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Santiago Calatrava: Form, Function, and Structure Follow Gesture

Developing the lexicon of forms through drawings and sculptures gives the Spanish born architect, engineer and artist Santiago Calatrava a great deal of freedom. The design process begins by creating forms in an abstract manner. The form is based on mathematical research and a study of nature, the human body, experiments in movement, and a combination of movement and structure, but according to Calatrava, form does not follow function. The assertion that form and function follow gesture is surprising from a man who, having obtained a bachelor's degree in architecture, turned to engineering for his master's degree and doctorate. As he sees it, Calatrava is studying how to design form in an abstract way, so that it can be a point of departure for developing suitable forms for architecture. Only at this point do considerations of static and gravity come into play. In the course of some twenty years, Calatrava has done more than 65.000 drawings and he continues to draw in the same intensity in the last decade. Calatrava sees the enormous accumulation of ideas as a source of strength. He relates to the ensemble of his artistic work as a sort of laboratory.

Santiago Calatrava's worldview contradicts Louis Sullivan's famous saying (first coined by Horatio Greenough) that "form follows function." For Calatrava, function does not dictate form – function follows form.

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Some of the drawings develop into sculptures, which sometimes serve as a point of departure for designing buildings. Looking at the sculptures, drawings and tables

again, over a period of time, Calatrava makes changes and amendments now and then, or develops some of the works into something else, sometimes more complex, sometimes more condensed and simple. The archive was, for the first twenty years, within reach, making the work directly and immediately accessible. Now it is in a computerized database. The advantage of a rich and developed lexicon of forms is that there is no need to start from scratch every time and it is possible to develop solutions with ideas that have already undergone the first stages of development and experimentation.

To the question as to the connection between architect and engineer, Calatrava replies that in sculpture, the functional side disappears. There are also types of buildings with a simple function, such as a bridge. Calatrava, who has built around 50 bridges claims a bridge has few functional needs. Its main function is to serve as a passage from one place to another. Its other function is to celebrate the connection between the two sides of the river and the city, making it an attraction, a conspicuous site, a meeting place, and a landmark. Perhaps this explains why bridges stress sculptural aspects more strongly than other public buildings do. The bridge near the Guggenheim Museum in Bilbao, 1990-97, illustrates that Calatrava's building deviates from the concept that form follows function. The bridge does not constitute the shortest line between two points – it is a parabola, increasing the distance from one bank to the other. The semi-transparent glass deck and the cables contribute to the poetic atmosphere that the bridge inspires, a feeling that grows at twilight when the bridge is lit up and its form is reflected in the water.

The suspension bridge over 100 meters high planned for the light railway at the entrance to Jerusalem – an area of commercial buildings and banal, nondescript housing unworthy of a city like Jerusalem – adds design quality to the entrance of the city without competing with the Old City and the city's historical and religious monuments on the other side of the ridge. Calatrava contributes a dimension of lightness and transparency to a city largely characterized by the powerful force and heaviness of stone buildings.

In railway stations, the functional need for vast halls has disappeared with the demise of the steam engine, but we still expect to arrive in an impressive and distinctive space. Calatrava tries to respond to expectations sculpturally using abstract space and light relating to the figurative aspect; thus in Calatrava's opinion, in designing a railway station form does not follow function – he aspires to design meaningful spaces that give the traveler the sense of arriving in a great city. At the station at Lyon airport 1989-94, for example, he attempts to produce a sensation of floating to connect the station with the adjacent airport. At the Path station at the World Trade Center in New York, his original design was planned to create meaningful flowing spaces and incorporates the play of shadow and light by exposing the concourse to the sky through moving "arms" like those in the Kuwait pavilion at Expo-92 in Seville or the sculpture *Shadow Machine*, which he exhibited in the garden of the Museum of Modern Art in New York in 1992, the entrance to the Alcoy Community Hall, in Spain in 1992, and the 60-meter high kinetic element on the roof of the Milwaukee Art Museum, Milwaukee, Wisconsin, 1992–2002. By

leaving the space open, with the help of movement Calatrava gives a poetic dimension to a functional site. Movement is a major theme in Calatrava's work and is expressed in every area: in the thousands of drawings of the human body in different poses, in sculpture, and in buildings with suggested movement through motorized movement.

