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Living Highrise. The shelf architecture - From paper project to virtual project

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Abstract

In this work we aim to deal with so-called "shelf architecture" – drawings which were never built three dimensionally in the physical world, except maybe in models, but not to be inhabited. Today the digital methods build a possibility to rebuild the past, but also to explore the future this way. We first analysed three utopias, one by Mies van der Rohe and two by Frank Lloyd Wright. In the second part we propose ourselves an utopia. All are skyscrapers, for which reason the load bearing structure was relevant at the moment of design, unlike for the virtual world, for which we build such a model at the end.

Rezumat

În această lucrare tratăm subiectul aşa numitei „arhitecturi de sertar" – desene care nu au fost niciodată construite tridimensional în lumea fizică, decât poate în machete, dar nu pentru a fi locuite. Astăzi metodele digitale oferă posibilitatea de a reconstrui trecutul, dar şi de a explora viitorul în acest fel. Am analizat întâi trei utopii, una de Mies van der Rohe şi două de Frank Lloyd Wright. În a doua parte propunem noi înşine o utopie. Toate utopiile sunt pentru zgârie-nori, din care motiv structura portantă este relevantă în momentul proiectării, lucru care nu este valabil pentru lumea virtuală, pentru care am construit o astfel de machetă în final.

Keywords: skyscraper, drawing, virtual world, housing, utopia, early 20th century

1. Introduction

Digital methods allow today to reconstruct the past, destroyed by catastrophes or by mentalities and followed by a reconstruction activity. It is the case of ancient Rome, pre1755 Lisbon earthquake, but also of the Philips pavilion by Xenakis for the Expo in Brussels.

The Xenakis pavilion was rebuilt by Vincenzo Lombardi from the University of Turin. Being a pavilion, it was not an architecture thought for a certain functionality, but as exhibition of a built utopia. As such, it is perfectly suitable for a dialogue between what can digital methods perform with respect to building. The ephemeral of the 1:1 model is put in dialogue with the permanence of digital art.

If in case of the Philips pavilion the model was a 1:1 ephemeral architecture, for large scale endeavours such as urban areas, or, in case of our paper, skyscrapers, the models are in smaller

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scale. However, such hard copy models serve as basis for the digital reconstruction. The Museum of Roman Civilisation contains a scale 1:250 model of Rome in the age of Constantine I built by Italo Gismondi which served as basis for the digital endeavour "Rome reborn" (http://romereborn.frischerconsulting.com/), which then inspired a number of reconstructions. The scale model of Rome was done 1935-1971. In that time, also Romanian scholars contributed through building models of Roman heritage, ex. Nicolae Lupu, a scholar at the Romanian School in Rome. In many cases contemporary digital reconstructions deal with scanning of such models, as it is also the case for historical Liege (virtual Leodium) and Nantes [1]. In other cases, where the hard copy model was not done as an effort in the second half of the 20th century, the modelling based on reconstruction from archives is preferred, as for the EUR exhibition in Rome. It is also the case of pre1755 Lisbon earthquake. The Museum of the City contains a model built at the 200th anniversary of the earthquake, and hence contemporary with the Rome model, which was scanned and a digital model done, while CHAIA at the University of Evora rebuilds using archives in a similar approach to EUR, in Second Life. This later approach brings us closer to our topic. Second Life is a game, and we can approach building or urban areas or of singular great scale architectural objects as such, and models, are in fact toys to learn architecture. We dedicate our paper not to urban areas, but to the scale objects, to the city in the vertical, which is the contemporary pendant in what vertical symbols of the city were, instead of the church from before, the skyscraper.

