Structure, Bridging, and John Cage

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In his seminal treatise on architecture, Vitruvius states that the architect "should be equipped with knowledge of many branches of study and varied kinds of learning," and that the architect should acquire a thorough understanding of scientific principles, manual skills, theories, and scholarship. He maintains that the individual aspiring to become an architect must be both "naturally gifted and amenable to instruction." Of particular interest to architecture (and to architectural education) is Vitruvius's differentiation of "the thing signified, and that which gives it significance. That which is signified is the subject of which we may be speaking; and that which gives significance is a demonstration on scientific principles."[1] Although written more than 2000 years ago, Vitruvius's brief chapter on education contains the fundamental underpinnings of a pedagogy that seeks to unite the scientific with the theoretical, and practice with scholarship.

The two points made by Vitruvius on signification are further elucidated in Mario Salvadori's *Why Buildings Stand Up: The Strength in Architecture*. In discussing the relationship between architecture and structure, Salvadori states: "Architecture, besides fulfilling a function, sends a message to the onlooker through its varied and significant forms. No passerby confuses a church with a jail. It is perhaps not so obvious that structure too has a message of its own: it can be a message of strength or elegance, of waste or economy, of ugliness or beauty. But without it, architecture cannot exist....Thus, in addition to speaking to us about usefulness, economics, energy, and safety, structure asks us to appreciate creativity and beauty."[2] For design students, particularly beginning design students, to add meaningful voices to the discourse on structure and its expressive potential in architecture, it is essential that early on in their education they acquire a basic understanding of structural principles and access to their poetic insight. Once so equipped, a creative synthesis of structure, form, and spatial order will emerge in their architectural design work.

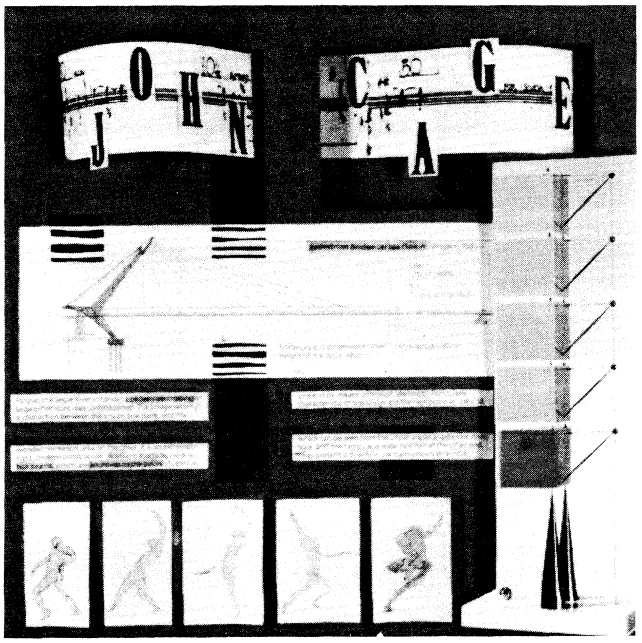

Fig. 1. Research and concept collage by Jayson Beltran.

Bridge as Paradigm and Cage as Client

In *The Architecture of Bridges*, Elizabeth Mock considers the bridge to be an architecture of a very special kind. She states that "since a bridge does not define space, but cuts through it, it is free of all the intricate psychological considerations that must be taken into account when space is molded or enclosed. Thus, paradoxically, a bridge is at once the most tangible and most abstract of architectural problems."[3] In addition to its abstract nature, the extraordinarily clear purpose of a bridge, that is to span a void, along with its structural reality, make it an ideal problem from which beginning design students can apprehend basic structural principles and their applications to create a meaningful architectural experience. From this they will be better prepared to undertake more complex building programs that require thoughtful and responsible organization of enclosed spaces.

John Cage is considered one of the twentieth century's most influential artists whose impact was evident not only in music, but in all the arts: painting, sculpture, theater, movies, dance, as well as aesthetic thought in general. By assigning

composer John Cage as the students' client, they were introduced to his philosophy on creativity, his concept of chance operations, and his last creative work titled "Rolywholyover A Circus,"[4] which provided them with numerous fertile points of departure for exploring the concept of bridging.

