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Orginal Article

Many beginnings: the thought, thinkers and actions behind the planet-oriented architecture

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Abstract: The article maps multiple planet-oriented movements in the history of modern (predominantly western) architecture. It looks for architectural pronunciation of social movements, political actions and historical moments. In writings of acclaimed architects and authors, it searches for origins of organic, vernacular and tropical architecture and their offspring in the contemporary approaches, views and design. The article documents changes of perception of relation between man, nature and architecture. It commences with the very first attempts to understand this relationship: idealization and romanticisation of nature, it finishes with the most contemporary analyses based on the holistic approach and computer simulation. The article draws an extensive panorama of authors and publications that researched planted-oriented architecture.

Keywords: modern architecture; organic architecture; regenerative architecture; vernacular architecture; tropical architecture

1. Introduction

The article browses through the history of modern architecture to look for movements that led to *planet-oriented architecture*. An environmentally-sensitive approach that puts the care for the Planet and Nature as the centre axis of the design agenda. The planet-oriented architecture roots in a holistic approach and the systems theory, where all the elements are interrelated and interdependent. The article looks to organize scattered ideas to have a clearer overview on the topics that have been already researched by scholars in modern history. It helps to revisit the ideas from the past to nourish the planet-oriented research and to explain the origins of the movements.

The text is divided in four parts. The introduction maps the history of environmental movements and is aimed to provide a wider perspective, pointing out the most important events and texts. It serves as a reference point to the next four parts on organic, vernacular, tropical and bioclimatic, and planet-oriented architecture. The sections are organized around

keywords and map the movements to explain the historical and contemporary frameworks that defined relations between architecture and the Planet.

The article is based on literature search around keywords: organic, vernacular, sustainable, green, restorative, regenerative, planet-oriented, tropical, bioclimatic; works of widely acclaimed architects and researchers; existing text on history of modern architecture – Modern Architecture by Kenneth Frampton and Modern Movement in Architecture by Charles Jencks; and a seminar on the history of modern architecture by Professor Gonçalo Furtado Lopes at the Faculty of Architecture of the University of Porto. The selected examples focus on the western authors of the 20th century, both practitioners and theoreticians. Furthermore, the article tries to find a more egalitarian perspective and revisits the modern movements looking for texts written by women.

2. Historical background

The movements which have shaped planet-oriented design have appeared every now and then, every fifteen years, every decade, every generation. John Ruskin's writings could be used as one starting point to understand and map modern critique on the relation of nature with a human. Ruskin, an English writer and critic, had a great impact on the way that nature has been understood among early 20th century society. Though, his vision of nature, or as he would write Nature [1], to underline the admiration and respect to nature, was, at least from today's point of view, romantic and idealizing. Many of his thoughts could be found in The Poetry of Architecture [2] written under the Old Greek pseudonym "Kata Phusin" (Κατα Φυσιν) which means 'according to nature, living by nature'. As John Dixon Hunt summarizes Ruskin's views 'the problems, [...], were not with nature itself but with the human treatment of it' [3]. It could also be Emily Brontë in Wuthering Heights who outlined the relation of inhabiting in relation to nature. Their artistic activity coincides with the time of rapid industrialization, urbanization, and, on the opposite pole, the environmental movement has been very active in public and political spheres. It led to establishing the first National Park, Yellowstone (USA), in 1872. At this point, the discussion on the protection and conservation of natural heritage was quite vivid. This movement should be probably considered the most efficient and effective in terms of environmental protection.

At the beginning of the century, a rapid industrialization brought severe air pollution to the cities. In 1905 Henry Antoine Des Voeux coined the term smog [4] that had commenced more profound discussion and research in that topic. In 1908 the National Conservation Commission was appointed in the United States of America. In the twenties and thirties there were some minor movements such as the funding of Izaak Walton League (1922), Convention Relative to the Preservation of Fauna and Flora in their Natural State in the USA (1933) or the publication of Game Management [5] on wildlife conservation. The Nazi Germany already in the 1930 has introduced numerous environmental protection policies [6] including the ban on vivisection and cruelty towards animals, and several restrictions on hunting. The intention was not as pristine as the actions could suggest – it was all part of a larger agenda of national identity building rooted in the romantic vision of man's relationship with nature.

The years of the world wars and armed races at the beginning of the 20th century destroyed the planet in an unprecedented way. The topic of the protection of nature was not a priority. It wasn't until the 1960s that Rachel Carson, an American environmentalist and author, wrote Silent Spring [7], a book about insecticides and their impact on biodiversity. But it was not a text purely about insecticides, it was about the industrialization impact on natural landscapes

and the capitalization of resources in the name of growth and prosperity. The publication is widely considered as a new chapter in the environmental protection movement. As a result, the US government banned the use of chemicals based on high DDT concentration from agriculture. The First Earth Day was organized on April 22, 1970, a year later Greenpeace was formed. In 1972, the Roman Club Report indicated the limits of planet growth and the risk of crossing them, confirming that the actual pace of growth is simply unsustainable and would lead to resource depletion. Though it was the Oil Crisis which commenced in 1973 that influenced the industries attitude towards nature, fused the previously dispersed environmental movements and allowed them to grow in strength [8]. The embargo targeted towards the most developed and industrialized countries such as Canada, Japan, the Netherlands, the United Kingdom and the United States alternated the development of their economy [9] and modern architecture, as its derivatives.

The future and the danger of planet destruction were discussed in particular at the turn of the eighties and nineties. In 1987, the Brundtland Commission Report – Our Common Future came out, which introduced to the common language the phrase 'sustainable development':

Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs [10].

In 1988 the IPCC (Intergovernmental Panel on Climate Change) was created. In the same year, James Hansen, head of the Goddard Institute for Space Studies at NASA testified to the American Congress that he is 99% convinced that it is mankind who is responsible for climate change [11]. In 1989 Time Magazine deviated from the 'Man of the Year' formula in favour of 'Planet of the Year': Endangered Earth. In 1991 a declaration on biodiversity was signed in Rio de Janeiro. In 1997 the Kyoto Protocol was signed, in 2015 the United Nations General Assembly set the 17 Sustainable Development Goals (SDG) to be achieved by 2030 as 'a blueprint to achieve a better and more sustainable future for all'. A year later in Paris most of the countries agreed to keep the global warming level below 2 Celsius degrees. Finally, in 2017 global environmental activity was hitting back. The latest IPCC Report indicated that radical and widespread initiative must be undertaken to avoid a severe crisis. All the mentioned events triggered certain architectural movements and approaches in modern history, shaping diverse solutions and attitudes, each time more informed and conscious.

There have been multiple beginnings of sustainable design, triggered by different political and social movements or events. There is some continuity and common denominators between them. Unfortunately, the planet-centred design has had many beginnings and many endings, each time focusing on a different aspect. The following paragraphs will attempt to organize the knowledge and practice around the following topics: organic, vernacular, planet-oriented, performance-oriented, bioclimatic, and regenerative.

3. Mapping architecture through publications

The idea of sustainability, green, planet-oriented architecture has evolved, changed its names, scientific bases, frameworks, and forms of expression throughout the years. As already mentioned, the word 'sustainable' in the context of development could be found only in the late '80s. Different definitions have been used to talk about relation nature – architecture – man. Scientists (atmospheric physicists, biologists, geologists, etc.) keep defining what is best

for a healthy planet and ecosystem. The knowledge and perception are constantly updated, reviewed, design approaches adjusted.

Understanding the relationship of nature – architecture – man developed throughout history was possible only because of advancement in understanding both nature and architecture. Some of the early approaches might seem naïve, or romantic, but they are the witness of time and probably the best attempt of its time. That is why the name of the approach itself in literature, journals, magazine titles varies: organic, bioclimatic, sustainable, green, restorative, regenerative, planet-oriented etc., they are current states of knowledge or willingness to use certain methods and techniques to design architecture that builds a positive (retrofit brownfields, capture pollution, reduce urban heat island, enhances biodiversity) and harmonic (enters in a symbiotic relation with living systems for example hosting bird nests, design according to topography) relationship with the planet. Planet-oriented architecture looks from the holistic point of view to provide the best living condition for humans and to restore and regenerate the ecosystem. In this framework all beings are on equal rights, and providing safe and healthy shelter for people cannot have a negative impact on other beings.

4. Organic architecture

Organic architecture as a movement was declared at the British architects meeting in 1939 [12] by Frank Lloyd Wright (1867-1959), although some previous thoughts were included in Burckhardt´s (1818-1897) early writings [13], Wright [14] and Sullivan (1856-1924) texts selection [15]. Nature[1] as the environment in which architecture is built was crucial to Frank Lloyd Wright's writings and architecture. In one of his first critical texts [16], written in the same period he was designing Prairie-style houses, in the cause of architecture he advised:

A building should appear to grow easily from its site and be shaped to harmonize with the surroundings if Nature is manifest here, and if not try to make it as quiet, substantial, and organic She would have been the opportunity Hers.

Later in The Natural House, a book dedicated to organic architecture built in harmony with the site by the use of local materials (though it did not reject steel as a material that allows larger spans and visual connection to the outdoors), he wrote:

The Usonian house then aims to be a natural performance, once that is integral to the site; integral to the environment; integral to the life of the inhabitants.

This quote might be a good reference for architecture performance much later, at the beginning of the 21st century, defined by Michael Hensel (1965-), German architect and scholar [17]. He argues that the measure of the sustainability of architecture lies in its *agency*[2] which is expressed in four domains: local communities, the local physical environment, spatial and material organization complex. Bruno Latour (1947-), a French sociologist, would

[1] Wright would always write Nature with a capital 'N'. Asked by Mike Wallace in 1957 about his religious vision he answered: 'my church, I put a capital N on Nature and go there.'

[2] 'In very general terms, an agent is a being with the capacity to act, and 'agency' denotes the exercise or manifestation of this capacity.' in Stanford Encyclopaedia of Philosophy

comment that architecture is one of the elements of a complex network of connection [18]. The Usonian Houses exercise a performative approach – for example, the Robie House in Illinois is ventilated naturally so that it does not use grid energy for this purpose; the glazing on its southern facade was maximized to increase solar gains and daylight autonomy, and limited in the north to increase energy efficiency. Finally cantilever roof overhang looks to minimise overheating in summer. In Herbert and Katherine Jacobs' Second House in Wisconsin, known as Solar Hemicycle, the north rear wall was protected by an earth berm which protected from heat loss, a superior part of the wall was exposed to allow natural cross-ventilation, high interior walls were made of stone that stores heat. South-facing crescent-like facades allowed sun rays penetration during the winter and protected by sun-shades in the hottest summer months. The Wright design could be considered a great example of a passive house and maybe a prototype of a nearly zero energy building. The performance and relation with the sun, wind, land were shaping the design of houses.

Marion Mahony Griffin (1871-1961) was Wright's apprentice and ran the studio during his travels. In a more conventionally organized office, she would have held the title of 'head designer or associate' [19]. She was one of the pioneers of the organic movement in architecture and collaborated on prairie houses. Later she teamed up with her husband and opened a studio of their own. Although she did not publish all her texts, as a digitized manuscript, these are available under the title: The Magic Of America [20].

All the evidence of historic civilizations among men prior to the Romans exhibit also the second essential – subordination to nature and indicate something in these civilizations that we lack – a closer relationship of man to nature. [...] *Feudal castles appear to grow out of the jagged rocks of Europe. The mud houses of the African deserts and the storied adobe cities of the Pueblo Indians in America are as distinctly part and parcel of a homogeneous nature* [...]

Marion Mahony Griffin points out that pre-civilized communities lived in a closer relation to nature. Civilization brought about the possibilities and progress which looked for more universal and large scale solutions. The ancient tribes used resources that were available in the closest neighbourhood. Today it could be defined as operating within planetary boundaries, biocapacity or within circular economy rules. The pre-Anthropocene societies, where the Anthropocene is understood as a geological era, predominantly due to their size, sacredness and technical skills, were unable to impact the environment permanently.

In Italy, in 1945, just after the II World War had finished, Bruno Zevi (1918-2000) and with Cinco Calparina and Silvio Radiconcini established *Associazione per l'architettura organica.* The organization looked for a new agenda, in opposition to rationalism, advocating for non-monumental architecture, that allowed fulfilling the spiritual and psychological needs of the society. It was a political, not an aesthetic movement. Maria Clara Ghia [21] points out three principles that it was built on: the first was political justice and freedom; the second, the need for a constitution that secures equality; and the third, to guarantee full social liberties. If any formal direction could be defined it must have been in opposition to rationalism and geometrism. Zevi explained the idea at the First National Congress of *Associazione per l'architettura organica*:

Organic architecture is a functional architecture, respecting not only the techniques and purposes as the building but also the psychology of users. Everything else is a gratuitous comment, you can go and update yourself [22].

The definition of organic of Zevi was vast and would rather constitute opposition to rational or *de facto* fascist architecture of the past. The relation with Nature or environment was not in its focus. The organic architecture of Zevi would take a human-centred position, not planet-centered. The term that Zevi uses is misleading, it is associated with living organisms not with the physical, spatial or psychological aspect of a space. In his book *Toward Organic Architecture* he wrote:

Architecture is organic when the spatial arrangement of a room, house, and city is planned for human happiness, material, psychological, and spiritual. The organic is based therefore on a social idea and not on a figurative idea. We can only call architecture organic when it aims at being human before it is humanist.

Such understanding of an organic approach does not look for relation with the Planet. It looks for the essence or properties of space. Similarly Wright used the expression the idea of natural materials based on its nature, where nature should be understood as properties not their source [23]-[25].

Last but not least there is the Finnish architect and designer duo, Alvar (1898-1876) and Aino Aalto (1894-1949). The organic aspect of their work could be analysed on two levels: formal (shapes) and in relation to nature. Aalto's shapes both in architecture and design express a continuity and softness of lines and surfaces. Just to mention the Church of the Assumption of Mary in Riola di Vergato (Bologna, Italy), Baker House in Cambridge (USA), or Savoy Vase. Their relation to nature was much more complex and should be understood in the context of Finland, a country located in between forest and lakes, on the periphery of Europe. Ari Hynenen observes Kirmo Mikkola's [26] statement that although Alvar Aalto never wrote a book which formulates the design principles, it could nevertheless be observed in his architecture, text, lectures or speeches. One of the elements that could be found in Aalto's architecture is biophilia – being surrounded with Nature – plants and animals, depending on the weather and seasons and more. This unique relationship with nature was popularized by Edward O. Wilson (1929-), American biologist, who in 1984 described these characteristics as: 'an innate tendency to focus on life and lifelike processes, urge to affiliate with other forms of life' [27] suggesting that since the very beginning humans have been in a strong, and inevitable, relation with Nature. In Aalto's work, it could be observed in the Town Hall of Säynätsalo (Finland), where the building is 'hidden' in the forest, blended in the rocky bed with multiple terraces, and provides a peaceful and intimate atmosphere.

Frank Lloyd Wright's person is key in the conversation about organic architecture. Until today architects are referring to his work and approach. A very wide framework drawn by Wright allows fitting projects of distant approaches or principles. Nevertheless, sometimes his ideas are reduced to pure formalistic and aesthetic decisions. There is much misunderstanding and confusion, for example, materials used by Wright should express its nature, not to be natural. The nature of materials is understood as their physical properties [23], [28].[3] In Fallingwater House (Pennsylvania, USA), one can find not only wood and stone, as probably

[3] It opens a wide field to interpretation and misinterpretation.

expected but also concrete and steel. Kenneth Frampton (1930-), an American architecture critic, summarized organic architecture:

Although it always escaped any precise definition, seems to have eventually meant for Wright the economic creation of built form and space in accordance with the latest principles of nature as these may be revealed through the application of the reinforced-concrete construction [29].

Today architects continue using 'organic architecture' with the same wide meaning. Carlos Martí Arís in 'La cimbra y el arco' observes that 'organicism in reality was a modality of functionalism' [30]. It could be interpreted starting from non-straight forms, through materials, to the relation with nature. The perspective can include architects starting from Wright, through Hugo Haering, Hans Scharoun, Paolo Soleri, Arthur Kieseler or more contemporary Javier Senosiain, Roznana Montiel, Hiroshi Sambuichi, Zaha Hadid or MAD Architects. Organic architecture should be understood as a period that allows to discover the importance of the relationship of architecture, nature and man that led to a planet-oriented approach. There are some elements, such as visual connection to Nature or attempt to blend with the landscape through the use of local materials.

5. Vernacular architecture

As an opposition to the International Style [31] announced at the exhibition Modern Architecture in MoMA of New York or standardization of architecture or rejection of local materials [32] several architects proposed to look at the past and the region. Among them the voice of the co-author of the catalogue of the exhibition: Lewis Mumford (1895-1990), the architecture historian and critic Sibyl Moholy-Nagy (1903-1971), the Egyptian architect and scholar Hassan Fathy (1900-1989) or the Moravian-born architect and writer Bernard Rudofsky (1905-1988) called for learning from the past.[4]

Grzegorz Rytel, a researcher from Warsaw University of Technology, points out [33] that the term vernacular architecture was used first in the mid-19th century by Gilbert Scott to define architecture that is typical for a certain region. This idea was expanded by Paul Oliver, author of the Encyclopaedia of Vernacular Architecture of the World, where he reminds that such architecture must be based on knowledge passing from generation to generation [34].

Mumford studied the relation nature – architecture – man at the beginning of the 20th century, for example in *Technics and Civilization* [35]. As Lance Strate and Casey Man Kong Lum observed '[he] is concerned in concrete and practical ways with both the biological and technological habitats of the human species' [36]. His lectures at Alabama College took the form of a book [37] which maps the relations with nature and human impact.

The individual unit must always be conceived and modified in terms of the whole. This cannot be done by architects who have their nose on the drawing board, and who, in their own conceit, have no regard for the principle of neighbourliness and no interest in the surrounding works of nature and man.

[4] Here the figure of *Angelus Novus* by Paul Klee persecuting.

Sibyl Moholy-Nagy, architectural critic and professor of the Pratt School of Architecture, dedicated a big part of her professional career to research and map vernacular architecture of the Americas. *Native Genius in Anonymous Architecture* [38], an outstanding guide to locally designed architecture based on indigenous and settlers experience is the most important part of her publishing in vernacular architecture. She had also previously published several articles on the same topic in Perspecta [39]: The Yale School of Architecture Journal and Casabella [40]. In the sixties, she continued her research and writing with *A Study of Education for Environmental Design* [41] or *The Making of Non-Architects* [42] to list some. She advocated for learning from the past as a strategy to design a better-performing architecture.

This folklore of building will be meaningless to those who define architecture either as pure aesthetics, expressed in Le Corbusier's poetic exclamation: "Architecture is the play of light-supreme and magnificent – on significant form"*; or to those who consider it predominantly a branch of modern technology, believing that "engineering will absorb architecture" and that the architect's function can only be defined in the turgid phraseology of the technocrat: "catalysing cooperative and potential resources into realigned and realizable technology and management strategy, providing a demonstrable increase in performance increments per unit of invested resources* [38].

Moholy-Nagy looked to the indigenous knowledge for its ingenuity and originality in resolving local problems, solutions which could be an alternative for industrialized and out-of-context solutions. Although *Native Genius in Anonymous Architecture* is much more profound and detailed than *Architecture without architects*[5] it never received as much attention. Bernard Rudofsky's book is a catalogue to an exhibition at the MoMA in New York. The photographic essay talks about regional architectures, materials, spatial solutions or response to climate. He writes:

There is much to learn from architecture before it became an expert's art. The untutored builders in space and time-the protagonists of this show-demonstrate an admirable talent for fitting their buildings into the natural surroundings [43].

The importance of this book should be seen as triggering regionalism in architecture.[6] It was not Rudofsky´s first approach to this topic. He obtained a title of doctor in architecture at the University of Vienna for his research in Greece concluded in: *Eine primitive Betonbauweise auf den südlichen Kykladen* [*Santorin*]*, nebst dem Versuch einer Datierung derselben* (*A primitive type of concrete construction in the southern Cyclades. Study case Santorini*) and in 1947 he curated an exhibition at MoMA: *Are Clothes Modern?: An Essay on Contemporary Apparel* [44] ,which was not an exhibition on clothes or fashion, but rather looked for regional patterns, local attributes, vernacularism. It was an exhibition of design and architecture.

The last author presented among the researchers in vernacular architecture is Hassan Fathy, the most celebrated Egyptian architect. In the movie *Il ne suffit pas que Dieu soit avec les pauvres* [45] he says:

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5 The Rudofsky exhibition and book was an album of photographs, most of them came from the collection of tourist offices, surveys made by others or museum collections [43].

6 Though it would look for the idyllic and romantic aspect of the countryside.

I'm an Arab architect who has lost every point of reference in Arab society, who has lost his arabité. I'm searching for architecture and urbanism, searching and trying to find my lost arabité.

Fathy advocated for vernacular architecture, local skills and the revival of craftsmanship. *Architecture for the Poor: An Experiment in Rural Egypt* [46] is a guide to holistic design in architecture based on cosmology and symbolism, *modus vivendi*, traditional building techniques – a strong belief in craftsmanship (he researches vaults used in Ancient Egypt), local materials and more. The text, based on his professional experience as a designer, is an antithesis to the omnipresent modernism and globalization.

There must be neither faked tradition nor fake modernity, but an architecture that will be the visible and permanent expression of the character of the community.

He reminded building industry stakeholders that local knowledge is crucial to respond to the actual problems. In the chapter "Climate and Architecture", Fathy analyses environmental conditions and traditional solutions to minimize heat radiation, temperature control or ventilation. In vernacular solutions he looks for a passive design[7] scheme.

His posteriori texts such as *Natural Energy and Vernacular Architecture* [47] or *The Mud Brick Manual: Vault and Dome Construction* [48] bring more solutions based on native knowledge. Even though he promoted vernacular architecture (in the meaning of 'from the place') he worked on a project in Saudi Arabia and New Mexico[8] (Muslim community at Dar al Islam) where he transplanted the ideas born in Egypt. Both locations share similar climatic characteristics and cultural background.

The vernacular studies were also undertaken by the modernist architects (practitioners) who look to expand their workshop and tools they used. In Portugal, a group of well-established architects, on the request of the government [49], travelled the country to look for popular architecture patterns. They mapped the relationship between landscape, territory, architecture and the ways of living. The efforts were concluded in the book *Arquitectura Popular em Portugal* [50] which is, until today, a primer for Portuguese-educated architects. Also, Lina Bo Bardi (1914-1992), an Italian-born, Brazilian-established architect, celebrated and researched popular architecture. Some of her thoughts could be found in the essay: *Architettura e natura: la casa nel passaggio* [51] for Domus:

Through deep evolution, the primitive instinct for protection that led man to build thatch and straw huts, cone-shaped shelters, or massive stone blocks, is again in force to define housing architecture which, although it adapted to the harsh laws of functionality and essentiality of modern architecture, they always retain the 'purity' of the spontaneous and primordial forms from which they derive. (...) We are not talking here of external appearances

[7] Passive design is understood as a strategy that replaces energy obtained from the grid with natural energy sourced directly from the environment (such as solar energy or earth heat) to enhance building performance. Passive measures are based on architectural and constructive solutions, material selection, building orientation or shape.

[8] Even though the locations were distant, they shared the same climate conditions, according to The Köppen climate classification and cultural background.

or regional folklore, but of those values that as a result of the serious investigation undertaken by modern architecture against the 'false', the 'stylized' and the 'crystallized'.

At that time there was no vision of planetary interdependencies, designing for local (vernacular) conditions was the way to an adequate response to the site, weather patterns, available material, and the way of living. Only more recent studies look for a more complete picture, and includes more, if not all the biotic and abiotic actors. For example Natalia Przesmycka [52] embraces the history, local climatic conditions, materials and resources, geographical conditions and cultural influences in search for a more holistic picture of the architectural vernacular production in Iceland.

6. Tropical and bioclimatic architecture

Once the idea of global architecture disseminated globally local versions of modernism started to appear in 'tropics'[9]. In the early '50 Le Corbusier (1887-1965), Jane Drew (1911-1996) and Maxwell Fry (1899-1987) were invited to Chandigarh to continue the plan for a new capital of an Indian state Punjab, a few years later the initial idea for The National Assembly Building in Bangladesh was conceptually conceived by Louis Khan, Pancho Guedes constructed housing projects in Maputo (interestingly Guedes embraced folk but not vernacular[10] architecture of Mozambique), 1957 Lucio Costa won a national competition to design Brasilia, in the early sixties in México Pedro Ramírez Vázquez designed Museo de Antropología. The academia did not stay behind and in 1955 the Architectural Association (AA) School of Architecture launched The Department of Tropical Architecture directed by Maxwell Fry and James Cubitt. The topic was first illustrated in Architectural Review [54] that was dedicated to the West African[11] educational buildings (where Fry and Drew were consultants already in the mid-1940s). Their field and consulting experience concluded in the book *Tropical Architecture in the Humid Zone* [55] that describes climatic characteristics and their impact on architectural design, health, and hygiene in illustration, map, diagrams and tables. The book is written as a practical guide, based on their experience and observation, for fellow architects. Almost ten years later, the same duo wrote *Tropical architecture in the dry and humid zones* [56] expanding the knowledge to other climatic zones. Anyway, the architecture was treated as an artifact, the solutions proposed were technical or technological and were imposing the European way of living and being. Otto Königsberger, an architect experienced in south India[12], who took over the chair of The Department of Tropical Architecture, published a short essay on tropical architecture in 1965 [57], which serves

[9] Although the idea could be tracked much earlier – already in 1810, Thomas Williamson in *The East India Vade Mecum* [53] criticized a lack of adaptation to climate and copying architecture: 'by no means consistent with common sense . . . and displaying a total ignorance of the most simple of nature's laws' pp.7-8. Also in the twenties of the XIX, with the flow of Jews and Jewish architects from Germany to Mandatory Palestine, Bauhaus architecture was transplanted. Though the formal style was not adjusted to the local climate, the cultural context was by the newcomers and was a continuation of the European diaspora life.

[10] Here folk is understood as an expression of certain aesthetics.

[11] From the forties West Africa was a field of intensive research and experiments. Next to Drew and Frey, Labelle Prussin was there surveying indigenous architecture in northern Ghana, Paul Oliver starts his research on vernacular architecture also in Ghana, Accra and Lagos are experiencing a great import of socialist architecture and architects.

[12] He commenced working for the Mysore State (a state that was granted a large autonomy from the British Empire) for westernized Hindi people and continued in the independent India.

as a reference to this day. Although it was *Manual of tropical housing and building: climatic design* [58] that has been widely published and distributed. In the introduction, the author explains that he addresses the book to the students and as a reference for practitioners, and finally as an aid for their clients. The text is a detailed technical guide to climate, vegetation, it introduces topics such as thermal comfort, ventilation schemes etc. The authors did not pay much attention to vernacular architecture. The sub-chapters on traditional architecture for selected climates are short, the examples are cursorily explained without diagrams showing for example air-flow, it is seen as a curiosity not as a problem-solving reference. The origins of the bioclimatic design are rooted in the International Style, which rejected local knowledge. Such architecture seems to be another tool in globalization and colonization strategy.

The first publication which tried to explain the physics behind the relation nature – architecture was Design with Climate by Victor (1910-1970) and Aladar Olgyay (1910-1963). A detailed guide [59] mapped the influence of the environment on architecture. Illustrated with numerous diagrams, sketches, graphs and photographs, it has been a base for a bioclimatic design for decades. It explains the influences of the climate, wind, humidity, topography on human performance, well-being and health. The modern-day computer simulations are rooted in the daylight or air flow studies presented in the book [60]. Limited bibliographical references prove its pioneering role. Before Olgyay published several articles and books on the impact of the environment to architecture: *The Temperate House* in 1951, followed by *Bioclimatic Approach to Architecture* and *Solar Control and Orientation to Meet Bioclimatic Requirements* and *Application of climate data house design* in 1954, and *Solar Control and Shading Device* in 1957.

The works of Drew, Olgyay and Königsberger echo into the research of Susanne Roaf, Professor of Architectural Engineering at Heriot-Watt University in Edinburgh. She is best known for strategies for adaptation of buildings for climate change [61] and verifying vernacular architecture sustainable solutions against the contemporary computer energy modelling [62]. Fionn Stevenson develops the same field through the lens of building performance evaluation, examining performance [63] in relation to energy efficiency [64], occupant satisfaction [65] or carbon emissions [66]. Their work brings an engineering aspect of contemporary architecture in relation to nature that could be measured and optimized.

[*I*]*n the warming climate* [*.. it*] *reminded us not to follow the stereotypical thinking of 'conventional wisdom' but to re-think each design decision clearly for ourselves and remind us that the sustainability stool has three legs, and if you lose one, the stool falls.* [67]

Last but not least, the works of the already mentioned pioneers from the '50s and '60s play an important role in understanding modern and contemporary sustainable architecture and its stakeholders.

Engineering companies (ARUP, Buro Happold, The Smith Group etc.), innumerate certification systems (LEED, WELL, Passive House, BREEAM etc.), high-performing architecture, digital tools (like Ladybug, Energy+, Ecotec) benefit from their work. Tom Eichbalm from the Smith Group chooses an orientation of The Chesapeake Bay Foundation based on the classes taken from Olgyay's *Design with Climate*. The thermal performance evaluation methods described by Olgyay, for example, are in use until today and were translated as digital tools for computer simulation. As David Leatherbarrow and Richard Wesley, scholars from the University of Pennsylvania School of Design, point out, Olgyay's 'research and publications laid the foundation for much of the building simulation software in use today' [68]. For example Ladybug Tools,

one of the most popular set of tools for daylight and energy visualization and simulation, uses Olgyay's work as a reference [69].

7. Planet-oriented architecture

Design with Nature [70], alongside the already mentioned *Silent Spring,* constitutes the backbone of planet-oriented thinking in the sixties. These two texts helped the activist to transform the enthusiasm into policies such as the National Environmental Policy Act in 1970 and the Clean Water Act in 1972. Ian McHarg (1920-2001) was a landscape architect, the knowledge he gained at Harvard University encompassed both architectural theory, biology and environmental science. Such education allowed him to write a book from a wider perspective: a planetary, holistic vision, where city and urbanization are understood as a continuation of natural landscapes. All the elements of environment, biotic and abiotic, form the context for architectural design. An attempt to design against it would, sooner or later, be a failure. The text brings detailed solutions and design strategies, speculation, and thoughts on the relation nature – architecture – humans. The work of McHarg is continued at The McHarg Center at the University of Pennsylvania. Fifty years after the premiere of the first edition the university published an up-to-date sibling [71].

Buckminster Fuller (1885-1983), one of the brightest minds of generation, designer and author of several books which have shaped design and architecture, in *Operating Manual for Spaceship Earth* [72] draws a picture of the Earth as an element of the solar system, an organism[13] that functions based on physical and chemical processes that keep regenerating and allow the appearance of life. According to Fuller, the Earth is a spaceship that flies through space and has limited resources which, once extracted, cannot be restored. The book was published just three years before the first issue of *The Whole Earth Catalog*[14], a magazine which advocated self-sufficiency, permaculture, ecology, and holism. The first colour image of Earth, taken in 1967 by the ATS-3 satellite, was used as the cover image of the first edition of Whole Earth Catalog. The catalogue was a part of a larger counterculture movement. In 1956 Paolo Soleri (1919-2013), Wright's apprentice started the construction of the Arcosanti, a bottom-up, community-driven development in Phoenix which looked to integrate architecture and ecology in a holistic way. In Arcology he observes [75]:

We interpose between the scattered plenitude of nature (remember its unhuman module of space-time) and the dense introspective plenitude of man, the platitude of our handiwork, the artificial. What we need is that in-between structural systems by which nature itself is filtered and welded in forms more apt to carry the extreme valence of contemporary man, an ecology made of nature and man, framed in an architectural system.