In [2] we gave an overview of the games based on skyscraper building as toys. Such ones include: "Collectors tumbling tower" (Cardinal Industries, 1999, which was to build in the height with pieces from below), "Sky high" (Skor-Mor Corporation, 1973, a tower from dice won pieces) and its successor "Ski-hi: a Japanese building game". (Peter G. Thomson, 1985), "Curtain wall builder" (Toy Tinkers, 1959), Gilbert Erector skyscraper set (1935, depicting skyscrapers from the 1930s), "Manhattan: the skyscraper building game" (Andreas Seyfarth, Mayfair Games, 1996, also with famous buildings, for a board game), and King Kong (Ideal, 1976), a game based on a film, which tries to save the World Trade Centre. This later includes 7 specimens as symbols for the construction resources, and thus is not really building the skyscraper as in previous toys. Such games/toys depict a logic close and at the same time different of that of the architects presenting large scale tasks in models. But they build on the logic of construction. Today, with tools such as SketchUp one can build virtually, and then print the model, without the structural logic.

We not only look to the past in this paper, but also to the future and construct virtually the utopias of the architects, the so-called "shelf architecture". Such shelf architecture can become a game to train certain dialogues between stakeholders in building.

Even is the skyscraper is an important topic of this paper, given the framing of the research question, we renounce to investigate the large body of literature regarding the increase of density in urban areas given by the presence of skyscrapers. We instead look at them as a symbol, as a landmark in the city, and as such as singular objects as Nouvel/Baudrillard would say.

A research questions was what lets some innovative approaches to the typology investigated here (the skyscraper) remain an utopia and not be built. And how can be, in this case, the utopia brought to further generations, which might want to materialise the approach, is another research question.
In order to answer to these questions we investigated some examples from the first half of the 20th century, and finally proposed a contemporary model. The challenges changed in these 100 years, as did the possibilities to materialise utopias, and hence the aspects on which we focus are different. In each case the novelty compared to mainstream has been highlighted. The utopia in this case is what brings a new architectural style to birth in case of the built objects, the innovation.

2. Investigation of non built examples and utopias following their architectural, constructive and innovative concepts – the 20s, 50s and 60s

2.1 Mies van der Rohe „Skyscraper for the Friedrich street", Berlin, competition 1921

In 1921 the design of a skyscraper in glass and steel was a dream for European architects. They built up on the earlier examples of the Chicago school. The best example of this school was the „Realiance building", named by Siegfried Giedion „swan song of the Chicago school" [3]. This building incorporates the experience of the entire school.

Mies van der Rohe was directed in his design towards the unity of the shape, following the motto „less is more". The skyscraper in Friedrich street was a glass tower, and through its design was Mies the first to design architecture with glass alone. Different from architecture in heavy materials such as stone, when building with Glass there is no play of light and shadow anymore, but there is something new, the play of reflection. Both are determined by the nature of glass as material. The materiality is made visible through the rendering the architect has done. [4] [5] [6].

According to L. Hilbeseimer [7] Mies van der Rohe was influenced by the model of the load bearing structure of a skyscraper in construction, when imagining a shape out of skin and skeleton. This concept was against that of Sullivan according to which „form follows function". In such a building the form remains the same even if the function inside changes. Exactly the structure out of skin and skeleton allows for adaptation to changing needs.

The skyscraper is built out of reinforced concrete slabs on a mushroom-like central structure. The storeys are supported by the central staircase in console. So no walls are needed in the exterior, and the external envelope can consist out of glass. The layout in plan is a triangle and the glass envelope led to the transparency of the corners, a good solution at this angle. Even more, the slim angles accentuate the reflections of glass.

Although the skyscraper was designed for Berlin, it has been built after 30 years later as housing tower „Lake Shore Drive" in Chicago.

2.2 Frank Lloyd Wright Housing tower project „St. Marks Tower" New York, 1929

Mies focused in his project on the material of the envelope, the glass. On the opposite, Wright thought first of all of a natural load bearing structure solution, an aspect ignored by Mies. The building is so designed, that the structure is emphasized. „A cheeky beauty, which doesn't hide the actual construction type". For Mies the glass envelope was more an aesthetical question, focusing on the characteristics of new materials brought by the 20th century. Wright goes one major step further. Light, openness and force are going naturally out of his project, as the drawings show. For the housing tower project „St. Mark Tower" Wright designed a structure in the shape of a tree out of steel, concrete and glass [8].