Santiago Calatrava is a universal designer who is inspired by nature and the human body and incorporates interest in architecture, engineering, design, and art. His work in all these fields combines structure and movement and creates a unique synthesis. He has, to a large extent, abolished the dividing lines between the different disciplines.

When Calatrava engages in art, he does so for its own sake. A few of his sketchbooks contain mathematical or engineering calculations that suggest the possibility of turning forms into structures. At the same time, the production capabilities are so deeply imprinted on Calatrava's mind that it is possible to manifest most of the ideas that emerge in his drawings without making major changes during the process of developing and detailing. When we compare the drawings and sculpture of the Twisted Torso with the tallest residential building in Europe, the Turning Torso Apartment Tower, Malao, Sweden, 1995-2005 we can see that the analogy to the human body and the exploration into the poetics of movement are all there.

Calatrava's drawings are done quickly and spontaneously. Although they evince a knowledge of architecture and engineering, they remain completely free of economic, technical, social, and other considerations that demand connections and compromises with the initial vision. In his art, Calatrava deals with human and mechanical movement, structure and form, subjects that also find strong expression in the other disciplines. His poetic approach is not confined to drawing and sculpture, it extends into his designs and the buildings he plans. This can be seen in the drawings of the Alcoy Community Hall, Alcoy, Spain, 1992-95. Calatrava toys with the idea of placing human figures in different positions to fill the special shape of the subterranean structure in Plaza Espagna, a kind of equilateral triangle whose apex is rounded. Not just people, but also the head and the skull of a bull appear within the contour line of the hall. In this case, it is possible to assume that the structure was designed before the attempts were made to merge the human figure and the head of the bull. Yet their use attests to the importance that Calatrava ascribes to the proportion and gestures of the human body as a key point of relativity in the design.

An example of the direct relationship between the bull and the structure can be seen in the figure raising one hand vertically and stretching out the other hand horizontally, with feet in motion. This serves as a point of departure for the design of the communication tower for Alicante, Spain, 1993, just as the drawing of a figure holding a torch serves as the Montjuic Communication Tower at the site of the 1992 Summer Olympic Games in Barcelona (competition 1989).

The standing lamp that Calatrava designed in 1989, one of the few items that were factory produced and marketed by a company specializing in design, has two handles supporting the lamp shade. These are hands, and a small ball that supports

the shade is the head. A human body is also the source of identity object for the shape of the tower that was planned for Monterey, Mexico. Here too, Calatrava's interest in a figure in motion, probably referring to the modern world, is encapsulated in a single image whose essence is defined by movement.

Calatrava did several thousand drawings of figures, mostly in a state of motion. Although these drawings seem a far cry from his buildings and sculptures, the element common to them and to his designs is movement. Individual figures and series of figures are drawn on successive pages (Calatrava sometimes likes to use Japanese sketch scrolls, which invite the drawing of figures in chain). The figures are dancing, running, or engaged in other movements. Cezanne's figure of the Bathers, 1885-7, in the collection of the Museum of Modern Art in New York serve as a source. Throughout the drawing of architectural structures, Calatrava sketches figures that serve as a scale and attest to the importance of the human element in planning an intricately engineered structure. As an aspect of his interest in human figures, Calatrava also draws human heads. Many such drawings appear in sketchbooks. They are not portraits of specific people, just as his figure drawings. He does not go into detail, although he gives each of the heads a unique character.

The eye with the emphasized pupil intrigues Calatrava in many drawings as well as the Planetarium of the Valencia Science Center 1991, where the reflection of the planetarium in the water pool complements the circle and underscores the connection between the building and the eye. The eye also serves as source of inspiration for the Opera house in Tenerife, as shown by the drawing of the eye alongside the section of the building. Similarly the eye is one of the sources of the sculpture Bird I, in which the ball standing on the base and the sweeping circular motion of the bird's wing can also be referred to an eye.

Calatrava has managed in his best works to create a synthesis of nature, the human body movement and gestures, form, the history of art, the history of sculpture, modern and contemporary architecture, and a knowledge of engineering in which mathematical and static calculations are intrinsic to the final development and meaning of the work.[1]

1 For the buildings, drawings, and sculptures mentioned in this essay see Alexander Tzonis: Santiago Calatrava, The Complete Works. New York 2004: Rizzoli; Michael Levin: Santiago Calatrava: Artworks. Basle, Berlin, Boston 2003: Birkhauser.