Title:	**The Race for the Sky: Unbuilt Skyscrapers**
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Subject:	Architectural/Design
Keywords:	Supertall Urbanization
Publication Date:	2008
Original Publication:	CTBUH Journal, 2008 Issue I
Paper Type:	1. Book chapter/Part chapter 2. **Journal paper** 3. Conference proceeding 4. Unpublished conference paper 5. Magazine article 6. Unpublished

The Race for the Sky: Unbuilt Skyscrapers

Unbuilt skyscraper designs are noted by many architecture critics as the best in the genre of tall buildings. This paper provides an exposition of various iconic and "unbuilt" skyscraper design proposals that have inspired architects and engineers to build ever-taller buildings and continue to fuel the twenty-first century race for the sky. The study identifies two categories of unbuilt skyscrapers. The first group includes skyscraper visions that were mainly proposed as part of a comprehensive urban development theory. Skyscraper proposals of the second group were aborted due to various conflicts that ranged from popular opposition to economic crises or hurdles. The paper concludes with a discussion of the current most daring skyscraper projects and the potential for revisiting some unbuilt skyscraper dreams.

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Mohamad Kashef practiced architecture, urban planning, and project management with multinational consulting firms and construction companies in the United States, Canada, Egypt, and Saudi Arabia. Taught courses, seminars, and studios in urban design, history and theory of architecture and urbanism, and historic preservation. Assisted various cities and communities in the United States in the preparation of downtown development plans and urban design guidelines. Research is focused on introducing a balanced physical planning and design agenda that integrates both architectural and planning knowledge with an emphasis on sustainable practices. A special research interest in tall buildings and multi-use structures that integrate unique architectural configurations with innovative technologies and green solutions. Other design and research concerns include heritage and urban conservation within a global context. Participated in the revitalization and restoration efforts of the Historic Citadel District in Cairo, Egypt.

The skyscraper was mainly an American invention that thrived and was propagated by the work of architects from the Chicago School, such as Sullivan, Burnham, Holabird, and Roche William Le Baron Jenny, regarded as the father of the Chicago School, designed the Home Insurance Building of 1883, which was a mere ten stories high, but considered the world's first steel skeleton skyscraper. It was iterated upon by the designers of the Woolworth, Empire State, and Chrysler buildings in New York City, following the institution of the 1916 Zoning Ordinance. The technique of building skyscrapers was subsequently refined by SOM (Skidmore, Owings, and Merrill) and transferred worldwide. Many of SOM's designs have become icons of modern American architecture, including the Lever House (1952) in New York City and the John Hancock Center (1969) and the Sears Tower (1973) in Chicago. Their work has laid the ground for a revolution in building heights that have currently exceeded 1,670 feet with the Taipei 101 Tower in Taiwan. In excess of 2000 feet, Burj Dubai in the United Arab Emirates, which is scheduled for completion in 2009, will probably break all previous records.

Advancements in structural systems, building materials and computer-aided design technologies are driving today's skyscraper design to a new horizon. Form and function are no longer complementary or tied together in a linear equation. From helicoidal and spiral designs to sail-shaped, cantilevered configurations, the tall structure is regaining its status as an icon and asserting itself as a symbol of culture and civilization. Unbuilt skyscraper designs are noted by many architecture critics as the best in the genre of tall buildings. This paper provides an exposition of various iconic and "unbuilt" skyscraper design proposals that have inspired architects and engineers to build ever-taller buildings and continue to fuel the twenty-first century race for the sky. This study identifies two categories of unbuilt skyscrapers. The first group includes skyscraper visions that were mainly proposed as part of a comprehensive urban theory. Skyscraper proposals of the second group were aborted due to various conflicts that ranged from popular opposition to economic crises or hurdles.

First Group: Skyscraper Urban Theories

Various twentieth-century skyscraper visions incorporated solutions to urban development problems, especially overcrowding and unhealthy living conditions. Three schemes were selected because of their comprehensive scope and profound impact on the development of modern architecture and urbanism. These include Le Corbusier's Contemporary City (Figure 1), Wright's Broadacre City (Figure 2), and Sant'Elia's Citta Nova (Figure 3).

