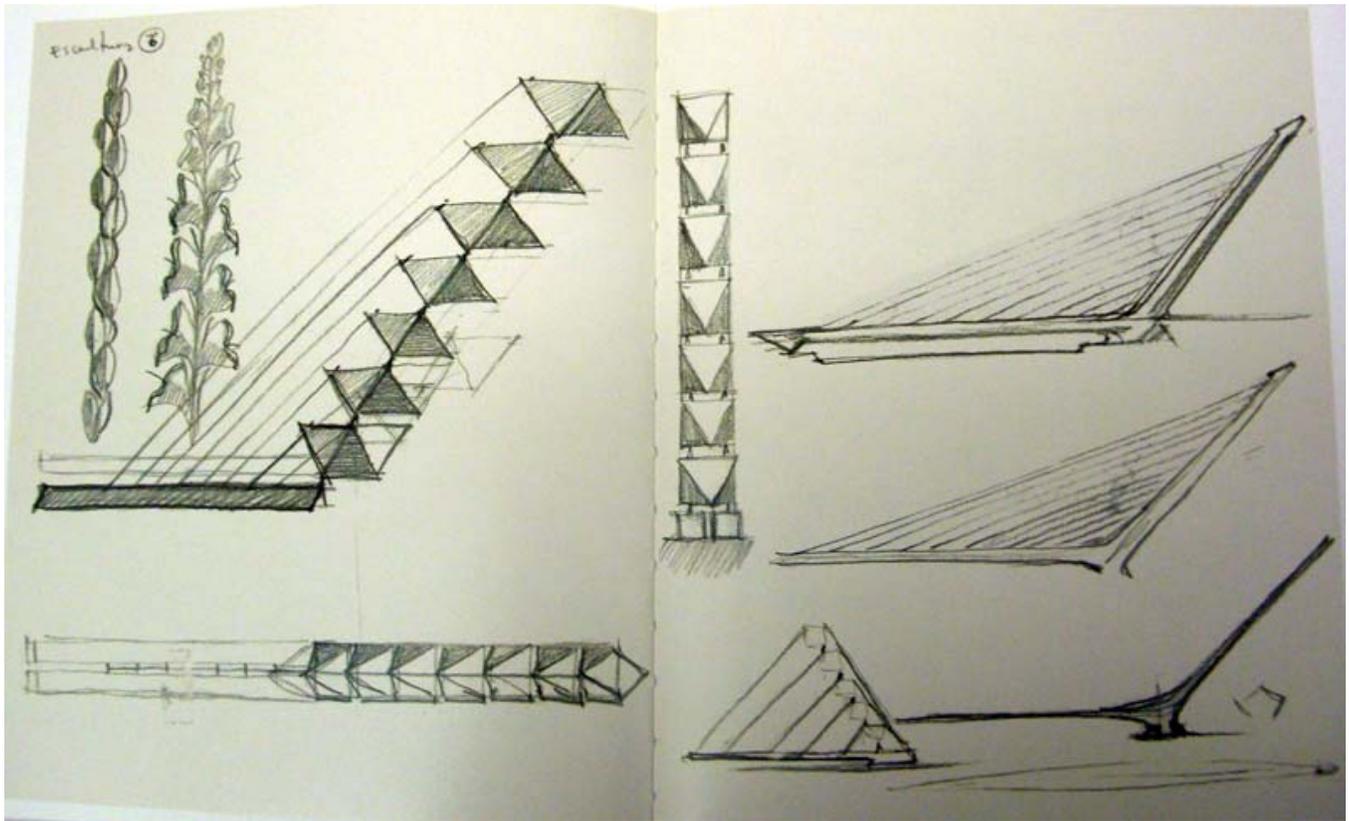
Bodega & Bebidas Winery, San Sebastian/Laguardia, Spain



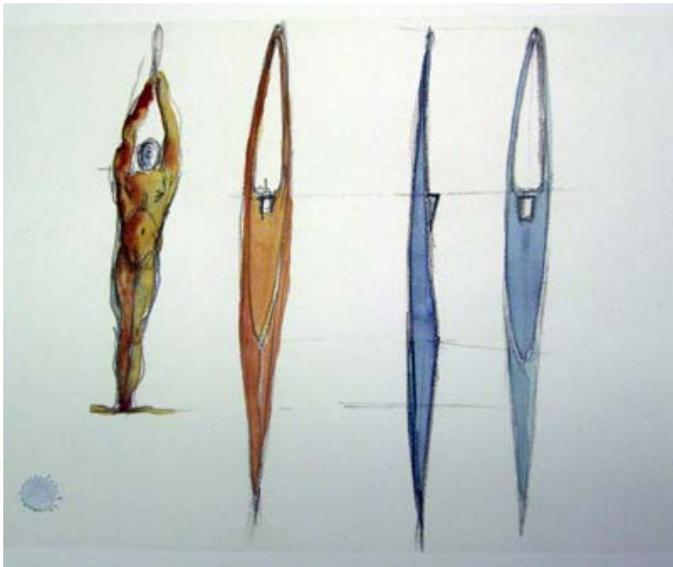
Sketching

In his book, Santiago Calatrava's Creative Process, Alexander Tonzis shows many examples of Calatrava's sketches of natural forms. Calatrava explores the relationship between natural forms and possible built forms.