However, some recent critiques on Paolo and Colly Soleri indicate that the project was far from being sustainable [76], due to its location, incorrect solar orientation of buildings or water management [77]. Soleri, alongside Drop City, is the most known building of the hippie movement of the sixties. Auto-sustainable communities were growing all around the world,

[13] The idea grows along with the General System Theory coined by Ludwig von Bertalanffy in the late 1930's and concluded in Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications,*1969. [73]

[14] The Catalogue edited by Stewart Brandt was published regularly between 1968 and 1971, later in an extraordinary matter. [74]

questioning capitalism and its production such as architecture and design. The architecture of such development has strong roots in cosmology, close relation with nature, and almost primitive living. In that context, the movement of *Earthships* commenced by Michael Reynolds (1945-) in the seventies must be mentioned. Reynolds, an American architect based in the hot and arid New Mexico, developed one of the first off-grid, self-sustainable houses, that used passive strategies, minimized waste, reused materials for construction or harvest and stored water on-site. His idea has spread in numerous locations, in different climates and geographical conditions.

The issue of the planet-oriented approach transcendent to all disciplines also to industrial design, which was an emerging discipline in the sixties and seventies. There is no doubt that Design for the Real World [78] by Victor Papanek (1923-1998) set the discussion on mass-production, the necessity of design, tools, topics, client-designer relations for several decades, and strongly influenced contemporary architectural thought. Papanek looked for the essence of design and the necessity of creation as an initial point in a discussion about sustainability and what is today called 'degrowth'[15].

Papanek was a part of a larger informal group formed by Rachel Carson, Buckminster Fuller, and Jane Jacobs. The group advocated for holistic design and looking for the essence of the problem, not to redesign or to fix the broken system. Jacobs (1916-2006), who was a social activist and journalist, strongly influenced the contemporary understanding of urban design and architecture. She looked for 'living neighbourhoods and street ballet' as a measure of a healthy city. In *The Death and Life of Great American Cities* [79] she writes:

Human beings are, of course, a part of nature, as much so as grizzly bears or bees or whales or sorghum cane. The cities of human beings are as natural, being a product of one form of nature, as the colonies of prairie dogs or the beds of oysters.

She looked to embrace nature and include all the beings, in the posthumanism spirit, as an equal element of the system. A city is a natural extension of the landscape, architecture is the ecosystem.

The idea of Planet-Oriented Design has become an important element of scientific research of today. For example European scholars organized around the idea of restorative and regenerative design have amplified the traditional knowledge production to building operation and maintenance [80], technology [81] and economy of scale looking for a holistic view and the entire lifecycle of a project. The restorative approach looks to reverse the harm and damage made by humans or caused by human activity on the natural systems. The concept of regeneration originated in a *living systems model* of Steve Larrick, American researcher [82] Bill Reed, architect, lecturer and author, introduced the idea of regeneration to architecture [83]. In that paradigm, the built environment has a positive impact on the ecosystem, e.g. instead of minimizing the heat island effect it ensures outdoor environmental comfort. The regenerative design looks to increase planetary capacity, empower all species, and enhance the ecosystem. The regenerative approach aims to create a more resilient and inclusive future.

The scientist and architects tried to expand their agency by working with Non-Governmental Organizations and publishing manuals for non-architects that look to help the local communities to build in an equilibrated and sustainable way. In the early 1980s, Secretaria de Assentamientos Humanos y Obras Públicas de México published a DIY (Do It Yourself)

[15] A topic widely explored during the last Triennale of Architecture in Oslo in 2019.

manual [84] written by Johan van Lengen which explains the variety of climates and the corresponding architectural solutions.

8. Summary

The first analysed movement – organic architecture – should be seen as a moment of establishing a new relationship between industrialization, a modernizing world and Nature, and as an origin of the posterior movements. Even though works of Frank Lloyd Wright or Alvaro and Aino Aalto should be seen as a modality of functionalism, they explored the relationship between man and architecture in the early 20th century. Organic architecture neither looked to protect nor regenerate Nature, it was an initial moment of understanding such a complex relationship. Vernacular Architecture should be seen as a source of knowledge based on the tradition and experience. There is no doubt that Sybil Moholy-Nagy and Hassan Fathy have seen traditional architecture as a source of knowledge to design according to the climate and with the use of local materials and skills. The care for the neighbourhood (Nature) has been a part of an agenda of vernacular architecture and traditional societies. Tropical and bioclimatic movements which looked to adapt architectural patterns developed in Europe and the USA brought a set of tools allowing measure performance of a building. Works of Otto H. Königsberger and Victor Olgyay on building performance allowed the establishment of a new discipline based on simulation which has been developed to the present day. Finally, the planet-oriented should be seen as the latest embodiment of the environmental-sensitive movement, one that embraces ideas of restoration and regeneration as the principal axis of the agenda. This framework allows observing the ecosystem from inside and outside. Architecture and the built environment as parts of a larger system play an important role in the ecosystem. Hence, to contribute in a positive way to regenerate the Planet, it should follow the recommendations of IPCC Reports and the 17 Sustainable Development Goals indicated by the United Nations. Multiple attempts such as the UK Architects Declaration of Climate and Biodiversity Emergency should be considered as tangible significant steps in the right direction.

All the movements emerged from care for nature. They used different tools, used distinct frameworks, and vocabulary. Although some continuity could be observed, two parts could be distinguished: the initial one, which circles around Wright, Aalto, Mumford, and Jacobs, and is based on emotions, relations, assumptions, and second – the quantitative, which commences with tropical architecture, represented by Jane Drew or Victor Olgyay. In recent years, the second approach has been taken over and continued globally to look for the best performing, engineered architecture, both in research and practice. The vernacular approach does not fit the globalized world of the architecture of glass and steel, though it has the most potential since the solution it employs has been reviewed for many generations and in its core has regeneration and positive impact on the environment that is a part of it.

The future research might look for a deeper understanding of vernacular architecture and its relation to Nature, researching regions that have not been explored yet. Following the steps of Rudofsky to look in the existing texts (it could include non-Western scholars) or of Sibyl Moholy-Nagy making a survey to look for environmentally-conscious solutions. Additionally, the further research could trace female presence in the field. The author believes that the role of Sibyl Moholy-Nagy, Jane Drew and Susanne Roaf is underestimated.

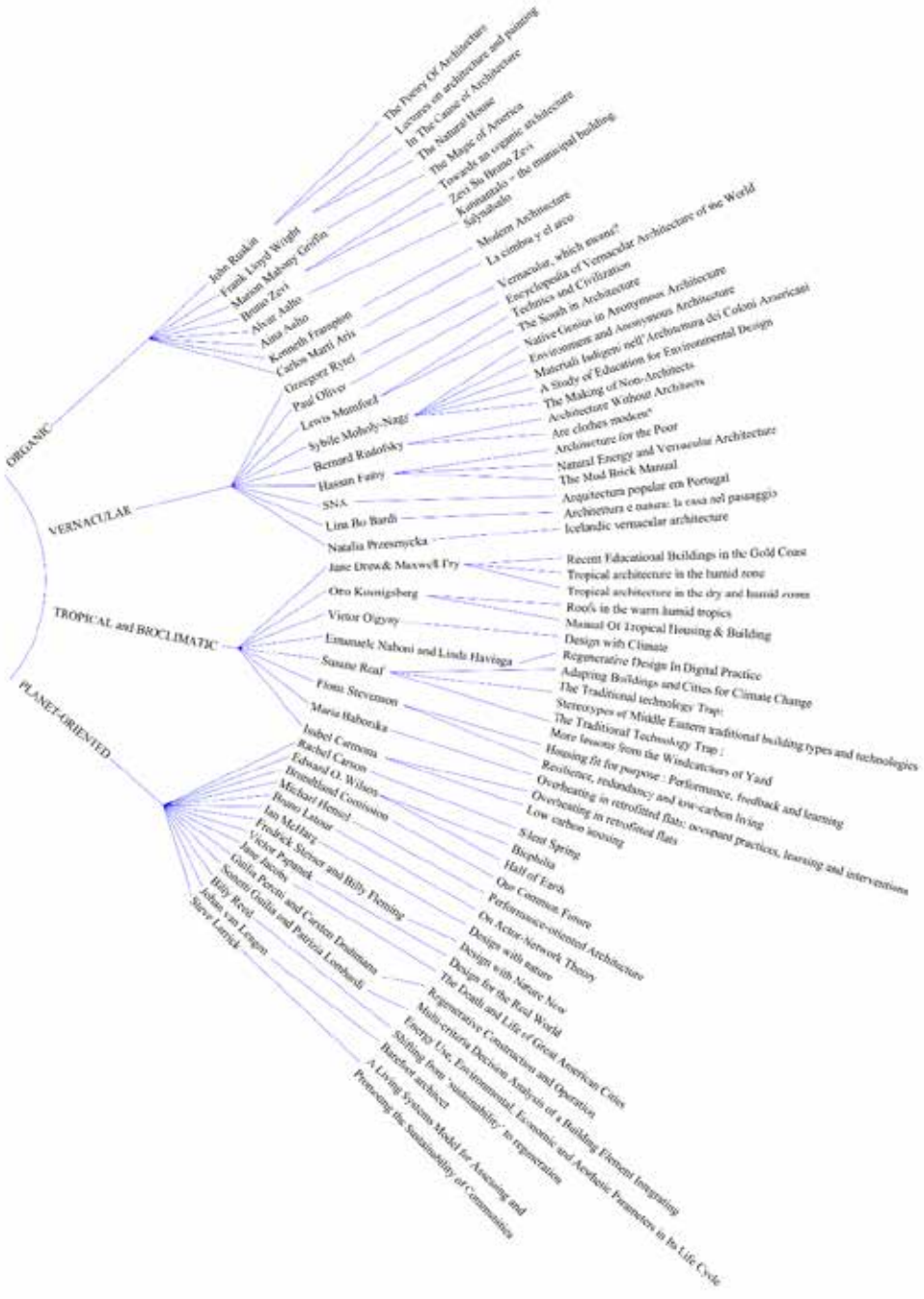

Fig. 1. Many beginnings: the thought, thinkers and actions behind the planet-oriented architecture – diagram (source: own study)

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Orginal Article

Society of Workers' Housing Estates and its attempt to overcome the residential crisis in interwar Poland. A contribution to further research

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Abstract: After the Great War, one of the most challenging obstacles of the newly recreated Polish state was to ensure residential space for the group of citizens most vulnerable to exclusion. Labourers indeed required an inexpensive and modest habitations maintaining modern sanitary standards. Such facilities were underrepresented in Poland at that time. Mostly overpriced and unsanitary flats were offered in 19th-century housing. Also new housing, although with all modern amenities, did not provide flats with parameters that could meet the expectations of the least wealthy of labourers. In such circumstances, at the end of 1934, a new state-owned company was created – the Society of Workers' Housing Estate (*Towarzystwo Osiedli Robotniczych*). Its aim was to build and grant loans for the construction of residential areas with flats meeting the needs of the lower-class labourers. Despite the difficulties, up to 1939, thousands of new flats were built under the Society's initiative. All these investments exemplify a successful and far-reaching social policy of Second Polish Republic that made residential crisis manageable.

Keywords: Housing estates, housing policy, labourers

1. Introduction

As a result of the First World War, Poland has regained its independence after more than century of non-existence. The recreated country, thus far having been part of three states, completely differed in terms of politics, society and economics, faced many organisational obstacles. One of the most important and challenging problems was to ensure civilized, residential space for all its citizens, especially for groups particularly exposed to residential exclusion such as the most indigent rank of labouring class, where accommodation shortage took most flagrant form. It was manifested mainly in living conditions, which did not comply

with hygienic standards and were truly violating the human dignity. It should also be noticed that, despite the then standards were not too excessive and were limited to providing the suitable amount of light and fresh air, it was hard to find buildings available for labourers, which could ensure such conveniences, not to mention about access to waterworks, sewerage and electricity. After all, the tenement house, which was a type of settlement that dominated the urban landscape in the end of 19th and in the beginning of 20th century, was criticised by most architects of the time, who were actively participating in transposition of the innovative, foreign architectural and urban solutions to Poland [1, pp. 60-61], [2, pp. 88-91].

2. The origins of workers' social housing in interwar Poland

Therefore, the issue of labouring class living conditions became one of the most important social problems faced by the newly created state. As far as in 1919, the parliament established the State Housing Fund (*Państwowy Fundusz Mieszkaniowy*), and by the law of 1927 imposed on the cities, impossible to meet in their financial situation at that time, the obligation to provide the most indigent families with adequate housing [1, pp. 59-60] . At the same time, the first housing cooperatives in Poland were created, at the head with Warsaw Housing Cooperative (*Warszawska Spółdzielnia Mieszkaniowa,* further „WSM") founded by the end of 1921 [3]. Its pioneering activity, however, did not lead to the development of solutions allowing to improve the accessibility of the smallest, at most two-room apartments, the only ones available for the worst-off strata of the working class. The blocks of flats built by WSM in Warsaw district of Żoliborz, mostly because of too extensive usable area, have proven not to be commensurate to the financial capacity of lower working class. It ultimately led to dominate the newly built estate by intelligentsia and so-called *proletarian aristocracy* and brought worse positioned workers to move to located peripherally within the downtown, but much cheaper, estate in the district of Rakowiec [3, pp. 39-50], [4, p. 4].

Fig. 1. Bruno Zborowski, Block of flats of the 2nd housing estate built by WSM in Żoliborz, Warsaw. *Source: National Library of Poland (Biblioteka Narodowa), p. F.63458/II, photo by H. Poddębski*

3. Society of Workers' Housing Estates (TOR)

3.1. Economic conditions of the project

The situation of housebuilding in Poland was clearly negatively affected by the Great Depression. The collapse of the economy, which in the Polish conditions lasted from 1929 until the mid-1930s [5, pp. 118-153], significantly limited the possibilities of improving the living situation of labourers. However, the later gradual economic growth allowed for another initiative aiming at improving the availability of affordable housing for workers. For this purpose, on 1st February 1934, the Economic Committee of the Council of Ministers (*Komitet Ekonomiczny Rady Ministrów*) founded the Society of Workers' Housing Estate (*Towarzystwo Osiedli Robotniczych*, further „TOR"), a state-owned company, which statutory purpose was to build and grant credits for building the workers' houses, which could comply with certain parameters, resulting from the real needs and limitations of their future users [4, p. 1], [6, p. 1]. At the beginning, the activity of TOR has been limited to validating loan applications and, when adopted, to addressing the loan request to the State Development Bank (*Bank Gospodarstwa Krajowego*, further "BGK") [4, p. 7]. In time, the Society undertook building of estates on its own. The financial stability of TOR was secured by the state shareholders[1]. In 1934, financing the credits was based on BGK Labour Found deposits. Next year, the resources of State Building Found (*Państwowy Fundusz Budowlany*) were added [4, p. 7]. Considering the scale and importance of this venture it can be astounding that the TOR-related source literature is not sufficient. The subject is analysed either selectively and concerns the architectural aspect of particular housing estates built with TOR involvement[2] or put in the context of another process[3]. However, there is a lack of literature entirely concerning the mode of operation and legacy of the Society which, within five years of its activity in interwar Poland, significantly contributed to housing conditions improvement of considerable number of the poorest labour class families. This fact could be the real reason for this subject to be omitted in the post-war literature. The communist Poland authorities, which monopolized the role of working people's benefactor, were not willing to admit that the pre-war Poland was not only interested in improving the working-class living conditions but also did it effectively.

3.2. General assumptions of the project and its background

This effectiveness, which interwar Poland owed to its own experience in the field of labour housebuilding, was undeniable. The usable area of flats built by the TOR founds[4] resulted from prior experiences acquired during the construction of above-mentioned WSM housing estate of Żoliborz. The issue of availability of the flats for financial limited workers was a key one. Primarily, target groups for planned estates were defined. In the case of single-family house held for sale they were "*non-manual and manual workers, earning up to 250* [polish złoty] *per month*" and with regard to flats in single- and multi-family buildings put to rent, it was just claimed that the level of rent should not exceed the financial limitations of the future tenants [6, p. 2]. Possibility of constructing the individual buildings has been rejected and, as a general principle, the building of whole housing estates or their parts was approved. It was

1 BGK, State Labour Found (*Państwowy Fundusz Pracy*), public insurance companies and Directorate General of State Forests (*Dyrekcja Naczelna Lasów Państwowych*) [4, p. 1].

2 For example [7].

3 For example [1] or [8].

4 It was 36 square meters for multi-family building and 42 for single-family building [6, pp. 2,6].

indicated that, for economic reasons, the housing estates will not be innovative, and their infrastructure may be limited to a necessary minimum. It's been also said that "*in the construction of housing estates following the foreign examples* [is not indicated, because] *the overall prosperity is much higher there*" [4, p. 9], [6, p. 4]. In order to reduce the general expenses it was decided that the loans will be only granted to the housing estates located on the state- or municipal-owned grounds. Purchasing a plot was only possible when there were no public grounds in the localization of planned housing estate, but just under condition that the purchase cannot be financed by the Society's loan. The need of an appropriate choice of localization has also been emphasized in order to secure the labour-like character of the estate. For this reason, peripherally located grounds were preferred as they were considered to be much cheaper and, therefore, less attractive for the wealthier groups of society, and as such less affected by potential gentrification than the downtown areas. Much more attention has been paid to the issue of extension and modernization of urban areas, which was particularly relevant at that time. Rejecting the investment in non-urbanized areas, the necessity of building the estates on the basis of existing settlement structure and in accordance with the valid site plans was underlined [4, pp. 9-10], [6, pp. 4-5]. Such actions were regarded as a chance for development of already existing cities and for spatial integration of newly created settlements with them.

3.3. Financial basis of the Society

Well-functioning system of loans has been considered as a basis of sustainability and proper functioning of the Society. Principles specifying the rules of loan granting protected TOR against abusing it by speculators and those who were wealthy enough to get credit without a Society's intermediation. Primarily, in order to secure the profitability of investment and thereby the labour-like character of the estates, the upper limit of loans[5] has been established. It was also set that constructed flats shall be intendent for people who are "*less wealthy and have lower housing expectations*" [6, p. 6]. Besides the mentioned usable area restriction, it was also banned to grant the loan for more than one flat per person. Finally, detailed rules were established. Only in respect of constructed buildings their amount could not be higher than 5000 zł multiplied by amount of flats foreseen under the building project. Organizing the surrounding areas could not exceed 20% of the building construction cost. However, when calculating the construction of residential buildings along with the organization of green areas, the amount of the loan could not exceed 80% of all costs. The fixed interest rate for the Society's loans was also determined, firstly at 2%, then reduced to 1.5% [4, pp. 7,8]. The loan repayment period depended on the type of the building[6]. According to the statistics on earnings and rent, TOR also set an upper limit for rent, which could not exceed 20 zł per month in all the housing estates it financed [4, pp. 1-3], [6, p. 7]. Limited with numerous conditions and sealed, the Society's system of granting the loans has proven to be essential for the whole venture. Primarily, low interest rates on loans were very beneficial. Considering that in 1933 the short-term loan interest rate was 6% and in case of the long-term loan 4%, the 2% interest rate offered by the Society had an extremely favourable impact on the revival of the housing construction industry. This enabled the transfer of investment pressure from the small-scale housebuilding for larger-scale one, which also included the workers' housing estates [4, p. 6]. This process seems to be confirmed by the number of housing estates constructed in later years under the TOR assistance system.

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[5] It was 5000 zł per flat – depending on the location of the investment, in agreement with BGK, it was possible to set a lower amount of the loan [6, p. 6].

[6] In case of brick construction, it was 50 years and in case of wooden 25 years [6, pp. 6-7].

3.4. Activities of the Society within the Central Industrial District (COP)

The Society began the lending of several new constructions already in 1934, when several investments were granted loans in the total amount of about 3.7 million zł. It was a truly momentous event – for the first time in history, when functioning under the free-market economy conditions, polish social housing achieved such a scale, both in terms of the amount of credited funds[7] and also in its territorial range, what was particularly significant. TOR covered with its activity the area of each of the three former partitions, what was a major contribution to reduce the economic disparities and also differences between the architectural landscape of the individual parts of the state. It's worth noting that the estates were built not only in larger cities, but also in much smaller industrial settlements or towns[8], which had a significant impact on the industry development of outside the large urban areas. In 1934, loans were granted to various types of borrowers. Local governments received 44% of all funds, co-operatives 23% and the Society itself 19%. The smallest loans were granted to the National Road Fund (*Państwowy Fundusz Drogowy* – 10% of all)[9] and to the state-owned factories (4%) [4, p. 11], [10, p. 9], [11, p. 11]. It should be noted that share of TOR itself in loans granted[10] increased whilst the share of local governments decreased[11]. It was caused mostly by deterioration of their financial situation and it should not undermine their role in improving living conditions of the less prosperous rank of labouring class in the first year of the Society's activity. In 1935, the financial resources earmarked for loans increased to about 9.3 million zł. Next year brought a slight decrease (about 8.4 million zł), however, in subsequent years, the total amount of credits granted began to increase again, amounting to 10.2 million zł in 1937 and 12.1 million zł in the record year of 1938 [10, p. 9], [11, pp. 10-13]. Comparing to the first year of it's operation, the Society's expenditure on financing the loans significantly increased by over threefold.

The foundation of Central Industrial District (*Centralny Okręg Przemysłowy*, further „COP") was an important circumstance that highly interacted the increasing involvement of the Society in the construction of workers' housing estates in 1936 [13, pp. 37-117]. As so far, TOR investments on the areas later included in COP has been focused in two cities and two smaller industrial towns[12] and were worth about 0.93 million zł [4, pp. 11,12]. The increase resulted from a number of factors. One of the most important was certainly the stabilization of Polish economy in the second half of the 1930s. Within two years from the formation of the District, the number and value of credits granted for investments implemented within its area increased almost eight times in relation to the expenditures from years 1934-1935 and finally amounted to about 7 million zł [10, p. 9], [11, pp. 10-11]. Another incentive was the growing threat to the state's external security. The arms industry, located mainly within the COP area,

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7 In 1934 the average wage of worker employed in the large and medium-scale processing industry was around 105 zł per month [9, p. 183].

8 Only in 1935 the Society's loans were granted to several investments throughout the country (Warsaw, Katowice, Chorzów, Poznań, Gdynia, Toruń, Grudziądz, Sochaczew, Hajnówka, Janowa Dolina (today Bazaltove in Ukraine), Zagnańsk, Starachowice, Częstochowa, Mościce, Dąbrowa Górnicza, Lublin, Lwów – today Lviv in Ukraine – and Łódź) [4, p. 11].

9 Its activity was mainly related to the construction of the estate located nearby the State Basalt Quarries (Państwowy Kamieniołom Bazaltu) in Janowa Dolina.

10 Up to 40% of the total value of the credits granted in 1935 and 49% in 1936.

11 The share of local governments in loans in 1935 decreased to 20%, and lightly increased in 1936 by reaching 24%. [12, p. 22].

12 It was Lublin, Radom, Mościce and Skarżysko.

was very important for the growth of Poland's defence potential [14]. It is not coincidence that the biggest loan granted[13] was earmarked for the workers' housing estate located near the planned Southern Works (*Zakłady Południowe*) in Nisko which was planned to specialize in the production of artillery weapons [11, p. 11]. Two housing estates built under the Society's assistance system within the District could certainly be considered as representative. They were located in its two important industrial centres, Radom and Rzeszów, where the big, state-owned arms industry enterprises were located[14] [13, pp. 118-153], [15]. The rapid development of those two cities, greatly stimulated by their incorporation to COP, drew the Society's attention to their growing demand of cheap, labour house-building.

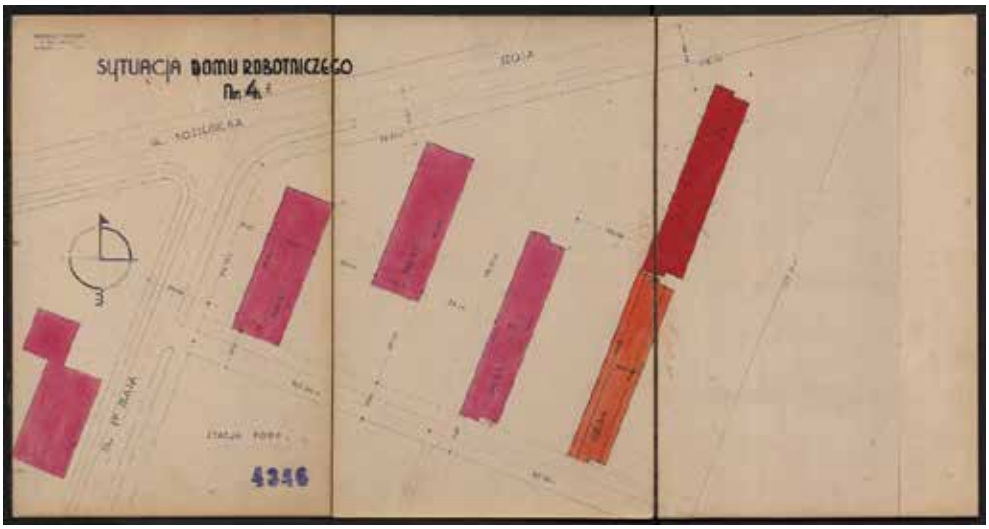

Fig. 2. Józefa Mehl, Site plan of the TOR housing estate in Radom. *Source: State Archive in Radom (Archiwum Państwowe w Radomiu), Municipal Records – Technical Documentation (Akta miasta Radomia – Dokumentacja Techniczna, further «AmR–DT»), p. 4031*

The estate in Radom is a good example of the realisation carried out by the local government. Before the First World War the town was a part of Russia-dependent Kingdom of Poland. In 19th century, Radom became one of its leading industrial centres and as such, like the whole Kingdom, was severely affected by the closure of the Russian market during the Great War. Therefore, in the case of this economically and administratively degraded town the COP investments created the opportunity to economic growth and were consistent with current state policy of placing the state-owned industrial enterprises within its area [16, pp. 125-131, 219-226]–[18]. In relation to the industrial character of the town, working class living conditions remained a very current issue, especially when the city was ruled by socialist parties for almost the entire interwar period [19, pp. 53-65]. Construction of the TOR housing estate in Radom begin in 1936 [8, p. 322], [20, p. 187]. According to the Society's recommendations regarding location, the block of flats has been situated on cheaper grounds, outside the strict downtown, at one of roads out of the city. The choice of

[13] It was about 1.75 million zł.

[14] It was State Arms Factory (*Państwowa Fabryka Broni*) in Radom and State Aviation Works (*Państwowe Zakłady Lotnicze*) in Rzeszów.

this location seems justified, considering the fact that after the Second World War, the former TOR housing estate was considerably expanded and in its immediate vicinity a new, much larger workers' housing estate was built in the 1950s [21, pp. 36-45]. Until the beginning of German occupation four four-storey blocks of flats were built, including one rough. A range of solutions testifies the innovation of this estate. For example, by planning the position of blocks in intermediate directions[15] an access to day light has been provided. The safety of pedestrian was ensured by locating blocks with access roads and green areas perpendicularly to the main streets. Flats usable area in the first three buildings were compliant with the TOR requirements[16]. Blocks were also connected to waterworks, sewerage and electricity [8, p. 324]. The architectural design of the Society's blocks in Radom is also an example of applying the innovative solutions of modernist architecture to the TOR's workers' house-building what completely denied the initial postulate of the Society, which, concerned about a significant increase in costs, originally intended to build on the basis of traditional solutions. As a result, people representing the most indigent rank of working class not only gained access to the basic facilities, but also were granted a previously completely unattainable possibility of living in aesthetic and modern surroundings

In Rzeszów the borrower was the State Aviation Works. In this case, construction of the housing estate under TOR assistance was a part of developing completely new industrial centre. This town is a significant example of the COP's influence on the development of the economically disadvantaged, eastern territories of interwar Poland. The inclusion of Rzeszów in the COP program resulted in its rapid development [22, pp. 204-206, 214][17]. Construction of the TOR housing estate may be certainly recognized as the manifestation of the city's development. The original plan was to build seventeen, three-storey blocks located in the suburban area. Until 1939, only four blocks for workers with flats meeting the Society's spatial requirements were built. Similarly like in Radom, blocks were situated in intermediate directions. The pedestrian's safety was assured through separation of the local traffic from citywide by situating the blocks perpendicularly to the main streets. Buildings were connected to the electricity and the flats had kitchens and toilets with access to running water and sewage. Cellars were designed as a bomb shelters while in the attic the laundry and drying room were located [8, pp. 298-300], [22, pp. 214-216]. Both in Rzeszów and Radom the estates were designed by using the latest achievements of modernist architecture and urban planning. Although the architecture of TOR blocks in Rzeszów was simpler than those in Radom, it is a fact that in those both cases the aesthetic value of the surroundings has been recognized as significant and influencing the quality of life of the estates' residents as positively as other facilities.

[15] South-west – north-east axis.

[16] In the last block of flats, finished by Germans during the occupation period, the original layout has been changed by combining smaller flats into larger ones.

[17] It is worth mentioning, that development of Rzeszów in the interwar period was so intensive, that after the Second World War, when Lwów with its surroundings was incorporated into the Soviet Union, it was Rzeszów that as the biggest industrial town in the area was chosen as a seat of authorities of new voivodship, created mostly from the remaining part of the pre-war Lwów voivodship.

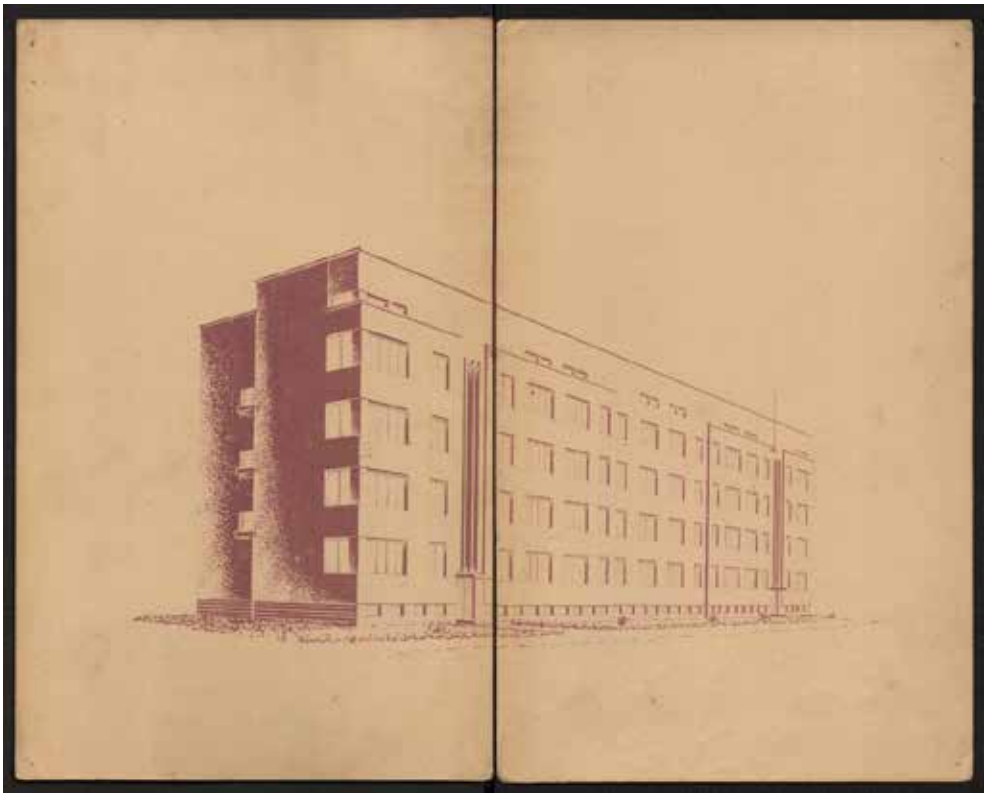

Fig. 3. Józefa Mehl, Axonometry of the 3rd block of flats of the TOR housing estate in Radom. *Source: State Archive in Radom (Archiwum Państwowe w Radomiu), AmR–DT, p. 3105*

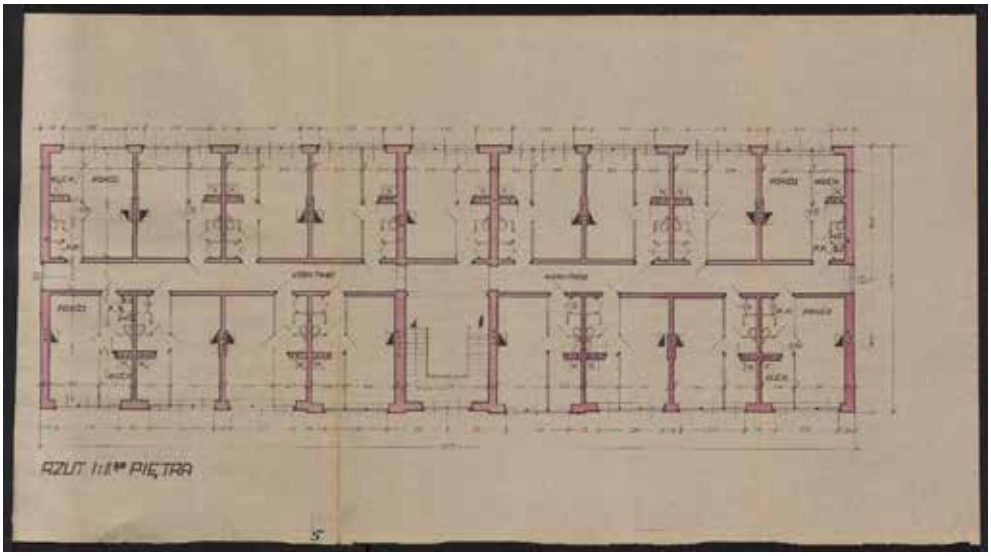

Fig. 4. Upper floors projection of the 1st block of flats of the TOR housing estate in Radom. *Source: State Archive in Radom (Archiwum Państwowe w Radomiu), AmR–DT, p. 4037*

4. Summary

The activity of the Workers 'Housing Estate Society was certainly one of the most significant achievements of interwar Poland in the field of workers' social housing, and for this reason it requires further and more detailed research. Having overcome the initial difficulties and drawing conclusions from earlier cooperative projects, a well-functioning state system of crediting the construction of housing with specific parameters, desired above all by the most needy layers of the working class, was created. The numbers themselves show the scale of the Society's success. For five years of its existence, TOR acquired for construction of workers' housing estates a remarkable sum of over 43 million zł [10, p. 9], [11, p. 11] which was spent on the construction of over 18 thousand workers' flats between 1934-1938 [9, p. 65][18]. The issue of architectural and urban innovation and aesthetics of estates financed by TOR loans also remains important. Contrary to the Society's initial assumptions, many of its later investments represented the highest rank, both in terms of urban and architectural solutions. Through the Society's activities, at least some of workers and their families, previously affected by the housing exclusion, gained the opportunity to live in a place which was not only equipped with all necessary facilities, but also aesthetic. The current achievements of the Society allow us to assume that if it were not for the war, the improvement of housing conditions of the worst-situated part of labouring class would be much greater. It may be concluded that, partly through the TOR's activity, the vision of Szczęsny Rutkowski, one of the then publicists and art critics has been fulfilled even to some extent. In 1932 he wrote with an almost prophetic sense: "*Let's give Polish architects the opportunity to work* [and] *within a few years* […] *they will create comfortable and beautiful flats, houses, estates and will enchantingly organize our Time and Space*" [23, p. 133]. The Society's legacy may certainly be an example of turning this faith into reality.

