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One Source of Goldberg's Curves

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Abstract

Bertrand Goldberg was a Chicago architect who built many curved designs throughout his career. He is best known for his Marina City project in Chicago (1960-1967), a groundbreaking urban complex featuring two tall round towers. At Marina City, Goldberg began his use of three-dimensional curved shapes formed in concrete. This significant development in his work was coincident with the ongoing artistic work of Lillian Florsheim, a family member, who was sculpting similar curved forms at the same time. Noting this shared evolution, this investigation offers one explanation to the question, "From where did those curves come?"

Keywords: Bertrand Goldberg, Lillian Florsheim, curvature, form, concrete shells, sculpture

The architect

Bertrand Goldberg was an architect and engineer based in Chicago, with over 200 built works in a career that spanned from 1937 to his decease in 1997. He is best known for the iconic Marina City, built in the early 1960s. This multi-building complex featured two round towers, which were at the time, said to be the tallest concrete structures in the world. The project was unique programmatically, formally and technically with, according to Carl Condit, *"...an assortment that required the engineers to exhaust every technique of concrete construction developed up to the time.*" [1]

Figure 1: Marina City, Chicago, Bertrand Goldberg Associates, 1959-67 [Hedrich Blessing]
Figure 2: bent wood chair, Bertrand Goldberg, 1939

Prior to Marina City, Goldberg's use of curvature was largely two-dimensional. It started with curved walls in his early houses, although he was notably inventive in other early works, including hanging buildings from masts, or involved with prefabrication making a pressed-steel bathroom and plywood boxcars. [2] His interest in curvature was explored in furniture, starting with a molded plywood chair from 1939, curved in two directions. In the 1950s, curvature entered his architecture, with a proposed motel in 1958 with two round towers. At that time, he designed a large domed arena for Florida, and when it was finally built in the 1960s, it used precast concrete rafters, to achieve its form using axial rotation. At that time, his interest in curvature moved yet further, with more complex shapes at Marina City. The focus of this discussion is that change, Goldberg's use of three-dimensional curvature, with shapes whose profile or radii change in space.

Marina City was the moment of transition. First proposed in 1959, the project featured two sixty-story towers, a free-standing theater, and a tall office building to the north. The round towers had a central core with radial beams and perimeter columns. The first eighteen floors of each tower were a continuous spiral parking ramp, the residential apartments located above. Each of 900 apartments had their own large curved balconies, supported by curved ring beams on perimeter columns. [3]

In 1960, Goldberg's office revised the detailing of the towers, with the perimeter columns now an unusual trapezoid shape with squared-off points to allow for clean connection to any of its eight faces. The flattened points received all the walls, both interior and exterior curtain wall, while the ring beam for the balcony sprung from a long face of the trapezoid as a sculpted support shape (Condit called these "haunches"). It was a solution in three dimensions, integrating balcony support with vertical structure along the building exterior. In 1962, Goldberg stated *"In our balcony cantilever at Marina City, we emphasize the clarity of our lines and loading, but in using a fluid material like concrete, we can mold the material to reflect more accurately our load patterns."* [4] It was feasible with custom fiberglass forms that were continually reused. [5]

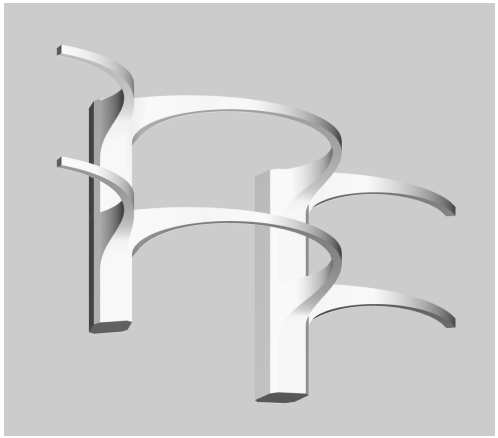


Figure 3: ring beam and haunch detail at perimeter columns, Marina City towers [drawing done later by author]
Figure 4: fiberglass formwork for haunches, Marina City, 1962 [Richard Nickel]

To the north, ten stories of offices above a lower floating volume (housing a bowling alley) were supported with only a single row of internal columns to facilitate office layouts. The remaining support was on the building perimeter by specially shaped cast-in-place concrete structural mullions. At the fifth floor, the load path from the upper building was transferred to the regular column grid of the site superstructure. Originally designed in 1959 conventionally with exposed rectangular beams and columns, it changed in 1960 to a far more intricate and expressive answer, with gothic-type arches and curved columns. The geometry of these vaults was highly controlled with a level of precision not seen previously in the work of the office. These details indicate a growing capacity in their use of three-dimensional curves, and raises the question of what was behind such evolution, from their simple solutions of the late 1950s to rich answers just a few years later?