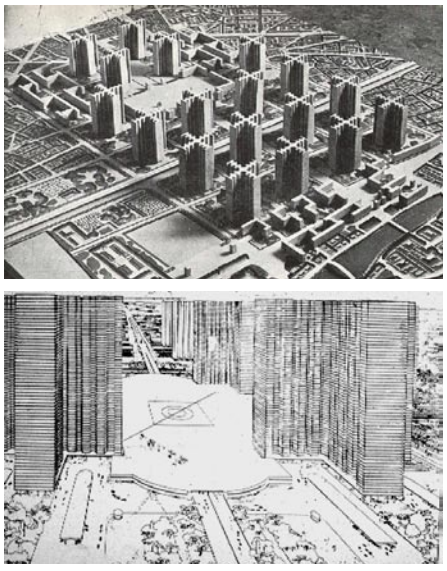


Figure 1. Le Corbusier's Contemporary City: Towers in Parks; the heart of the Contemporary City included 60-story skyscrapers and an airplane landing platform (Boesiger et al. 2006)

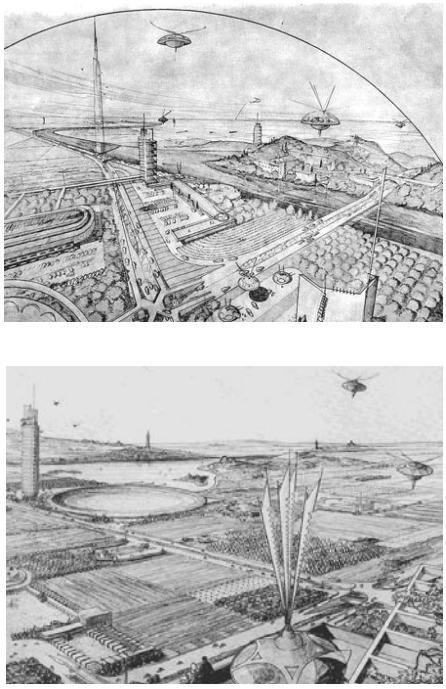


Figure 2. Images from Wright's Broadacre City (Wright 1958), the Mile High skyscraper and its most recent inspiration: "Burj Dubai," The actual building height as of February 2008 has exceeded 2000 feet.

Le Corbusier's Contemporary City

Le Corbusier wanted to literally dismantle all forms of pre-modern urbanism and replace them with a scheme of towers and highways. He believed that cities needed to have high population densities to function properly. Nevertheless, Le Corbusier was appalled by the congestion of 1920s cities, which he attributed to the inefficient road network and building configurations that did not match the spirit of the machine age. The key was the famous paradox, "We must decongest the centers of our cities by increasing their density" (Hall 1996, 207). He called for the demolition of congested urban centers and their replacement with soaring towers interspersed by super highways and green spaces (Sewel 1993, 32). Le Corbusier envisioned a "Contemporary City" (1923) for millions of people housed in skyscrapers that would cover little more than five percent of the land. Buildings would be elevated on "pilotis" (stilts) to allow park space to flow right underneath (Benevolo 1980; Boesiger et al. 2006). His planning schemes departed dramatically from those of then-existing cities, and generally aimed to avail of the technological innovations of the 20th century. Almost all of his schemes remained on paper except for Chandigarah and few single-block buildings that he built in Paris and Berlin (Hall 1996, 212). However, Le Corbusier had an immense influence on modern architecture and planning. The idea of a "tower in a park" that currently pervades most cities was mainly derived from his urban vision (Figure 1).

Frank Lloyd Wright's Broadacre City

Frank Lloyd Wright wanted to fuse the city and the country so that the urban-rural distinction would no longer exist. The individual house, built within a one-acre farm, became the center of the human settlement in which everything from living and recreational patterns to means of transport was flexible and configured according to personal imperatives (Wright 1958). Wright's Broadacre City was highly progressive in the sense that it afforded its inhabitants in the 1950s a kind of technological and transportation gadgetry yet to be achieved today. Forward-looking helicopter flying crafts were portrayed throughout the design proposal as the primary mode of transportation in the city. Wright envisioned a very low-density settlement that comprised every building type he previously designed (Lang 1994) (Figure 2).