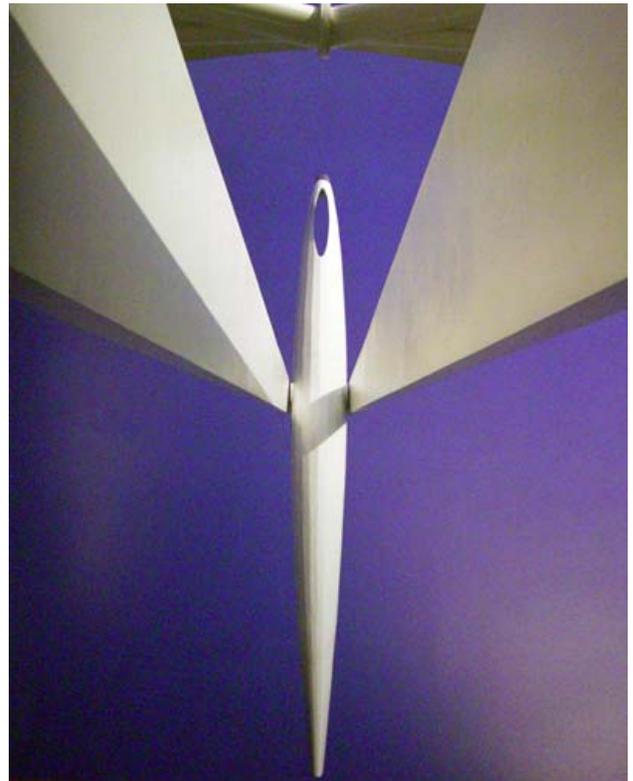




The human figure is frequently the inspiration for Calatrava's work.



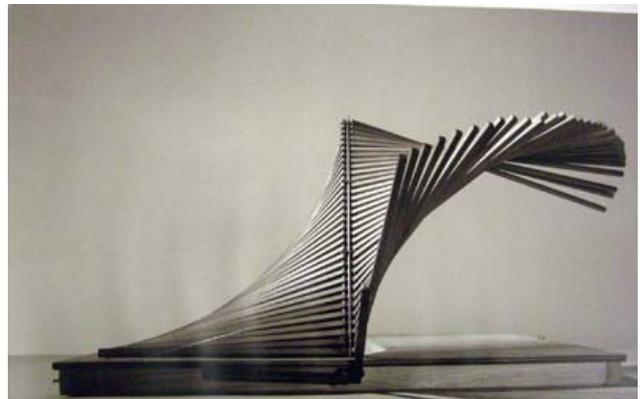
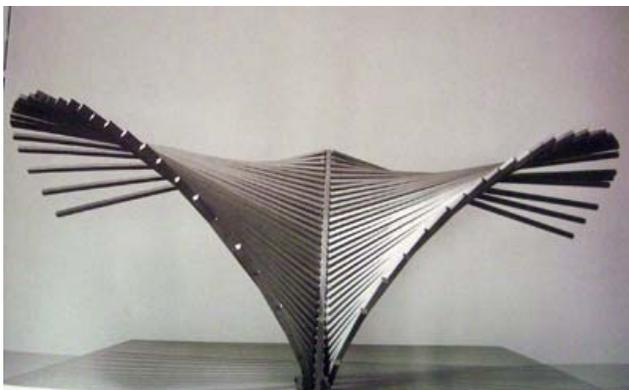
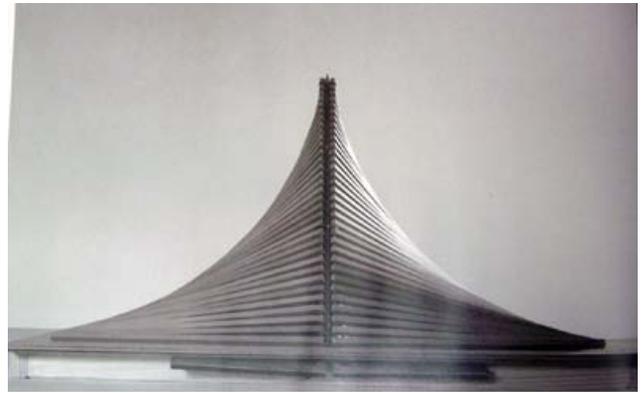
2004 Athens Olympics Torch





Montjuic Standard Lamp. 1989.

Wings



Wings are a recurring theme in Calatrava's work. These examples show his analogy between the human form and a winged creature. The model is early exploration of kinetic sculpture animating straight segments to affect curves as with his wave forms. This wing model is built almost literally in huge scale at the Milwaukee Art Museum (see page 1 for photo).

Gunther Feuerstein in his book Biomorphic Architecture, shows sketches from Calatrava's design process for the Kuwait Pavillion. He drew two hands open and apart, and then together with interlocking fingers (5). In the Kuwait Pavillion finger-like or rib-like members pivot to open or close the pavilion.



Kuwait Pavillion, Expo '92, Saville Spain

Santiago Calatrava's structures are an unusual blending of art, architecture, engineering, and reflect his great love of natural form and motion. His choice of white as the only color in his creations reinforces this emphasis on form and motion. His sketch books illustrate the direct connection in his design process between the human form or forms found in nature and his structures. The structures are anthropomorphic or natuomorphic without blatant mimicry. They echo things that we know and therefore give his work familiarity. Yet his works are individually unique and a departure from traditional built form. Calatrava's works are distinct and monumental without being alien to the human form and the natural world as is much of contemporary monumental architecture.



The PATH Terminal, World Trade Center site New York

Bibliography

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2. Harbison, Robert. Photos by Rosselli, Paolo. Creatures from the Mind of the Engineer: The Architecture of Santiago Calatrava. Zurich & Munich, Artemis, Verlags AG, 1992.
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5. Feuerstein, Gunther. Biomorphic Architecture: Human and Animal Forms in Architecture. Stuttgart , Menges, 2002. http://books.google.com/books?id=Bx9zJTFUmdUC&pg=PA105&lpg=PA105&dq=kuwait+pavillion+sketches&source=web&ots=4dlj9Fd b5I&sig=VyrSxCZNVJAAVj1KjY_UtwqMLTk#PPA179,M1 12/08/07.