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Are There Intelligent Options in Skyscraper Design?

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Summary

The striving to build higher and higher structures is visible throughout the entire human history. But only the last one hundred years deserve to be called as an era of the skyscraper. During this period we were witnessing an astonishing development of this building type. At the same time, there were increasing, often insane tendencies to regulate the planning of skyscrapers, mostly in forms of zoning laws. Parallel ideas were trying to circumvent the official ordinances by theoretically applying some unorthodox methods. Among the future intelligent options in skyscraper design are the concept of interconnected cluster of skyscrapers as well as shapes of towers utilizing the open, void areas in their facades.

1. The role of regulations

History teaches us that the building of the city or any large urban complex within a city can follow basically two paths. One is in maintaining a certain order, rigid compositional structure, symmetry, introduction of an axial matrix with views and controlled traffic lines. Many exceptional examples of this group are part of the cultural heritage of the mankind: Versailles, Schonbrunn, plazas in Rome and other cities, and the group of skyscrapers in Rockefeller Center in New York.

Each society is trying to impose certain regulations in order to prevent chaotic and unrestricted explosion of unwelcomed sizes and shapes of buildings on the footprint of the city. The tool for such regulation is the zoning law (A) which attempts to set up the series of conditions regarding the organization of functional elements and their image within the entire

city. Environmental concerns (the length of shadows, etc.), maintaining the street lines, setbacks, and others are also addressed here.

The rectangular plans of ancient Greek cities, often neglecting a morphology of the terrain and cutting into the stone the entire parts of the city just for the sake of maintaining the right angle grid, can be seen today as an abomination of the healthy urban planning. This grid in some American cities in larger scale has many advantages, but it also can be dull.

2. Reinterpretation of Some Undesirable Rules

Sometimes the planner has to rely on inspiration from the borderline disciplines. One such effort is based on the theory of fractals. It was described originally in the author's 1986 study "Unconventional Design Possibilities for Skyscrapers at Waterfront Lands" (B), and later refined and updated in the 1997 paper "A Quest for Sanity in Skyscraper Design" (C) for the conference in Sao Paulo. The present study will examine the interdependence of the urban design theories with some other fields.

3. Theory of Chaos

The second path in the development of the city growth is distinguished by everything but order or symmetry, or a clear geometrical concept. The seemingly chaotic image of Santorini or Venice would indicate a lack of compositional order, a disorder, but we have to admit it is a lovely, delightful and charming disorder. Here we cannot but register the following anecdote: When Le Corbusier visited the United States the first time, his ship was entering the New York harbor. Looking at the skyline of Manhattan and noticing the visual results of the first, heroic era of skyscrapers, Le Corbusier exclaimed: "What a disaster !". Then he added: "But what a beautiful disaster".

The chaotic results in some urban areas, being it a group of almost nomadic one story shanties in the "Gold Rush" time (representing an unadulterated chaos), or St. Gimignano type concentration of the medieval towers (D) nicknamed protoskyscrapers, will attract more attention when we'll start to realize that they reflect enormous physical energy as well as human psyche.

In the second half of the 20th century, mathematicians started to pay more attention to the theory of chaos (E), or disorder, later renamed as the theory of complexity. In the other fields, like economy, the systems (F) and irregular patterns that were discussed and analyzed. Not so in the probably largest area of human endeavors, in the past and present

building activities. Architectural historians like to stratify these achievements into clear periods, styles (G) and demarcation lines between them. The present times require much more background knowledge from the planners and their trainers, the academia. In the age of computers and virtual reality, the new generation of experts will have to combine the old methods with a new angle of complex evaluation of conditions and events and be ready to challenge the archaic zoning ordinances.

4. The Intricacies of Randomness

In the complexities of creative life and time, a pure randomness is to be distinguished from theoretical chaos, althought they may overlap. Randomness can even be predictable by a sharp individual used to deal with multifaceted challenges.