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Orginal Article

From emergency shelter towards disaster-relief housing – Tōhoku's reconstruction case study

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Abstract: This paper presents the post-disaster reconstruction of the Tōhoku region. Although Japan has always been one of the most prepared countries because of its long history with natural disasters, the 2011 Great East Japanese Earthquake and tsunami might be one of the most significant disasters recorded in the country's modern history. This unprecedented disaster that has shaken Japan is a decisive turning point for the entire society as well as for architects and urban planners. Almost ten years later, reconstruction work is still ongoing. This paper introduces specifically Japanese architects' involvement during the three phases of recovery: emergency shelter, temporary accommodation and permanent housing. After the first stage of perplexity and doubt, architects gradually stepped up and started initiatives to resolve the disaster victims' precarious situation. This article outlines some of the architects' actions through the three phases of recovery since the 3.11 disaster. Each of these temporalities has its issues and challenges which the urban planners, architects and designers tried to solve using their know-how to help rebuild devastated communities.

Keywords: Earthquake, Japan, Reconstruction, Planning, Housing

1. Introduction

On the 11th of March 2011, an unprecedented earthquake of 9.0 magnitude rocked Japan, from north to south. A few minutes later, a series of tsunami waves fell down the Tōhoku coast, devastating over 500 square kilometers, mainly in Miyagi, Iwate and Fukushima prefectures. The incident in the Fukushima Daiichi power plant reactors forced the evacuation of the nearby population outside of the radiation-affected area.

This triple disaster caused severe casualties: 16,000 victims, 3,000 missing people, 330,000 homes devastated and nearly 550,000 refugees [1]. Also referred to as "The 2011 Great East Japan Earthquake and Tsunami," it is a decisive turning point for the entire Japanese society as well as for architects and urban planners.

After a disaster, the priority is sheltering people during the three phases of recovery: emergency shelter, temporary accommodation, and permanent housing. Even though Japan has an increasing frequency and impact of natural disasters, architects have not played a significant role in post-disaster recovery before the Great East Japan Earthquake.

Nonetheless, the major crisis that arose in the aftermath of this disaster inspired the architects' commitment to take part in the reconstruction [2], [3]. Following March 2011, some Japanese architects were indeed involved in each of these phases, applying their design skills to help with rebuilding devastated communities.

This paper aims to analyse these architects' actions in reaction to the disaster and the role they played in Tohoku's revival. They had especially a leading role regarding the rehabilitation of housings including some innovative ideas, such as a partitions system in the shelters, new temporary accommodation or community-friendly disaster-relief housing.

2. Emergency shelter

Due to Japan's history of natural disasters, the government has developed evacuation shelters and temporary housing to provide better health and safety conditions for Japan's affected communities. After the 2011 disaster, victims could find clean water for drinking, washing, and a sewage system in these evacuation shelters.

Nevertheless, these facilities are generally wide open spaces like school gymnasiums, lacking privacy for the victims who stay there for months waiting for relocation to temporary housing (Fig. 1). The priority in this phase is to provide privacy to improve the comfort of the refugees.

Fig. 1. Emergency shelter without partitioning. *Source:* [4]

Fig. 2. Emergency shelter with partitioning. *Source:* [4]

In response to this issue, Shigeru Ban has been working on a partition system using paper tubes and clothes since the early 2000s. This system, called "Paper Partition System" is light, flexible, and does not need any fixation, making it easy to assemble and disassemble.

The 1995 earthquake in Kobe was a triggering event for Shigeru Ban to get involved in humanitarian causes. He created the "Voluntary Architect Network," a Non-Governmental Organization, to help him in his task. With this network of volunteers (students and architects), he travelled worldwide after natural (or human) disasters to build shelters for refugees made of cardboard tubes [5].

In total, between April and July 2011, more than 1,800 "Paper Partition" units were sent and installed in Tōhoku in the different prefectures affected by the disaster (Fig. 2). The architect went on-site with the Voluntary Architects Network group to supervise and help with the structure's installation [6].

However, Shigeru Ban also pointed out that some of the shelters were reluctant towards the partition system: " [...] some of the shelters' management did not want us to do it, because they said that it is going to make it harder to control the victims" [7].

3. Temporary accommodation

3.1. *Kasetsu jūtaku*

After a few months of living in the emergency shelter, refugees are progressively relocated to temporary accommodation called *kasetsu jūtaku* 仮設住宅. The government is financing these accommodations through a special "in case of disaster fund" and then hires private developers for construction. Nearly 52,000 temporary accommodations were built after the 2011 disaster: 22,000 in the Miyagi prefecture, 14,000 in the Iwate prefecture and 16,000 in the Fukushima prefecture [8].

These prefabricated units are narrow and unfit for harsh weather [9]. The entire family sometimes has to live in only 30 square meters, putting refugees at risk of falling into dangerous social withdrawal and depression [10]–[12]. In order to solve these precarious living conditions, some architects have been trying to improve the temporary housing system by proposing new models.

During the installation of his "Paper Partition System" at the emergency shelters, Shigeru Ban met the mayor of Onagawa who explained his small municipality's difficulties in finding suitable lands to build temporary housing.

The government policies regarding *kasetsu jūtaku* 仮設住宅 require many hectares of flat land beyond the reach of tsunamis waves. Nevertheless, the municipality situated on the hillside lacks considerably viable land to accommodate these dwellings. Ban proposes to use the baseball stadium to build a project of temporary housing using old shipping containers, piled up on three levels. This system allows fast execution, has excellent resistance to earthquakes and reduces construction costs. Furthermore, stacking frees up some ground to offer community spaces.

This reinvention of the traditional temporary housing system did, however, have some difficulties at the outset. The architect explains that even if the building met seismic prevention standards, the system being a first, permits had been challenging to obtain. Another requirement was to be able to benefit from the budgetary aid of the prefecture. The rooms' size thus respects the imposed standards but improves the interior space (in particular storage) thanks to the donations collected by the association.

Ban continues his commitment to helping disaster victims in Onagawa. Together with VAN, he organized a survey in the temporary settlements to inquire about the positive and negative aspects of the current temporary housing. The purpose was to hear the opinion of the occupants in order to improve the quality of life.

In total, VAN visited more than 30 complexes in Onagawa and carried out nearly 400 interviews in order to improve the current system for the *kasetsu jūtaku* 仮設住宅. Ban's work in

Onagawa's city was not limited to temporary architecture. The mayor asked him to build the new train station in 2015, which became a crucial element in the city centre revival [13], [14].

3.2. "Home-for-All"

Scattered communities and cramped living conditions do not enhance social cohesion in temporary housing complexes. In response to this issue, Toyo Ito and his colleagues of Kysin-no-Kai have created the concept of friendly places where the inhabitants could meet and share convivial moments [15]. That is the origin of the "Home-for-All" project (みんなの家 *Minna no ie*), with the installation of community spaces in the *kasetsu jūtaku* settlements after the disaster of 2011, which later expanded to various contexts [16].

Fig. 3. Sendai "Home-for-all". *Source:* [17]

The first "Home-for-all" was built in Sendai with the financial support of *Kumamoto Artpolis* (Fig.3). For this attempt to create a community space, Itō points out the challenge of designing a public building for "all" in its most primitive form [18].

Thus, after lengthy discussions with the residents, the design was oriented towards a "typical house": a large double-pitched roof, an outdoor veranda, a wood stove... Plenty of other "Homes-for-all" were built later on the architects' initiative, using private funding or patronage of various Japanese and foreign companies.

Nevertheless, the most emblematic one is Rikuzentakata's Home-for-All, which granted Toyo Itō his fame and popularity. This small town in the Iwate prefecture, also the birthplace of the photographer (and friend of Itō) Naoya Hatakeyama, was entirely devastated by the tsunami. Toyo Itō chose this meaningful location to set up an innovative project which he wanted to showcase at the Venice Biennale. The aim was to raise international awareness of natural disasters and their repercussions and solicit support for further Home-for-All projects.

The architect summoned three young architects to work with him on the design: Kumiko Inui, Akihisa Hirata, and Sou Fujimoto. Together, they frequently visited the site to talk with

the residents and listen to their wishes for this community space. Their encounter with Mrs. Sugawara, a fervent actress in the community of Rikuzentakata, was a decisive asset to fulfil their project.

Rikutenzataka's Home-for-All was exhibited at the 13th Venice Biennale entitled "Architecture, possible here?" [16]. Hatakeyama's large pictures from the site before and after revealed the devastation, while at the same time, models, sketches, and interviews describe the process and progress of the ongoing project.

This exhibition mixing architecture and photography raised the spectator's awareness about the 2011 disaster and its aftermaths. It conquered the biennale's jury, which granted the highest award, the Golden Lion, to Itō and his acolytes. This award also gave international media coverage to the project, encouraging the development of Homes-for-All across Japan.

Toyo Itō continues to build "Homes-for-All" across Tohoku with the help of young architects, and later in Kumamoto (after the 2016 earthquake) [18]. For him: "Devastated areas where everything is lost is the ideal opportunity to take a new look at what the architect really stands for. 'Home-for-All' may consist of small buildings, but raises the essential question of what form architecture should take in the modern age and beyond" [16].

4. Reconstruction

Once the emergency and temporary accommodation phases are over, the question of building for the long term appears. [19]–[21] How can architects participate in this process generally dominated by civil engineering?

4.1. *ArchiAid*

Architects, academics, and students from the Tōhoku region founded *ArchiAid* to help the disaster-stricken areas. The group aims to support reconstruction actions through a network of volunteer architects and avoid isolated activities in this vast and scattered affected area of the Sanriku coast[1]. To this end, their objectives are:

1. Create an international network to support reconstruction projects.
2. Encourage education by bringing together professionals, students, and inhabitants.
3. Gather and promote information about the disaster.

The network has been overseeing numerous initiatives in these three domains since 2011, whether by organizing exhibitions, workshops, or supervising reconstruction projects [22]. It has made a long-term commitment to the region and has been particularly active in Ishinomaki city or in the more remote parts of the Oshika and Onagawa peninsula.

ArchiAid teams were sent on-site to work with local communities in round-table discussions and workshops to tailor specific proposals to each locality. By means of researches and workshops, the members were able to understand the will of the inhabitants and carefully propose individualized reconstruction [23].

[1] The Sanriku Coast (三陸海岸, *sanriku kaigan*) is a coastal region on the Pacific Ocean, extending from southern Aomori Prefecture through Iwate Prefecture and northern Miyagi Prefecture in Tōhoku (northeastern side of Japan main island of Honshu). Its rocky shoreline is made out of cliffs, sharp rocks, and sandy beaches.

4.2. *Living access type*

After the Kobe earthquake in 1995, studies have shown the emergence of various social problems among victims after their unfitted relocation [24]. Many cases of unemployment, alcoholism, and solitary death (孤独死 *kodokushi)* are recorded in these public housing units, where the apartments usually follow the most common North-South typology (Fig. 4).

Recent studies have shown that to reduce the risks associated with loneliness, it is necessary to provide meeting spaces in these buildings [25]. Promoting community relationships between neighbours would help to reduce the risk of depression and its derivatives among refugees.

In this context, Yasuaki Onoda–architect-urbanist and founder member of the *ArchiAid* group–proposed an adaptation of the living access type developed in several reconstruction projects carried out in Tōhoku. The Urban Renaissance Agency UR (UR都市機構 / *UR toshi kikō*), a semi-public independent administrative institution in charge of the Japanese public housings, started using it in the 1980s [26]. This plan reverses the classic North-South layout, in line with three morphological principles:

1. Place the alleyway to the south.
2. Adjoin the living room so that it also faces south.
3. Install the bedroom to the north to ensure privacy.

Following these principles, the plan designed by Onoda offers a south-facing public area, supporting exchanges between neighbours, with the entrance of the housing (Fig. 4). The living room is located on this facade to maintain links with the outside, while spaces requiring more privacy are set back on the north side [27].

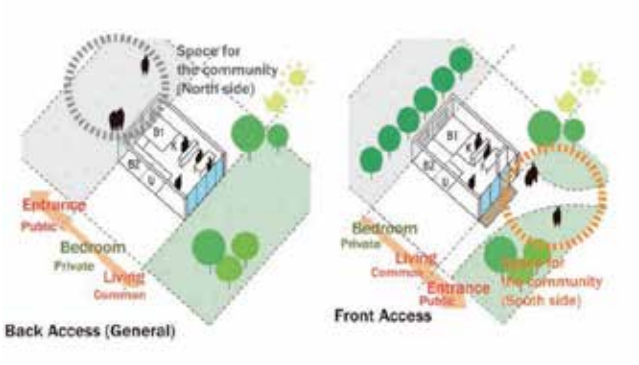

Fig. 4. Living/front access plan: a schema for community-friendly housing *Source:* [27]

Therefore, some architects, urban planners and landscapers became involved as advisers in public housing reconstruction projects. Their leading role has been to guide the disaster-affected municipalities in the construction of *fukko jūtaku* 復興住宅 (reconstructed housing) in order to offer a good quality of life to the inhabitants [27].

In the wake of Japan's experience of the 2011 disaster, inhabitants' solidarity has risen [28], [29], leading to a "living together" movement that has also impacted housing. Furthermore, some *fukko jūtaku* projects offer new typologies combining the characteristics of the individual house with those of collective housing [25].

5. Study case: Iwanuma's successful relocation plan

The author visited several disaster-relief housing neighbourhoods in the Miyagi prefecture in September 2018 to make photographic documentation and observations from the most direct sources. Among these projects, we selected Iwanuma's for further urban and architectural analysis.

Iwanuma (岩沼市) and its 40,000 inhabitants, is located in the Miyagi Prefecture, south of Sendai Airport. During the 2011 disaster, the tsunami waves reached further inland, drowning nearly half of the city's area. The city suffered considerable damages (human and material): nearly 180 victims and more than 1,200 houses ruined by the water. The seashore and its fishing villages were entirely destroyed.

Nevertheless, the Japanese government policies for reconstruction prohibit construction in these areas, considered now as a "disaster-risk area." There is an urgent need to solve the problem of these communities' relocation.

In July 2012, the City Council officially launched the project by acquiring land west of the Tamaura district. After receiving all the necessary authorizations from institutions, the City Council transmitted the decision-making powers to the residents. Thus, the city of Iwanuma wished to promote a participatory process in which citizens develop the project, guided by professionals.

As the relocation project involved six villages, it was decided that each of them would have three representative members on the Council for Urban Planning. For more balance, each village had to recommend an elder, a woman, and a young person among its representatives.

A team of 18 inhabitants was thus invited to work along with three professionals (a landscape designer, an urban planner and a housing policy specialist[2]) who guided them through the various stages of drafting the master plan. The Council met nearly 28 times between June 2012 and December 2013 to discuss various aspects of the project.

The Council members wanted to maintain the community ties that are important in these villages, mainly composed of elderlies. The Council's priority number one was to ensure that people from the same locality are relocated to the same neighbourhood area.

Avoiding group members' dispersal prevents isolation and social withdrawal, which is a particularly high risk for refugees [10]. The Tamaura-nishi district (Fig. 5) has been divided into six zones, one for each village, mixing private and collective housing.

Fig. 5. Example of *Fukko Jūtaku* built in 2015 in Tamaura-nishi, Iwanuma City (Tōhoku) *Source:* own study

[2] Mikiko Ishikawa for landscape, Yasuaki Onoda for urban planning and Yoshihide Sanbe for housing policies.

The three public housing projects located in the contact zones are intended for residents of the two adjoining villages. The concept is to combine two villages to form a "cluster" including a park and a meeting place (集会所 *shūkaisho*). These two community's spaces welcome the residents' events: "Public housing for the people of the village would be distributed among these clusters, with each site connected to each cluster as part of a community" [27].

The inhabitants chose the architects for the public housing projects through a proposal competition and a public presentation. These three disaster-relief housing projects (災害公営住宅 *saigai kōei jūtaku*) built in Iwanuma have then become references, regarding the short delay of construction, but also the quality of the dwellings, which are one of the first attempts to apply the concept of the "living access plan."

Fig. 6. Example of housing following the living access type, *Source:* own study

The example presented in Figure 6 was designed by the Urban Architectural Planning Partnership (UAPP) and included 44 detached houses built of wood. The architects created the dwellings using a pattern that divides the space into four zones. The bathroom and kitchen are combined on a quarter and located in the northern part, leaving the rest for the living spaces to the south, which open onto a shared outdoor terrace connecting to the central "Green Road."

This "Green Road," accessed via gently sloping ramps, facilitate access for persons with reduced mobility. These easy-access pedestrian paths lead through the entire neighbourhood to the community's cluster (park + meeting place).

Each green space has a singular characteristic. For instance, the western park is called "*Igune* Parc" (in reference to a specific Tōhoku tree) and is mainly dedicated to relaxation and contemplation of nature. The "*Bōsai* Park" (*bōsai* means risk prevention), due to its central location, has a role in strengthening disaster prevention. On the east side, the "*Kodomo* Parc" offers a playground for the youngest ones (*kodomo* means children). These three parks are connected by a green promenade that spans the district from west to east, enhancing soft mobility.

In the eastern part of the district, a spacious park is located with a water tank behind the commercial area. This park symbolizes the newly-built neighbourhood and was designed to host community events and festivals such as the *Hanami*[3] or other local celebrations.

6. Conclusion

This paper outlined various types of actions taken by architects during the three recovery phases of Tōhoku. The concepts that have emerged will undoubtedly influence the way we think about and design housing from now on.

The importance of including meeting places to encourage residents' community was admitted after the failures of 1995. Preventing the social withdrawal of refugees has thus become a priority in these social housings, which systematically offer community spaces like parks, "meeting spaces" (集会所 *shūkaisho*), or "Homes-for-All" (みんなの家 *Minna no Ie*). Implementing new morphology in these dwellings, promoting south-facing spaces, and facilitating meetings between neighbours, are different proposals made by the architects in response to this issue.

However, the theory envisioned by the designers can sometimes differ from its actual application on-site, as the needs of the inhabitants may be different from what the architects had thought in their initial concept. Even though the community networks have been proven to be essential in the recovery process, building a community from scratch seems a complicated task.

In fact, in the increasingly individualistic Japanese society where local communities are disappearing and where neighbours do not know each other, may not be the most favourable conditions for the emergence of a "community spirit."

On the contrary, Iwanuma's relocation project can be said to be successful because it has achieved the protection of the already existing community. By simply avoiding the residents' scattering during the relocation process, the city has managed to keep tight the ties of the community instead of struggling to create a new one.

On the other hand, even if these first attempts to create community-friendly housing are not a resounding success yet, they nevertheless demonstrate the architects' commitment to improving refugees' lives. Since 1995, much effort has been put into improving disaster-relief housing in Japan, especially regarding the social aspect. The improvement of disaster-relief housing is always an ongoing process, and there will be further enhancements in the future, learning from past mistakes.

7. Acknowledgement

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Orginal Article

Design at the root of biophilia. Imitation. Nature

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Abstract: According to the current state of research on the phenomenon of biophilia, the positive influence of nature's elements on humans has long been widely understood. Since the negative impact of urbanised areas on quality of life was noticed, human-friendly architecture has been redefined, where the physical and mental well-being of people using buildings, remains highly dependent on their contact with the environment. Selected examples of existing buildings analysed two different approaches to contemporary biophilic architecture; one where nature is the pedestal of the whole building and one where the interpretation of nature translates into technological, engineering or structural solutions. The architectural examples modelled on nature have gained recognition in local communities and worldwide renown, so it can be concluded that the flourishing of organic and bionic architecture is fully justified. Biophilia determines human well-being, while remaining closely related to the natural environment.

Keywords: organic architecture, contemporary architecture, landscape architecture, biophilia, nature

1. Introduction

To put it simply, biophilia can be defined as a consciousness-rooted love of nature. "Art imitates nature and supplements the ubiquitous (and discovered by the human) deficits" [4, p. 206]. Although the viewpoint on the inspiration by nature has evolved throughout the centuries, the imitation or negation of the inspiration by nature constituted a topic for discussion in every epoch. Thus, considering architecture is art, it is difficult not to notice floral ornaments in detail or the form of some buildings. When analysing the placement of the elements of the façade a golden ratio, which is commonplace in nature, can be spotted. "Architecture, not less than painting, has been an imitation of nature through the intuition of its basic rights. (…) The finest architecture is one that was close to nature" [13, p. 165]. However, as the most primary function of a building is shelter,

it is very important to analyse its relationship with the surroundings. "It is commonly understood that the basic function of architecture is the protection of its user from the environmental conditions, which often "cuts out" the user from the outside world". It is equally important therefore, to *ensure a harmonious existence of humans and nature* [7, p. 45]. Current research of the biophilia phenomenon shows a positive influence of elements of nature on humans [8]. Human integration with nature is paramount, it positively influences mental focus and general wellbeing. "An architect also cooperates with living creatures – people, who are even more unpredictable than plants. If they won't feel well in the house that was built for them, the beauty of the building becomes useless, because the house voided of life becomes peculiar" [12, p. 14].

This article analyses two different approaches to biophilic architecture. The first one depicts nature as the pedestal of the whole building. The exposition of this principle resulted in the synthesis of the building with the surrounding landscape. The second viewpoint shows buildings mimicking nature, which on one hand are strikingly unnatural, and on the other expose the tour de force of technology and engineering of modern architecture. Architectonic examples where chosen specifically to depict natural elements – rocks and water – both in harmonic and artificial context. Such strong contrast enhances the two opposites of biophilic architecture, which were analysed and characterised in this article.

Rock caves have provided shelter to humans from the prehistoric times, therefore the use of this natural phenomenon as an example is an obvious choice. In addition, objects carved in stone were being created since the ancient times, in various parts of the world. They were mostly used as a place of worship, however some of them served as homes. The objects in question are complexes of man-made caves, which up to this day amaze with their sophistication and craftsmanship. Their value is attested by the fact that they belong to the World Heritage List, UNESCO. Especially worth mentioning are the ruins of the Nabatean town in Petra in Jordan, Mesa Verde National Park in the United States, the valley of Bâmyân river in Afghanistan, or Turkish Cappadocia.

The second natural component analysed in this paper is water, an element essential for life. Human settlement has always been constrained by the location of rivers and sweet water reservoirs. The element of water has been a subject of worship for many civilisations, and its healing powers have been recognised since the ancient times until present. Moreover, the impressive development of balneological parks proves that despite the evolution of hydro technology, the proximity of natural water sources is still deemed essential.

These two elements: water and rocks – in terms of architecture – have contributed most to human survival.

2. Biophilia in architecture

Since the ancient times, archetypal examples of nature have been duplicated on facades of buildings as ornaments and details. Such aesthetics, in addition to its symbolism, did not convey the idea of biophilia and longing for nature. It was not until the 19th century when abrupt changes took place in the industry and technology, which resulted in sterilisation of buildings and spaces adjacent to them. The degradation of biodiversity, green spaces, namely the creation of heat islands, resulted in the loss of the contact between humans and nature. The fact that urbanised areas have a negative influence on the quality of life was noted and at the same time first definitions of human-friendly architecture were coined. "It would be wrong to say that space and surroundings have no effect on behaviour and feelings of their users" [9, p. 29]. Physical and mental wellbeing of humans is highly dependent on their contact with the natural environment. "At the source of all theories and hypotheses related to mechanisms of perception and preference is so-called biophilia hypothesis,

which assumes that the general tendency to natural environments preference is an outcome of the 'genetic code' created throughout millions of years of humans inhibiting the earth" [1, p. 28]. Therefore, the efforts were begun to restore what was taken away from humans as a result of industrial revolution and industrialisation of space. It seems obvious that "crucial biophilic needs are related to the desire of health, efficiency, and wellbeing" [8, p. 183] and that these values are the negation of the modern metropolitan environment. Excessive surface sealing and heavy pollution of air and water resulted not only in negative changes in the local environment, but also in the climate change. The development of civilisation diseases caused by the reception of negative stimuli had an effect both on physical and mental health of the society." recipients consider natural landscapes to be particularly attractive, albeit with signs of management, with a high degree of diversity in spatial elements and species, and with a moderate or high degree of complexity". These preferences condition the necessity of a balanced development. A designed landscape should be managed in a way that would prevent further degradation and negative transformation of space, assuring a captivating visual layer at the same time. It is important to mention that Kellert defined biophilia as a biologically 'weak' feature, thus it can be hidden or can disappear completely as a result of the neglect of simulation and maintenance of biophilic values [3, p. 3]. The author of the thesis in chapter one of 'Dimensions, Elements, and Attributes of Biophilic Design' focused on singling out features that have a positive influence on the psyche of users. He identified two fundamental dimensions of the biophilic project – organic or naturalistic and a dimension based on locality or tradition. Additionally, he distinguished six elements of the biophilic project: environmental functions, natural shapes and forms, natural templates and designs, light and space, relations based on locality, and development of human-nature relations. These elements are combined with seventy attributes, which together constitutes detailed tips for designers and developers, with an aim of creating constructions of positive influence of the users' psyche. In this publication authors compared the above features, dimensions, components, and attributes, which they assigned to the analysed buildings in relation to various forms of imitating nature. The theories of Wilson and Appleton showed that even a simple contact with a replica of a flower or a pattern that occurs in nature has a positive effect on retaining good spirits [14, p. 952]. The imitation of nature was defined anew as one of the elements of biophilic design.

3. Harmony – a synthesis of nature and landscape

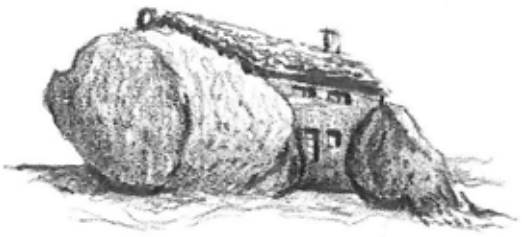

Fig. 1. *Casa do Penedo* (Dżoana Latała-Matysiak, sketch, 2020)

Fig. 2. Villa Vals, proj. SeARCH & CMA (Dżoana Latała-Matysiak, sketch, 2020)

Fig. 3. Fallingwater, proj. Frank Lloyd Wright (Dżoana Latała-Matysiak, sketch, 2020)

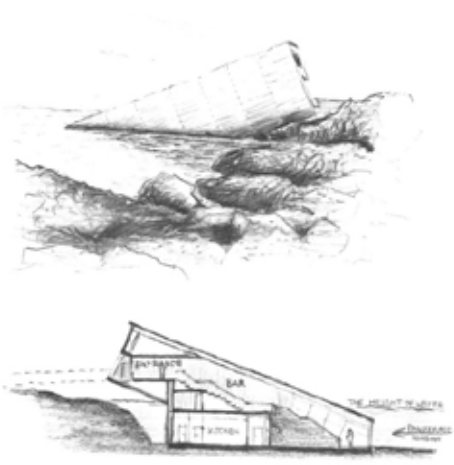

Fig. 4. Under, proj. Snøhetta (Dżoana Latała-Matysiak, sketch, 2020)

The agreement of structures, colours, and shapes, and a consequent use of natural materials sourced from local fields is the first action that comes to mind when considering the integration of man-made and natural elements. A significant example of such action is *Casa do Penedo* (Fig. 1), known also as *Stone House*. A small house is located in northern Portugal about 14 km from a town Fafe, in Braga district. A foundation of its structure are four massive boulders guiding the outline, height as well as width of the building. The house is almost entirely built of stone, with an exception of small windows, doors, and roofing. The man-made elements were made of materials, the look of which does not negatively influence the visual impression of naturality. The building is an excellent example of the integration of architecture with the surrounding landscape. When looked at from the distance, it seems to be camouflaged among surrounding rocks. At closer exploration the house seems to be squeezed or tucked in between the rocks, thanks to a distorted statics of window openings. It is hard to resist the impression that the building wants to be as close as possible to nature. This impression is amplified by the fact that despite the proximity of the wind power plant, there is no electricity in the house. The building is so unique that it caught the interest of the main information portals [23], [26], [27], and the house became an icon, one of the most grotesque and at the same the most picturesque buildings in the world.

The second project, which was created with the same intention and with the complete integration of the building into the landscape, is *Villa Vals* (Fig. 2) located in Switzerland. The contemporary building, completed in 2009 by the architects of the SeARCH & CMA group, redefines the integration of architecture with the natural environment. The Villa gives the impression of "camouflaged", embedded in a mountain slope. The usable space is located underground, only the central patio "cutting" into the steep slope creates a big facade with a large area of window openings [35]. Due to the lack of extraordinary cubature, the *Villa* is visible only at the top of the mountain, or from the slopes on the opposite side – it does not interfere with the landscape.

Casa do Penedo and *Villa Vals* falls within the definition of the first fundamental dimension of Kellert's biophilic design, where architecture has naturalistic or organic features, defined as a shape in the visual sphere [3, p. 5]. Thus, it comes naturally to refer to the 1939 *Fallingwater* project by Frank Lloyd Wright (Fig. 3), who introduced the notion of biophilia to the general terminology. This architect defined the concept in an interview he gave to NBC television in 1958. "The meaning of organic, in philosophical sense, is being. Organic means, in a philosophical sense, being. Where the whole applies to parts and parts apply to the whole. Where the nature of materials, the nature of the purpose, the nature of the whole performance become a necessity, it follows what significance can be given to the building as a creator" [22]. Wright's life's work was based on the relation among the building, human, and nature. This relation was classified as a special value and the connection between a building and landscape as key elements of development of the modern architectural design of the 20th century [29]. In celebration of these values *Fallingwater* was included in the World Heritage List, UNESCO [29] in 2019, as one of eight buildings designed by Wright.