Broadacre City never fully materialized, but in many ways it represented the ultimate American dream of a high level of individualism, much open space, and high mobility. The physical form of Wright's Broadacre City has partly become a reality in the current American urban and suburban landscapes. Ironically, Wright designed a mile-high skyscraper (5,280 feet) to be the focal point of such a very low density and rather horizontal development. The tower was estimated to have 528 stories and a gross area of 18.46 million square feet. He envisioned the tower as the visual anchor of the downtown that would be seen from every corner of Broadacre City. Wright conceived a slender skyscraper with cantilevered floors. Following his organic architecture credo, he likened his tower to a tree trunk with branches (Linn 2004). Wright's tower (Figure 2) was never built, but the concept of a mile-high skyscraper has become engrained in the minds of many architects and designers. It continues to fuel the race for reaching higher altitudes, as evidenced in Burj Dubai, which is somewhat reminiscent of Wright's Mile High. When completed in 2009, Burj Dubai will stand at approximately 2,000 feet.

Antonio Sant' Elia's Citta Nova

Born in Lombardy, architect Antonio Sant'Elia became involved with the Futurist movement that originated in Italy at the beginning of the twentieth century. Sant'Elia is the supposed publisher of the manifesto "Futurist Architecture", in 1914, in which he articulated his vision for the city of the future. Citta Nova was a highly industrialized urban conglomeration that featured bold groupings of monolithic high-rise structures with terraces, bridges and elevated walkways (Figure 3). His ideas probably influenced the mega city concepts of the sixties and seventies in which an entire city was envisioned as a large-scale disposition of interconnected buildings and enclosed city spaces. None of his designs were ever built but the heroic industrial expressionism of Sant' Elia' Citta Nova has influenced many architects and designers and probably inspired the designs of large indoor shopping malls, college campuses and massive industrial and office complexes across the world.

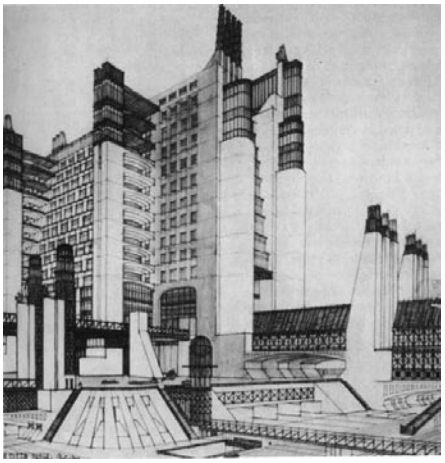


Figure 3. Images from Antonio Sant' Elia's Citta Nova; large groupings of monolithic high-rise structures with bold building masses interconnected with bridges and elevated walkways

Second Group: Commercial Skyscrapers

Skyscrapers in this group were mainly proposed for commercial purposes in different parts of the world. They were aborted due to various conflicts that ranged from popular opposition (The Grand Central Tower by I. M. Pei) (Figure 5) to economic crises or hurdles (the Dearborn Tower in Chicago by SOM, Figure 6 and the Grollo Tower in Melbourne, Figures 7 and 8).

Office Tower at Grand Central by I. M. Pei

The decision to abort building a tower on the site of the Grand Central Terminal in New York was hailed as a victory for the historic preservation movement in the United States. Grand Central (1903-13) was designed by Reed and Stem and is considered a fine example of American academic architecture that shows the influence of the "Ecole des Beaux-Arts" (Fletcher 1961, p. 1156). The Terminal façade is topped by a finely sculptured clock and the barrel-vaulted space inside is considered one of the great interiors of the period. The Landmarks Commission denied approval for several skyscraper proposals at Grand Central because of the Terminal's historic significance and the opposition by the public as well many notables, including Jacqueline Kennedy Onassis and architect Phillip Johnson, who marched with many others in the streets to "save Grand Central" (Tyler 2000, p. 85) (Figure 4). I. M. Pei's 80-story tower concept had a tapered, circular cross-section with an elegantly proportioned hourglass profile (Figure 5). The building shell was encompassed by a crisscross, structural bracing system that met both at the base and beyond the top of the building at twelve points. The hourglass profile and the exposed structural bracing system, together with the various open floors, provided the tower with a dramatic ethereal effect and a rather futuristic look for a skyscraper concept from the 1950s. Grand Central Terminal would have been razed to clear the way for I. M. Pei's skyscraper proposal. The opposition was so high that Pei's concept was passed up and development rights were transferred to a nearby site.