„Why not going into the height, Frank?" had been F. L. Wright asked once [9]. And this building grows like a tree, around an enormous central core. The different floors are like branches of this core and build the vertical separation between the sectors. The sectors are connected through lifts and staircases till the central core. Installations follow the model of a tree as well. Each floor is, also in this case, a console from the central tube. The glass envelope is hanging on the console slabs, the interior separation walls stay one these slabs.

The building contains four flats with each two storeys, on triangle layout, each separated from the other. The irregular shape of the rooms is resulting from adaptation to the shape of the building. On the lower floor is the day zone with living room, kitchen and toile; in the upper floor are the spaces of the night zone such as sleeping room, dressing room and bathroom. The living room has a so called „supanta", meaning that a part of the living rooms has two floors, which allows that the floor is visible from outside only at every second floor. This leads to a transparency effect.

St. Marks Tower was developed as landmark for the city Broadacre, but not constructed in this form. Shortly after the start of the construction the construction was stopped – the idea of the tower had to wait another thirty years to be realised. The tower has been finally built as Prince Tower in Bartlesville, Oklahoma.

2.3 Frank Lloyd Wright „Illinoise mile high skyscraper" Chicago, 1956-1959

The idea of a „mile high skyscraper" was born when F. L. Wright was suggested to design a radio tower. He found that such a tower has to have some other building function, and so he designed a futuristic skyscraper, a challenge for his imagination [10].

With its 528 storeys this building should be five times higher than the highest building in the world, a city in the sky. Doubtlessly in this case the focus was on the rigidity of the structure. Wright chose the tripod, the most stable structure. The perimeter of the building decreases in the height. The core thought lays in the same treelike structure as at St. Marks Tower. The thought of the tripod comes in question also for the pilots foundation. [11] [12] This principle is very similar to that which saved Imperial Hotel in 1922. For the slabs he thought of high tension steel. The loads from the floors are balanced against central beams. All components have an integral character, so that the loads are balanced in any point of the building, and stiffness is achieved also in the critical points of the mile high skyscraper.

It is questionable if the console system would lead to the needed rigidity. Despite the tripod like shape, there is only a central column. The reduction of surface with height does not convince, since in case of such a high building the load from wind is more important than that of weight. The asymmetric shape is also unsuitable for this. Also, at such heights windows must be understood differently, as they cannot be opened anymore, the contact between inside and outside is like in a plane. Finis Farr noted that „this is the only project of Wright which has something scaring". [13]
At such height conventional lifts cannot be used anymore. So the elevators should be operated with nuclear energy. The exterior parapets, the exterior horizontal and vertical elements as well as the elevators were designed from golden metal, so the building makes the impression of a unitary metal structure. Additional, not public, elevators, connect different parts independently of the main elevators.

The one mile high skyscraper is divided into four parts and can be reached from four sides over four access ways. So the look of the fountains and of the plants is put for this reason in connection to the entrances, each independent from the other. There is also a covered parking place for about 15 000 cars and two landing places for 75 helicopters.

3. Virtual project

In frame of the focus „Living in a dense zone" we designed a housing skyscraper with the project theme that there should be a reaction to the site, as well as a critique and suggestions to the topic of housing.