Let's two buildings appear as identical, complying with all the conditions of the zoning law, such as height, sky exposure curves, etc. The setting of the buildings, however, in the matrix of city might be offensive, not sensitive to basic aspects of common sense, etc. Hardly a satisfactory condition. Now let's multiply this condition several times. (There were years when on Manhattan alone 40 to 60 high-rises were under construction at the same time.) If we add to it the influences of nature and study them for a long enough time, such a status will cease to be qualified as randomness. It is on its best way to become a chaos, although recognized as such only some decades later. In the realms of physics we call it entropy. But what about the urban design, where unmeasurable categories like talent, inspiration, emotional world, intuition and creativity are involved ? In such a case, existing regulatory models are useless. Here we have to rely on the other set of tools, the theory of games.

5. The Game Theory Applied to New Urban Concepts

The classical teachings of statistics maintain that in the coin-toss game the chances of getting either heads or tails are even. Not so, says the "Gambler's Ruin" theory (H), the absolutelly unscientific speculation, according to which in the long run the gambler always looses.

In the game theory, the alternatives are being studied, one of them reminding us of the Gambler's Ruin, and called the "worst case scenario". Based on the work of John von Neumann (I), covering the model of general equilibrium, planning problems, numerical methods to determine optimum strategy and many other pertinent topics, his ideas were further developed for the economics by a Nobel Prize winner (1994) John Harsanyi (J). We know that economics as a field is a very important part of our life.

But it's still only a part of it. It touches some other fields like technology only marginally. On others, like art, religion, etc., its impact is often questionable.

In the urban sciences, the participation of economics is subordinated to the larger picture. Then why the theory of games was never studied and applied in the field of city planning ? Because of our intellectual laziness ? Or inability - or fear - to deal with something more complex than the zoning law ? In adopting some aspects from the game theory to the ways how we plan today's cities we can enhance the image of our environment.

6. Interconnected Cluster of Skyscrapers

While the environmental issues were so far concentrated on the quality of life in the surroundings of the skyscraper, mainly on the ground level of adjacent lots and city blocks, there is an unexplored field of mental state of persons living or working in the super high floors. The acrophobia (fear of heights) and claustrophobia (fear of being in an enclosed place, like elevator) are only two samples of uncomfortable feelings, many times multiplied by the swaying of the structure (K). One way to eliminate these fears is to build a cluster of interconnected skyscrapers (Fig. 1).