Figure 4. Philip Johnson, Jacqueline Onassis, Bess Myerson, and Edward Koch marching in support of Grand Central Terminal (Maddex 1985)

Figure 5. I. M. Pei's 80-story tower proposal (Linn 2004)

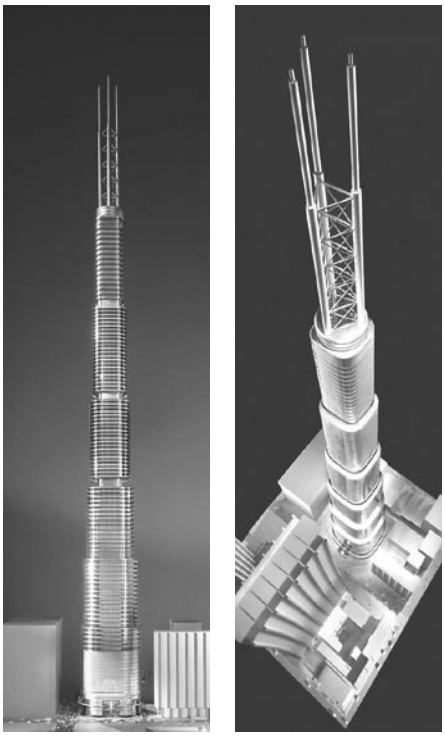


Figure 6. "7" South Dearborn, Chicago, Illinois by Skidmore Owings and Merrill (www.emporis.com)

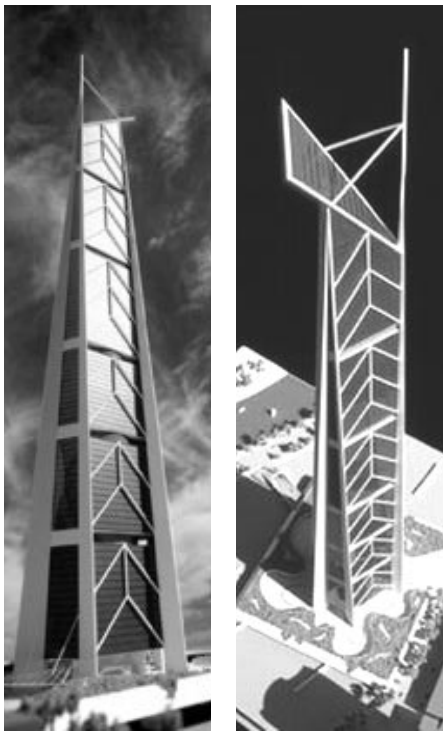


Figure 7. Grollo first tower; Harry Seidler & Associates (www.seidler.net.au)

"7" South Dearborn, Chicago, Illinois

This tower proposal was slated to be 108 stories of usable space (1,550 feet) topped by 450-foot-high communication antennas, which would have been, at the time of its projected completion (2004), the world's tallest building (Figure 6). It was planned as a 1.9 million square foot, mixed-use complex, including 765,000 square feet of office space and communication facilities, 90,600 square feet of commercial space, and 75,000 square feet of diverse retail functions, such as restaurants, shops, a fitness club, and other related services. As Skidmore Owings and Merrill indicated, the tower would have complemented the vibrant Central Business District in Chicago with a full range of residential, retail, and commercial activity 24 hours a day, seven days a week. With a smaller footprint than that of many shorter skyscrapers, the 2000-foot Dearborn tower would have been one of the most slender towers, with an overall aspect ratio of approximately 8.5 to 1 (Baker et al. 2000). The tower offered a major advancement in the engineering of tall buildings. SOM indicated that the tower design consisted of a "stayed-mast structural system;" a reinforced concrete wall in the core tied diagonally to structural steel mega-trusses at the mechanical floors (two points along the tower's shaft) and widely spaced columns at the perimeter of the lower half of the building. The mast structural system allowed column-free and reduced thickness floor plates and also provided support for the cantilevered sections of the building clusters above (SOM). The tower was articulated into six floor clusters. The lower two clusters were separated by setbacks and the upper four clusters were divided by notches and cantilevered from the core. The aluminum and stainless steel exterior and the soaring antennas underscored the building's role as a communication tower. The project was cancelled because of financial difficulties related to the high-tech market slump in the late 1990s and especially because the communication companies sponsoring the broadcasting antennas backed out.