Beginning Design and Expectations

Beginning design students in the undergraduate five year program at the University of Houston College of Architecture are introduced to the design process through a series of predominantly abstract exercises. These exercises, loosely based on Bauhaus principles, have been canonized over a period of more than two decades.[5] During the fall semester of first year, the exercises are kept brief and are primarily two-dimensional. Students arrange compositions that explore positive and negative spatial relationships, color, and relief, on eleven inch square white boards. The semester concludes with two projects that are three-dimensional explorations that focus on the nature of the cube. The expectation is that from these exercises, each student achieves a basic understanding of compositional principles of proportion, symmetry, asymmetry, rhythm, repetition, and balance. In addition, the solutions are to be well-crafted, precise, and visually pleasing. During the spring semester the students are required to complete three projects. In the first project, which is five weeks long, students are introduced to analytical principles by way of the case-study method of fairly complex, well-known buildings. The results include the construction of precisely crafted basswood models, ink drawings of the buildings, and analysis diagrams. In the second project, which is two weeks long, the students are asked to design a room responding to light that relates to their previous case-studies. The designs are modeled in foamcore, and charcoal sketches are drawn depicting the effects of the light. In the last project of the semester, students are to develop their first architectural program into a habitable composition. Drawings and models that represent their ideas are required. The expectation is that lessons learned from the case-studies facilitates the transition from simple abstract projects to increasingly complex architectural projects.

The second year program is similar to the first year program in that it too, begins with abstract exercises. In the fall semester, the projects consist of three-dimensional "point-line-plane"[6] explorations that emphasize scale as a reference to human dimension, physical relationships among architectural elements, and craftsmanship. There are three projects of varying length during this semester. In the spring semester the projects (typically there are two) are less abstract and increase in architectural complexity. The expectation is that students in second year design learn to develop "architectural ideas from the abstract to the specific"[7] and achieve a high degree of craft in the construction of their models.

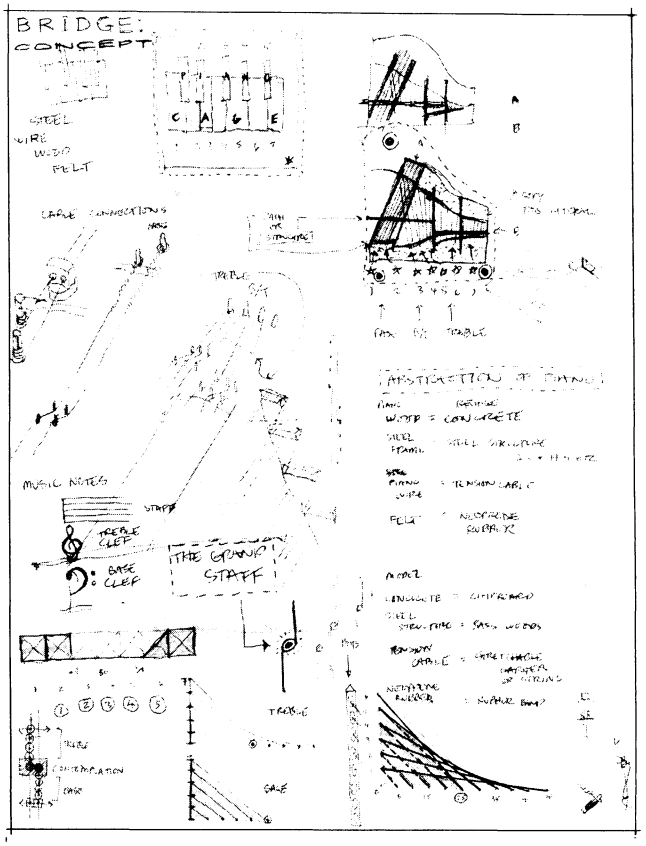

Fig. 2. Concept sketches by Jayson Beltran.