The connection between the building and landscape, places the building in the second fundamental area of Kellert's biophilic design. Said dimension is based on localisation, which is in turn linked to culture and identity, and the ecology of the place or geographical region [3, p. 6]. It encompasses site-specific as well as *genius loci*. *Fallingwater* is located in Mill Run, Pennsylvania, in Bear Run Natural Reserve. The waterfall, above which the building was erected, was a starting point of the whole project, constituted a part of the entirety, and at the same time the part was the whole. In his own words "It is a part of its environment and serves more as an ornament than a disgrace" [28]. This synthesis does not only lead to harmony in the visual layer, but also provides a new definition of domestic tranquillity. "*Fallingwater* is a great blessing, one of great blessings, which can be experienced on earth, I think there is nothing that equalled to coordination, the feeling of solidarity, where the forest and stream, rocks, and all structural elements are conjoined in such subtle manner that truthfully no noise is audible, even though the sound of falling water can be noticed" [11, p. 53].

The bond of the building with the natural environment is clearly visible in the contemporary realization *"Under"* (Fig. 4), completed in 2019. An underwater restaurant designed by the Snøhetta office is located off the coast of the village of Båly in Norway. The 34-meter-long monolithic body of the building rests directly on the seabed, 5 meters below the surface of the water. The contemporary form in no way imitates the surrounding landscape. "The structure has been designed to fully integrate into the marine environment over time as the roughness of the concrete shell will function like an artificial reef" [31].

The harmony and spatial manipulation between architectonic and natural environments, a skilful fusion of light, mass, and ratio favours the feeling of comfort and moving in various conditions [3, p. 11]. This is how the fourth biophilic element, which can be easily noticed in both the *Fallingwater* and *Under* projects, was defined. What's interesting, in the first case, building the layout of rooms was designed so that the user experienced the tightness and felt claustrophobic in dark and narrow corridors located on the outside of the house. The further from the centre, the more open the space becomes to finally integrate into the landscape. In the *Under* building, the panoramic window allows the restaurant's customers to observe nature. "For most of us, this is a whole new world experience. This is not an aquarium, these are wild animals of the North Sea. This

makes it much more interesting. It leads directly to the wild." – Rune Grasdal, Principal Architect of *Under* [26].

4. Disharmony – the proximity to nature through imitation

Fig. 5. Biblioteca España, proj. Giancarlo Mazzanti (Dżoana Latała-Matysiak, sketch, 2020)

Fig. 6. Centro Eventi Multifunzionale, proj. Bargone Architetti Associati (Dżoana Latała-Matysiak, sketch, 2020)

Fig. 7. Liebian International Plaza, proj. Cheng Xiamao (Dżoana Latała-Matysiak, sketch, 2020)

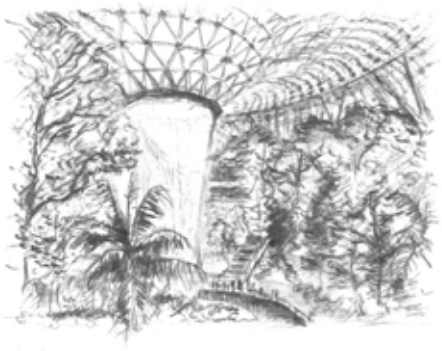

Fig. 8. Jewel Changi Airport – Rain Vortex, proj. WET Design (Dżoana Latała-Matysiak, sketch, 2020)

"The problem of falseness and imitation has been present in architecture actually since the beginning of time" [10, p. 162]. This trend has been enhanced due to the notion of eclecticism, which has been unwittingly imitating the architecture of previous eras. It is the 19th century that is often described as "the most imitated and false century in the history of architecture" [10, p. 154]. Imitation continues at its best, mainly thanks to bionic and organic forms, which are modelled on nature. *Biblioteca España* (Fig. 5), completed in 2007, which towers over the city of Medellín in Colombia, was created in such spirit. The complex comprises three blocks, styled to resemble massive boulders, which due to their placement are perfectly exhibited in almost all parts of the city.

ArchDaily created a perfect definition of this architecture: "a landscape building that redefines the folded mountainous structure in form and space, nullifying the idea of landscape

like a background and encouraging the ambiguity building – landscape" [21]. This pioneering approach to site-specific architecture makes the building not only want to integrate with the landscape, but also becomes its interpretation. This can be assigned to the second biophilic element of this project – natural forms and shapes. One of the developments of this point is the metaphoric representation of landscape, which appears integrated [3, p. 9]. According to Kellert artificiality, although imitation of nature is popular, it rarely causes a lasting positive response, even if it is an exact copy. The progress of natural vanishing evokes the feeling of closeness and satisfaction, and this process takes place incomparably slower when durable material is used. In case of *Biblioteca España*, the façade of the building is cladded with natural stone to make it resemble the rocks. Importantly, a pronounced division of panels is visible, and the form of individual rocks is geometrical, sharp, and modern. Architecture never pretends to be something it is not. Inspiration by nature is visible in form, however thanks to the building's dynamic shape we can recognise the artificial element in the landscape.

We can draw the same conclusions when looking at the *Centro Eventi Multifunzionale* [CEM] (Fig. 6) project located in the Italian town of Verbania. The complex, completed in 2016, grows out of a unique union of mountains, city and water. Here, too, the facade made of sheet metal with a clear joint does not imitate the perfectly oval structure, and its colour harmonizes with both the lake and the sky. "The lake stone is the symbol of the project and the striking context of the surroundings was the centre's greatest challenge," said Bargone Associati, co-founder Federico Bargone [25]. Although the location and the perspective of viewing both complexes – *Biblioteca España* and *Centro Eventi* are significantly different, both forms have many common features. With reference to "landscape architecture". The complex integrates with the surroundings, and the boundary between the architectural form and the landscape is graded by incorporating a natural amphitheatre, where descending concrete stands allow users to observe a breath-taking view of the lake and the surrounding Alps.

Surface buildings designed by Frank Lloyd Wright – *Fallingwater* and Giancarlo Mazzanti – *Biblioteca España* differ, however when we compare the notion of organic architecture defined by Wright with Mazzanti's idea of architecture, we notice that the building-human-nature relationship is paramount in work of both architects. The website of EQUIPPO MAZZANTI, a design studio established by Mazzanti, reads that the team "believes architecture is one of the keys for the construction of a more competitive and sustainable society. The studio reaches out to contribute towards social transformation and wellbeing, devising detailed contextual research, and involving local actors through its design process" [25].

Frank Lloyd Wright spoke negatively about imitation, in his words "architecture will transform into fraud" [18, p. 171]. Le Corbusier summarised this phenomenon using slightly less forceful language: "sculpture and painting appear in architecture then, when a mistake needs to be concealed" [20, p. 10]. Therefore, it can be concluded that main impulses that conditioned imitation were economic conditions and technological shortcomings. However, when looking at the *Liebian International Plaza* complex (Fig. 7) in China, it is hard to repel the impression that in this case, it was the engineering and technological craft that was the motivation to the creation of the highest artificial waterfall located in a built-up area. Interestingly, the purchase of technology is the sixth, and last, biophilic element, according to Kellert. It is classified as an intrigue, temptation, the need of exploration, discoveries, secrets, and creativity related to problem-solving. These features are the synthesis of intellect and imagination, which has a positive effect on the human-nature relationship [3, p. 13]. "Architecture is an art inseparably linked to technology" [6, p. 187], and the level of design is a derivative of many factors, but mainly cultural and socio-economic factors [19, p. 102]. This explains the seed

of insanity in the project, which was built in a country that has one of the largest economies of the world.

The Liebian International Plaza is not trying in any way to pretend that it is a part of nature, but its shimmering, glass façade and dimension typical for skyscrapers do not weaken the biophilic influence. What is interesting, even with such artificial form, this building can be written into the Kellert's classification, into the first, alternative dimension of design, to be more specific: "Symbolic or substitute experience includes not real contact with real nature, but rather a representation of the world of nature through image, video, metaphor, and more" [3, p. 6].

Director of Ludi International Group and the skyscraper's designer, Cheng Xiamao, admitted that he wanted to link the construction with its location. Guiyang is located in the mountains and is so densely foliaged that it resembles a forest. What is interesting, Guiyang province is known for the largest waterfall in China, located in Huangguoshu National Park, with the largest in the world agglomeration of waterfalls [24]. Therefore, it is not surprising that the tallest, measuring 180 meters, artificial waterfall in an urban landscape was created in the capital of this Chinese province.

The second architectural record belongs to the 40m high Rain Vortex waterfall (Fig. 8), which is the main attraction of *Jewel Changi Airport*. It is the world's tallest indoor waterfall and its concept reflects Singapore's reputation as the "Garden City". The concept was realized by Safdie Architects and Peter Walker & Partners, responsible for the selection of plants and landscape [23]. The waterfall itself was designed by the design company WET Design. The whole assumption, completed in 2019, is the art of technology whose heart is the waterfall. It is powered during violent storms, when water flowing from the roof of more than 10,000 gallons per minute can collect a significant amount of rainwater for reuse [30]. Water from the tanks is also used for passive cooling, as the recirculated rainwater disperses throughout the interior and flows down the entire glass façade.

Jewel Changi Airport can be classified on a par with *Liebian International Plaza* in terms of nature-inspired form and technology, and also embedded in the first, alternative dimension of design. In the case of the first assumption, however, the biophilic sensations are reinforced by lush vegetation, which is an almost faithful imitation of the forest. The nature of plantings carried out in accordance with the naturalization of the landscape enhances the feeling of communing with the real nature, so the biophilic feeling is multilevel.

5. Conclusions

A synthesis of two such different elements – artificial and natural – on its surface may seem to be only possible when imitation and assimilation of the visual layer of both elements is used. An adequate choice of rough texture, neutral colours, and rawness of form is the key here. However, while analysing a modern interpretation of architecture and nature, it can be found that they are nearly identical. "Nature, thanks to the use of biotechnology or the discovery of genetics, is designed and can be considered as one of the fields of design" [5, p. 31]. Architecture, on the other hand, due to the use of design programs, is defined with the use of parameters. "This in turn opens the way to understanding of architecture as a code and comparing it to DNA, the carrier of genetic information" [5, p. 7]. The above definitions of nature and architecture marked the beginning of the new branch of bionic architecture, where solutions observed in nature are being introduced. This concept does not always have the characteristics of biophilia, and the interpretation of nature translates into technological

solutions. Nevertheless, the link between architecture, nature and technology is inseparable and its evolution continues today.

Casa do Penedo and *Fallingwater* are a negation of the era in which they were created. The 20th century was focused on mass-production – uniqueness was in low demand, and it could only be materialized in a specific area or place. These objects were perfectly summed up by a Japanese architect – Kengo Kuma – "in this sense, I doubt if there is anything that has more character than architecture" [17, p. 8]. It was the desire of authenticity in the unauthentic times that lead to the creation of a new branch of architecture, where objects inspired by nature dominate modern design [7, p. 44].

Frank Lloyd Wright's words even though uttered a few decades ago, for many are still a marker of decent architecture. "Human homes should not look like blocks glistening in the sun. Every building erected to achieve people's goals should be like an element, like a thing coming from the earth, harmonizing with its natural surroundings and related to the area on which it stands. The house is not going anywhere" [18, p. 196]. Although the shape of *Biblioteca Espana*, *Centro Eventi Multifunzionale* or *Under* can be compared to building blocks, surely its integration with landscape and the clarity of its modern form, which is not blindly imitating the rocks, ideally reflects Wright's theory.

"The integration of art and proper technique has made old utopias achievable" [2, p. 73]. Requirements that modern architecture has with regards to the place and function that the building should have in the urban tissue caused that the construction sometimes shocked with its form. "Although beauty and originality are not mutually exclusive, originality often does not evoke beauty" [16, p. 438]. It is worth therefore to use examples, which we subconsciously regard beautiful. The golden ratio, which is a commonplace in nature, and which has been used in architecture for centuries, gives the recipient the impression of order and agreement. Thus, again, it is important to accept the superiority of nature as a prototype for imitation because "harmony (...) has been present in nature before people introduced it to art – nature aims to make all its works perfect, and this could not be possible without harmony" [15, p. 107].

Biophilia is recognized as an innate feature, which influences both mental and physical wellbeing of humans, highly dependent on contact with the natural environment. Above-mentioned examples of nature-inspired architecture gained both recognition among local communities and as well as international acclaim, which is a result of the positive admiration of architecture described in this article. "Aesthetic attraction to nature is one of the strongest tendencies of the human species" [3, p. 14], and thus the blossoming of organic and bionic architecture can be fully justified.

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Orginal Article

Architecture as the art of creating human-friendly places, Lublin public space

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Abstract: The public space of a city plays a special role in the life of every human being, as it meets basic and at the same time most important needs related to safety and comfort of life. It is a combination of an idea and a technique, which for centuries has reflected the changes taking place in people's social and cultural life. While the city is a multi-layered structure with a clearly separated private and public zone, creating mutual relations between the buildings. Camillo Sitte saw the city urban spaces as a work of art, które should be designed in such a way that the inhabitants feel safe and happy, as it is not just a show-off of technical skill, but an artistic undertaking [1]. The art of designing architecture does not exist for itself, but is created for the target audience. It provides a harmony that satisfies human needs and guarantees survival. It is an important factor influencing the development of an individual through the organization of a social living space. Urban spaces are primarily people and their needs that change over time. The first part of the article is devoted to the role of public spaces and the idea of the city as a work of art. The second part, in turn, is an attempt to define architecture as a kind of fine arts, taking into account the role it plays in the social life of Lublin's residents. The article is an attempts to emphasize the importance of architecture in designing a human-friendly environment as an art design that meets social expectations with the use of selected examples urban space of the city of Lublin.

Keywords: architecture, art, work of art, public space, urban space

1. Introduction

One of the definitions describing *architecture* is the *art of shaping space* [2]. Creative design means creating space and creating an original and unique work of art. The architect, by observing nature, develops his sensitivity to the surrounding space, becoming a creative designer. The space created by him becomes an area of new quality, a meeting place, which often combines painting, sculpture and architecture. He/she creates a new area that is accessible and friendly to people.

Architecture is a combination of ideas and technical possibilities, as well as satisfaction of basic human needs, which result from the changes taking place in social and cultural life. It

has a very important social function, as it satisfies humans physically, mentally and spiritually, guaranteeing their harmonious functioning in the environment [3]. Contemporary and past products of architecture have a direct influence on man. The space organized by the architect provides people not only with shelter, but also satisfies them emotionally and mentally.

Architecture has a communicational function that the designer (artist) uses to realize her vision as well as satisfies his dreams and desires, where the image serves as a link between the architect and the recipient, between the architectural object and culture. It is shaped under the influence of two components: cultural and physical. They allow for the distinction between the figurative-architectural form and the user-construction form. The image of an architectural object through signs, codes and culture is transferred from the realm of everyday reality to cultural space, where the architectural form is incorporated into the sphere of culture. It is the physical form of one's fantasy and a mirror which reflects people's minds. It gives form and shape to what does not exist yet, and it lasts even after people's death [4].

Today's architecture uses the latest technologies and solutions, created with respect for people and the surrounding nature. It is the most complete and the richest domain, constituting one coherent organism, which stimulates one to think, just like art does. Nowadays, many people are looking for architecture that can cope with the biological, sensual and motoric life of a human being. More and more often architectural projects create a close relationship with the environment, nature or climate as it has been the case with Japanese architects for centuries.

Architecture defines a certain area, gives them functions, defines meaning, creates cities and villages. It changes the environment, people and their moods. It sanctifies places, constitutes the structural framework of reality, arranges space, closes or opens buildings. Architecture makes the world visible, can have a therapeutic, but also destructive power. It creates borders between public and private space. It is the peak of human creativity, as evidenced by many contemporary buildings. Architecture has gone beyond its existing, easily definable boundaries. Architects are no longer just designers, but cultural agents, pioneers of new ideas, making it possible for people to change from one way of life to another. Architecture can write its own stories [5].

The article discusses the importance of selected public spaces and stresses their role in the social life of Lublin residents. It presents examples of friendly urban spaces that enable people to satisfy not only their basic needs, but also those of a higher order, such as the need for self-realization, acceptance, and inspiration. They are spaces that inspire action and stimulate creativity. The article also analyses literature related to the city and its multidimensional character. On the basis of the proposed examples and own observations from Lublin, the role of architecture as an art fulfilling social expectations and increasing the comfort of social life is shown.

2. Architecture – space – happiness – significance

In the history of architecture there was no shortage of such periods in which rationalistic elements prevailed over arithmetic elements and vice versa. It often happened that the high level of technical skills of an architect was far from what was necessary to satisfy basic psychological needs of a human being.

Since the beginning of history, man has been involved in the construction of buildings and the organization of the surrounding space. With time, humans began to give their works more and more interesting spatial shapes, which satisfied the need for beauty, harmony and aesthetics.

For years, scholars have been wondering what architecture really is and what kind of creative activity it manifests itself in. History shows that due to the specific nature of the subject matter and the impact on man, there were difficulties in qualifying it into any field of art. In ancient times architecture included such skills as astronomy, astrology, construction of sundials or machine construction, but with time its activity and function was limited only to the design of goods for human use [6].

Over the centuries, the definition of architecture (gr.arcitèkton – builder) has undergone many changes, which were related to what and to whom the architectural art was to serve. The most characteristic for those times was the definition contained in the Great French Encyclopaedia, which reads as follows: *the architecture is rich in its own soil, provides so much material, that it is clearly distinguishable from other arts, it covers issues so unique and specific only to itself, that it should be presented separately and remain within the limits of its own domain* [7, p. 27].

The majority of the theorists of those times unanimously expressed the view that architecture was supposed to serve man above all and cannot be useless. It should meet the social needs of citizens, remaining in close connection with tradition and contemporary conditions in which it is created.

The 19th century marked out a new field of activity in art, thus separating it from reality and transferring it into the sphere of romantic tendencies. It contributed to turning to the rapidly developing technology in the field of construction, which was the main means of implementing the architect's idea. The division that emerged between architecture and new technology contributed to the search for a new concept for it. John Ruskin (1819-1900), wrote that *architecture is nothing more, than an ornament added to a building*, George Gilbert Scott (1811-1878): *architecture unlike an ordinary building is the decoration of the structure* a Edwin Lutyens, (1869-1944) *architecture begins where, its function ende* [6, p. 23].

The beginning of the 20th century saw a more formalistic definition of architecture as the art of constructing and organizing space expressed through construction [8]. The best-known definition proposed by Le Corbusier is: *architecture is a wise, coordinated play of solids in light* [9, p. 27]. After World War II, a more profound understanding of architecture as an art resulting from form and shape, called the art of shaping space, began to emerge.

The changes that took place in the 19th and 20th centuries in the field of technology in construction were so fascinating that they contributed to the lack of attention to the functional and aesthetic values of buildings. The beauty of the buildings was neglected. Therefore, people began to seek contact with ancient art and monuments of architecture, in which he found undeniably the beauty of the talent of artists and their works. With time, new architectural forms began to unify, often becoming monotonous and boring. Newly built houses and cities became identical and template, devoid of charm and individual beauty, to which man did not like to return. The quality of mental health of the human being was no longer cared for in favour of modern technology and unlimited possibility of comfortable life. The pursuit of technological perfection has pushed the natural needs of man to the margin, thus destroying the sense of order, peace and harmony. Despite the shaping of the reality of the early years, there was a group of architects who were able to use both new technological achievements and the needs of the community.

Today, it is no longer necessary to prove that man demands from architectural design, in addition to the rational benefits of safety, to ensure him/her positive emotional and spiritual experiences. The materials used for architectural projects have a direct impact on human health,

affect all people's senses and enable their healthy development. It is the art of architecture design that is able to meet social expectations, because it has the ability to shape the environment, which is guided by the laws of aesthetics and the rules governing beauty.

Architecture can be considered as a kind of utility art, which creates and divides space, at the same time meeting social expectations, ensuring comfort and safety of life. Marco Frascari has classified it in the category of non-utilitarian art, which satisfies the primordial human need for shelter, by combining materials in such a way as to give them an individual meaning [5].

The concept of architecture consists of two inseparable and mutually complementary elements, such as art and talettes, expressed in the form of architectural realization. An architectural work is defined as any three-dimensional element within a space that is created with the use of the necessary knowledge and talent. It deals with the organization of spatial elements and allows to consolidate the architect's idea, constituting a more perfect form of art meeting social expectations.

Art, which is a cultural expression, plays a key role here, as the architect's main task is to create and search for beauty on the basis of familiar rules, principles and available materials. The essence of architecture is not only what the creator herself considers beautiful, but above all the creation of what is expected of her by the community to which belongs [6].

Over the last few decades, the essence of the architect's activities in shaping space and organizing an environment favourable to man has increased significantly and consciously. Through proper selection of proportions and shapes, logical arrangement, and applicable rules, it has become an art, which has been called architecture for many years. This kind of creative activity often uses knowledge from various scientific disciplines depending on the type and scope of undertaken activities. Architecture is therefore an artistic discipline that organizes and shapes space for human needs, an *art* whose primary goal is to arouse admiration in the way no other discipline can. It can create timeless works of art that provide shelter and improve the quality of life.

Architecture is the art of building a community that engages both the creator and the recipient. It stands out from all other fields of art in that it presents what is useful to man and constitutes the basis for his existence in the world. It is characterized by a richness of form, which includes a combination of practical and spiritual satisfaction, making it a unique kind of art that *fulfills human dreams*. Contemporary architecture gives the environment and its inhabitants an identity. It exerts a positive influence on the observer during direct confrontation with the object, surprising him positively. The environment designed in this way is favourable to social life and is a subject of care and understanding for the human being [10].

With regard to the space created by architecture, the most important thing is to focus the senses on positive stimuli and sensory experiences. Architecture is considered to be the art of creating space through specific applications visible to the eyes, which are the basic tool for perceiving buildings with the senses. Touch allows a human to understand the world around him and has great therapeutic potential. Through touch, man experiences the world around him/her and the space in which he moves. Happiness for man is a space that has a natural and unforced positive effect on human senses and body [11].

3. Architecture and art

Over the centuries, many masters of architecture have created their own definitions, which talked about the values of architecture and art, attributed to them at the time of their formulation. Many attempts have been made to determine which manifestations of human

activity should be classified as art, which as architecture, and which criteria should be used to define them.

Władysław Tatarkiewicz, when formulating the definition of art, claimed that it is a conscious and not instinctive skill, which is used to produce things according to the rules prevailing in a given epoch. It involves reconstructing things, constructing forms, and expressing experiences in a way to delight, move, or shake the viewer [12]. Roland Frèart de Chambray wrote that: *Art is an infinite thing, which develops and evolves continuously. It adapts to the disposition of centuries and nations, which have different judgements and define beauty, each in their own way* [13, p. 13].

Czesław Przybylski defined architecture as *art that seeks to create works of art that evoke a familiar shudder in the recipients, by which we recognize that we are faced with a real work of art* [14, p. 28]. Similarly, Le Corbusier talked about the state of mind that allows the observer to admire architecture, creating the world of art [9]. Architecture is therefore an art of building, a science enriched with knowledge from various fields, which is used to create unique works of art.

Throughout the various epochs, the division of the definition of art has changed many times, and it was only in the middle of the 18th century that Charles Betteux used the term *fine art* for the first time. The above mentioned formulations are an extremely important element in the deliberations on the concept of architecture, as the art of shaping space in the aspect of the existence of the concept of the theory of architectural art. This theory contributed to the fact that architecture was recognized as a field of art which created a new, urban landscape. It began to be perceived not only as a building material, but also as one of the forms of art responsible for creating space for people.

Architecture is an art in the full sense of the word, it is a mathematical order, fulfilled harmony, which is based on the proportions of all its components [15]. Two prominent philosophers, G.W.F. Hegel (1770-1831) and G.Lukács (1885-1971), believed that architecture expands the basic type of house according to the basic criterion of beauty. A house is a man-made and man-serving man building [16]. Architecture is a real space in which human life takes place, so it is different from a typical drawing or painting space [17]. It is closely connected with art, since it shapes social space by means of artistic forms of expression, where its main aim is to design for people.

The art of architectural design is a reflection of the individual moods and tensions of the creator, expressed in the original shape and form. It often results from the natural predispositions of the designer, which allow to realize the imaginary spatial form in the real world [6]. Every creator lives in the world of imagination, which is the spatial imagination of an architect. An architectural work can be considered good if it simultaneously responds to social needs in economic, functional and structural terms.

Architecture is a form of visual art that differs from sculpture, graphics, painting and photography in that it is not able to reproduce with such detail and truthfulness the visual images created by the real world. It also cannot give such a clear and comprehensive idea of forms or colours that exist in nature. Architecture is also very different from construction, because only a building that delights with its beauty, form, rhythm and proportions can be considered a true work of art of architecture [18].[1]

[1] States that as a result of the extensive influence of French culture in the 17th and 18th centuries, the concept of fine arts was accepted by Anglo Saxon theorists as meaning a philosophical entity, to such an extent that it has been widely forgotten that, in France itself, the profession of architect had been completely separate from Académie Royale de Peinture et de Sculpture until they were forced to merge after the French Revolution.

The art of architectural design is generally considered to be everything that came into being in its real spatial shape and serves a specific purpose. The process of creating this work of art begins with an idea that requires, above all, an extraordinary creative effort and commitment of the designer-artist. What counts here is the whole creative process, and not just the final result itself, considered an *architectural work* [6]. Therefore, it is difficult to imagine that a project (drawing) being an element of art could be created without a concept and without imagining it, at least in the most general outline, in the creative process.

The art of architectural design consists of three basic stages, such as: an idea created in the imagination of the creator, a drawing design and its realization (i.e. execution in accordance with the design in nature). This process is very similar to the creation of a painting work of art. The painter, before starting to make a painting, imagines creating a project, creates a sketch and finally realises and presents the work. The creative act allows the artist to express his/her own idea through drawing to the very existence of the work itself. Edward Warder Rannels argues that architecture should be studied as a form of art, a material realization of concepts and artistic goals, as in the case of other forms of art such as sculpture and painting, and even poetry and music [19].

Creating a painting by an artist is similar to architectural design, as when painting an image, the artist starts with composition and adds further elements, such as colour or light, which determine its territory. From the circle, the architect, while designing, starts from the functional arrangement, light or the form of a solid presented by means of a drawing, ending with the realization in space. Architects, like artists, with their work present a separate creative attitude, through which they mark their presence in the designed work. The painted image becomes meaningful when it comes into contact with the viewer, and similarly, architecture begins to exist when the user starts to benefit from it, and only then the designer's vision is fulfilled.

Architecture is one of those fields of creativity that have always served man and the whole community. The form in which this process takes place is often influenced by the inner inspiration of the author, who is aware of all economic and social conditions. The creator of an architectural work has always been and will always be a person who is a part of society closely related to his environment. He is able to feel intentions and needs, takes into account his habits and contributes to the individual intellectual development of a person. He has the ability (gift) of spatial imagination, thanks to which he creates works that meet the expectations of the community in which he functions. During the creative design process, the architect takes into account not only the immediate environment in which the work is to be executed, but also all topographical, climatic, functional, structural, economic and social conditions. Like a painter painting a picture who gradually covers his canvas with paint, the architect fills the empty space with architectural content. He uses the means of expression characteristic of the artist, such as composition, light, texture, dynamism and the functional arrangement that forms the basis of the composition, triggering the same creative processes. Skillful use of current technological and constructional solutions by the architect allows him/her to realize an idea that integrates art with technology.

Architecture is an art that has a pernament and direct impact on the human environment. It enters all forms of social life, influencing culture, psyche and customs, where every decision made by an architect can have an impact on decades of social life. An architectural work is an inseparable element of social life, which influences its further development. People are the main users of architectural objects, which reflect their economic, political or social needs. It is visible in various forms, such as the organization of space, urban areas, places of work or

leisure. Therefore, regardless of whether it is a sports, work or leisure centre, these facilities are designed to meet human needs in such a way that the user likes them visually and enjoys spending time in them [20].

Contemporary creative architectural design includes not only objects, but also the whole environment, as well as the very relationship of the work with the recipient, which is man [21]. It includes interactions with the user where the architectural work is closely related to art, and has integrative and mutually stimulating properties.

Almost from the very beginning of the art of design, architects have worked with artists both on building projects and on the interior design itself. Today, the artist increasingly plays an important role in the design process, where together with the architect, he/she creates unique works such as Serpentine Pavillon (2007) in London or FAT Architecture for Alain de Botton's Living Architecture [22].

Observing the current work of architects, it can be said that for some time now, it has focused mainly on the humanization of architecture. This has resulted in a greater understanding of architecture and its subservient role in social life. Architectural art took on the right meaning in the search for beauty, the pursuit of harmony, proper proportions, justified plastic shape, in other words, everything that can and should bring aesthetic satisfaction. One of the manifestations of these tendencies among contemporary architects is the presentation of their visions in the form of a plastic model, which is an inseparable element of a project drawn up on paper.

In the art of design (...) ideas do not have to be complicated and most of them are successful because they are simple and functional [20].

4. Architecture for people and urban/public space

Architecture itself does not really exist as a stand alone concept, because it is always in some kind of environment called architectural space. Therefore, the very environment in which the object will be created is important. When creating new spaces, the architect must first of all take care of the sustainable development of the space, because he/she is responsible for the possibility of its being used by future generations.

Camillo Sitne wrote about the importance of urban spaces for man, who believed that beautiful architectural spaces have a positive impact on man [1,p.8]. Jan Gehl, on the other hand, stressed that architecture should respond to social needs and provide a sense of happiness [23]. The influence and significance of architectural spaces on people was the focus of great modernists, such as Le Corbusier and Frank Lloyd Right, who aimed for maximum functionality and comfort, meeting social expectations – providing happiness [24]. Le Corbusier raised the issue of anticipating and responding to the needs of individuals [25]. Jane Jacobs presented the city streets as the quintessence of social life, which provided security and successful social life [26]. The city is not only supposed to be beautiful but also friendly to people, it should satisfy aspirations and the need to establish social contacts [27]. Raymon Unwin believed that architectural projects should provide the greatest possible comfort for residents and improve their lives [28]. Kevin A. Lynch made a breakthrough in the heritage of urban planning by exploring how individuals move around the urban landscape, how they perceive it, and what impact the urban environment will have on them [29]. Christian de Portzamparc saw architecture not only as a professional discipline, but as a social responsibility [30].

The public space of the city, as Camillo Sitte wrote, is: *a living element of cultural development*, [1, p. 17] where the elements that make up it should be human-friendly in order

to satisfy the people's needs for mental and physical comfort of life, by establishing social contacts [1, p. 23].

In a public space, a person should find what is conducive to his/her well-being, inner balance and leads to closer social ties. These are factors that strengthen the sense of social dignity, where a friendly environment fosters an attitude of respect towards the users of a given space. This is closely related to accessibility, lack of physical barriers, sense of identity and security. Public space has an impact not only on the quality of life but also on social relations, which can be described as social dignity of life [31].

In her article on dignity in public spaces, Nora Jacobson highlights a number of important issues. Attractive urban spaces are those that meet the need for self-confidence, peace, trust and solidarity that allow users to count on each other's support. The author also emphasizes the important role of beauty and peace of the environment, as a feature that strengthens the sense of human dignity [20]. In this context, the art of designing local spaces takes on two important meanings. On the one hand, its value is influenced by the material form, i.e. the existing architecture, its shape in the form of furniture, equipment, sculptures, monuments and other symbolic elements. On the other hand, the well-being of the users depends on the motivations in which a person, in a formal or informal way, is guided in the creation of relations between the users.