The Grollo Towers in Melbourne, Australia

The first project was proposed in the mid 1990s by architect Harry Seidler as a 120-story tower with 3.5 million square feet of functional space and a total height of 1,640 feet. Had it been built, it would have seized the title of the tallest building in the world from Kuala Lumpur's Petronas Towers (1,480 feet). Despite the wide-open landscape and relaxed urban fabric characteristic of Melbourne, the designer portrayed the tower as an alternative to urban congestion in the city (www.Seidler.net.au). The developer (Bruno Grollo) conceived of the tower as an icon or a landmark that would confer a global character on Melbourne similar to what the Opera House does for Sydney. Structural stability and graceful proportions were achieved by a distinct upward, tapering profile supported by six massive, triangular columns defining the building's exterior corners (Figure 7). The exterior columns were connected by a visible structural bracing system shaped like upward-pointing arrows that created a vertical sensation, moving the eye toward the apex and bolstering the perceived height of the skyscraper. The design incorporated some green elements, such as photovoltaic devices embedded in the facades and a uniquely inclined pinnacle to harness the sun's energy and reduce the ecological footprint of the tower (Seidler; www.Seidler.net.au).

The second Grollo tower concept (Figure 8) was proposed on a different site in Melbourne (the Docklands) in 1996 by architects Denton Corker Marshall (DCM). Shaped like an obelisk, the proposed tower would have been 120 levels (1,148 feet) plus a light pinnacle that would have reached 1,820 feet above the ground. At this height, it would have surpassed all other towers in the world (DCM; www.dentoncorkermarshall.com). Despite popular opposition, the second tower concept was approved and given the go ahead in 1998. The project's demise, however, was prompted by the developer's failure to meet conditions for construction financing.

Figure 8. Grollo second tower by Denton Corker Marshall (DCM) (www.skyscrapercity.com)

ELA tower, Tel Aviv

The ELA tower (Figure 9) was proposed in 1995 by the Japanese architect Shin Takamatzu, in association with Eliakim Architects. The forty-story tower concept (approximate height, 450 feet) had 280,000 square feet of office space, 100,000 square feet of residential space, and 20,000 square feet of commercial space, with an estimated total area of 400,000 square feet (Zukowsky et al. 2000; Emporis). The tower had a striking configuration, in that it looked like a butterfly that is ready to take flight. The building mass was uniquely divided into two parts: The building proper was shaped like three attached convex lenses accentuated with three pairs of communication antennas; the wings gracefully embraced the central part and terminated in two major supports that frame the main entrance of the building. Like other designs by Shin Takamatzu, the building mass was highly articulated and exuded a hand-carved architectural sensation. The building of this tower was postponed indefinitely.