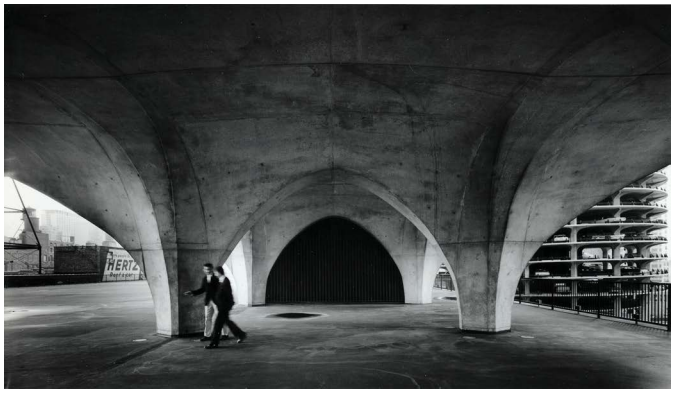


Figure 5: vaulted spaces under Office Building at Marina City, 1965
Figure 6: Office Building under construction, Marina City, 1963 [Portland Cement Association]

The artist

Goldberg's understandings of form were deeply influenced by artistic explorations undertaken outside the office by a family relation, Lillian Florsheim. Born in New Orleans, Lillian married Irving Florsheim of the shoe company in 1918 and moved to Chicago. In 1946 she bought a small house on her own and in 1951 studied sculpture at Chicago's Institute of Design (ID), established by Moholy-Nagy as a continuation of the Bauhaus in Germany. Florsheim being at ID was no accident: her daughter had married a young Bertrand Goldberg in 1946, and he was sympathetic to the work at ID, having attended the Bauhaus in Germany in the early 1930s.

Figure 7: Lillian Florsheim in her studio, 1953 – note small string models.
Figure 8: *Porcupine*, Lillian Florsheim, 1963 [New Orleans Museum of Art]

Following her studies at ID, Florsheim began making both figural shapes and string constructions, having learned the technique which had been brought to the school by Moholy-Nagy. Her string works became more elaborate over time, essentially sculptural investigations of descriptive geometry. [6] Her work varied – she also arranging same-shaped plexiglass pieces, with an interest in negotiating rule structures, to make a figure called *Porcupine*, with good humor.

At the same time, she began making curved shaped sculptures, layering wax over wire armatures, which were then cast. This work with curved shapes followed a line of thought largely developed by two European artists, Georges Vantongerloo and Max Bill. She was exposed to their work at ID by her professor, Hugo Weber, who introduced her to these artists.

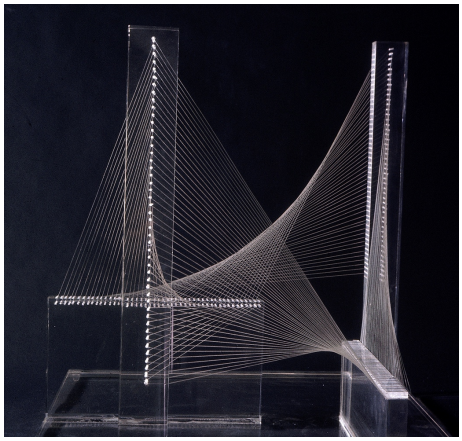
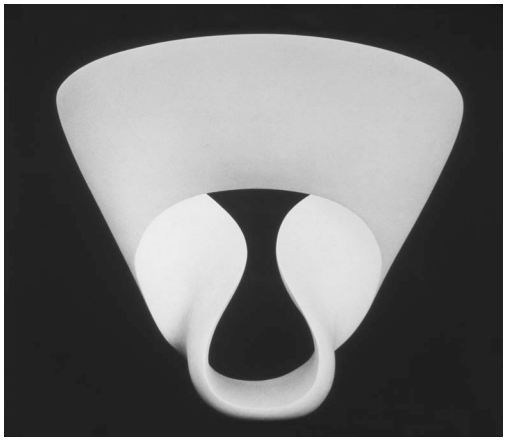



Figure 9: *Curved Surfaces,* Lillian Florsheim, c. 1964
Figures 10: *Nefertiti,* Lillian Florsheim, c. 1963

Vantongerloo was an early member of De Stijl and was known for his use of geometry in his compositions; he had begun his work on abstract curvature as early as 1917, working in painting and sculpture, although he later designed some furniture and a few architectural works. [7] In the 1950s, Florsheim established a close relationship with the reclusive Vantongerloo in Paris. In 1956, she acquired one of his important sculptures, *Plan et l'Espace,* curved planes from 1945, followed a few years later by his *Rapports des volumes eminant de l'ellipsoide* from 1926.