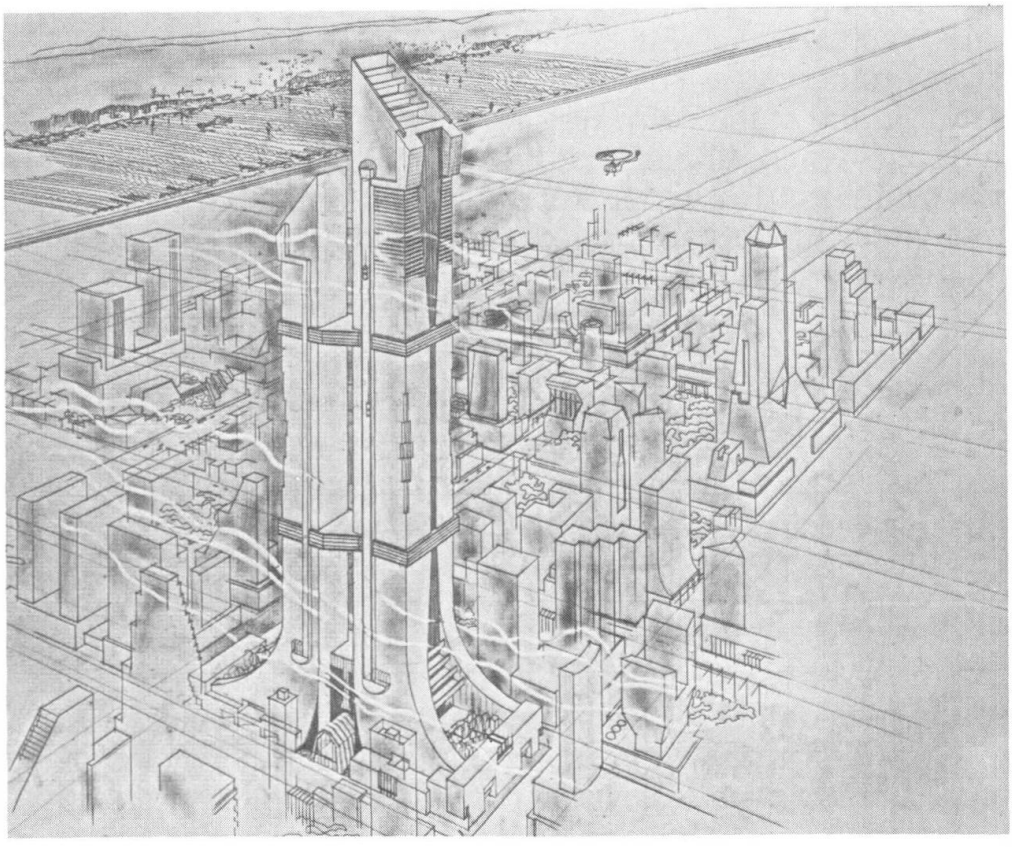

Fig. 1 : Author's study for the World's Tallest Building (1981) shows the skyconcourse at every 40 floors.

7. Skyscraper Image Revolution

The image of the building plays a decisive role in minds of people, not often valued as an important attribute in the individuality of the city. But to what degree one can always invent new shapes and images ? It's like with the music, where it is no end of combinations. The new skyscrapers in Dubai (Fig. 2 and 3) remind us of the creative fermentation of futuristic styles as strongly as the architecture of Tel Aviv did of the international style in the late thirties. Some of the latest skyscraper designs show voids, openings in their mass, as in the future World's Tallest Building in Shanghai (Fig. 4). It makes them not only more interesting but helps in easing the wind pressure on the skyscraper wall.

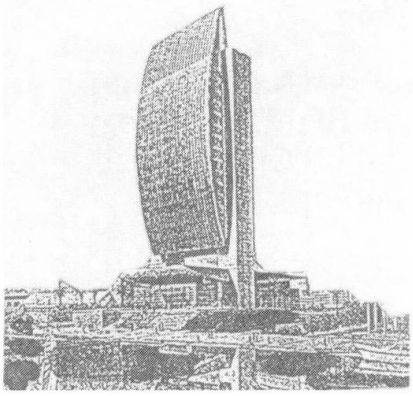

Fig. 2 :
National Bank of Dubai

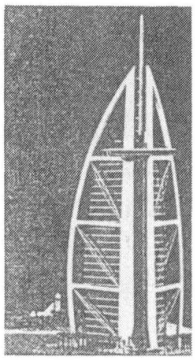

Fig. 3 :
70 story Chicago Beach Tower Hotel in Dubai

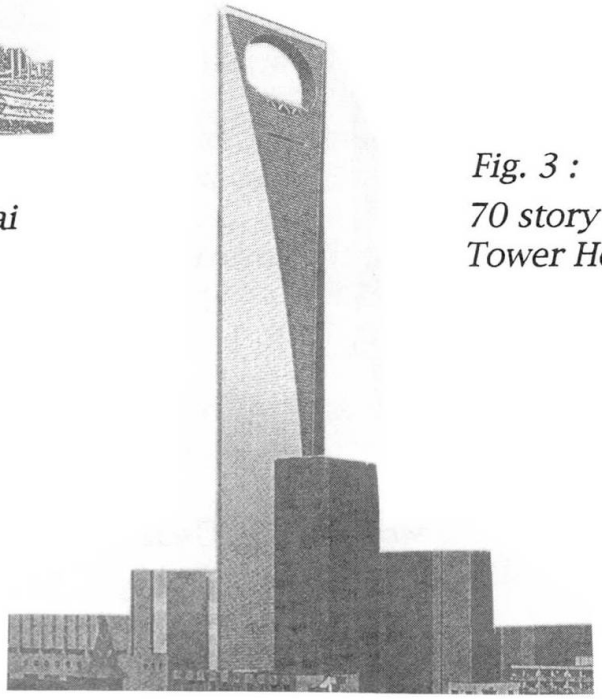

Fig. 4 : World Financial Center in Shanghai, the future (2002) World's Tallest Building

8. Conclusion

There is more than one way how to enrich our life by taking the inspiration for our creative thinking from the other fields.

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