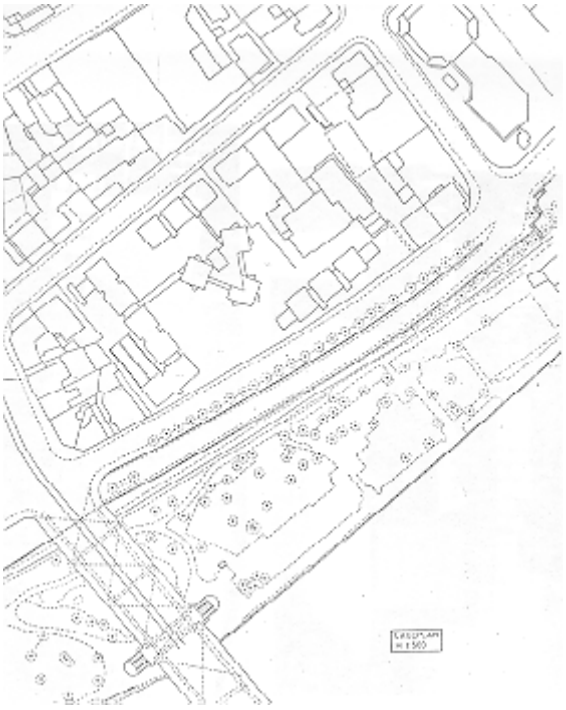

Figure 1. Site plan of the whole development: skyscraper and low rise construction. Drawing: M. Bostenaru.

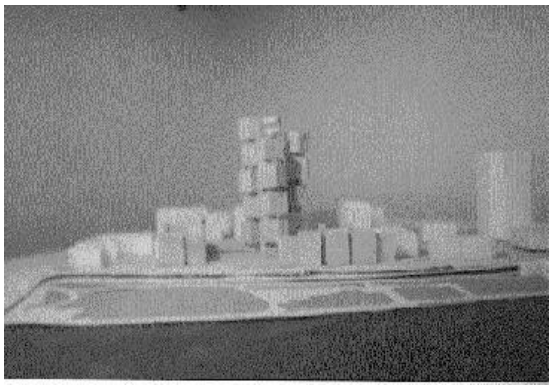

Figure 2. Model at urban scale. Photo: M. Bostenaru.

Unlike the utopias, this design had a concrete site (Fig. 1). The site for the planning was in the centre of Frankfurt, in the immediate vicinity of the Maine. The urban concept followed two goals: to keep the integrity of the urban block and to make possible a view of the Maine from the next street. Skyscraper, symbol for Frankfurt, is all around the centre. In the closer surroundings, on the opposite, the skyscraper is an accent in a low rise region (Fig. 2). It works as polarization point and this is the idea, which was included in all levels of design: the tower is the core of the constructed area, a lobby is the core of the tower and the living rooms are the core of each housing unit (Fig. 3). Through the spatial shape of the tower we tried to act against the anonymity of skyscrapers through more variability. A lobby is a vertical street, on which small houses are hanged branch wise. The cube is the main entity of this division. A triangular shape structure allows an equal looking possibility on all view values of the environment: from the Maine to the skyscraper silhouette of the city (Fig. 4).

For this reason the functional concept is based on creating spatial places for different forms of housing. The cubes are connected through set back glass floors, which, like the central lobby,

contain community spaces (bars, meeting rooms) and try to create through this an identity of the neighbourhood consisting out of four housing units one above the other (contained in a cube).

In this basic concept we integrated different housing units for young and old, singles, pairs and families. The larger housing units (a smaller number) for the families with numerous children/more generation families are in the lower cube (close to nature) while the singles/yuppies contain the isolated places on the peak.

New life into the old city through bringing back housing means here, that housing is developing in the height and presses through this the office functions into the low rise constructions, so that these appear only as serving infrastructure.

In the design process we integrated the concept of the load bearing structure. For the low rise constructions a moment resisting frame structure out of reinforced concrete has been foreseen. For the skyscraper the load bearing structure consists out of a reinforced concrete plate without beams, tensioned in two directions. This allows the free space division in the housing cubes, the direction of which changes after each four storeys. The floating effect of the cubes is reached through columns which are set back from the façade.