Figure 11: *Free Form Construction*, Lillian Florsheim, 1962
Figures 12: *Plan et l'Espace,* Georges Vantongerloo, 1945 [Goldberg Family Archive]

Work of the architect

Goldberg's had interest in organic, unified projects – combining architecture and structure closely – a view not uncommon in the 1950s. He worked with a similarly minded structural engineer for the Marina City towers in 1959, Hannskarl Bandel of Severud in New York. Bandel wrote in 1966 "... *probably the most remarkable and important development in modern engineering is the search for a way to combine the different elements of a structure into one complex but integrated load-resisting whole - a continuum.*" [8] Goldberg's notions could not have been expressed more clearly.

Bandel was not the only engineer working on Marina City. In 1960, Frank Kornacker joined Bertrand Goldberg Associates as the lead structural engineer. Quite talented, he had been Mies' structural engineer for 860-880 Lake Shore Drive and Crown Hall at IIT and was the likely designer of a conceptual structural model from Goldberg's office, titled "Drape Shape". [a] This study of force lines and curved forms is known only from a single published image in a 1960 newspaper article, and is the precedent for the curved vaults at the Office Building at Marina City.

A theater building was also designed for Marina City. Originally conceived as a shell structure, the early drawings for its curved roof form are quite similar to Florsheim's string models. Built a few years later, its interior space was revised and the roof had a different shape and structure.[b]

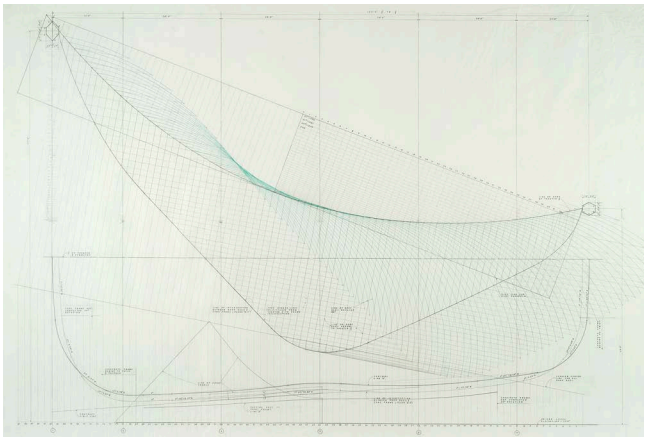


Figure 13: "Drape Shape" model promoted by Goldberg, in Chicago American newspaper article, 1960
Figure 14: Theater Building study, Marina City, Bertrand Goldberg Associates, c. 1962 [Art Institute of Chicago]

During construction of Marina City, Goldberg also designed the Brenneman School in Chicago, with 24 classrooms, each topped with small shells shaped to bring daylight into the rooms. The parabolic shells rested on vertical sidewalls. They were built without formwork, with sprayed concrete and self-supporting reinforcing.[c]

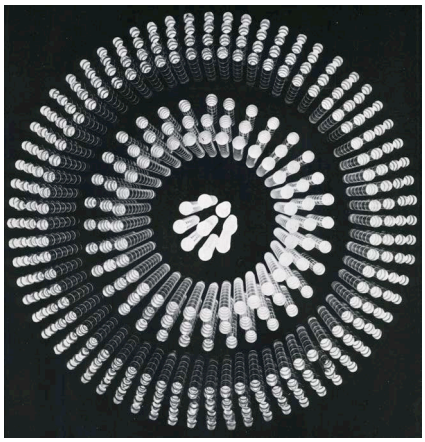
Figures 15, 16: Brenneman School, in construction, Chicago, Bertrand Goldberg Associates c. 1964

Subsequently

The early 1960s was a period of intense interest in three-dimensional curvature for both Goldberg and Florsheim. However, ultimately this focus was not sustained, as both moved to simpler ways to achieve shapes of interest. Goldberg use of curves continued, largely in two dimensions for reasons of simplicity. His Raymond Hilliard Homes of 1965 was a public housing project of four buildings. Each had curved walls, vertical extrusions, for all their exteriors. This became the standard approach for most subsequent works of the office, including the many hospitals built through the 1970s and 1980s. The hospitals were designed around patients clusters grouped radially around nursing stations, typically four clusters per floor. As the cluster size varied at each hospital, so did the exterior wall and profile of the patient towers. Use of three-dimensional curvature was limited, used only at the transition between the orthogonal base building and the patient tower.