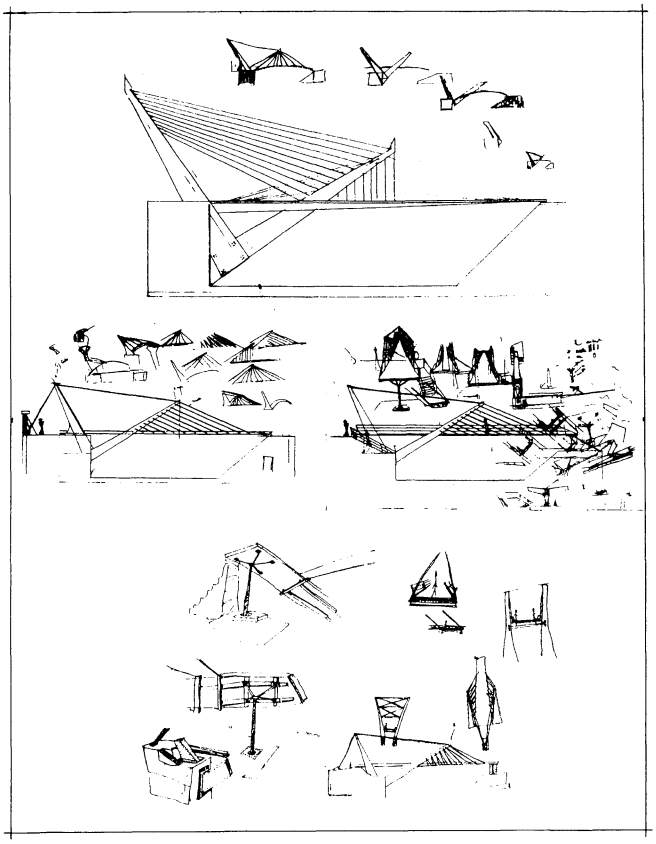

Fig. 3. Concept sketches by Martin Ayanegui.

The Project

Working within the constraints of a beginning design program that consists largely of predetermined exercises, the author presented to her second year design studio a project titled *A Bridge for John Cage* as an interpretation of one of the curriculum exercises.[8] The pedagogical intentions of the project were multivalent. The main goals included introducing the students to structural principles emphasizing the concept of bridging; the expressive potential of structural and architectural integration; modeling materials and constructing techniques that simulated as closely as possible, within the constraints of the model, real structural forces inherent in each type of bridge;[9] and investigation of the relationship between architectural structure and musical structure, as defined by John Cage.[10]

The project was three weeks long and executed in two phases. The site required a pedestrian bridge that could span 50' from a soft soil condition to a bedrock condition. The first phase (one week) involved investigating bridges and the work of John Cage, and the development of concept sketches. Their findings were presented in collage form. At the beginning of the second phase, the students were provided with a lecture on basic structural principles by a structural engineer that included elaboration of the three primary forms of bridge construction: beam, arch, and suspension, and the nature of compressive and tensile forces. The lecture was followed by discussions on the structural clarity of these forms in relation to the students' concept sketches from the first week. To facilitate their understanding of Cage and his work, they viewed a video tape on Cage, and attended "Rolywholyover A Circus" which was the current exhibition at Houston's Menil Collection. Several of the students had participated in *Tension Builds*, a multi-disciplinary series of events exploring the concept of tension in music, art, and architecture, which took place at the college.[11] Responding to the lecture as well as their research on bridges and Cage, the students developed their concepts. During the remaining two weeks they were encouraged to integrate structural and architectural ideas along with their interpretations of Cage and his work into their proposed solutions.

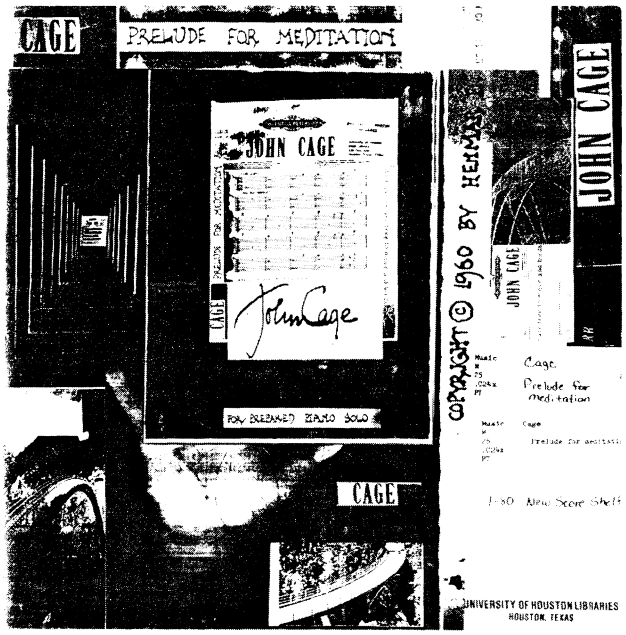

Fig. 5. Research and concept collage by David Culloty.