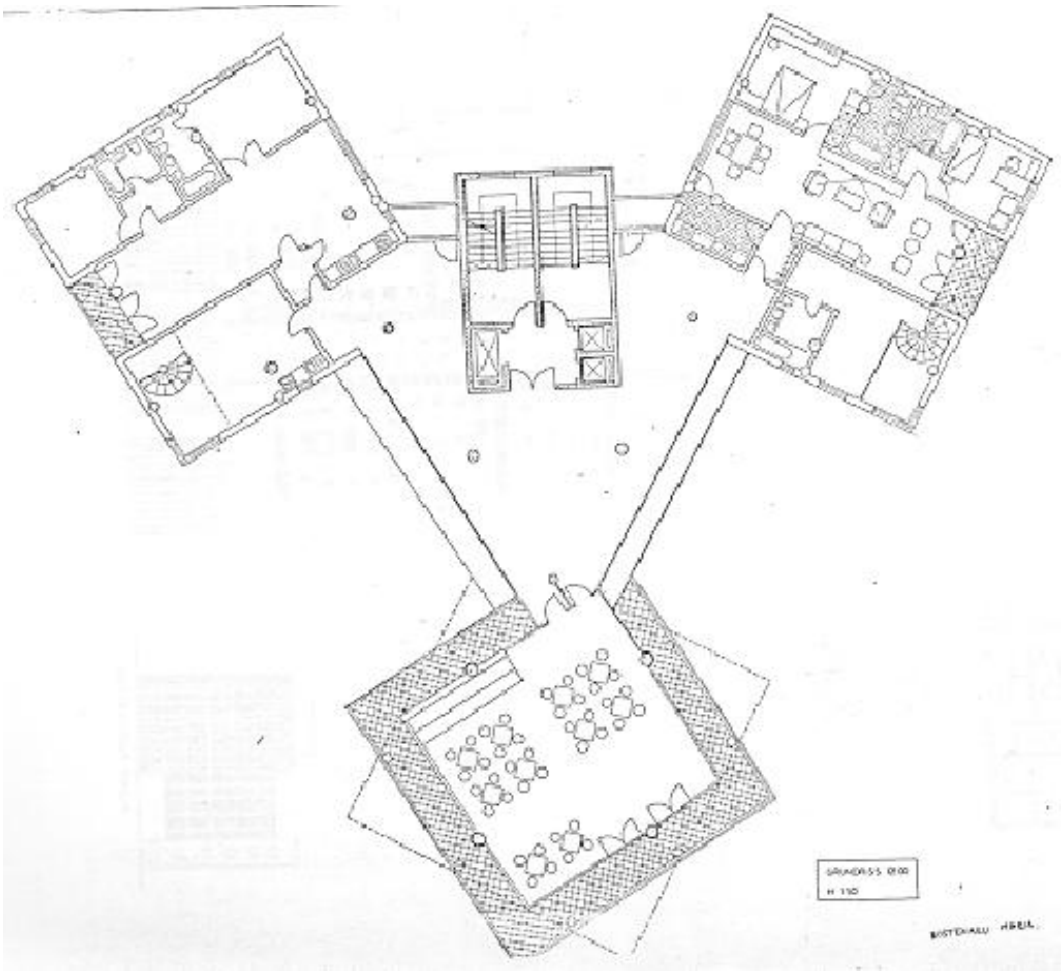

Figure 3. Plan of a current floor. Drawing: M. Bostenaru.