Figure 17: Raymond Hilliard Homes, Chicago, Bertrand Goldberg Associates, Chicago, 1965
Figure 18: St. Joseph's Hospital, Tacoma WA, Bertrand Goldberg Associates, 1975

By the mid-1960s, Florsheim also moved to simpler geometries. She made a large number of works assembling plexiglass rods in different shapes, achieving dramatic visual effects by use of the materials. Recognized for their meticulous execution, she had much success with these plastic constructions, with shows in a number of galleries and museums in the U.S. and Europe.



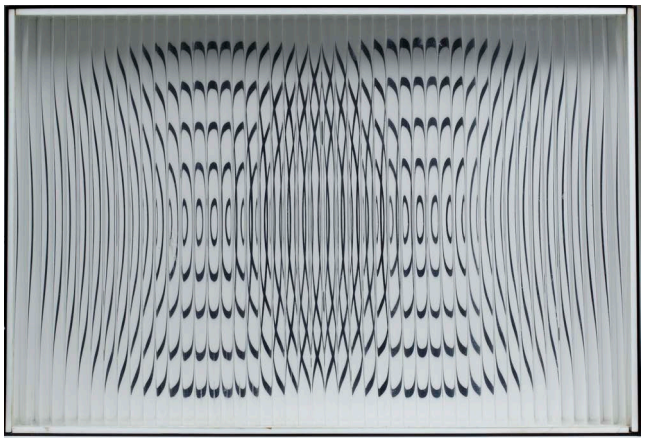


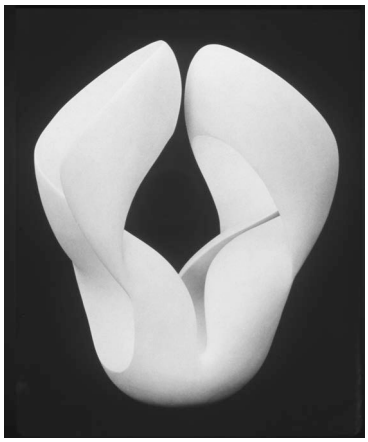
Figure 19: *Rings of Rods*, Lillian Florsheim, 1968
Figure 20: *Almadine,* Lillian Florsheim, 1967

She continued studying geometry and form but unlike her earlier works, these were separated: geometry became pattern and her forms simplified. In architecture, geometry, form, and structure are typically considered as direct overlays, one just as the other. Goldberg's work, evidenced by the unusual "haunches" and trapezoidal-shaped columns at Marina City, suggests a more fluid relationship to structure and form. It is likely his exposure to Florsheim and her art introduced a variety of ideas and possibilities to him not known from his earlier Miesian education.

Interplay

Did the sculptural work of Florsheim impact Goldberg's architecture, or did Goldberg help guide the artist? The answer is likely both. The dating of their works is close but suggests that Goldberg helped guide Florsheim in a transition to her sophisticated string pieces, as he was working on similar problems of descriptive geometry in his office at the same time. Florsheim was able to change her emphasis quickly over just a few years, and try new approaches and ideas, and her explorations were of interest to the architect. Consider these then as parallel investigations, one by an artist, the other by an architect, done in proximity, a sharing across disciplines.

Florsheim's *Quatrefoil* (1963) is one of her more significant curved sculptures. It springs from its central base into four symmetrical quadrants. So too, Goldberg's hospital towers were largely designed in similar quadrants, and at Prentice Hospital in Chicago, were cantilevered from a central core. While not identical, these two shared a formal similarity, even though their sizes were completely different.