The city is a spatial and social structure in which people live, work, play, use different services, gain education, enjoy entertainment, and experience culture. Nowadays, already at the design stage, more and more attention is paid to ensure that each component functions properly and is used in the most effective way. The concept of a friendly city, which is sustainable, healthy, safe and more accessible, is becoming increasingly common. Cities that not only satisfy basic human needs but also inspire and stimulate human creativity.

Architectural forms used in space, serve as elements of terrain, where greenery and water are components of urban and architectural space. They positively influence the perception of the city landscape. Thanks to their characteristic features, they become important landmarks on the mental map of the city. They can be orientation points, contact points, or places that stand out for their unique identity and original, non-standard appearance [32]. It is not art to erect monuments, but the real art is to shape a large space in a sustainable, functional and environmentally friendly way. The beauty of architecture is the whole of spatial activities, not a single object detached from the rest.

Architectural work, is a permanent element of the human environment, which regulates the way of life and existence. Architecture has an indirect impact on human life because of the place of residence in the city or housing estate, as well as the building or apartment. Currently, the most important issue for the architect is to design spaces that ensure above all mental health and comfort of social life. Architecture is responsible for the art of shaping space for the benefit of all mankind.

The basic task of architecture is to design the building and its proper adaptation for the potential user and to provide him/her with a visual aesthetic appearance. Vitruvius, thousands of years ago, said that, durability, usability and beauty must be taken into account during construction process [33]. Contemporary architect has a difficult task, because he has to decide himself what and how to design a building in order to encourage the recipient and meet his/her expectations. Architecture has one more very important task, namely to organize the human space in the perspective of the building and the whole city.

Architecture itself does not exist, but it is always in some kind of environment, that is, it creates an architectural space which is not only a spatial structure, but above all, it is created by people and their changing needs.

5. The value of city space and human beings

Nowadays, many towns and cities are dominated by the expansion of modern urban and architectural solutions, creating a uniform structure. To meet the expectations and needs of residents, architects more and more often create places where urban space regains its human dimension, co-creates and enriches the cultural heritage of a given area. The realization of the architects' vision serves to improve the living conditions of the inhabitants by creating new spaces for recreation, meetings, having fun, and resting. Increasingly, unused urban areas are being transformed, making them more accessible and attractive for the users themselves.

Contemporary cities are often difficult to move around due to the lack of important landmarks, which adversely affects the sense of security and psychological comfort of a person. A large part of people spend their free time more and more often in impersonal shopping malls, which replace traditional shopping habits existing for centuries in city spaces. The interiors of shopping malls, in fact, are a substitute for a human-friendly space, as they do not have the appropriate, powerful enough to make life buzz in them [27]. Manuel Castells believes that time and space are being transformed by modern information technology. Modern society is organized around a space that is based on flows of capital, information, technology, images, sounds and symbols. In this space, time is deformed and physical space disappears [34].

For Manuel Castells, it was clear that everything that generates power, money or information is linked to the exchange of network impulses. For him, one type of power is to create and control cultural codes, that is, ways of thinking about ourselves and the world around us. At the same time, he claimed that the abundance of information makes us stop in the consumption phase [35]. In his paradigm on information technology, Manuel Castells pointed out the ubiquitous influence of new technologies on all human activities, which would serve to revitalise local communities (rebuilding civil society) and encourage greater political participation [34], p.10-15].

According to Castells, alongside the use of digital social networks, it is important for social movements to create new public space. To this end, social movements can occupy urban space and buildings of symbolic significance, as such spaces create a community that opens up public space for a debate [36].

Nowadays, society is dominated by haste, which affects the whole of human life and the finalization of man. Sociologists are recording more and more dissatisfaction with life, and the constant chase does not allow us to enjoy everyday life. Paul Virilio believed that the increasing speed of life raises a factor that broadens the scope of human power on the one hand and violates human rights by concealing violence on the other. He believed that every new device brings about a form of disaster. As a representative of a post-modern paradigm of thinking, he was convinced that reality had become out of control, no longer being possible to be understood in any way [37].

Nowadays, it is becoming increasingly easy for modern people to gain various pleasures, and this is largely due to the technical devices that shorten our work. And although it would seem that we should have more time for ourselves, there is still not enough of it. That is why it is so important to create spaces where people can stop, at least for a moment in the city centre, to enjoy nature, the surrounding environment and relax.

In his book *The Social Life of Small Urban Spaces*, published in 1980, W.H. White described the close relationship between the quality of urban space and social activity, proving that even small changes and improvements can significantly enhance the quality of life of the inhabitants of the Mishmen [38].

We live in a consumer society today, which significantly affects all aspects of our lives. Due to increasing consumption, people are becoming a commodity in the consumer and labour markets [39]. The constant rush that accompanies man does not give him the opportunity to think about using his free time, which in turn leads to internal emptiness.

The dynamic development of new technologies has led not only to changes in the way of thinking but also in behaviour in physical space. Nowadays we live in a population of people who think and react differently, as well as have a different way of understanding the world and the space around them [40]. Contemporary urban space increasingly encourages the user to both rest and play. It is a form of human activity that makes the user happier and is so important in times of consumerism.

In the centres of large European cities, people often feel good, as the streets and squares are picturesquely woven into the urban landscape. It is believed that well-designed spaces are the ones that we see and remember, the ones we are happy to return to and have a nice memory of. All this is due to the visual value of a given place, which is not only a source of comfort, but at the same time constitutes a psychological abatement for the inhabitants.

People are also observers of the public spaces around them. They accept the material reality in which they live with its values, building an emotional connection with the surrounding space. As user-inhabitants, they adapt their reactions to their surroundings, while tourists (visitors) contemplate a given space by means of subjective experiences, creating an image of a given place, which they use to recreate images and emotions connected with it from memory.

In the rush of everyday life, very often the inhabitants do not have time to use the available spaces or even admire them. Increasingly, urban life (congestion, noise, etc.) is associated with a number of stressful factors that lead to exhaustion and fatigue. However, it turns out that such spaces are very much needed because they have a positive impact on the user and determine their behavior. Making these spaces accessible to the public provides the residents with the opportunity to recover from everyday stress, stimulates positive reactions and above all allows them to relax. Often such zones bind different areas of the city together, providing a background for development or stimulating social activity. Thus, the spaces proposed below positively determine the behaviour of the residents and their reactions, and contribute to rebuilding an emotional connection with their immediate surroundings.

After all, the space surrounding a human being should be a kind of work of art, because it can influence his or her mental state, giving him or her peace and joy, stimulating his or her comprehensive development [41, p. 21]. This type of space is, therefore, not only a source of emotional experience, but also a stimulus for positive impressions, which increase the feeling of security in inner-city areas. The most important value of these spaces, which are part of the city landscape, is their legibility and ease of movement.

On the basis of own observations and analysis, a characterisation of selected examples of urban spaces under the account of openness, interest, accessibility, comfort and influence on the development of civil society was conducted (Tab.1). The analysis was conducted on selected spaces of the city of Lublin as such, such as: Saski Garden (Fig. 1), Plac Litewski Square (Fig. 2) and the Krakowskie Przedmieście Street promenade (Fig. 3). These spaces have been designed to serve their residents in visual, aesthetic and social terms. Each of these

spaces is subject to personal evaluation by its users, who appreciate its advantages resulting from direct contact with the environment. The most important function they perform for both residents and visitors (tourists) is to provide opportunities to establish social contacts.

Tab.1. Table illustrating the evaluation criteria for the selected public spaces

Public space	Is it open to everybody?	Does it have something intetresting for everybody?	Can it attract people from all the town?	Does it have framework for city development?	Is it life--friendly area?	Can it help to develop a citizen life?
Saski Garden	+	+	+	+	+	+/-
Litewski Square	+	+	+	+	+	+
Krakowskie Przedmieście Street	+	+/-	+	+	+/-	+

Fig. 1. The Saski Garden in Lublin, author's photograph, 2019

Fig 2. Litewski Square in Lublin, author's photograph, 2019

The Saski Garden (Fig. 1) was established in 1837 on the initiative of Ignacy Lubowiecki, President of the Lubelskie Voivodeship Commission, according to the design of engineer Feliks Bieczyński. The idea of its creation was to build a public park for a wealthy social group of Lublin. When designing the space, the architect wanted to refer to the existing Czartoryski Park in Puławy, which became his inspiration. The original garden was located on Lubartowska Street, on the Czechówka River, but because of the distance from the Old Town, a new location was chosen, which once belonged to the Dominican Order in Wieniawa. The name *Saski Garden* itself was taken from the Warsaw garden thanks to the residents of Lublin, who believed that the park at that time was as beautiful as the one in the capital city [42].

The first step towards the renovation of the garden was taken in the mid-nineties on behalf of the Municipal Economy Department of the Office. After the renovation, the garden became more accessible for the community of Lublin and visitors. In 2012, the area was again thoroughly rebuilt to please its residents. Currently, the garden is divided into sectors, where you can walk through beautiful alleys filled with colorful vegetation. You can relax here on a bench near a pond or visit a playground equipped with modern and colorful equipment that attracts parents with children for long hours. We can find here a bird cage, a sundial, a gazebo and a concert shell where cultural events take place. There are also a few preserving elements of art in the form of sculptures, monuments or artefacts of small architecture, which create a unique and legible structure of the park he objects placed in different locations, are charac-

teristic landmarks, at which you can stop at least for a moment. They give a unique identity to a given place and create characteristic points of tension, impressions, sensations and emotions.

The Saski Garden is an ideal place to take a break from the daily hustle and bustle of the city, which makes it very popular not only among Lublin residents but also visitors. This area is a special place, which is the space of generally accessible recreational interior. Additionally, it has many surprising and architecturally interesting solutions created for the needs and with the thought of its inhabitants in mind. The friendly space created by the garden allows to slow down the pace, creates an enclave of peace and continuity, allows to maintain social contacts, anchors the man in history and culture, providing a sense of bliss. Here we can find spaces for different age groups of people, activating also young people and children. It is a peculiar social space. The park is an attraction through specially designed greenery, which only provides isolation from the street noise, but will provide shelter on hot days. It consists of multi-threaded forms of colorful vegetation, which provide a play of light and shadow introducing a mysterious atmosphere. The area of the garden is a place where the inhabitants of the city enter into relations with other people, at the same time reading the meaning coded in space. The area of the park is accessible to all people, enabling confrontation with the users of the city, where people want to meet, act and feel the joy of being there.

Litewski Square was established in the 1820s and was originally called Drilling Square, being intended for military parades (Fig. 2). Nowadays, it is located in the former suburb of Krakow. The area used to be located between the main trade route of the city and the road running along the Świętokrzyskie estate in the direction of the Wieniawa district [43]. Currently, the square is located outside the compact buildings of Krakowskie Przedmieście and has the shape of a triangle. Since 1839 it has been called Litewski Square. It includes a monument to the 3rd of May Constitution, a monument to Marshal Józef Piłsudski, and a tomb of an unknown soldier.

Litewski Square is one of the most important places on the map of Lublin. It often plays a representative role because of the most important celebrations and national holidays that take place there. In 2017, its thorough revitalization was completed, which contributed to even greater interest in it. It is regularly used as a place of meetings and interesting cultural events, becoming a perfect meeting place for families with children, looking for a moment of rest. Since its revitalisation, Litewski Square has become even more important for the residents of Lublin. There is a music-playing, illuminated fountain in the central part of the square, a string of fountains along the new part of the promenade next to the building of the Polish Post Office, and modern and colourful child's facilities, such as swings and slides, that attract whole families. The modernised so-called *Lublin's living room* has been rebuilt both for its inhabitants and tourists to allow spending a pleasant time here. The new space has gained an interesting layout of paths, green squares and modern elements of art, becoming beautiful and above all, useful place for residents. This area brings together many generations into one place. It is one of the important points characteristic for the city of Lublin, which allows people to calm down, relax, and sometimes make new friends.

Fig. 3. Lublin's Promenade, author's photograph, 2019

Another of the main places of this type in Lublin is Krakowskie Przedmieście Street (Fig. 3), which in a natural way is an important space for city dwellers, both in terms of usefulness and visual aspects. The name Krakowskie Przedmieście used to mean not only a street, but in the Middle Ages and the Renaissance the whole district, opposite the Krakow Gate, around the route leading to Krakow, was defined in this way. In 1575 there was a fire in which most of the medieval buildings, both the suburbs, burned down. The reconstructed house on Krakowskie Przedmieście Street was already bricked up, which made the city an important centre for the nobility of the time. In 1657, affected by war damage with the Swedes, Lublin fell into decline. Krakowskie Przedmieście ceased to be a representative street and turned into an ordinary utility district. The fall of the street lasted until the partitions, although during the reign of Stanislaw August Poniatowski (the Krakowska Gate was then renovated). In the years 1815-1918 Lublin was ruined by wars, where only the Municipal Office introduced the city from a deep crisis within a dozen or so years, and expanded and modernized it. In the interwar period, Krakowskie Przedmieście was the city's main and most representative street and has become, after Ogród Saski [the Saxon Garden], the favourite walking place for Lublin residents to this day [44]. Of particular attraction for the residents are downtown streets with traffic off, like part of Krakowskigo Przedmieście Street, where all its width is available for pedestrians. In favourable climatic conditions, restaurateurs put tables and chairs outside, decorate them with flowers or colourful cushions, giving them a warm and cosy character. They are a perfect space for various cultural events, meetings, shows, and performances of different nature and content. The more functions they perform, the more important these spaces are. The square

is a place to meet with friends, go for shopping, walks and participate in cultural events. The multifunctionality of these spaces should be seen as an important feature that proves the quality of public spaces created for people.

Two types of urban public spaces, such as parks and city squares, play a very important role/function in fulfilling citizens' needs. These spaces are accessible, inclusive, and enable social relations to be carried out, offering a variety of activities such as walking or cycling. When analysing the multifunctionality of public spaces, attention should be paid to the location of commercial spaces within them, which undoubtedly increases the importance of the spaces used [45].

The art of building space should be beauty in its broadest sense. When we talk about the beauty of contemporary architecture, we mean the whole environment that surrounds it. It is these spaces that are closest to man, because it is in them that people are brought up and learn of aesthetics and beauty of architecture. The environment creates awareness and, depending on what it looks like, it shapes the aesthetic sensitivity of people in it. Inhabiting a given environment, a person often gets used to particular places, which often means accepting both their advantages and disadvantages. Therefore, the space in which we are brought up is of great importance because it is this space that shapes our sense of beauty and aesthetics of the surrounding space.

The examples of public spaces presented above are not only of utilitarian but also of emotional importance for the residents of Lublin. It is in their area that various activities of both individual and social character are carried out. In this context, their quality, accessibility, and functionality are important. Friendly spaces are areas in which individuals carry out various activities giving the rhythm of life to its inhabitants are those that are often used to implement activities of a civic or political nature. The modern city provides a stable basis for people to take up new challenges, i.e. to actively spend their free time in friendly spaces. Cyclical old age fairs, food fairs taking place in the very centre of the Old Town, are conducive to building social bonds with simultaneous trade exchange. All these elements testify to the character of a given city and are important identification points not only for its inhabitants but also for tourists.

The image of contemporary architecture of many cities is an event between architecture and its user, which reveals the essence of the place. In its opinion, the basic one is to adapt to the requirements of contemporary man. The way of experiencing this event is fully dependent on its expectations of the space in which it is located, used, where it becomes its most important part. Public space arranges public, collective life and enables closer interpersonal contacts, which releases positive emotions, which are often missing in everyday life.

Friendly and accessible architecture is both for architects and people. The first one is characterized by the desire to surprise the viewer with a novelty by using new technology, scale, form or texture. The second focuses on creating friendly spaces in which people can feel safe and good. The search for novelty and innovation will always be more attractive than tedious "creation", but the demand for human and environmentally friendly architecture is greater and more desirable than for *shocking constructions*.

The public spaces presented above are meeting places that have grown almost to become social 'institutions', so important that life cannot be imagined without them. They are a guarantee of urbanity and social coexistence. They emphasise the relationship between man and space, which leads to emotional bonds and gives them a sense of security. Parks, green areas or streets with traffic off, are often a source of physical activity that is so necessary for the

emotional and mental health of society, and also a lifesaver for the city. An important feature of all these newly created and reconstructed urban spaces is to adapt to changes in society and nature in such a way as to meet social needs and expectations. Nowadays, for architects, it is no longer the primary objective to shock people with more and more complex projects, but to serve people and their needs. The currently emerging projects-solutions are adapted to constantly changing social, economic and environmental conditions. These urban spaces that are being rebuilt are adopted in such a way as to keep up with the constant changes and thus meet social expectations.

5. Conclusions

Nowadays, every city creates a complex organism which is supposed to satisfy all human needs and conditions. Shaping the structure of the city space requires cooperation between specialists and experts in various fields, so that a well-functioning, vibrant, healthy and friendly organism can be created. Individual city spaces should create a synergic system which, above all, will be conducive to living in ever-changing conditions. It is often said that the work of a designer-architect ends when a given building is put into use, but only then does the architecture begin to fulfil its social function, that is its most important function for which it was created. It directly influences the shaping of human behaviour and provides support in everyday life and the urban environment. One of the key factors that enables urban spaces to meet expectations is the willingness and frequency of visiting and spending time with loved ones and family in these spaces.

Over the years, the awareness of design and the perception of the social role of the architect have changed. Currently-designed buildings do not lose their message and do not constitute only an impersonal spatial form. They have gained a new dimension of art based on designing in accordance with the environment. Designers follow current trends in art and architecture and choose what is modern, practical and friendly to people and their surroundings. They are often beautiful, designed with a sense of taste and care for the natural environment. For an architect, people's needs and their mental, social and aesthetic condition, have become the primary goal.

Contemporary architecture is free of any limitations, it represents what is here and now by means of an astonishing variety of forms and shapes. The inseparable relationship between art and architecture allows us to create extraordinary objects, almost without limitations, whose functionality and care for people are in harmony with nature.

Aesthetic, functional and attractive creative design has become the architect's overriding goal. Buildings are created in such a way that the user enjoys his place of work or residence so that he can come back to it willingly and find it enjoyable to stay inside.

On the basis of the presented examples, it can be concluded that most of the works of contemporary architecture and urban planning are favorable to man and the surrounding environment. Architects create projects for and with people in mind, while meeting their needs, expectations and dreams. Useful design for the community is a difficult task that requires emotional intelligence, maturity and commitment from an architect. Every designed object is a *brick* in this complex machine, which is a *city*. It is buildings such as flats, shops, workplaces, meetings and recreation places that satisfy people spiritually, mentally and visually, changing the whole of social life.

Contemporary architecture, instead of dwellings or workplaces, creates *living spaces* that offer diverse lifestyles, where in different parts of the city, work, study, and recreation

take place as close as possible to each other. This is a very important part of social, cultural and economic life, which focuses on the needs of people creating places to live. Recipients of architectural spaces are very diverse, therefore they are treated as an important element of integration in the city where the identity of the place results from the community and the people who create it.

Architecture creates a given space, places where people have grown up and are usually the most lasting memory for them. More and more often people need this kind of rest, during which they would shade themselves physically and mentally from everything. Then they look for places from where they can rest comfortably and remain the owners of the area for a while, which gives them a sense of security. Public space is treated as a place for meetings, communication and dialogue between people. Parks, streets or squares are places that are known to establish and maintain contact with other people. Nowadays, architects not only design the city, but also give it a function by introducing various types of chase (e.g. benches, tables, hammocks, swings), which encourages inhabitants to spend their free time there.

It seems that today, more than ever, public space has to compete with the virtual world, with spending time on the Internet or with social life in social media. That is why it is so important to create spaces that provide people with a sense of happiness, becoming an oasis of peace, tranquillity and the joy of everyday life.

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Orginal Article

The architecture of the former Carmelite Monastery in the Mali Dorohostai village in Volhynia

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Abstract: Monasteries of the Roman Catholic order of the Carmelites were well-represented in the historic cities of Volhynia (e.g. Berdychiv, Dubno, Vyshnivets, Kisilin, Lutsk, etc.). One of them was built in the Mali Dorohostai village, which currently is a part of the Mlyniv district in Rivne Oblast of Ukraine. This monastery, built in the mid-18th century, was closed in the 1830s, and then adapted by the Russian Tsar for the use of Orthodox Church. During the first World War, it was completely destroyed. The architecture of this monastery is almost forgotten in modern historiography. The recently discovered archival drawings from the first half of the 19th century give a good idea of the stylistic and structural characteristics of the no longer existing monastery.

Keywords: Volhynia, Mali Dorohostai village, Carmelite Monastery, architecture

1. Introduction

There are a lot of still “unread pages” in the architectural history, especially when it comes to little-known documents with architectural drawings. Scattered in diverse archives, these sources sometimes reveal the unexpected, forgotten phenomena of the past – even when they represent only one small piece of paper, yellowed from long lying in the archive shelves. Unknown or at least little-known information may be of great importance. Such unexpected finds in the old archives may help to fill some holes in the background of the history of architecture. Such discoveries are especially important when they describe the unexpected (or unknown) architectural building or element, which has long ceased to exist. One of them is the former Carmelite Monastery in the village of Mali Dorohostai near Mlyniv town in the Rivne Oblast (Fig. 1).

2. The history of the Church

There are not much information about the history of this Church. It is mentioned very briefly in "Geographical dictionary of the Kingdom of Poland" [1], despite the fact that this edition is generally characterized by a sufficiently detailed content. Strangely enough, this Monastery is not even mentioned in the publications of Polish researchers B. J. Wanat [2] and J. Kowalczyk [3], Wołyniak [4] and L. Popek [5] also said about it very few things.

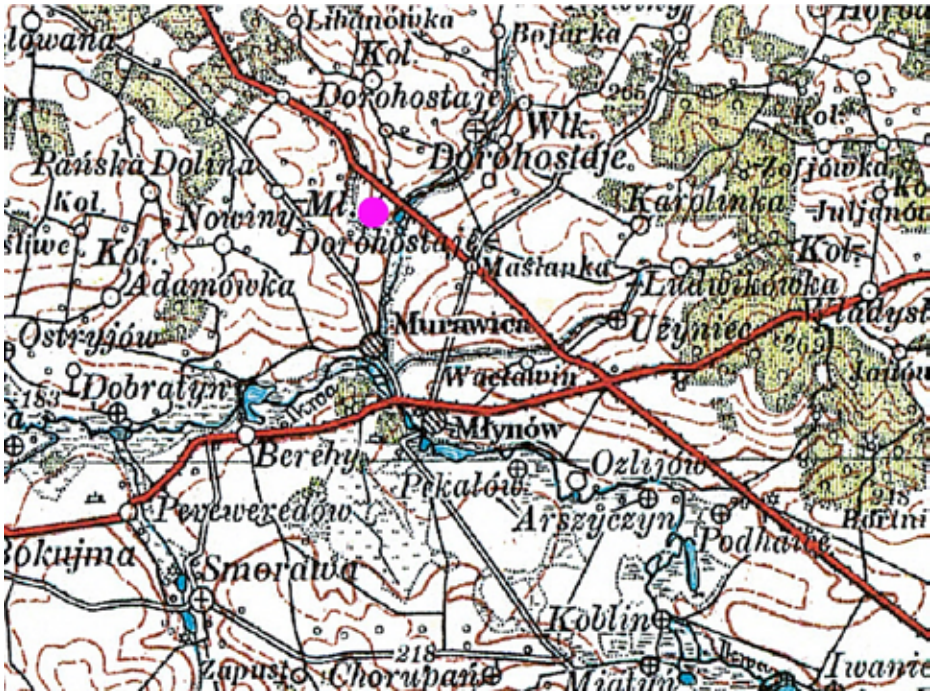

Fig. 1. The location of the Dorohostai village on the geographical map. Source: Wojskowy Instytut Geograficzny. 77-Luck. 1928. Scale: 1:300000

A brief information about the Church was presented at that time also by N. Teodorovych: "The Church of the Intercession of the Blessed Virgin Mary. Rebuilt from the Carmelite Church, founded in the 18th century. Made of stone, rebuilt in 1873. All parts were renewed, with a new iconostasis, and a bell tower above the porch of the Treasury funds (9 000 rubles) and parishioners (2 000 rubles) [...]. In 1887, painted inside and outside" [6].

Interesting facts were also presented in one of the guidebooks to Volhynia. "5 kilometres North from Mlynov are Velyki and Mali Dorohostai, i. e. two villages by the Ikva river; where one-fifth of the 4,000 inhabitants are Czechs. In the 17th century, these estates belonged to Sapieha princely family, and later were divided between the newly arrived Bohemian settlers (colony Maslianka). In the Mali Dorohostai, Jan Sapieha and his wife Constance von Gerburt founded the Carmelite Church on the site of the ancient Arian Church in the early 17th century. It was a solid Baroque building with one nave, completed in 1679, and after abolition in 1832[1],

[1] It concerns repressive actions of the tsarist authorities in Russia about the Catholic Church after the Polish uprising in 1830-31s.

it was rebuilt into a Russian Orthodox Church. During the First World War, the Church was destroyed and only bare walls without arches remained" [7].

Unfortunately, these days not every resident of this picturesque village is able to say where exactly this temple was. Currently, only a few elderly remember its existence. And there is only one old man, who, on the basis of on the tales of his ancestors, could show us the place, where this Church was standing before WWI.

3. The survey of archival materials

Only one paper describing the state of the Church after its takeover from the Carmelite Order was preserved. The document written in Russian is called "The design of the former Carmelites Monastery in Dubno County, in the village of Dorohostai. Copy" [8]. There were four administrative remarks on the side of the text, which specify the circumstances of the creation of this paper. In general, the notes confirmed the intentions of the Russian authorities to undertake drastic repressions against the Roman Catholic Church after the November Uprising of 1830-31.

The earliest note on the margins states: "It was written on January 31st day of 1836. Measured and charted from the nature by Volhynian diocesan architect K. Mikhailovsky". Below, however, it shows that it is a copy made by a draftsman Domontovich on 22nd February 1840. Another note is the confirmation of the document by the Commission of Projects and Estimates on 31st January 1840. There are also signatures of the architects from St. Petersburg P. O. Visconti and O. Ruska [9]. The last note made on 5th February 1840 is the approvement of the Council of Communications and Public Buildings. There is also a signature confirming the verification of the compliance of this copy with the original.

Architectural designs on the paper are concise and consist of three images: a plan of the Church together with the line of the surrounding stone walls (Fig. 2) and the main and side facades (Fig. 3). Details of planned changes to the previous architectural style of this Church are not known. Although, as it seems, the main architectural characteristics of this sanctuary remained unchanged.

According to the plan, it was a single-nave church with a cylindrical roof, narthex, and small rectangular altar with two side extensions. There is a reason to believe that these two extensions and the iconostasis were the design proposals to adapt the former Carmelite Church to the needs of the Orthodox Divine Liturgy. For it is uncharacteristic for the Carmelite Church to lack the other buildings within the stonewalls. It seems that according to this project, they had to be dismantled.

The main and side facades are drawn neatly enough in watercolour technique, with three-tier composition scheme of the main facade, representative architectonic articulations – the entrance portal, vertical pilasters, and horizontal profiles of the central gable, and two small symmetrical towers completing the composition of the facade. There are almost no architectural articulations on the side facade, which might be interpreted as the result of the special cleansing of the previous Baroque style of Carmelite Church.

The information given by M. Teodorovych about the bell tower "over the porch" is particularly interesting. It confirms that there was a new annex to the Church by the main entrance. In the 2nd half of the 19th century, it was a fairly common way to make architectural transformation of former Catholic and the Greek-Catholic (Uniate) churches to the architectural canons of the Russian Orthodox Church. After the two Polish uprisings, imperial authorities have strengthened anti-Catholic politics and hence more radical architectural transformations of former Catholic churches and monasteries.

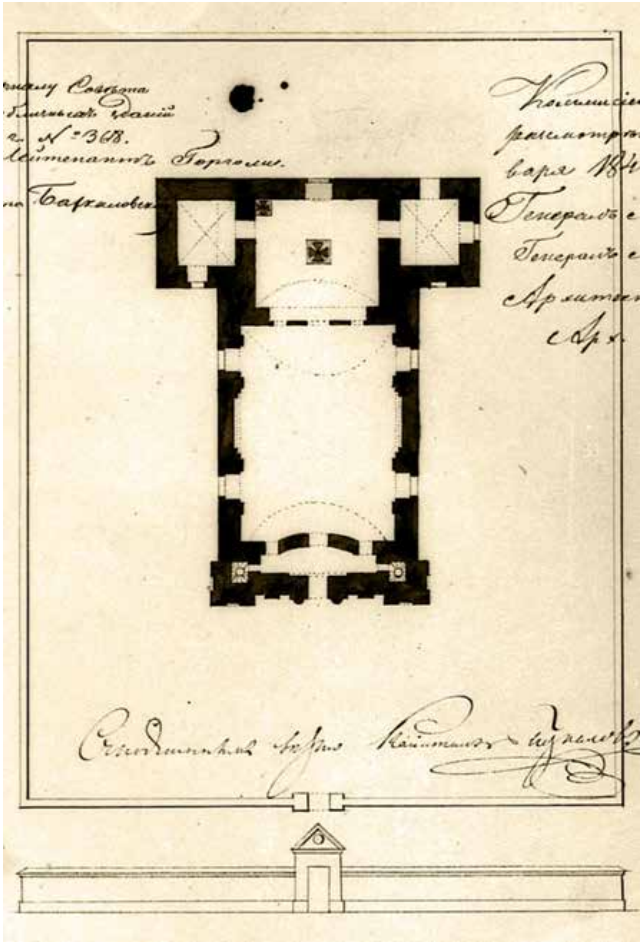

Fig. 2. “The design of the former Carmelites Monastery in Dubno County, in the village of Dorohostai ”. Fragment 1. *Source*: RSHA collection

Fig. 3. “The design of the former Carmelites Monastery(…)”. Fragment 2. *Source*: RSHA collection

A practical approach to the adaptation of the Catholic Church to the Orthodox Liturgy is confirmed by another archival paper entitled "Of the repair of the former Carmelite Church which came into possession of the Orthodox Ministry in the village Dorohostai in Dubno district of Volhynian province" [10].

The temple was destroyed during the First World War and the actual changes in the architectural forms of the temple in the process of its adaptation to the different needs of the Orthodox Church are difficult to judge. Nevertheless, these blueprints can be perceived as the first attempt to adapt the building for the use of Orthodox Church. This is probably the reason why there is not even one residential or auxiliary building indicated on the paper, which certainly existed in the days of the Carmelite Monastery.

4. Summary

Undoubtedly, an unknown author of this architectural drawing was facing a hard task. He was to adapt the former Catholic architecture to the different liturgical traditions of the Orthodox Church. However, he had apparently a rather cautious stance on the architectural transformations of the church. A possible reason for his adopted stance could be, firstly, the stylistic conservatism of the former Carmelite Church and, secondly, the implementation of Orthodox architectural forms at that times would be difficult and very costly. At the end of such architectural transformation, the former Catholic Church would become the Orthodox style with only minimal stylistic changes. In 1873, the Church was rebuilt once again, this time fully in accordance with so called the "Russian Revival style". Afterwards, during the WWI this sacral building was completely destroyed. Nevertheless, as its archival pictures show, it remains an interesting example of a Catholic Church in Volhynia, built by the Carmelites for needs of their local Monastery, later adapted for the needs of the Russian Orthodox Church, and finally lost during WWI.

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Analysis of technical problems in modern super-slim high-rise residential buildings

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Abstract: The purpose of this paper is to present a new skyscraper typology which has developed over the recent years – super-tall and slender, needle-like residential towers. This trend appeared on the construction market along with the progress of advanced structural solutions and the high demand for luxury apartments with spectacular views. Two types of constructions can be distinguished within this typology: ultra-luxury super-slim towers with the exclusivity of one or two apartments per floor (e.g. located in Manhattan, New York) and other slender high-rise towers, built in Dubai, Abu Dhabi, Hong Kong, Bangkok, and Melbourne, among others, which have multiple apartments on each floor. This paper presents a survey of selected slender high-rise buildings, where structural improvements in tall buildings developed over the recent decade are considered from the architectural and structural view.