Each of the nine interpretations of a bridge for John Cage represents a small fragment of what each student learned about structural principles and their expressive potential in architecture. The carefully crafted models reveal that each student developed an understanding of materials, connections, and structure. The models were constructed at a scale which engaged the viewer, physically and mentally, in the experiences of crossing as well as pausing on the bridges that each student created. The students' sketches and collages reflected their search to understand their client, John Cage, and his work. From Cage they learned that structure in music "is its divisibility into successive parts from phrases to long section. Form is content, the continuity. Method is the means of controlling the continuity from note to note. The material of music is sound and silence.

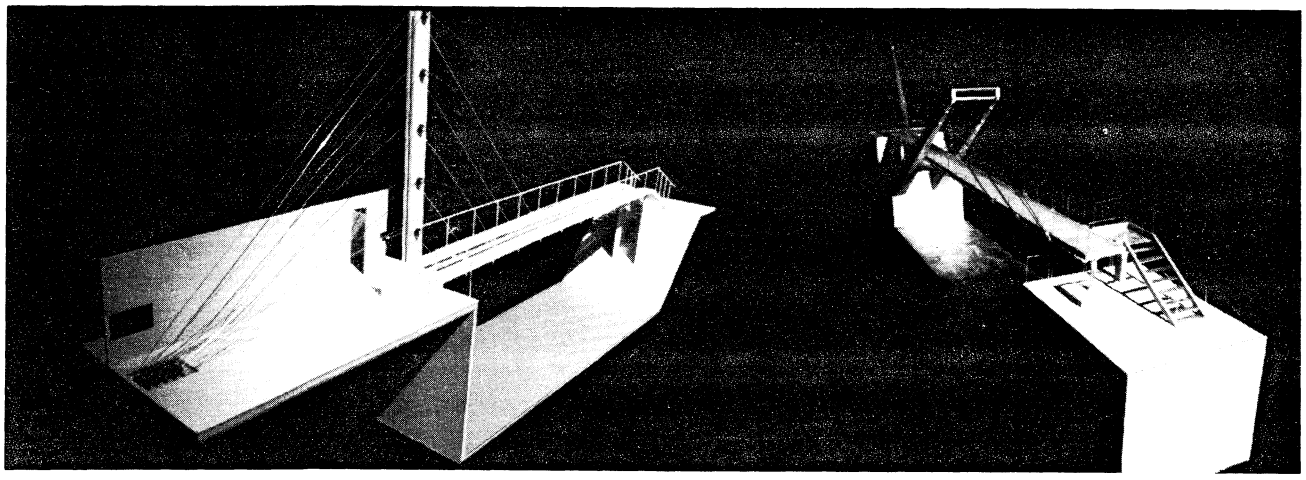

Fig. 4. Final models by Jayson Beltran and Martin Ayanegui.

Integrating these is composing."[12] Within the paradigm asserted by Cage, they determined the structural parallel in architecture to be its divisibility into the load supporting elements of columns, beams, arches, and cables, which when used to define space become screens, walls, and platforms, and that the integration of these elements into a harmonious whole approaches architecture. The character of John Cage was introduced in this exercise as a cathartic energy to compel the process whereby the student assigns form to idea. More specifically, the importance of emptiness as a design element and aesthetic value was impressed. John Cage the client encouraged spontaneity and acquiescence to the non-conventional idea, and effectively became the bridge connecting the students to their own poetic sensibilities about the process of making.