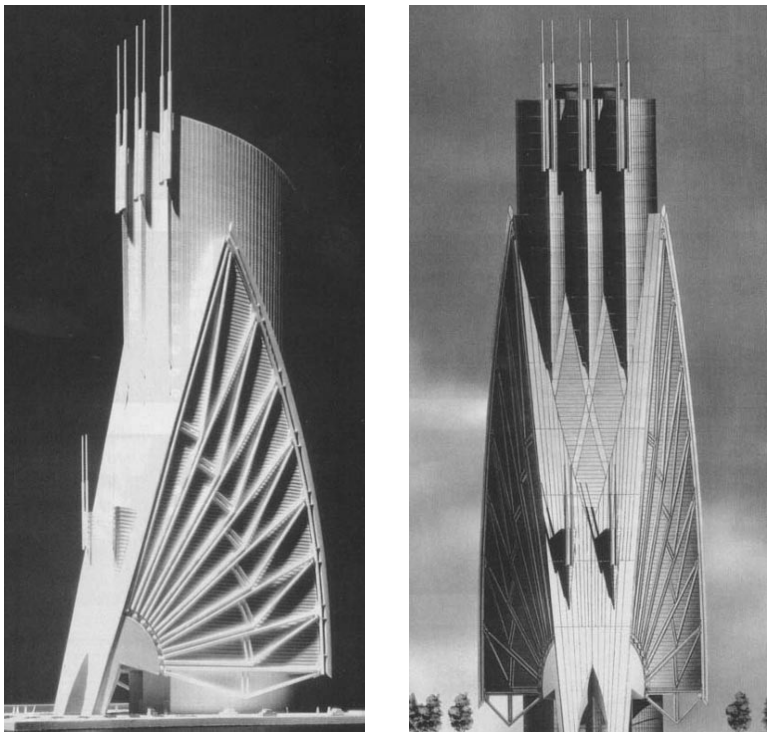


Figure 9. ELA tower concept, Tel Aviv (Zukowski et al. 2000)

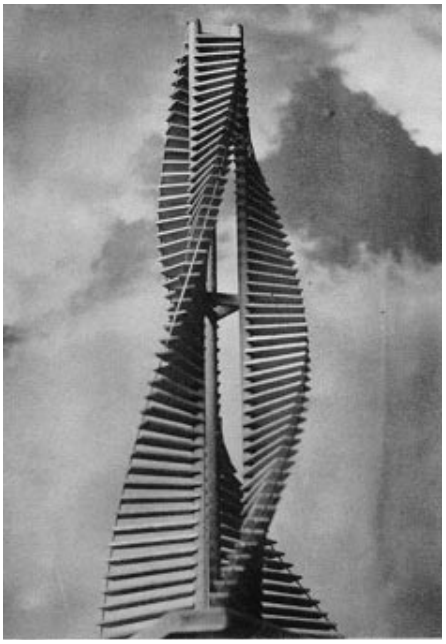
Al Rajhi Tower in Riyadh

Al Rajhi Tower (Figure 10) is still on the drawing board and not yet finally cleared for construction. The tower is sponsored by Al Rajhi family in Saudi Arabia, often described as the country's wealthiest non-royals and as being among the world's leading philanthropists. The sail-shaped tower was designed by architect W. S. Atkins and, if built, could reach a height of 1,150 feet, with a gross floor area of 865,000 square feet; it would be the tallest tower in Saudi Arabia (Atkins, www.atkins-me.com). It is planned as a commercial tower for office use and ancillary facilities, such as conference rooms, exhibition spaces, restaurants, etc. The bottom floors are designed as a shopping mall and connected with the rest of the development, which boasts a lavishly designed piazza with water features, cafes, and sitting areas nestled within palm trees and an oasis landscape environment.

Figure 10. Al Rajhi tower concept, Atkins W. S. (www.atkins-me.com)

The Helicoidal Skyscraper

Though not a commercial skyscraper proposal per se, the Helicoidal Skyscraper (Figure 11) vision by Manfredi Nicoletti was included here due its ethereal composition and dramatic architectural form that preceded some of the recent helicoidal-inspired skyscraper visions. Manfredi envisioned half-a-kilometer skyscraper (1,600 feet) that would pose minimum resistance to wind loads and achieve maximum utilization of tension and compression stresses. The open central nucleus of the structure is composed of three cylindrical columns that are disposed in an equilateral triangle form. Three massive helicoidal tension-loaded cables anchor the nucleus to the foundation and provide the structure with a torsional strain counterbalancing an opposite torsional strain exerted by cables inside the nucleus. The Floors are connected between the nucleus columns and helicoidal cables, giving additional rigidity to the tower structure. The vertical nucleus absorbs all vertical compression loads and provides sufficient space for elevators and other mechanical installations (Nicoletti M 1970).