Keywords: tall residential buildings; development; slenderness; structural system; advanced materials; damping systems

1. Introduction

In the global race for the title of the world's tallest building, height is no longer the only valuation criterion. At present, records related to their slenderness are being set in the construction of tall buildings. A new generation of groundbreaking, slender structures that most often perform a residential function is growing worldwide. Latest skyscrapers are pushing slenderness to previously impossible levels.

Slender, tall buildings in large metropolises are becoming more and more popular because they allow to accommodate large volumes of space on a relatively small area,

which is economically and environmentally beneficial. These buildings characterize with the smallest possible footprint.

The slenderness of high-rise buildings is defined by the height to width ratio at the building's base. According to the standards, buildings with slenderness greater than 10: 1 are considered to be slender. Table 1 lists the most slender tall buildings in the world.

Due to high land values and liberal zoning law, Hong Kong was once a pioneer in building pencil-thin (needle-like) towers [1]. For example, Highcliff, which was designed by Denis Lau & Chun Man Architects & Engineers studio and completed in 2003, features an extraordinary slenderness ratio of 20:1 (height to width). However, this was the only example of this type of residential tower, with a height exceeding 250 m and of such a slim design in Hong Kong. The trend of building very tall, slim apartment buildings began in New York. Skyscrapers One57, 432 Park Avenue, 56 Leonard, 30 Park Place, 53 West 53rd, and 111 West 57th Street put New York on top of the extraordinary slender high-rise building league table [2]. Eight residential towers in "Billionaires Row" reinforce the view that New York is a cosmopolitan city, with its residents coming from all over the world (Fig. 1). Inspired by New York's slender residential 80 to 100-storey towers, other buildings of this type have recently begun to pop up in Dubai, Abu Dhabi, Melbourne, Brisbane, Toronto, Mumbai, Moscow, etc. Besides Central Park in Manhattan's Midtown, the other key city that fulfilled its aspirations to become the capital of high-rise and slender buildings is Dubai. The remaining pencil-type buildings are spread across twenty-one other cities.

However, the type of needle-like buildings in New York differs fundamentally from the structures found in the other, abovementioned cities. The super-slender apartment towers of New York have a significantly lower girth as each floor is designed to contain only two apartments. In contrast, other tall, slender residential towers built worldwide contain more flats per floor. This multiplicity requires a larger floor space to accommodate extra elevators needed to handle the volume of traffic. They also require a large central core devoted to mechanical systems and shared hallways [3].

Tab. 1. The list of the world's super-slender tall buildings (developed by authors and based on [7].[8])

Building	Location	Slenderness ratio height/width	Structure	Function
111 West 57 Street	New York	24:1	steel/concrete	residential
Central Park Tower	New York	23:1	concrete	residential
125 Greenwich Street	New York	20:1	concrete	residential
Highcliff	Hong Kong	20:1	concrete	residential
150 North Riverside	Chicago	20:1 at base	composite	office
220 Central Park South	New York	18:1	concrete	residential
Collins House	Melbourne	16.25:1	concrete	residential
432 Park Avenue	New York	15:1	concrete	residential
MahaNakhon	Bangkok	13.6:1	concrete	residential/hotel
Burj Mohammed Bin Rashid Tower	Abu Dhabi	13:1	concrete	residential
Etihad Tower T2	Abu Dhabi	12:1	concrete	residential
Marina 101	Dubai	12:1	concrete	residential/hotel
53W 53th MOMA Tower	New York	12:1	concrete	residential
One Madison Park	New York	12:1	concrete	residential
Pearl River Tower	Guangzhou	11.7:1	composite	office
Ocean Heights	Dubai	11.5:1	concrete	residential
One Bennett Park	Chicago	11.5:1	concrete	residential
Neva Tower 2	Moscow	11.3:1	concrete	residential
Princess Tower	Dubai	11:1	steel/concrete	residential
Trump World Tower	New York	11:1	concrete	residential
Cayan Tower	Dubai	10.8:1	concrete	residential
30 Park Place	New York	10.5:1	concrete	residential/hotel
Elite Residence	Dubai	10.3:1	concrete	residential
56 Leonard	New York	10:1	concrete	residential
9 DeKalb Avenue	New York	10:1	concrete	residential/office/retail

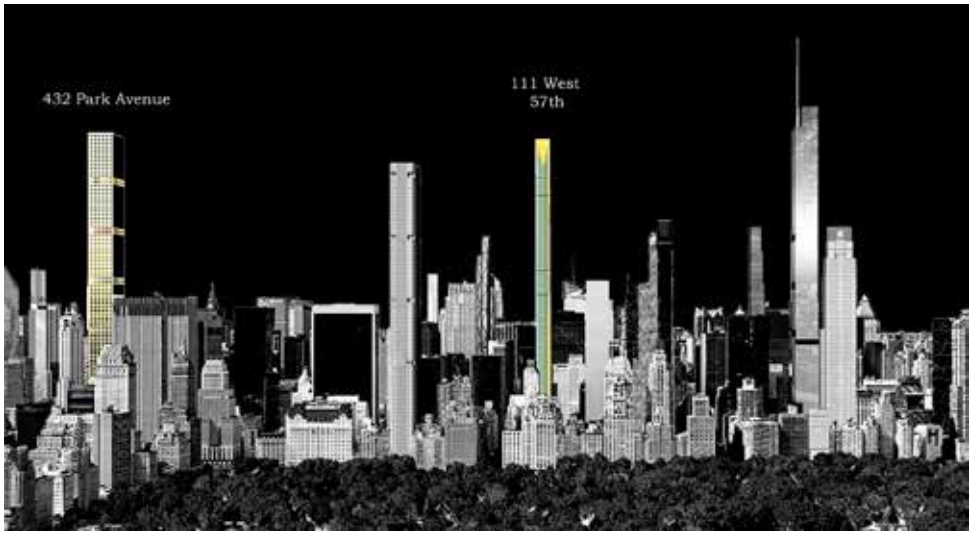

Fig. 1. Eight residential skyscrapers in "Billionaires Row" in New York (developed by authors based on [4])

Until the beginning of the 21st century, most high-rise buildings served as office towers. After 2010, the number of super-tall residential buildings increased rapidly. Since 2011, 262 buildings over 200 m height were built (Fig. 2).

The newly erected 111 West 57 Street (Steinway Tower) building in New York with slenderness ratio 24:1 is the world's most slender residential skyscraper. Following New York's lead, super-slender buildings are also being constructed in Australia. One example is a proposal for the "Magic" tower in Melbourne [5]-[6], a 330-meter tall super-slender, triangular-based construction with a slenderness ratio of 27:1.

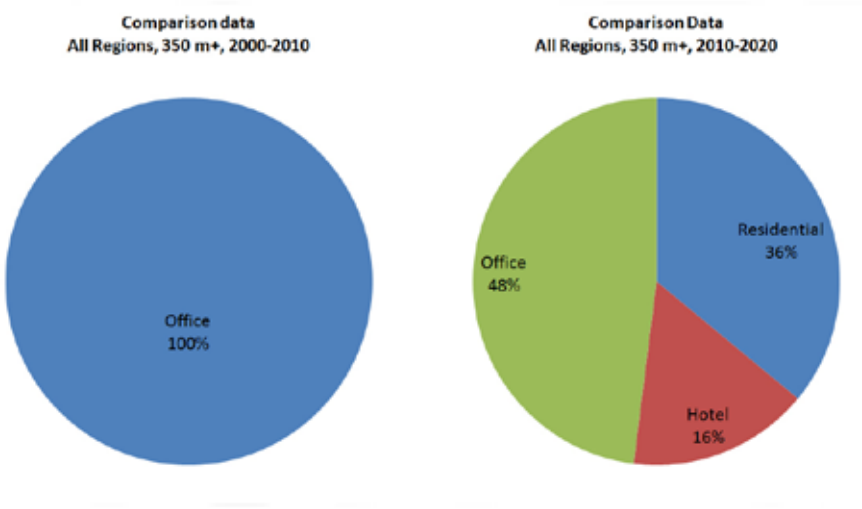

Fig. 2. Comparison of the percentage share of tall residential buildings over 350 meters in the years 2000-2010 and 2010-2020 (based on the global tall buildings database of Council on Tall Buildings and Urban Habitat)

2. Historical development of slender high-rise buildings

The history of building skyscrapers began in Chicago and New York in the late 1880s, not as a sign of lofty ambition, but as a commercial necessity. By the year 2019, a total of 1 521 buildings over 200 m height were built in 140 cities worldwide (database CTBUH). At the beginning of 2010, a new super-slender form of a skyscraper was initiated in New York. This was due to the increasing shortage of land, population growth, and a specific need for luxury apartments.

The first period of building slender high-rise buildings saw a rapid increase in height. At that time no municipal regulations limited the height of buildings. Completed in 1909, the Metropolitan Life Insurance Tower, of 213.4 m and 50 storeys, had a lot of only 22.9 m x 25.90 m.

The second period dates back to the 1920s. The first Zoning Law of 1916 states that the building's shape up to a certain height should have been the same and above it had to decrease. Moreover, the upper floors' building area could not be more than 25% of the bottom space.

The examples of this new characteristic cascade type of a New York skyscraper are the Empire State Building, Chrysler Building and 570 Lexington Avenue. At that time the skyscrapers only housed hotel apartments. Until 1929, apartment buildings were regulated by the New York State tenement house laws, which set their maximum height at 46 m. After 1929, a revision of the Multiple Dwelling Law allowed constructing higher apartment buildings. The San Remo and El Dorado's twin-tower form on Central Park West established a new standard of luxury living [10]. After 1961, a new zoning law [11], determined a maximum permitted total floor area for a building lot. The new formula defined Floor Area Ratio (FAR) as the sum of the total area of the above-ground part of the building to the plot area [12]. The law has established a principle that allows design and building without special control, whilst complying zoning rules and not exceeding the maximum FAR for a lot (Marine Midland, 277 Park Avenue, Home Insurance Plaza). Moreover, the air rights were introduced, which allow a building that has not used all of the FAR to sell unused air rights to the owner of neighbouring lots. This type of action referred to as "transferable development rights" allowed developers to combine plots to increase the FAR for a single building. Currently, all tall buildings use this method to obtain the maximum FAR.

Between 1969-1976, sky-living buildings' unprecedented heights became possible in Chicago when the mixed-use modernist tower, John Hancock Center and Water Tower Place, developed apartments on its upper floors [13]. There are currently 53 residential buildings above 150 m high in Chicago, but only two can be categorized as slender ones (Park Tower, One Bennett Park).

In New York, the next period of skyscraper residences followed with the rise of condominium towers, which saw a boom in the mid-1980s, which were especially centred around Fifth Avenue and 57th Street (Metropolitan Tower, City Spire). These towers were the first to use slenderness as a dominant strategy. Completed in 2001, Trump World Tower is an example of a new type of luxury, which grew in popularity in the 21st century due to New York's latest super-slender, super-luxury high-rise residential buildings.

During the years 2005-2010, several ultra-luxury, slender towers were built in New York, including 100 East 53 Street, Eight Spruce, 56 Leonard, 50 West Street, and One 57. Another common feature for these landmark buildings was that they were designed by world-famous architects (Norman Foster, Frank Gehry, Christian de Portzamparc, Jacques Herzog, and Pierre de Meuron).

Development of tall, slender residential buildings is rapidly increasing worldwide. As of November 2019, there were 94 residential towers above 250 m (database CTBUH), 23 of which are slender. New York boasts the largest number of super-slender tall skyscrapers [11], with others being built in Chicago, Dubai, Abu Dhabi, Melbourne, Guangzhou, Moscow, and Bangkok. In the next five years, developers worldwide are set to complete about 50 new super-slender residential towers, more than double the number currently standing. This boom underscores the growing desire among the world's super-wealthy to live "above it all". Hong Kong made a mark in the history of tall, slender residential buildings with the Highcliff building completed in 2003, which was the slimmest building in the world at the time. However, in the following years, Hong Kong stopped building such tall residential buildings.

3. Methods

The basic research method used in the paper includes identifying a group of super-slender tall buildings. The relations between the architectural form, the structural system, and the

construction material used are significantly visible. The trend related to constructing high-rise, slender residential buildings involves two solid foundations: a technological and economic one. The authors try to analyze various aspects affecting the spread of this trend in global architecture. At the beginning of its development, the difficulties associated with creating slender residential skyscrapers were enormous due to the complicated design process, risks related to financing and commercialization, and the challenging organization of construction works conducted on a large scale on small lots. New York initiated the transformation of the existing office towers into slender residential towers, and became the reference city to analyze this problem. A city that can be considered a laboratory of architecture and urban planning. In the paper, the authors used a method that takes into account the following elements:

- The collection of information which concerns the creation of the slim residential towers in New York and other cities and the advanced technologies of their construction.
- The analysis and synthesis of the acquired information based on the literature search and own review experience.
- Conducting, according to a structured scheme, architectural and structural analysis of selected slender high-rise buildings that are the most significant of this type.

The authors' main intention was to present a new typology of tall buildings and the main factors related to their design. In the analysis, apart from touching upon aspects related to the strategy of slender buildings and the standard requirements for their construction, attention was drawn to some other elements, such as: characteristic load-bearing structure, which was adopted from earlier skyscraper solutions; foundations construction; use of ultra-strong concrete; the strategy of reducing wind action; damping systems. The collected source material and the presented characteristics allowed to indicate the main determinants of super-slender tall buildings.

Moreover, the authors' idea was to analyze sustainable construction features included in the designs of super-slender residential buildings, including reducing energy consumption in their construction and operation, the maximum use of daylight to illuminate rooms and minimize interference with the surroundings. The analyses of elements related to the design of slender tall buildings presented in the article, obtained from the synthesis of the collected data, may be an additional source of information about the design of tall buildings.

4. Characteristic of super-slender high-rise buildings

4.1. Requirements for the design of slender tall buildings

Super-slender skyscrapers are an expression of advanced technologies, modern building materials and tools to facilitate their design. Each project has individual features, and the main engineering challenge is related to the mitigation of wind action. The wind action is the basic variable load, and not only the variability in height is essential, but also asymmetrical loads in the plan, leading to a dynamic twist of building. Many years of experience enabled the construction of residential buildings to reach heights of over 400 m. Using innovative design solutions and often new intelligent materials, the form and function could be adapted to their residents' different needs [14]. Super-slender tall

buildings are for developers' optimal real estate, guaranteeing high market value due to the high demand for residences with magnificent views [15].

General stability for this type of buildings is the most important element of the design. From the building statics' point of view, the computational effect caused by destabilizing loads must be smaller than the effect caused by stabilizing loads. Therefore, super-slender high-rise buildings should have adequate mass. The main material used in their construction to increase their mass is concrete.

The building design is based on the fulfilment of two limit states according to standard codes. The ultimate limit state is related to the strength requirements of structural elements and ensures adequate structural robustness. Serviceability limit state is related to the deflection of structure and floor slab acceleration on the acceptable level and provides the required comfort level to residents.

The following are the most important requirements for the designers of super-slender high-rise buildings:

- To counteract the impact of wind.
- To ensure stability, especially for the ground with low load-capacity and on unstable earthquake areas.
- To protect the building against a progressive and disproportionate collapse in the case of accidental impacts (internal explosions, human errors, terrorist attacks).
- To develop new construction techniques to reduce time and minimize costs.

4.2. Slenderness strategy

A critical aspect of the analysis of these types of buildings is slenderness strategy. This strategy strives to ensure that there are no large apartments on a typical floor and they are situated at a height where the view is undisturbed by neighbouring buildings. New York counts the most slender tall buildings. They constitute a separate category among all other slender constructions, i.e. the New York residential towers contain one or two units per floor with an area of 220 m^2 to 740 m^2. For comparison, in Dubai, the second city after New York with many needle-like buildings, the average number of units is 4 to 6. A summary of the number of apartments per level in the world's tallest slender residential buildings is shown in Table 2.

Tab. 2. The tallest residential slender towers in the world (based on the global tall buildings database of Council on Tall Buildings and Urban Habitat)

Building	Location	Levels	Residential Units Condo/Hotel	Completion Date
9 DeKalb Avenue	New York	73	417	2022
111 West 57th	New York	84	58	2020
Central Park Tower	New York	98	179	2020
125 Greenwich Street	New York	273	72	2020
220 Central Park South	New York	65	116	2020
Neva Tower 2	Moscow	79	814	2020
Collins House	Melbourne	60	298	2019
53W 53rd MOMA Tower	New York	77	145	2019
One Bennett Park	Chicago	67	345	2018
Marina 101	Dubai	101	506/281	2017
30 Park Place	New York	67	157/185	2016
56 Leonard	New York	57	146	2016
432 Park Avenue	New York	85	146	2015
Burj Mohammed Bin Rashid Tower	Abu Dhabi	88	474	2014
Cayan Tower	Dubai	73	495	2013
Princess Tower	Dubai	101	763	2012
Elite Residence	Dubai	87	697	2012
Etihad Tower T2	Abu Dhabi	80	387	2011
One Madison Park	New York	50	69	2010
Ocean Heights	Dubai	83	519	2010
Highcliff	Hong Kong	73	113	2003

The small floor area makes its core super compact. It contributes to reducing the number of elevators and appropriate service strategy. For example, the most slender skyscraper in the world (111 West 57 Street building, New York), which has 80 stories and 60 apartments, is served by two passenger elevators. Clearly higher than the average floor-to-floor height (up to 4.7 m) increases the sense of space and comfort. At 432 Park Avenue, New York, the architects and engineers elaborated special design that results in the thinnest profile and minimal footprint. The tower's lower floors without views are used for residential amenities, e.g. storage, pool, gym, and spa [16].

4.3. Advanced materials

The evolution of modern slender high-rise buildings is associated with the technological achievements of material engineering. Innovative and recently prevalent smart materials (such as phase change materials, shape memory alloys, magnetorheological liquids) enable creating a complex form and structure [17] as well as obtaining previously unachievable super height energy efficiency.

This type of buildings is designed using ultra-high-strength concrete. UHSC is made of high-quality cement with a low water-cement ratio using highly-effective chemical admixtures, such as shaping rheological properties (plasticizers and superplasticizers), mineral additives, especially micro-silica (spheres and silicon dioxide), as well as micro-fillers

and fibres [18]. To reduce the hydration heat, fly ash is used to replace portions of the cement's content. Fly ash also provides better workability and less segregation due to its smaller particle size and lighter weight when compared to cement. Other raw materials, such as coarse aggregates and sand, are stocked in a shaded area with automatic water sprinklers to control their temperature. Polystyrene foam also plays a vital role in the curing of concrete. The foam's purpose is to achieve the same temperature in the top and middle layers of concrete.

Additives significantly increase the strength (above 150 MPa) and modulus of elasticity (50000 MPa), as well as accelerate the curing of concrete (low hydration heat, not to exceed 70°C) and enable construction works in conditions with very high temperature amplitudes. Concrete reinforcing bars also have very high strength in the range from 280 MPa to 690 MPa.

The main advantages of concrete structures against the steel structures of tall residential buildings include:

- Less noise transmitted between floors.
- Less sway due to wind shear.
- Temperature is more consistent even though energy costs are typically lower due to thermal mass.

4.4. Foundation

The foundation of super-slender buildings should meet the higher demands concerning bearing capacity and sensitivity to different settlements. Its stability depends on the form and size of vertical forces which have a stabilizing effect. The phenomenon of instability can be compared to buckling due to which the structure can lean. In order to provide stability of the building against wind pressure and seismic forces, designers are forced to build underground floors. Due to the higher construction costs of underground rather than above-ground storeys, 2 to 3 underground levels are usually implemented. The method of foundation building depends on soil type and hydrological conditions. The best soil type is solid rock which occurs, among others, in Manhattan. If the load-bearing soils are at a greater depth, pile foundation is used. The piles are deepened to a considerable depth to layers of soil with high load capacity. The piles transfer loads from the building to the ground by friction between the side surface and the ground and the pile blade's pressure on the load-bearing layer. The pile system of various lengths and diameters is designed based on stress distribution under the erected building.

Another type of foundation classified as deep foundation is a slab-pile composite foundation [19]. It is a special type of pile foundation, in which its top cooperates with the piles, and its main purpose is to limit the settlement of the building. This foundation transfers part of the load directly to the ground under the slab and the remaining part to the piles [20], Fig. 3. Under the pressure of the slab, the ground settles directly under it together with the piles, as a result of which there is no sidewall resistance in the upper part. Vertical stresses under the plate cause additional horizontal stresses in the ground, which act on the piles, significantly increasing the resistance of their side surface in deeper layers. The distribution of forces between the slab and piles, as well as on individual piles, their sides and bases, is the result of a complex system of mutual interactions and cooperation of these elements.

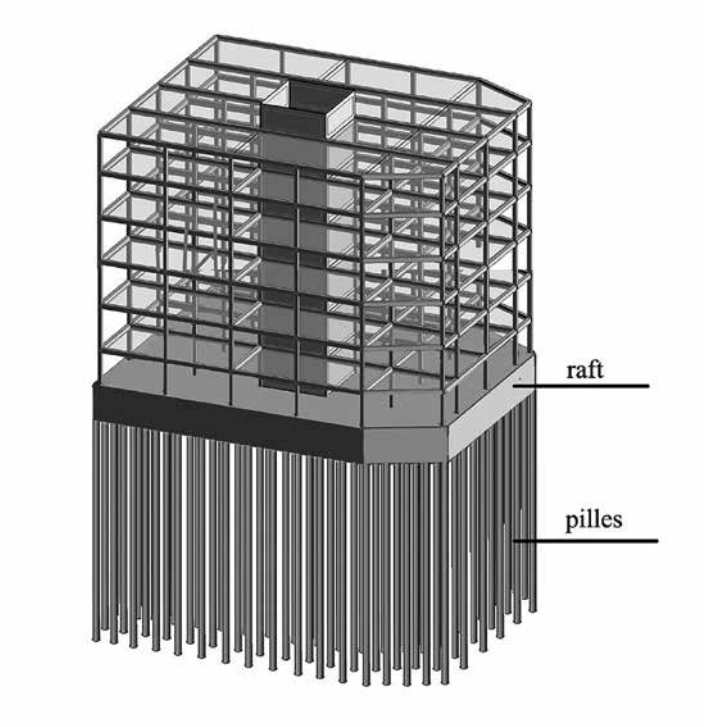

Fig. 3. The system of piled raft foundation (developed by authors)

The foundation design depends on many features of slender buildings [21]. The most important can be included

- Weight of building due to the transfer of vertical loads on the foundation.
- Second-order effect (P-Δ analysis), causing additional bending moments.
- Wind action causing large bending moments in the foundation system.
- Influence of cyclic wind impact in the lateral and vertical direction.
- Dynamic building response for higher modes of foundation vibration, when their natural periods can be excited by the wind.

4.5. Structural systems

With the increase of tall buildings with a high structural height and slenderness ratio, more attention is paid to the efficiency of structural systems. A super slender high-rise building's lateral stability is very often achieved through "frame-tube" structures with outriggers.

Frame Tubes was invented by Fazlur Rahman Khan in the 1960s and was used for the next two decades. However, its use was later limited due to the location of the perimeter columns and its impact on the façade form. However, this system was again used in slender buildings. The best examples are residential skyscrapers, such as 432 Park Avenue in New York and Marina 101 in Dubai (Fig. 4). For this type of buildings, the framed tube system is better integrated with the floor plan and façade system [22].

Fig. 4. Super-tall residential towers: a) 432 Park Avenue (New York, photograph by authors), b) Marina 101 (Dubai, developed by authors based on [28])

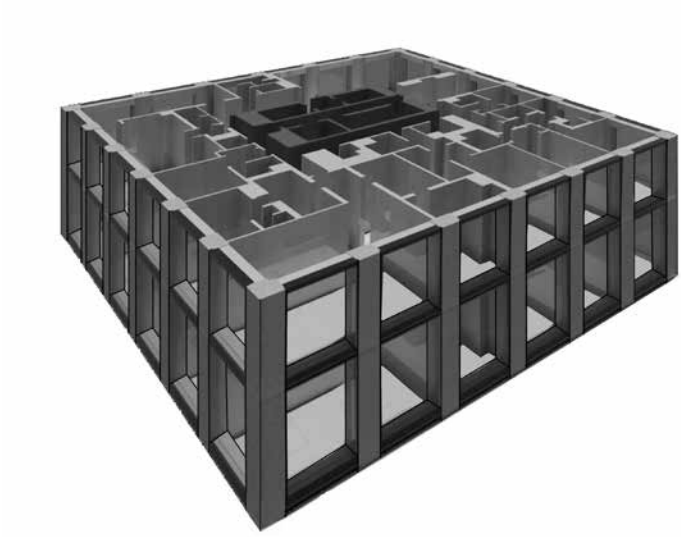

Fig. 5. Levels of a tall residential building whose floors are typically composed of many separate rooms (example of 432 Park Avenue, developed by authors)

A common system in super-slender, high-rise buildings is the outrigger frame system, which works by coupling together two structural systems – the rigid frame system on the perimeter and the core system to obtain the unified structural behaviour [23]-[24]. An outrigger performs the function of extending in the horizontal direction the core to peripheral columns. It is mainly designed in the form of a shear truss or shear walls (Fig. 6). They usually occupy one floor for the purpose of mechanical equipment and are characterized by high flexural and shear strength [25]. This structural system that increases the shear frame's rigidity is based on the action of a cantilever tube. It works by supporting the core and transferring loads to peripheral columns. In the case of a damped outrigger, the end of the outrigger is connected to the column via a damper. As the building sways under lateral loading, differential movement between the outrigger and column occur, resulting in a damping force [26]-[27].

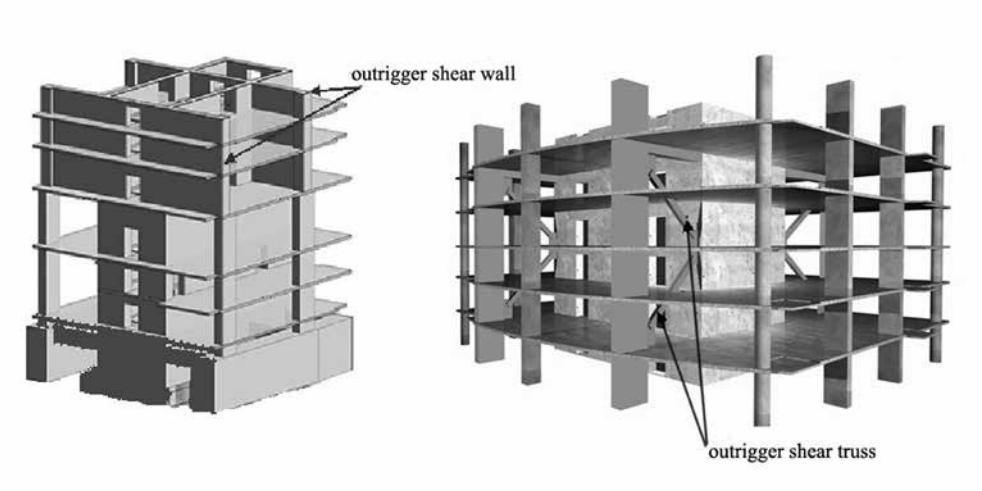

Fig. 6. Outrigger systems in slender high-rise buildings (developed by authors)

4.6. Strategy of reduction of wind action

The basic period of natural vibrations of a building is directly proportional to the slenderness ratio. Therefore, for buildings with large slenderness, this value is considerable. The critical load results from the difference between wind pressure on the windward side and suction on the leeward side for tall buildings. An additional load is also a perpendicular load acting with torsion. To comply with the serviceability limit state, the lateral displacement and acceleration of vibration must not exceed the limit value. Too large lateral displacements can cause damage to the structural and non-structural elements of the building. At the same time, excessive acceleration of vibrations affects the feeling of discomfort for its residents [29]. An important problem in the initial design phase is determining the required structural damping. For this purpose, an analysis of along wind action is carried out on the basis of pressure and load coefficients, assuming the average wind speed to assess the average load [30].

Crosswind effects can also be significant (Fig. 7). When the wind acts on a building, it induces vibrations, which results in an organized vortex shading pattern. From a structural point of view, the preferred mode of vortex shedding should be antisymmetric. The organized pattern of vortex shedding generates the largest forces in a perpendicular direction to

the wind action [31]. These forces have oscillating character, and the load on the structure may increase as a result of resonance. The crosswind force depends on the geometry of the building plan and changes with height. In the case of slender buildings, which usually have a cuboid body with little geometric variation, the crosswind effect is particularly significant in the induction of motion. Torsional vibrations result from an eccentric loading and occur when resultant wind load coincides with the centre of the floor mass. Torsional-flexural coupling of vibrations can cause torsional motion of a building. Its response depends on the ratio of transverse to torsional frequencies. The occupants' comfort is crucial, and designers have to set the building's motion limits. Generally, in high buildings, the reinforced concrete core is the main load-bearing element and determines the rigidity. However, in slender residential buildings, it is very compact [32]. The designers' strategy to reduce these wind-induced motions consists of obtaining an aerodynamic shape (changing the building plan geometry, Fig. 8) and introducing vertical openings (atria) enabling the wind to penetrate the building to minimize the vortex shedding [33].[34].

Despite many countries developing codes for wind load assessment, they cannot accurately capture wind interaction with a high-rise building structure due to the gusty nature of wind and dynamic response of building [35]. In order to thoroughly investigate the problem, skyscrapers are tested in wind tunnels to accurately assess the response of longitudinal, lateral and torsional winds in a tall building, as well as to check how well the façade and other architectural elements work on breaking vortices. The building model and the layout of adjacent buildings and the most significant elements of the environment (dense greenery, different terrain levels) are placed in the tunnel and subjected to an air stream simulating wind.

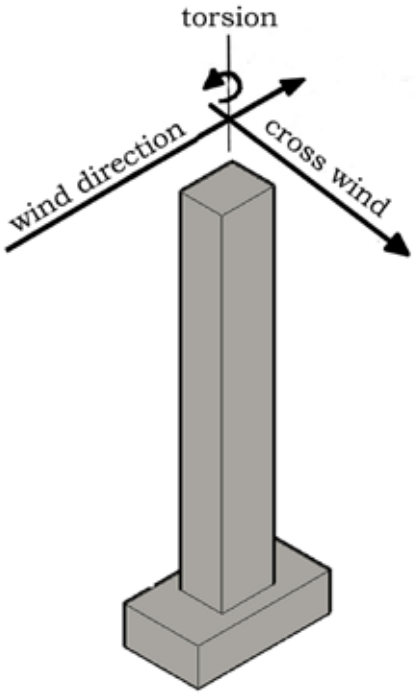

Fig. 7. Wind action on high-rise building (developed by authors based on [36])

One of the most important methods used in the wind tunnel is the High Frequency Force Balance Method (HFFB). Wind-induced loads are measured at the base of the building model. The analysis determines whether the building has uncoupled translational and uniform mode shapes under the action of averaged loads that are correlated with the measured loads [37]. The HFFB illustrates global wind impact on a building as a sum of static and dynamic interactions. From HFFB procedures applied in a wind tunnel, the wind-induced response in the building can be determined. Based on obtained results, some improvements in the building can be made in the following form: optimal building orientation, changing of height, changing the floor location for stiffening elements such as outrigger truss, application of damping devices, etc.