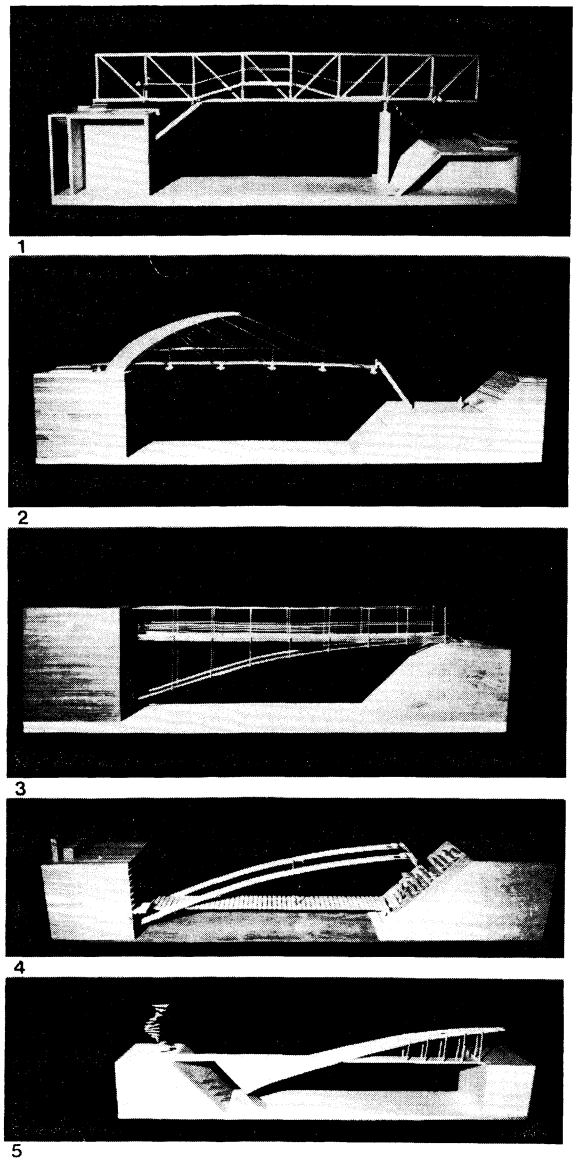

Fig. 6. Final models 1-5 by Mark Reynolds, Junaid Abbasi, John Mapes, David Culloty, and John Puhr.

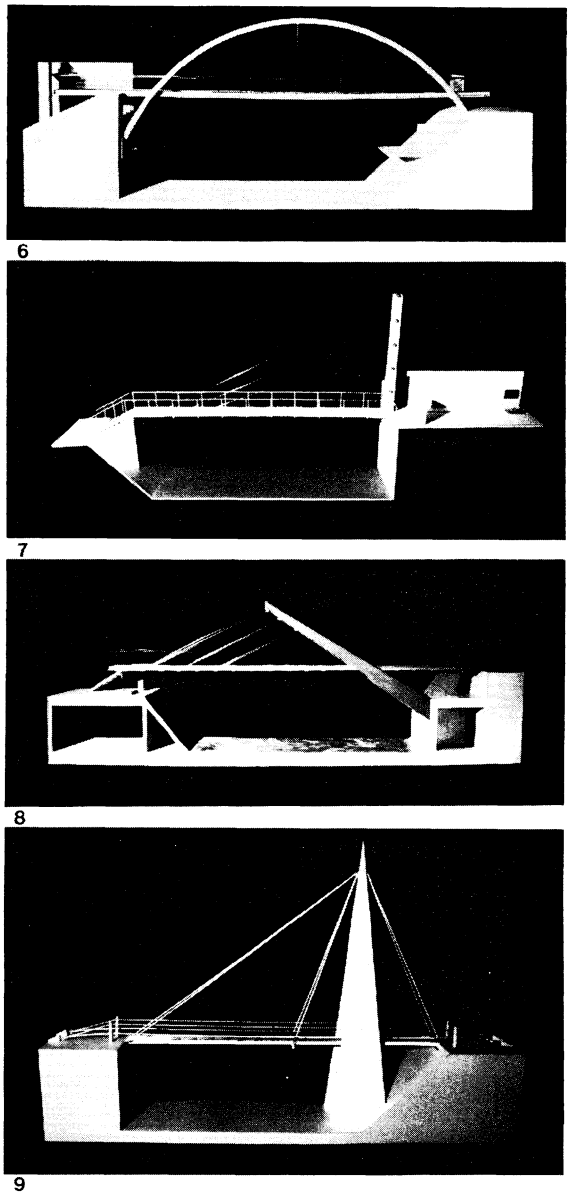

Fig. 7. Final models 6-9 by Carlos Hernandez, Jayson Beltran, Martin Ayanegui, and Jim Halloran.