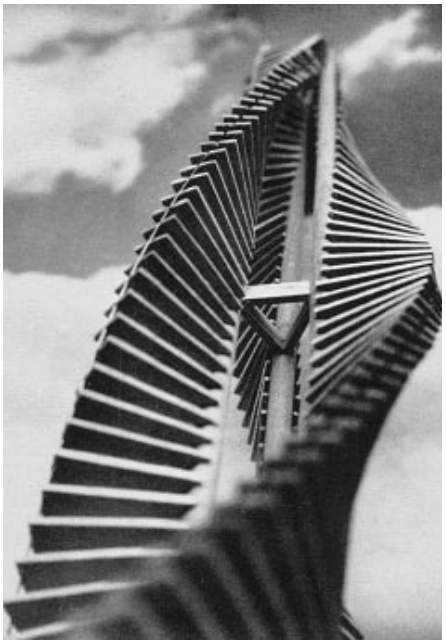


Figure 11. The Helicoidal Skyscraper vision by Menfredi Nicoletti (Nicolletti 1970)

Epilogue

Skyscraper building has been driven in part by the scarcity of land in congested urban areas, as in the cities of New York and Hong Kong. Higher land value renders a stacked-up office space a more efficient and economically viable solution; there is no where to go but up. However, the sheer size and spectacular height of skyscrapers engages people's imaginations, emotions, and memories. Once built, a skyscraper becomes a symbol for the place where it resides. The image of the Empire State building has come to represent New York City globally. The Sears Tower turned into a household name that epitomizes technological prowess and corporate power in Chicago. Considered the last great engineering achievement of the twentieth century and the tallest buildings in the world for several years, the Petronas oil company towers have become symbols for the economic success and arrival of modern Malaysia. They are a source of national pride and provide Malaysians with a sense of accomplishment and reward for being the world's chief exporter of semi-conductors. Petronas Towers created a powerful image that forever will be associated with Kuala Lumpur.

The catastrophic collapse of New York World Trade Center Towers in September 2001 led some to predict the end of the Skyscraper Age. These predictions proved to be wrong; New York is rebuilding and when completed in 2010, the Freedom Tower will pierce the sky at 1,776 feet high, in a clear reference to the year of U.S. independence. Despite the recent Asian financial market crisis, the Shanghai World Financial Center is moving ahead and scheduled for completion in 2009. At 1,614 feet high, it is expected to be among the tallest in the world. Taipei 101, the tallest building in the world today (1,670 feet) is being challenged by Burj Dubai, which is expected to rise above the 2,000-foot mark. A spiraling, 115-story tower is on the drawing board and may be built along Chicago's lakefront. This bold proposal comes on the heels of equally bold, but unsuccessful attempts, such as the famous "Skyneedle" of Cesar Pelli. The race is on! The last hundred years have produced three different skyscraper styles. The golden age skyscrapers refer to those built before the World War II, the Woolworth, Empire State, and Chrysler buildings. These were unique structures with Art Deco ornamental references and iconic configurations. After World War II, the elegant, art deco skyscrapers gave way to the glass and steel box characteristics of modern architecture. The glass and steel box grew out of a strict interpretation of the modern dictum, "form follows function." The idea of exposing the steel and concrete members and removing any ornamental references or structural impurities was embraced as a requisite for good architecture. The Seagram building in New York epitomized this Skyscraper Age that was summed in Mies Van Der Roh's slogan "less is more."

The next generation of skyscrapers is referred to in different ways, such as postmodern, high-tech, ultramodern, etc. Advanced building materials and structural systems, as well as digital media, are fueling architects' imaginations and desire to test the limits and indulge in creating spectacular building configurations that can be described as steel and glass firework displays. Form and function have become somewhat dissociated. From helicoidal and spiral to sail-shaped, cantilevered configurations defying gravity, the tall structure is regaining its status as an icon and asserting itself as a symbol of culture and civilization. Unbuilt skyscrapers represent a rich resource for ideas and building configurations. Some unbuilt skyscrapers have been so iconic and ahead of their time that they are noted as the best in the genre of tall buildings and often inspired the design of subsequently built skyscrapers. This paper has not been an exhaustive survey of unbuilt skyscrapers. Rather, it mainly aimed to expose some of the unique designs that influenced the development of 20th skyscrapers and to articulate an outlook on the mind-blowing possibilities of skyscrapers in the twenty-first century.

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