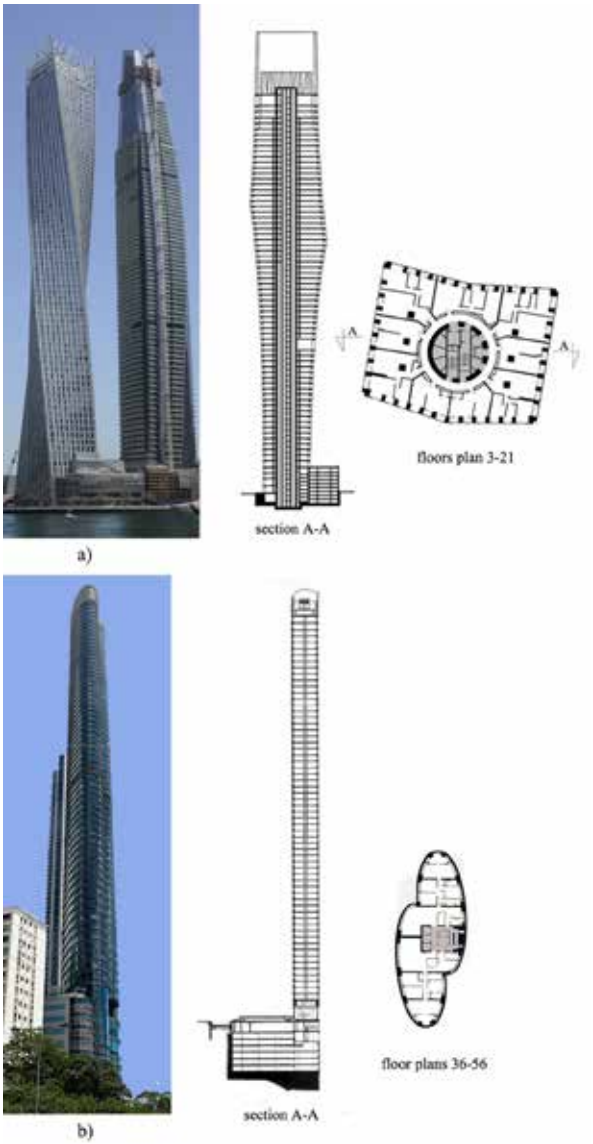

Fig. 8. Aerodynamic changing of plan geometry of residential buildings: a) Cayan Tower (Dubai, UAE); b) HighCliff (Hong Kong, China) (developed by authors)

In addition to experimental methods, computer programs based on fluid dynamic can simulate the impact of wind on the building. The most popular software programs created for this purpose are Fluent, Airpak, Tass, Comis, Trnflow, etc. However, despite technological advancement, which increases the possibilities of computer simulations, laboratory tests still give more accurate and reliable results.

Another method that allows vibration reduction is the use of special vibration dampers [38]. There is generally a distinction between active, semi-active, passive and hybrid dampers. The most popular types of silencers in slender buildings are tuned mass silencers (TMD), which are installed in the upper part of the building and use water tanks that act as counterweights, Fig. 9. Tuned mass dampers are designed to adjust their position when the building is moving [39]. Viscous dampers (VD) integrated with structural elements are another type of dampers used in slender tall buildings.

In addition, special antivibration pads that can transfer and absorb vertical and horizontal vibrations are used in the building's underground zone. As a result, the building under the influence of vibrations, moves in a snake motion; deviates from the centre of gravity in a controlled manner and does not go beyond the outline of the foundations.

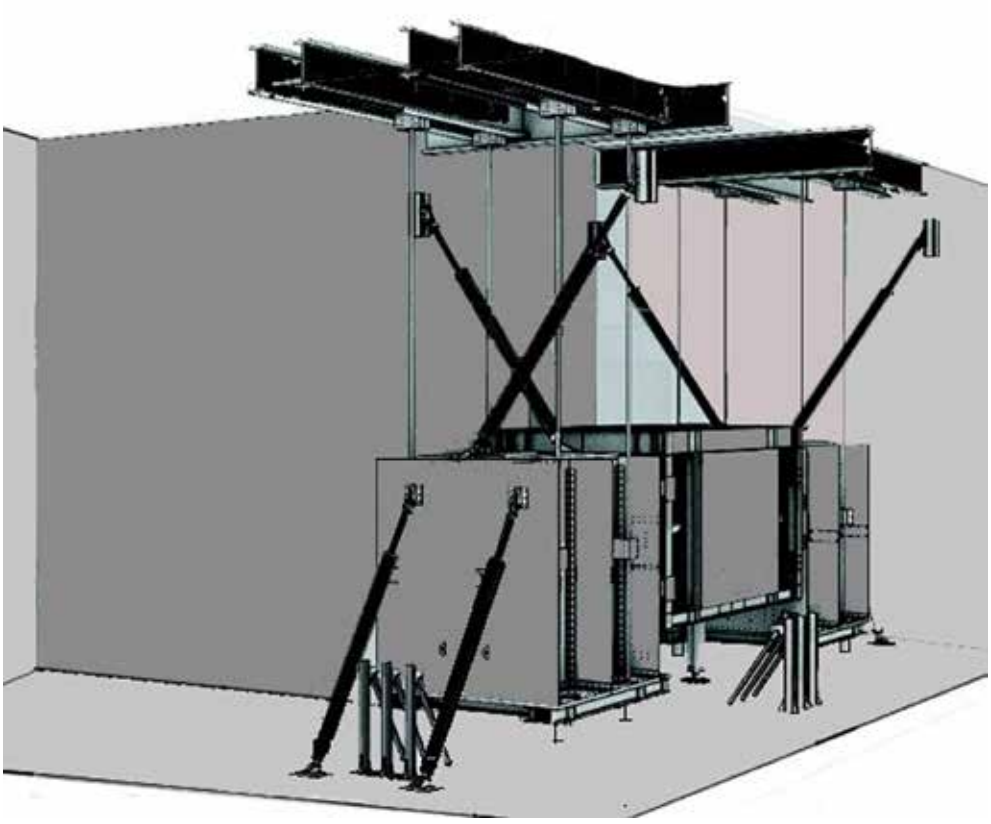

Fig. 9. Example of tuned mass damper installed in some slender skyscrapers (developed by authors)

4.7. Sustainability

The main goal of the design processes of high-rise buildings is to pursue the idea of low-energy construction. It involves the full use of renewable energy technologies. Due to buildings' verticality, more land can be allocated to public use in the form of squares, shopping centres, and recreation areas. The vital aspect of a sustainable tall building is the orientation and shape of its plan, which will allow the maximum advantage of daylight usage. The façade and the area given to windows are also of ultimate concern for determining the thermal insulation of the exterior walls and for gathering light. An example of an energy-saving element is a double-skinned façade with a ventilation system and a closed cavity type, whose operation involves creating a closed, empty space in which insulated glass units with two or three glass panes are mounted on the inside, and single glazing on the outside. Other passive low-energy strategies include natural ventilation, the location of service core, sun blinds, atrium, and smart materials. Low energy use is fundamental for sustainable development. The main issue can be seen as how this energy is generated. Active solutions that can be implemented through technical installations include solar collectors, photovoltaic panels, wind turbines, CHP system, fuel cells (PEMFC, PAFC, SOFC, AFC, MCFC), and a combination of heat pump technology with geothermal energy. Also, a computer-intelligent monitoring system plays a vital role in managing energy consumption. The building management system (BMS) is a centralized control system for managing various systems, such as fire protection, security, communication networks, elevators, HVAC systems, etc.

5. Examples of selected super slender high-rise buildings

The main criterion for selecting examples of slender residential skyscrapers was their super slenderness, an original geometric form designed by outstanding architectural studios (Jaros, Baum & Boles (New York); Rafael Viñoly Architects (New York); Bates Smart (Melbourne); Foster & Partners (London); Buro Ole Sheeren (Berlin), as well the geographical and historical aspect. In addition, an important element in analyzing the considered buildings was the preparation of the authors' photographic documentation. The super-slender skyscrapers presented in the article were created in competing metropolises as a result of the search for an original and revolutionary architectural and structural form, using the greatest technological achievements.

5.1. 111 West 57th Street (New York, under construction, 435.3 m)

The 111 West 57th Street building is a residential skyscraper with a steel and concrete structure designed by SHoP Architects. The tower has been erected in the courtyard of the former Steinway building designed in 1925. The world's most slender skyscraper is located between 6th and 7th Avenues on 57th Street in Manhattan. A remarkable aspect of the tower is that its location is almost perfectly aligned with Central Park's centerline. This will give future residents a very symmetrical view of the lush green space, the Upper West Side, and the Upper East Side [40].

Fig. 10. 111 West 57th Street (photograph by authors)

The building is 435.3 m in height and contains 84 floors at the above-ground level and one underground floor (Fig. 10). Because of its location in Manhattan, where bedrock is close to the surface, the foundation of the building is made up of conventional footprints with approximately 200 rock anchors that extend to 30.5 m [41].

The 111 West 57th was designed on a square shape plan with a dimension of 18.3 m, Fig. 11. From the south side, approximately two-thirds of building height gradually set back and taper the cross-section. The highest section of the building is steel frame structure situated at the level of 383 m with a high of 52.4 m. The architects were inspired by the famous skyscrapers from the golden era of Manhattan, namely the 30 Rockefeller Center or Empire

State Building. A fully-glazed curtain wall system with vertical strips of bronze was used in the north and south façades, and terracotta rain screen panels with glass and bronze ornamentation in the east and west. In the entire building, a crucial role is played by the façade structure, which supports the weight of terracotta tiles and gives the building a multiplied slenderness effect.

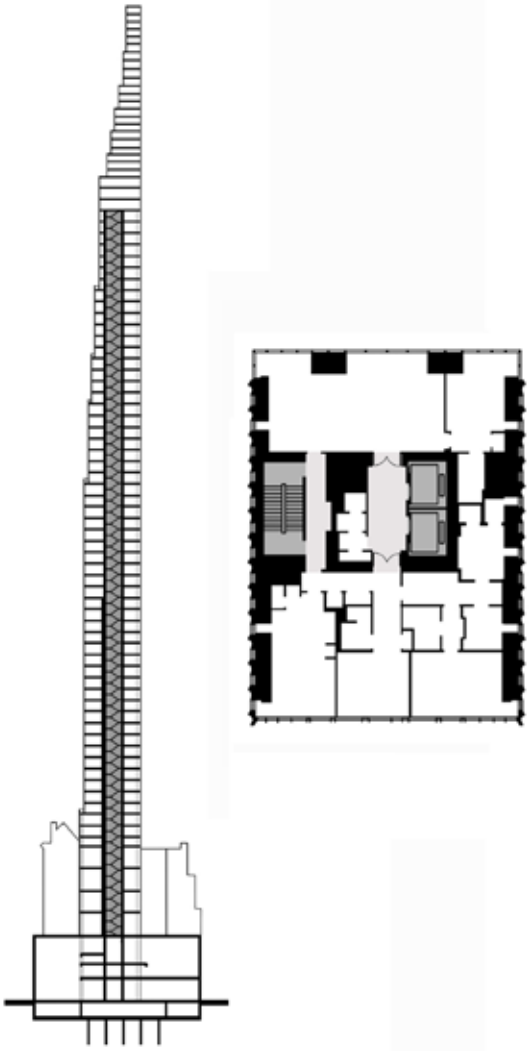

Fig. 11. 111 West 57th Street: plan and section (developed by authors based on [44])

5.2. 432 Park Avenue (New York, 425.7 m)

432 Park Avenue is a residential skyscraper with a concrete structure designed by the Rafael Viñoly Architects studio. The tower is located between Park Avenue and East 57th in

Manhattan. The building consists of 125 condominiums on middle and upper levels and amenities for residents and retail area on lower levels. The building is 425.7 m in height and contains 85 floors at the above-ground level and 3 underground floors (Fig. 12). 432 Park Avenue is designed on a square plan with a dimension of 28.5 m, Fig. 13. The main architectural attributes are symmetry and very simple geometry. The body of this building has a cuboidal form with large slenderness. 432 Park Avenue was built on the site of the demolished Drake Hotel from 1927. With a slim silhouette and a façade of regular rectangular division windows, the building gives the impression of being extremely lightweight. The original composition of the façade refers to a metal basket designed by Austrian architect Josef Hoffmann.

The foundations of the building are footings with 60 rock anchors that extend down from 18.3 to 21.3 m into Manhattan's bedrock [39]. The concrete for the foundation and part of the superstructure has a strength of 96.5 MPa. The tube-in-tube system [7] is a main load-bearing system that provides the tower's lateral stability. Internal concrete core with dimensions 9 m x 9 m is connected with the perimeter tube, which has a form of the concrete frame. The core wall is 75 cm thick. The 1.1 m wide exterior columns, spaced 4.7 m apart, are connected by spandrel beams to form exterior tube [45]. The dimensions of these elements decrease with the increasing height of the building. It was also applied large beams, at every 12 floors with double-story plant rooms, to connect the outer tube with a central core.

Using the highest strength concrete (100 MPa) enabled both the column sizes to be minimized and intruded into the usable livable area [46]. Because of the slenderness and to counteract wind-induced vibrations, the storey plant rooms are open, which allows the wind to flow through the building and minimize vortex forces.

Despite the lateral stiffness and open double-storey plant rooms, structural designers added extra mass to the upper levels by increasing the thickness of concrete floors from 25 to 45 cm. Moreover, two 650 tonnes tuned mass dampers were installed at the top of the building, and viscous dampers were integrated laterally with structural elements.

The 432 Park Avenue design can be considered sustainable, which uses renewable energy technology to be LEED-certified in the near future.

Fig. 12. 432 Park Avenue (photograph by authors)

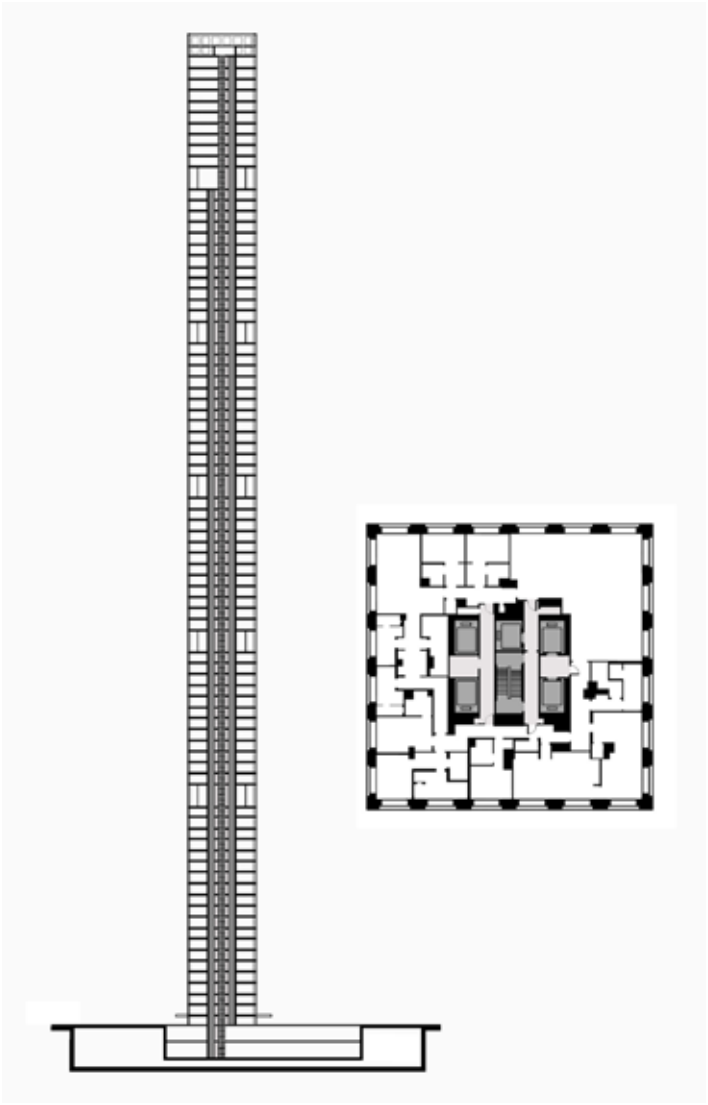

Fig. 13. 432 Park Avenue: plan and section (developed by authors based on [47])

5.3. Collins House (Melbourne, 189.6 m)

Collins House is a tall residential building with a concrete structure designed by Bates Smart studio. The building is located at the corner of Collins and William Street, in a very prestigious central location in Melbourne, which has a similar meaning to Fifth Avenue in New York. It is constructed on the top of an existing 3-storey Makers Mark building whose façades derive from the Art Nouveau period. Collins House is 183.4 m in height and contains 59 floors at the above-ground level and one underground floor (Fig. 14). Two top floors are occupied double-storey penthouses. The plan of this building has a rectangular shape with a dimension of 11.7 m x 40.0 m, Fig. 15.

Fig. 14. Collins House (Courtesy of Bates Smart)

Fig. 15. Collins House: plan and section (developed by authors based on [50])

The tower is supported by a piled raft foundation. The load-bearing structural system is based on concrete shear walls on each side. The side walls are stiffened by two transverse walls forming a rigid box in H-section in the east-west direction [48]. No columns on the north and south elevations allow maximum daylight. Up to 14 floors, the building is constructed from monolithic concrete, while above these levels, designers applied Hickory's prefabricated elements [49]. As a result, the building became one of the tallest modular building in the world. The modular system allows a more flexible arrangement of units, which can be repeated on different floors depending on their function.

The building's façade is a system of a double-glazed curtain wall. On the eastern façade above level 14, the floor system is cantilevered out 4.5 m in the form of rizalit. In the north and south façades from 14 to 27 floors, there are axially wide loggias. Additionally, from 14 to 47 floors are designed a strip of narrow loggias. Openings in the building and shifted center of its mass results in a magnification of vibrations acceleration due to torsional effect. In order to counteract vibrations in north-south and east-west directions, two liquid tuned dampers, which are located at the plant room level, were used.

5.4. Burj Mohammed Bin Rashid Tower (Abu Dhabi, 381.2 m)

The Burj Mohammed Bin Rashid tower belongs to the World Trade Center complex, which comprises two tall buildings. The higher, residential and the lower, commercial tower, also known as Trust Tower offices. The Burj Mohammed Bin Rashid is a residential skyscraper with a concrete structure designed by Foster and Partners studio. The tower is located in a residential suburb of Abu Dhabi in Khalifa Area. The building is 381.2 m high and contains 88 floors at the above-ground level and 5 underground floors (Fig. 16). The tower was designed on an elongated quadrangle plan. Reflective façade has wave-like form and wraps the entire building in a regular pattern, Fig. 17. The glazed cladding creates a mirage effect inspired by the desert landscape phenomenon. As a result of the wavy form of the building, a unique floor plan was obtained, which allows arranging the space in many different ways.

Fig. 16. Burj Mohammed Bin Rashid Tower (photograph by authors)

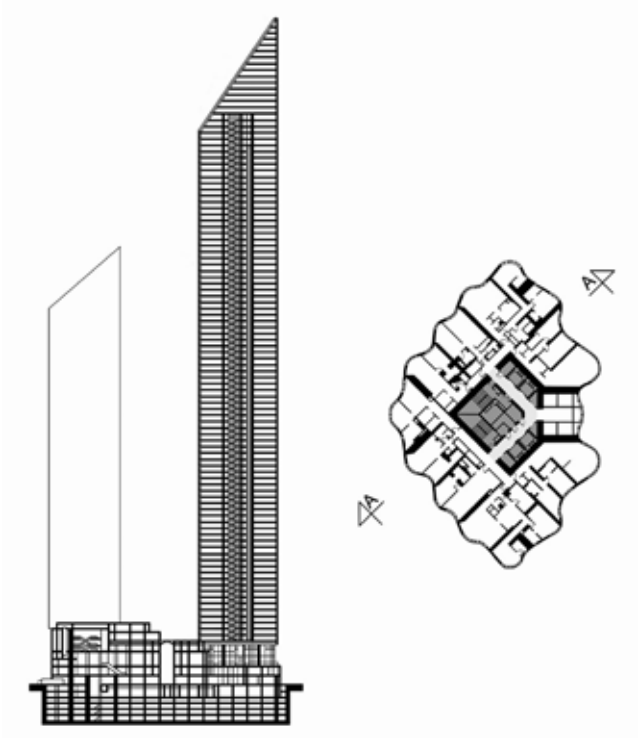

Fig. 17. Burj Mohammed Bin Rashid Tower: plan and section (developed by authors based on [51])

The Burj Mohammed Bin Rashid foundation consists of a pile-supported raft, where piles were utilized as settlement reducers. Reinforced concrete walls placed around the elevators and stairs in the tower's central core create a lateral load resisting system. The system forms a stiff spine, which resists lateral loads and provides the tower's torsional stiffness [51]. Reinforced concrete outrigger and belt walls are located at three mechanical plant floors over the height of the building. These outrigger and belt walls connect the core to the reinforced concrete perimeter columns, allowing the lateral overturning forces to be resisted by the entire width of the tower, even though there is essentially no structure around the perimeter. The wall-columns, which were designed to be thin and hidden in the room partitions, line the perimeter so that an absolute minimum amount of exterior perimeter is blocked by the structure. Many solutions based on renewable energy were used to increase the energy efficiency of the building (such as solar collectors, ventilated three-skin façade). Moreover, local building materials were applied to reduce embodied carbon.

5.5. MahaNakhon (Bangkok, 320.0 m)

MahaNakhon is a two function skyscraper (residential, hotel) with a concrete structure designed by Büro Ole Scheeren. The skyscraper is located in Bangkok's Central Business District. The literal translation of the name MahaNakhon is a "great metropolis". The building is 320.0 m in height and contains 79 floors at the above-ground level and 1 underground floor. (Fig. 18). With its distinctive sculptural appearance, MahaNahkon was carefully carved in order to present a three-dimensional "pixel" that circles about entire building, Fig. 19.

The seven-storey podium intended for a shopping center characterizes with many internal and external cascading terraces that resemble a mountainous landscape. The three-level restaurant has double-height spaces and a rooftop bar with an observation deck.

MahaNakhon is supported by mat foundation (8.77 m of height) and barrette piles (129 with a size of 1.2 x 3 m) which reach to a depth of 65 m below grade [53]. The central core wall provides structural stability to lateral loads. Its dimensions are the largest at the basement (23 m x 23 m) and gradually decrease towards the top of the building (23 m x 14 m). The gravitational loads are supported by 12 mega-columns surrounding the core along with its height. Lateral stiffness was strengthened by outrigger walls linking the center core walls to the mega-columns at transfer floors on 3 levels. The mechanism minimizes the fundamental period of vibration and the lateral drifts and accelerations, in turn lowering the risk of human discomfort.

Fig. 18. MahaNakhon (photograph by authors)

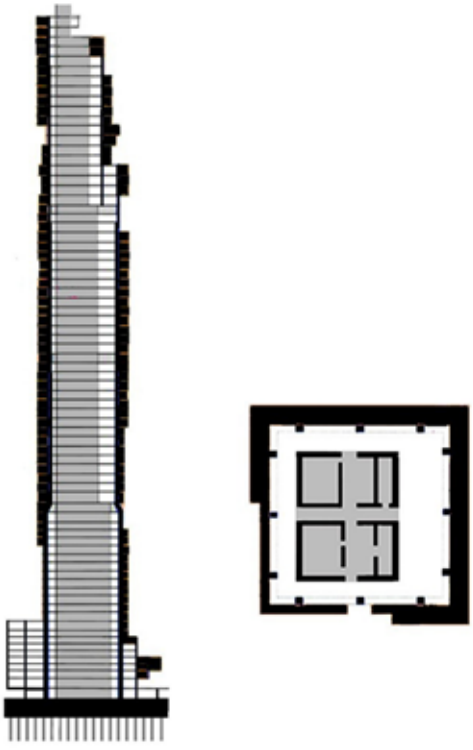

Fig. 19. MahaNakhon: plan and section (developed by authors based on [54])

The slabs consist of post-tensioned band beams with reinforced concrete flat slabs. Almost 30% of the floor slabs are cantilevered, creating the pixilation effect achieved through the stacked surfaces of cantilever terraces. MahaNakhon's floor slabs vary from floor to floor throughout the tower providing many different arrangements of units. The residences have ceilings of up to 3.4 meters high and floor-to-ceiling glass windows to provide expansive panoramic views. The MahaNakhon wall system is a unitized curtain wall comprised of large units of low-e double-layer glass and mullions and special hooks that lock the units together. The façade system was designed to be hung from the edge of each floor slab with special horizontal joints between panels.

In order to increase energy efficiency, the following elements were applied: independent controls for air, power, and water; lighting controls with modern LED technology, energy management, mechanical parking systems, and smart home automation.

6. Discussion

At first, the design and construction of tall and thin skyscrapers (also named pencil towers or needle-like towers) seemed completely economically unviable. However, currently, after completing several projects around the world, it can be seen that this form of the building has become a kind of trend among high-rise residential buildings. Due to the lack of land in desirable locations of various metropolises, and therefore sky-high property prices, developers are trying to integrate tall buildings into existing infrastructure on a small plot. New super-slender residential towers, which stand on very narrow footprints, offer more than just luxury residences with the iconic building's postal address.

Due to their slenderness and compact core, these buildings have one or two apartments per floor, which affects its spatial exclusivity. The crucial aspect of designing such buildings is that they provide astonishing views of the surroundings. For example, in New York, a city that pioneered this trend in architecture, panoramic views of Central Park are worth astronomical prices.

However, saving land by building upwards does not come without consequences – super-tall buildings cause severe shading. This issue roots a moral problem. An exclusive group of wealthy tenants having extraordinary views affects other residents' environment. Architecture critics, Aaron Betsky and architect Steven Holl, among others, have questioned the social aspects of such buildings. They criticized the developers who have been transforming Manhattan into a capitalist "holy land without space for the poor".

Tab. 3. The list of the most costly residential high-rise buildings (developed by authors)

Building	Location	Cost (Billions, USD)
Central Park Tower	New York	$3.00
Princess Tower	Dubai	$2.17
One57	New York	$1.50
220 Central Park South	New York	$1.40
432 Park Avenue	Moscow	$1.25
111 West 57th	Melbourne	$1.00
MahaNakhon	New York	$1.00
Neva Towers (1.2)	Chicago	$1.00

Slender skyscrapers are incredibly costly to build (Table 3). This is because of innovative materials and construction solutions, a small number of apartments and difficult construction conditions on a narrow plot. However, they are an attractive investment for developers due to high demand and popularity among affluent clients, especially in New York. The high prices of apartments enable the employment of the best architects and the most outstanding designers and engineers, as well as the application of the most sophisticated technology. The attractiveness of the investment means that these types of buildings are purchased by foreign investors, and as a result, they are hardly used throughout the year.

Designers aim to maximize interior space in slender skyscrapers; therefore, the structural support is more likely to come from the building's exterior. A mechanical floor with heavy equipment is usually located on the upper floors to stabilize the building and counteract the effects of wind. The main challenge for designers is to provide adequate lateral stiffness. In a tall building with a high slenderness ratio, ensuring human comfort is vital. The application of outriggers on a few levels is necessary to improve the stiffness of the tower by linking the center core walls with surrounding columns, where push-pull mechanism with axial forces is created. Outriggers counteract by bending under wind loads. The rigid belt surrounding the building causes external columns action. This mechanism minimizes the dynamic action of the wind loads, lowering the risk of the residents' discomfort.

It is currently possible to build higher buildings using structural elements of the same cross-sections by using ultra-high strength concrete. This undoubtedly contributed to the development of the trend of slender tall buildings. Recent formulations of concrete make the structure more rigid and strong enough to support heavier loads. Perhaps major problems that have to be solved are found in building technology, which relate to the use of cranes and construction platforms in a small space and at a very high altitude. The traditional procedure of placing the crane in the compact core of slender skyscrapers has many limitations and requires the use of special technologies, which are costly and require improvement. The use of computer technologies (CAD, BIM), as in other architecture fields, allows the logistical and economic development of projects.

7. Conclusions

The main factor influencing the development of slender buildings were economic considerations related to high construction land prices and the real estate market demand from wealthy clients. Another contributing factor was the search for an original, revolutionary geometric form made possible by technological progress.

The development strategies of super-slender towers evolved in New York over the past decade. These up to 100-storey high buildings contain luxury apartments with beautiful views of the city skyline. Because they comprise only one or two apartments per floor, they offer a view from three or four sides of the world. This fundamentally differs the New York skyscrapers from the traditional ones.

Following New York's footsteps, Hong Kong, Dubai, Abu Dhabi, Melbourne, Brisbane, Toronto, Mumbai, Moscow, etc. started constructing slender residential towers. Slender residential skyscrapers erected in the metropolis' centres on tiny plots become a global architectural trend. Zoning laws and high prices of land were important factors driving this type of structures. This fashion of pencil-shaped structures is associated with an incredibly high cost of construction.

Recently, advances in materials and engineering have made building both super-slender and super-tall possible. This is enabled by the following technical factors: applying ultra-high strength materials, advances in structural modelling, computing power, simulation, and aerodynamic shaping. Application of ultra-high strength concrete to a compact core with an outrigger system allowed designers to minimize the structural elements in the apartments, providing the possibility of flexible arrangement and preserving stunning, uninterrupted views.

Wind-induced vibrations in super-slender tall buildings have been reduced by increasing lateral stiffness and increasing total weight. The new use of the outrigger system provided additional damping to reduce wind load and vibration acceleration. Also, tuned mass dampers and aerodynamic building shape optimization were complementary auxiliary methods for their design.

There are mechanical and structural limits to how high-rise a building should be. Still, the higher a building is, more rigid and more robust should be its structure. There is no doubt that super-tall, slender buildings are the most technologically advanced constructions in the world. However, the question arises whether modern technologies and high expenditure make this architecture an outstanding work.

American architects Ali and Al Kadmany [55] believe that tall eco-friendly buildings may become the primary housing type of future. However, the main disadvantage of all skyscrapers, especially super-slender ones, is their elitism, resulting from very high constructional and exploitation costs. Moreover, the density of tall buildings in metropolitan centers causes shading of the terrain, which may be beneficial in countries with high sunshine, but unfavorable in countries with a temperate climate. Undeniably, however, ecologically sustainable high-rise buildings are the future of worldwide construction.

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Analiza technicznych problemów super smukłych współczesnych wysokich budynków mieszkalnych

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Streszczenie: Celem artykułu jest przedstawienie nowego typu wieżowca, która rozwinął się w ciągu ostatnich dziesięciu lat w formę bardzo wysokiego, super smukłego budynku mieszkalnego. Obecnie w wyścigu o światowy rekord nowym kryterium stała się smukłość. W centrach wielu metropolii ze względu na coraz mniejszą ilość dostępnego miejsca oraz bardzo wysokie ceny działek budowlanych, architekci zaczęli projektować wysokie budynki na niewielkiej powierzchni. Innymi czynnikami powodującymi rozwój tego trendu były względy ekonomiczne, wraz z zapotrzebowaniem rynku nieruchomości na luksusowe apartamenty z panoramicznym widokami, jak również postęp technologiczny umożliwiający wybudowanie super smukłych

wieżowców. W ramach tej typologii można wyróżnić dwa rodzaje budynków. Ultra-luksusowe super-smukłe wieżowce z jednym lub dwoma apartamentami zaprojektowanymi na jednej kondygnacji, które są charakterystyczne dla dzielnicy Manhattan w Nowym Jorku oraz inne smukłe wieżowce w Hong Kongu, Dubaju, Abu Zabi, Bangkoku, Melbourne itp., które mają więcej apartamentów na poziomie jednego piętra. W artykule przedstawiono przegląd wybranych smukłych wieżowców oraz ich cech konstrukcyjnych i architektonicznych w odniesieniu do postępu technologicznego wysokich budynków ostatniej dekady.

Słowa kluczowe: wysokie budynki mieszkalne; smukłość; system konstrukcyjny; zaawansowane materiały; systemy tłumienia drgań

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Orginal Article

Urban design and therapeutic landscapes. Evolving theme

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Abstract: The global pandemic of COVID-19, which enforced strict isolation, demonstrated the responsibility of architects and planners for public health promotion. While the concept of therapeutic landscapes is rather new, the quest for designing health-promoting human environment is at least as old as urban planning. The garden suburbs of Ebenezer Howard and Patrick Geddes were planned to promote health and well-being. The ultimate goal of Le Corbusier was to provide daylight and fresh air to each apartment. However, towers in open green space, which were built according to his visions, turned into unfriendly large suburbs. Today, the definition of therapeutic landscapes encompasses not only physical aspects of environment but also social and psychological factors. This study focuses on attempts to create health-promoting places. The interesting question is what are the architectural features linked to health promotion? Although the individual perception of health-promoting places is subjective and may vary, there are some objective qualities of eco-neighbourhoods that are conducive to human health and longevity. This study combines literature review with field observation and resultes in the development of the conceptual framework which can be consolidated into the universal standards for health-promoting places.