NOTES

[1] Vitruvius Pollio, Marcus. *Vitruvius The Ten Books on Architecture*, translated by Morris Hicky Morgan, Dover, 1960, originally published by Harvard University Press, 1914, (p. 5).

[2] Salvadori, Mario. *Why Buildings Stand Up The Strength of Architecture*, W.W. Norton & Company, Inc., 1980, (p. 26).

[3] Mock, Elizabeth B. *The Architecture of Bridges*, The Museum of Modern Art, New York City, New York, 1949. (p. 7).

[4] "Rolywholyover A Circus" an exhibit for museum by John Cage was his last major composition, and was presented to the Houston community, January 14-April 2, 1994, by the Menil Collection. The exhibition originated in Los Angeles, and from Houston, traveled to New York, Tokyo, and Philadelphia. It included many important works of visual art, which were moved every day according to a computer programmed chance-generated score. The main concept behind the exhibition is the "Circus," which Cage saw as a dynamic work of art. As he put

it, "The basic idea is that the exhibition would change so much that if you came back a second time, you wouldn't recognize it." (from the catalogue)

[5] Turner, Drexel, *Open Plan: The History of the College of Architecture University of Houston 1945-1995*, University of Houston Atrium Press, Houston, Texas, 1995. (p. 23). In this history of the college Drexel Turner states that in 1971, Arthur Hacker (Yale, 1971) "reorganized the college's first year design sequence as a combination of neo-Bauhaus basic design exercises, sensory explorations, and readings in environmental psychology". In 1976, when Robert Timme (Rice, 1971) assumed responsibility for the program he replaced the experiential components with basic design exercises "patterned after the first year regimen of Elinor Evans at Rice University, who had studied under Albers at Yale."

[6] Ibid., Robert Griffin (Auburn, 1970) who was hired in 1972, "transformed the second year design program into a carefully graduated series of building design exercises proceeding from "point-line-plane" analyses to program-based decision-making. Griffin brought new consistency and rigor to the early undergraduate experience as well as a high degree of craft reflected in models of wood and metal — tendencies that filtered upward into the work of advanced design studios."

[7] From the College of Architecture University of Houston Architectural Program Report to the National Architectural Accrediting Board, 1993. (p. 47,48).

[8] The assignment for all second year design studio sections was titled *A Place for Contemplation*. It was three weeks long and sited near Allen's Landing on Buffalo Bayou in downtown Houston.

[9] Watson, Wilbur J., in *Bridge Architecture*, William Helburn Inc., New York, 1927, (p. 19-20), describes five classifications of bridges by type: "The Arch, the mechanical principle of which is that of a curved structure, the elements depending upon the compressive strength of the material used. The Simple Beam, depending primarily upon the bending strength of the material. The Suspension, or cable bridge, utilizing the simple principle of the cord in direct tension. The Cantilever, making use of mechanical principles similar to those of the simple beam, but requiring an anchorage at one end. The Truss, requiring the use of connected members, some in compression, some in tension, and some as simple beams."

[10] Cage, John. *Silence: Lectures and Writings by John Cage*, Wesleyan University Press, Middletown, Connecticut, 1987, seventh printing, (p. 62).

[11] *Tension Builds: sound...structure...space...* was a project created and organized by the author that focused on the theme of tension and its presence in sound, structure, space, and movement. It was a week-long series of events that included a large scale installation of tensile structures by Charles Duvall, and the long stringed instrument by Ellen Fullman in the 4-story atrium of the college, and a series of collage exhibits in the gallery by UH architecture students. The project included lectures, performances, and workshops for UH students and elementary school children from neighboring community organizations. The entire project was free, open to the public, and dedicated to the memory of John Cage. It was the culminating event of "CityCircus," a city-wide series of events organized in conjunction with the Menil Collection's presentation of *Rolywholyover A Circus*. "CityCircus" was an integral component of *Rolywholyover* which Cage saw as way of reaching beyond the boundaries of the traditional museum experience.

[12] Cage, John. *Silence: Lectures and Writings by John Cage*, Wesleyan University Press, Middletown, Connecticut, 1987, seventh printing, (p. 62).