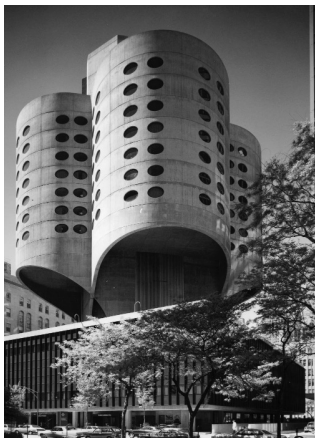
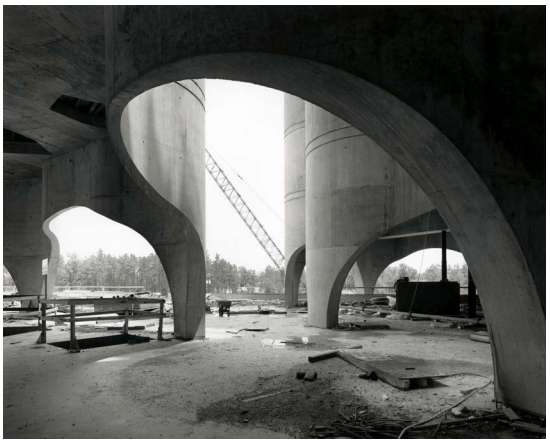


Figure 21: *Quatrefoil*, Lillian Florsheim, 1963
Figure 22: Prentice Women's Hospital, Chicago, Bertrand Goldberg Associates, 1974 [Hedrich Blessing]

The last hospital and major curved work completed by Goldberg was Providence Hospital in Mobile Alabama in the 1980s. The building shape came from the floor plan, and the exterior wall was structural, cast in concrete as a vertical extrusion. As the wall came to the ground, blockouts were used to make large openings. Technically, the transition was achieved by an internal redistribution of loads and the wall got thicker as it changed to acting more columnar, with arched openings at the ground level. The transition is not unlike similar to what occurred in Florsheim's earlier sculpture *Quatrefoil* with its many changes from interior to exterior. Things start one way and become something else.



Figures 23, 24: Providence Hospital, Mobile, AL, Bertrand Goldberg Associates, 1986

Conclusion

One must take care assessing the relationship between Florsheim and Goldberg, as the artist did not make the architecture, nor did the architect make the art. Florsheim's evolution, from sculptures and string constructions to more optical works, engaged both architectural- and art-related interests, while an assessment of Goldberg's buildings includes other factors instrumental in their design, including progressive investigations into program, structure, and social concerns, all partners in the process.

Goldberg maintained a broad set of interests throughout his career, and his interest in Florsheim's art was just one of many areas he considered as related to architecture. Within a broad umbrella, the structural studies such as Drape Shape expanded his thinking, as did Florsheim's work with geometry and form. Both were key in his ongoing development and help explain the rapid transformation of his work in the early 1960s, a period of particularly rich investigation on many fronts. It suggests an ongoing role for such explorations in similar pursuits of significant and substantive answers.

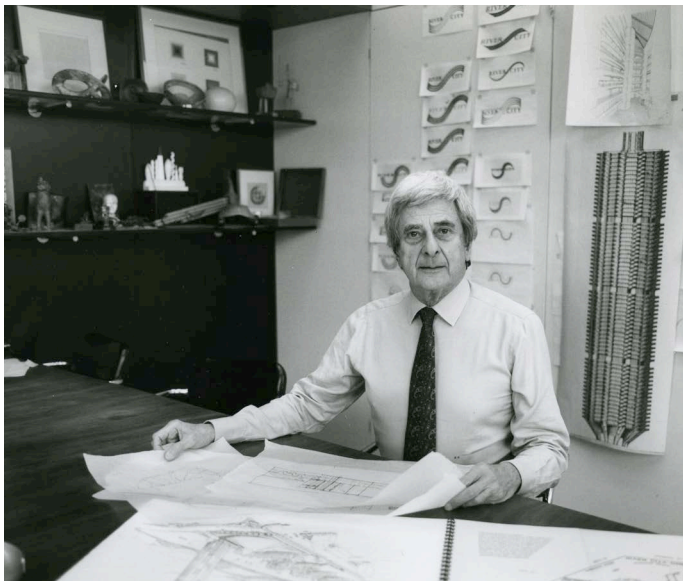


Figure 25: Bertrand Goldberg in his office, 1982[d] [David Belle]

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[8] H. Bandel, "New Concepts in Structural Design", *Structure Systems*, Heinrich Engel, Praeger, p. 269-276, 1968

[a] Kolbjorn Saether, a Danish engineer who studied shell structures, was in the office at this time. His role remains unknown.

[b] The theater building changed from a shell to a steel saddle-type configuration, sprayed with concrete. Its interesting structure was designed by Bandel.

[c] The shells at Brenneman still exist, although they are hidden under cover of a large steel structure.

[d] On the shelves is a Vantongerloo sculpture, borrowed from Florsheim.