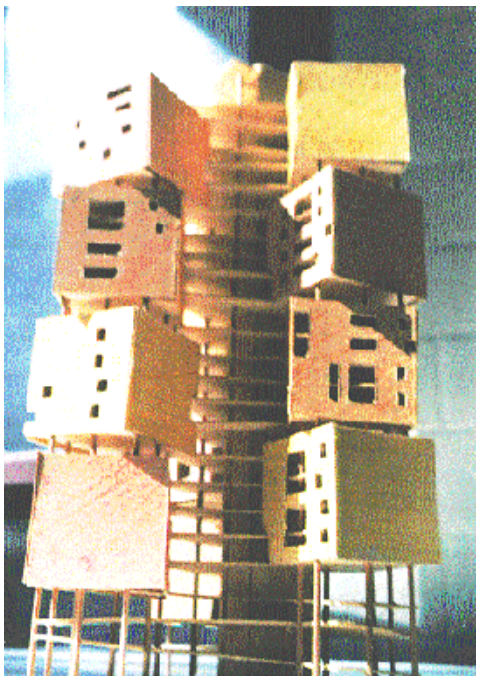

Figure 4. Model at building scale. Photo: M. Bostenaru

4. Discussion and conclusions

Not always did the lack of an appropriate investor prevent these utopias of being built: sometimes it was the not yet experimented enough structure, dealing with innovative materials. This impediment does not exist in the virtual world. So for the historical examples discussed, the utopia consisted in the fact that building them was not possible with the technologies of the time. With today's technologies the mankind came closer to it, for example building in Dubai a skyscraper close to the utopia of Frank Lloyd Wright, or the other examples named.

The utopia in the proposal of the authors is however different. It wasn't related to the load bearing structure, but to the function, the architectural programme. First, such an architectural programme (housing) is utopia for a skyscraper. To have dwellings in the height is a fight with the climate. Contemporarily the green towers in Milan tend to fight against this as well. Second, the architectural programme of housing demands for a fight against anonymity, which is commonly found in office programmes. The curtain walls proposed by Mies were in line with this anonymity; this is why in our utopia we propose only a core of glass, in which the bodies of cubes are branched. The cube itself as basic shape is connected to a utopia. It can serve to express some spatial feelings at morphology level. In this utopia we considered the spatial feeling of getting together, reflected in the common spaces at different levels: urban, building, housing unit. On another level, the structure is an issue to express the dynamic shapes in this utopia as well, but it is not the main one. Even for the architecture model (Fig. 4) it was possible to find a structure and this was properly computed in a structures seminar. But this is the difference between architecture model in paper (Fig. 2 and 4) and architecture model on the computer. The later, as said, does not demand structure, and the 3D printing derived from it either. In the dialogue structure-space the spatial approach wins in the digital model with respect with the traditional drawing and model building approaches of architects of the the 20th century.

If we were to interpret the hard copy models of the utopia we propose, in Fig. 2 we present a model at urban scale, compatible with those named to have been scanned in several digitalization approaches. This model is suitable to become a game. Different cubes can build the resources to

compose skyscrapers of different heights, with different compositions of the individual neighbourhood. Actually the game can lead to more diverse alternatives. The model in Fig. 4 is rather something for the curtain wall builder, since here the wall, not the cube, is an element of colour in dialogue with the structural slabs connected by the columns. The curtain wall is thus common element to the utopia approaches described, even if so different and not out of glass. The toy itself can be translated into a digital game, naming the resources which can be combined, a skyscraper building game instead of a city building game, the vertical city in the utopias.

In an approach we did ourselves to digitally represent landmarks in urban areas [14], we built on an own concept to digitally represent the impact of the 1755 Lisbon earthquake mentioned in the introduction [15]. For this, landmarks are represented as strategical objects with respect to the urban area which is seen as a zone. They are derived with the same method spaces are expression of a feeling in a cube, through morphogenesis. For the skyscraper model all cubes are strategic elements, and, although we did not approach this problem deeply, through this the skyscraper becomes a point of density, accumulating strategically detailed areas of the city in the digital project. On the other hand, in our model there is variation within the same ground shape, and this dialogue has to be considered when composing digitally the model: what is repetition and what shall be edited, and thus the approach to escape anonymity becomes also requirement in the digital composition. Within the same shape different interior subdivisions are done, which reflect differently in the not anymore curtain wall.

If in the past such utopias remained paper architecture conserved through drawings, today the digital methods give an opportunity to virtually construct such utopias. They can exist as photorealistically rendered image, or can even be subject of walk through. Such parcour can be done in form of film or as interactive navigation. Such renderings serve the client, but can also be only created for computer games, by the designer or even the users. In computer games such as second life they can be populated with virtual inhabitants.

The issue of looking to high rise housing and high density is currently one of importance for large urban centres, where these buildings are vulnerable. Interventions to upgrade have to be combined with efforts to conserve the historic substance at least digitally.

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