Keywords: urban design; therapeutic landscapes; health promoting places; architecture

1. Introduction. The concept of therapeutic landscapes

The concept of therapeutic landscapes was coined by Wilbert Gesler to describe places which are believed to promote healing , for example Lourdes in France or Epidaurus in Greece [1]-[3]. Gesler defined *therapeutic landscapes* as places where *"physical and built environments, social conditions and human perceptions combine to produce an atmosphere which is conducive to healing"* [1, p. 96].

However, the design of healthy places is not the invention of XX century. It has always been the main concern for planners since antiquity. Marcus Vitruvius Polio (ca. 75 BC -15 BC) advised to carefully observe the behaviour of animals and test the environmental qualities

before establishing new communities. He insisted on avoiding unhealthy places to build human settlements [4].

For centuries the natural beauty of landscape was an important factor when choosing a place to live. However, the situation changed dramatically after the industrial revolution. For vast majority of workers drawn to fast-growing cities there was no choice. The living conditions were repelling in poor XIX century districts. That drew the attention of many thoughtful inventors who searched for a solution. Albert Levy (2012) stipulates that three revolutions in medical sciences: *Pasteur (1885), Freud (1900) and environmental revolution (1987)* directly influenced the urban planning [5]. Can we expect the fourth COVID-19 revolution? The time will show.

1.1. The garden suburbs of XIX century

The Pasteur revolution (1885) in medical science might have impacted Ebenezer Howard (1850-1928) and Patric Geddes (1854-1932). At the end of the 19th century, they noticed that the traditional model of city surrounded by medieval fortifications was obsolete. Ebenezer Howard proposed a "gentle" revolution based on spatial separation of work and living [6]. He invented a method of urban planning in which small neighbourhoods were surrounded by greenbelts. Howard assumed that the garden city was the practical solution and alternative to the traditional city. The advantages were: possibility of contact with nature in the city and separation of pedestrians and vehicle traffic. From the very beginning he created a vision of sustainable city, without environmental pollution resulting from chaotic urbanization. Howard's ideas were further developed by Patrick Geddes. He created a vision of parks with museums, libraries, universities and other public facilities built inside [7]. Unfortunately, Ebenezer Howard's ideas were the origin of modern separation of functions. Howard created the foundations for social planning and social housing on one side, but also for modern zoning on the other.

Ebenezer Howard's ideas were quickly put into practice in the designs of new neighbourhoods in England – Hampstead Garden Suburbs, Letchworth and Welwyn.

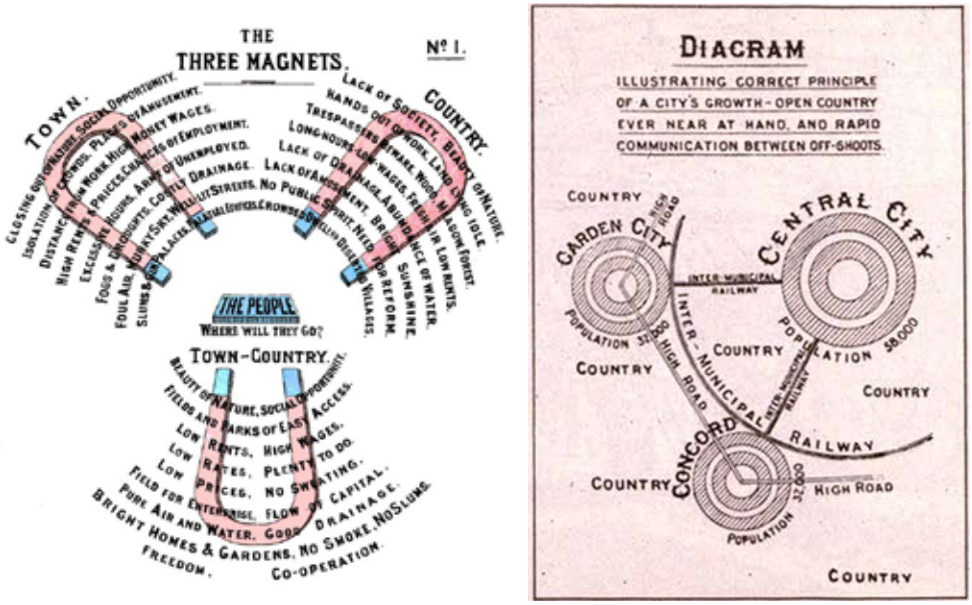

Fig. 1 & 2. The scheme of garden suburbs, *Source:* [6]

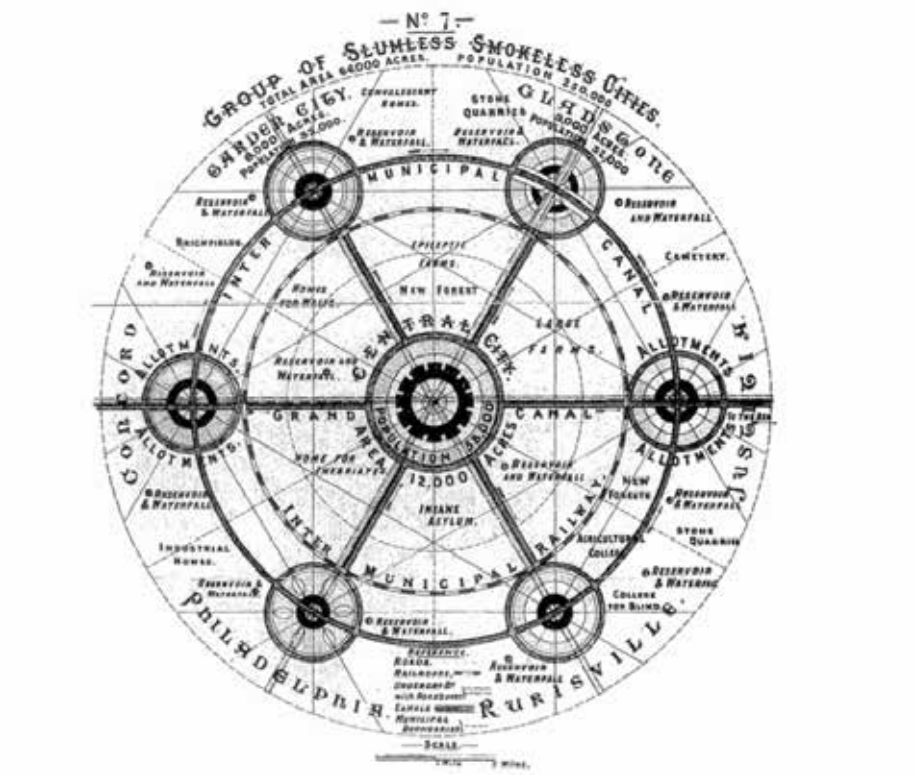

Fig. 3. The scheme of garden suburbs net, *Source:* [6]

1.2. XX Century neighbourhood

In 1929, Clarence Arthur Perry presented the concept of neighbourhood unit for about 5,000 residents, where all basic facilities – school, church, shops – were located within walking distance from homes. The centre of the housing estate, where the services were to be located, was to become a centre of social life that would integrate residents. The concept of providing a full functional program in the centre of the district within the range of pedestrian path is one of the foundations of sustainable eco-neighbourhoods today.

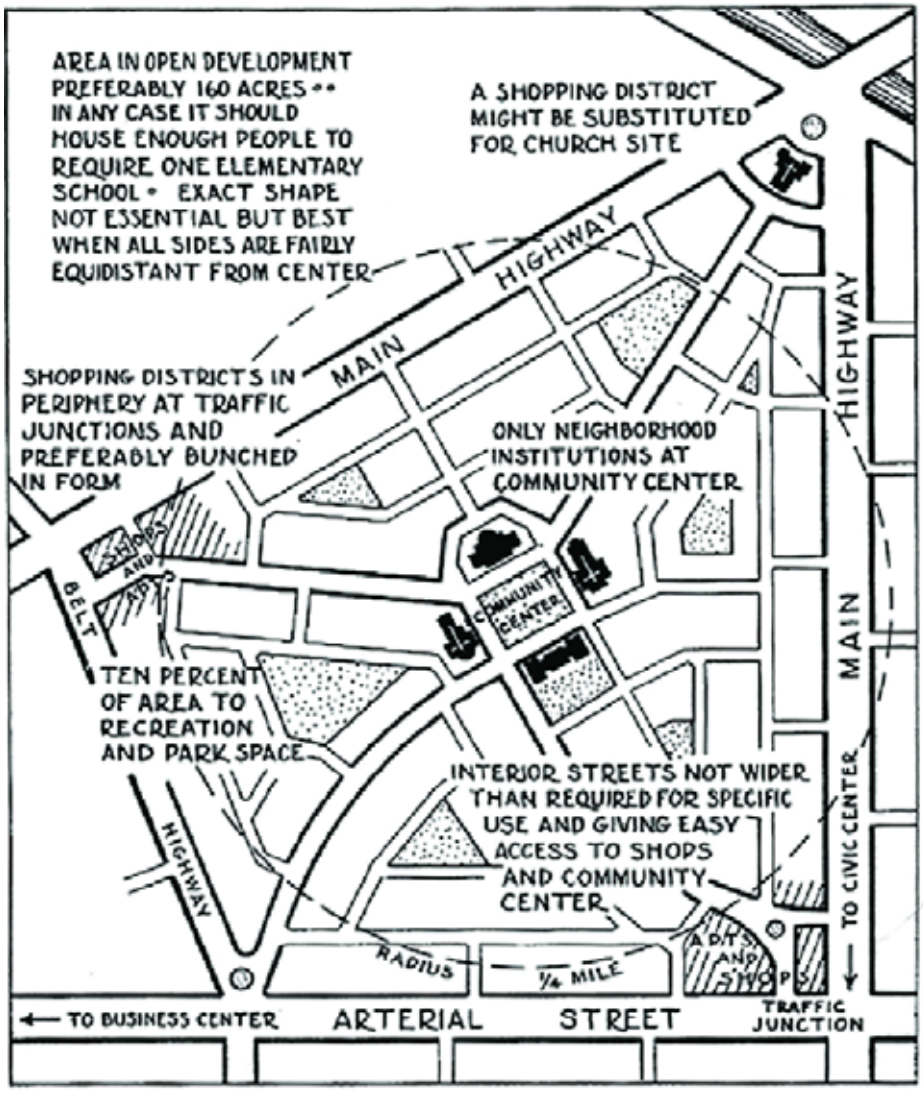

Fig. 4. Clarence Perry, Neighbourhood unit scheme, *Source:* [8]

Architects Clarence Stein and Henry Wright, inspired by the success of Letchworth and Welwyn in England, designed the city of Radburn in New Jersey. It was supposed to be a safe

haven for children, because the pedestrian and vehicular traffic were separated. Architects proposed a new type of garden city adapted to car traffic. Traditional building quarters were replaced by superblocks, with an area of about 23 ha, off the main roads. Inside of the superblock there were the cul-de-sac – one way streets. The separation of pedestrian and vehicular traffic used in Radburn has become a popularly used way to ensure safe communication for pedestrians.

However, this solution also created some inconveniences. The problem of superblocks is the lack of an alternative access road to homes if the main access road is closed for any reason (accident, etc.). This urban solution has an impact on the increased formation of traffic jams during peak hours. Today, other ways to diminish the traffic are applied.

Fig. 5 & 6. Radburn masterplan and cul-de-sac concept, *Source:* [9]

1.3. Le Corbusier ultimate goal

In 1933, the International Congress of Modern Architecture CIAM was organized. One of the leading figures at the CIAM congress was Charles Éduard Jeanneret – Le Corbusier (1887-1965). Le Corbusier proposed a complete departure from the traditional form of urban fabric. He proposed loosely arranged towers containing apartments, offices and accompanying functions instead of traditional quarters of buildings that make up the streets. He presented the Voisin de Paris plan, where he planned to demolish the historic buildings and replace them with office towers and lower service buildings. He also presented his plan for the suburbs – Ville radieuse. As he said, it was a new, vertical model of garden city . The ultimate goal of Le Corbusier was to provide daylight and fresh air to each apartment. He wanted to provide residents with views of greenery. Le Corbusier's ideas, and especially the departure from the forms of buildings that created the street, had a great impact on post-war urbanism. However, towers in open green space, which were built according to his visions, turned into unfriendly large suburbs.

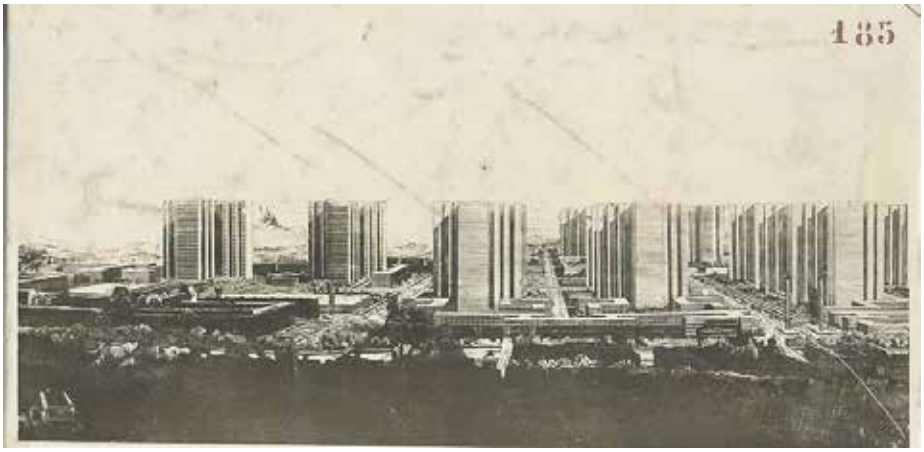

Fig. 7. The Plan Voisin for Paris redevelopment proposed by Le Corbusier *Source:* [10]

1.4. Sad story of modernist garden suburbs

The ideas of Le Corbusier opened the Pandora's box of modern large prefabricated housing districts. Typically, they were built very quickly using the industrialized methods on the outskirts of cities. Unfortunately, the inhabitants of those suburbs had to face numerous problems from the very beginning. Large scale of those districts totally excluded walkability. Many of those districts were totally deprived of services, leisure and sports facilities. Workplaces were located in other districts, thus, a lot of time was lost to commuting. The uniformity of buildings made it difficult to create mental maps. The public spaces were often neglected. There were no possibilities for creation of local identity. Sadly, more social problems accompanied modern suburbs. As a result, some of them had to be destroyed, for example Pruitt-Igoe neighbourhood in St. Louis, Missouri. Others, like the "Serpentine" public housing development in Pantin, France, needed urban regeneration. Modernist suburbs, zoning separation of functions and vehicle congested towns were a road to nowhere.

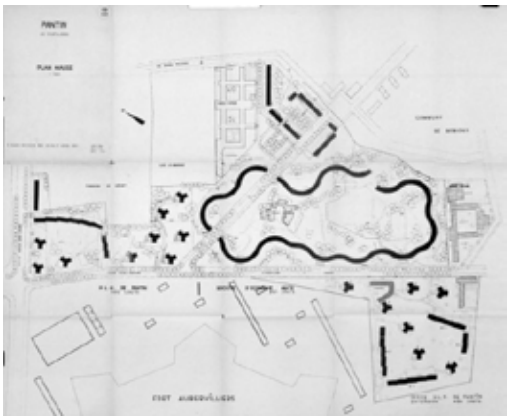

Fig. 8 (left). The "Serpentine" public housing development in Pantin, original masterplan, 1959, *Source:* [11]

Fig. 9 (right). The "Serpentine" public housing development in Pantin, urban regeneration project masterplan, 2006, *Source:* [12]

Another problem brought by modern district design was suburban sprawl, which consumed agricultural lands in the outskirts of the city, destroying ecosystems and landscape values.

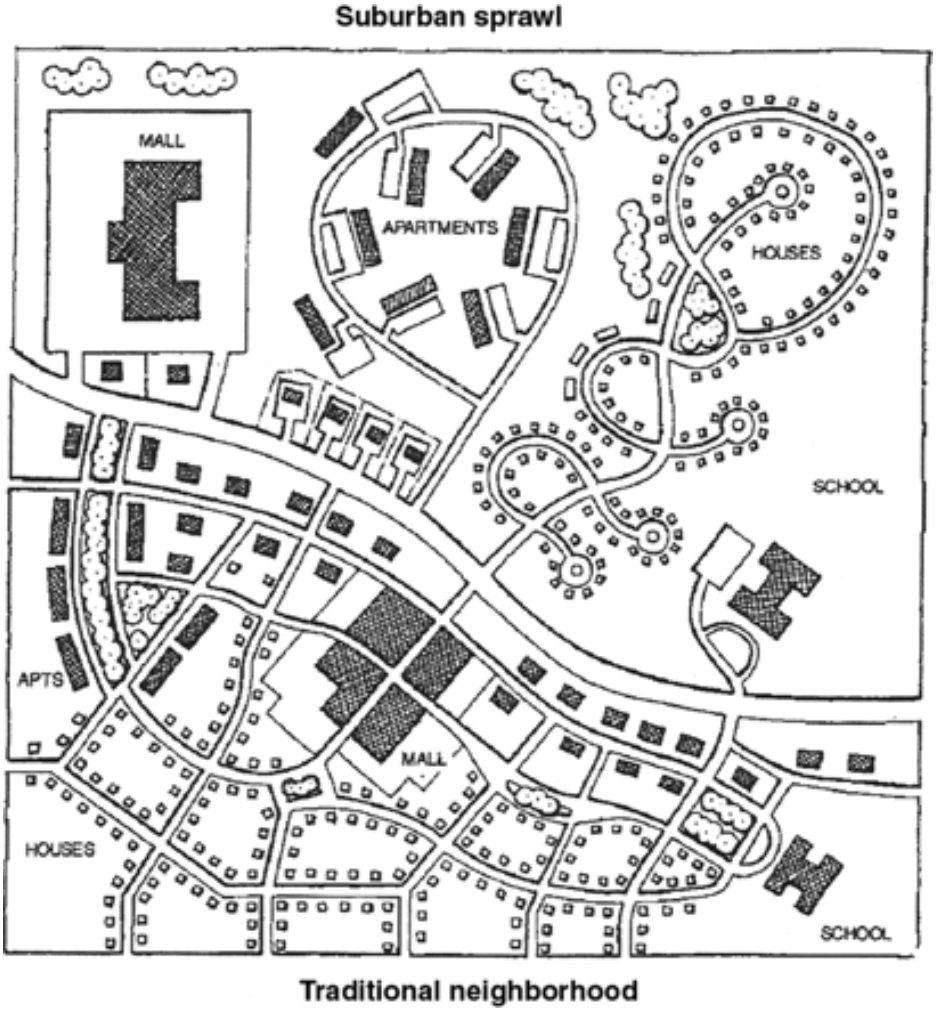

Fig. 10. Comparison of street networks and land use in sprawled (upper) and traditional (lower) neighbourhoods, *Source:* [13]

1.5. Green urbanism once again. Return to traditional city?

The sustainable development movement brought back interest in traditional urban forms. Yosef Rafeq Jabareen (2011) compared various typologies of urban tissue using following categories*: Density, Diversity, Mixed land use, High Compactness, Sustainable, Passive solar design, Greening and Ecological design* [14]. According to his opinion, the traditional urban form is the most sustainable. The international certificates, which assess the sustainability, for example EcoQuartier, HQE, BREAM, LEED Neighbourhood, etc. also stipulate traditional urban form. Typically, eco-neighbourhoods have larger quantity of green areas (about 1/3) and traditional urban layout with streets, facades and urban blocks [15]-[18]. Another impor-

tant factor, typical for traditional cities and pivotal for eco-neighbourhoods, is the functional diversity. It supports the economic viability by creating nearby workplaces.

Fig. 11. Model of l'écoquartier des Meuniers, Bessancourt, France, *Source:* [19]

There are new ideas about the green city and therapeutic landscapes. One of them is the biophilic city. This concept derives from biophilia – the natural innate bond each human has with other living creatures. The biophilic city is a city which facilitates effortless everyday contact with nature to all inhabitants. That concept of city planning requires easy access to urban parks.

The new vision for salutogenic city presents neighbourhoods designed like large urban parks with buildings submerged in greenery. It derives from the concepts of Patric Geddes (public buildings in the park) and Le Corbusier (towers in greenery).

The old urban tissue is regenerated with the so-called new generation of urban parks, which let greenery sprawl into surrounding streets. The numerous small urban pocket parks create dense grid of green and blue infrastructure. Once again the greenery within city borders praised by Ebenezer Howard, Patric Geddes, Frederic Law Olmsted [20] and the hygienist movement in Europe (represented in Poland by Henryk Jordan), is regaining importance.

Today, the positive influence of urban parks is linked to psychological and physical regeneration, promotion of physical activity and social contacts [21]. Public parks are designed to accommodate all those needs.

2. Purpose of the study. The universal pattern of design for health affirming urban places

The impact of built environment on human health can be explained by multiple factors. This study focuses on possibilities to mitigate the negative environmental impact using architectural features and improve the architectural and urban design. The research question was what health-promoting qualities of built environment can be created and influenced by human

actions. Firstly, the concept of therapeutic landscapes was studied, followed by health-promoting places and architectural features of salutogenic design.

2.1. Therapeutic landscapes and health promoting places nowadays

There are places and landscapes with established reputation for miraculous healing. Gesler [1, p. 96] defined *therapeutic landscapes* as places where *"physical and built environments, social conditions and human perceptions combine to produce an atmosphere which is conducive to healing."* Be that as it may, the perceptions of *therapeutic landscapes* might be individual and subjective. Spaces that are perceived as *therapeutic* by one person could be experienced as unsettling for another [22], [23]. The term *health-promoting places* is more extensive and refers to *everyday places that unite the qualities of therapeutic landscapes to influence people's physical, mental and spiritual healing.*

2.1.1. Method

First, a review of traditional literature was carried out in order to find features identified by researchers as contributing to human comfort and well-being. This search can be defined as a scoping study on a broad topic to summarize and disseminate research findings [24]. The strategy involved hand-searching reference lists, key journals, electronic databases and existing networks [25]. The timeframe was limited to the final date of 2020. There was no start date. It was assumed that any findings are valuable, regardless of the date of research. This study led to a comprehensive list of attributes of human-friendly and health-promoting public spaces. The successive systematic literature review was undertaken to narrow search results to *therapeutic landscapes.* This search was conducted in January 2020 using the terms "*therapeutic landscapes*", within three comprehensive electronic databases (EBSCO, Web of Science, Scopus). Additional manual searches were conducted to identify recent publications in this field of study (checking the contents tables of 'Health and Place', 'Landscape Journal', 'Social Science and Medicine', and 'Urban Greening and Forestry'). The term "*therapeutic landscapes*" was initially introduced by Gesler in 1992, therefore the search dates ranged from 1992 to January 2020. Search was narrowed to full-text scientific papers. This search returned 114 results. Study of SCOPUS with "therapeutic landscapes" 2011-2020 full text returned 155 results. Search through Web of Science returned 388 results.

2.1.2. Results

This study's objective was to establish a comprehensive list of common features of *therapeutic landscapes* which were mentioned in literature. Although the focus was primarily on the therapeutic landscapes and research identified via the scoping review, the wider bodies of literature were consulted. The methodology consisted of content analysis. The results are presented in Table 1.

Table 1. Results of the literature review. Attributes of health-promoting places. *Source:* Author

RESULTS OF LITERATURE REVIEW. ATTRIBUTES OF HEALTH-PROMOTING PLACES		
Material aspects – physical and built environment conducive to health-promotion		
1. Access to public park		
Distance to open public park	Physically close, visible and easily accessible.	[23], [26]
Pathways to park		[27], [28]
2. Functional program		
Psychological and physical regeneration		
Natural Landscapes	Forested land [34], [37] coastlines, woodland, and riverside environments [23].	[29]-[40]
Natural physical beauty	Magnificent scenery tranquillity, beauty and remoteness [41] natural physical beauty [42].	[23], [40]-[42]
Green open space	Savannah like prairies, open clearings in the woods.	[30], [32], [43]- 47]
*Presence of Wate*r	Preference of natural, meandering water banks covered with plants. Therapeutic value of water [42]. Presence of water (rivers, lakes and fountains) [37] Coastal environment [52].	[22], [23], [29]-[32], [35]-[37], [39], [40], [42], [44], [48]-[52]
Place to rest in the sun and in the shade	A clearing with lots of sunshine, a place open to the south	[48]-[50]
Place to rest in silence and solitude	Secluded garden. The pleasure garden, sense of enclosure. Places protected from the wind, direst sunshine embodied restoration sense of calmness and peace, peaceful, quiet place.	[23], [26]-[29], [38], [43], [45], [46], [48], [53]-[55]
Possibility to observe other people	Possibility to observe the others without being seen. Contact with surrounding life.	[26], [30], [46], [47]
Possibility to observe animals	Rich in species of birds. Contact with surrounding life, sights, sounds, and movements of certain types of wildlife.	[22], [23], [26], [37]
Physical Activity Promotion		
Sports and recreational infrastructure	Points of activity every 100m. Activity pockets. Attractive equipment. Equipment for various sports. Sports infrastructure (tennis, soccer field, baseball court, badminton, cycling path, etc.).	[46], [48], [53]
Attractive equipment for all age groups	Places for teenagers, children, adults, dog owners, etc.	[46], [49], [50]
Community gardens	Garden for hortitherapy. Communal gardening on allotment sites. Community gardening.	[3], [21], [23], [57]-[61]
Space for particular users	Creative play for children. Equipment for teenagers.	[36], [48]-[50], [62]

RESULTS OF LITERATURE REVIEW. ATTRIBUTES OF HEALTH-PROMOTING PLACES		
Material aspects – physical and built environment conducive to health-promotion		
Catering for basic needs		
Safety and security	*S*ecure to use without risking any physical unpleasantness.	[26], [32], [45], [63]
Places to sit and rest	Places to rest and meditate adjacent to the pathways with controlled microclimate thanks to plants, water and lighting. Easy to control– np. movable chairs, choice of places to sit – height, material of the bench, armrests, etc.	[48]-[50]
Shelter	Sheltered places to sit and rest. 'Refuge'– a place to hide from danger or threats.	[27], [28], [53], [55], [59]
Restrooms		[49], [50]
Drinking water		[49], [50]
Food	Stands with food.	[48]-[50]
3. Organization of space and functions		
Architectural variety of urban environment		
*Focal points and landmark*s	Landmark, Central point, Dominant point, etc.	[27]-[29], [35], [48], [53]
Structure of interiors and connections *Legibility*	Hierarchy of open spaces. Orientation and way finding.	[26], [31], [32], [43], [44], [46], [47]-[50], [64]-[67]
Pathways with views	Possibility to choose among many pathways, alternative way, accessible pathways; Continuous loops, paths to determined places. Pathways with interesting views. 'Prospect' – having an overall grand view of the landscape, with potential for discovering resources.	[27]-[29], [49], [50], [59], [65]
Invisible fragments of the scene (Vista engaging the imagination)	Vista engaging the imagination.	[30], [43], [44], [47]
Framed views		[48]-[50]
*Human scal*e	Distances small enough to determine human face expression and mimics, hear the human voice.	[29], [35], [48], [54], [68]
Optimal level of complexity	Legible elements of complex composition.	[33], [35], [43], [44], [47], [54]
Engaging features		
Controlled Risk/Peril	*S*ource of shimmering noise –e.g. fountain, instruments, etc., a mountain to climb on.	[47], [30],
Movement	Calm and slowly moving water,breaking waves, boats bobbing up and down, cyclical changes created by the tides, and moments of intensity created by patterns of light hitting the water.	[23], [30], [33]

RESULTS OF LITERATURE REVIEW. ATTRIBUTES OF HEALTH-PROMOTING PLACES		
Material aspects – physical and built environment conducive to health-promotion		
Sensory stimuli (Sight, Hearing, Smell, Touch, Taste and Spatial Orientation)	*Pleasurable* multisensory immersion. embodied relationships with specific scents.	[23], [27], [28], [30], [46]
4. Sustainability		
Biodiversity protection.	Rich in species; A room with various species of plants and animals, rich in flowers and fruits. Rich in habitat and exotic species. Rich in species of birds and animals.	[29], [32], [37], [45], [46], [69], [70]
Native animals	Fascination with nature. Habitat species.	[36], [45], [47], [48], [70]
Native plants	Natural succession of plants.	[29], [32], [37], [45], [47], [48], [70]
Attributes which promote social contacts		
Organization of events	Space for attractive events, meaningful activity, social life characterized by bonds of trust, reciprocity and cooperation.	[23], [46]
Gathering place for groups	Environment for being together. Place for integration of all age groups in open green space. Social opportunities.	[26], [37], [45]
Safety	*A* sense of security, inclusion, and belonging over time.	[23], [38]
Attributes related to human perceptions – spiritual and symbolic		
Placemaking	*S*trong positive sense of place, symbolic and cultural values; monuments, theatres, exposition pavilions, etc.	[22], [23], [38], [45], [69], [71]
Culture and connection to the past	Place with fascinating history. The use of paintings and statues. Community-based heritage conservation.	[23], [30], [37], [40], [45], [46], [71], [72]
Sacred places	Access to sacred places in open public green space, sacred pilgrimage sites, holy wells and springs, land of miraculous healing.	[2], [3], [22], [23], [27], [28], [42], [48], [73]
Personalization, participation of users		[26], [36]

2.1.3. Space characteristics linked to therapeutic qualities

The key review findings were summarized into material, social, spiritual and symbolic dimensions as initially referred to by Gesler to characterize therapeutic landscapes (1996, p.96). In the beginning, it was presumed that the *health-promoting places* unite the therapeutic attributes, but *therapeutic landscapes* are places of established reputation of well-known places of healing, thus the spiritual and symbolic aspects give them an additional advantage. The research evidence suggests that social capital is explicitly linked to well-being and fostering recovery [38], [74], [75]. The literature review suggested that the material aspects can construct *human-friendly public space*s, but the social conditions are needed to create *health-promoting places*, while the spiritual and symbolic aspects further define *therapeutic landscapes* (Fig. 12).

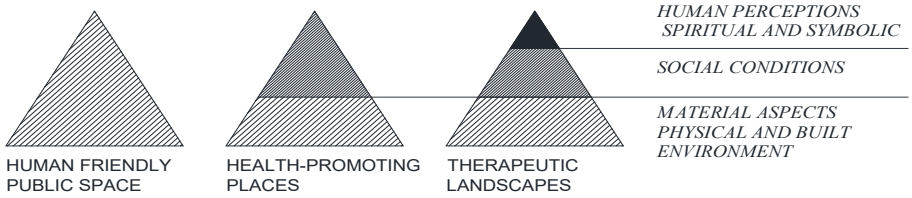

Fig. 12. Diagram showing the attributes directly related to therapeutic landscapes overlapping general qualities of human -friendly public space, *Source:* [76]

2.2. A universal pattern of design for health promoting urban landscapes

The studies of literature and field observations led to development of a conceptual framework presented in Table 2.

Table 2. A universal standard for health-promoting urban places. *Source:* Author, [76]

A UNIVERSAL STANDARD FOR HEALTH-PROMOTING URBAN PLACES.				
1. SUSTAINABILITY	2. ACCESSIBILITY	3. AMENITIES	4. DESIGN	5. PLACEMAKING
1.1. Place Area Location Surrounding urban pattern 1.2. Environmental characteristics Soil quality Water quality Air quality Noise level Forms of natural protection Green and Blue Infrastructure 1.3. Biodiversity protection Parts of open green space not available to visitors Native plants Native animals Natural maintenance methods 1.4. Sustainable water management Rainwater infiltration Irrigation with non-potable water 1.5. Parks of Second (New) Generation 1.6. Urban metabolism 1.7. Ecological energy sources	2.1. Distance to park 2.2. Sidewalk Infrastructure- Width of sidewalk Evenness of surface Lack of obstructions Slope Sufficient drainage 2.3. General conditions of walkways Maintenance Overall aesthetics Street art Sufficient seating Perceived safety Buffering from traffic Street activities Vacant lots 2.4. Traffic Speed Volume Number and safety of crossings Stop signs On-street parking 2.5. User Experience Air quality Noise level Sufficient lighting Sunshine and shade Visibility of nearby building 2.6. Public transport stops 2.7. Sufficient Parking	3.1. Psychological and physical regeneration Natural Landscapes Green open space Presence of water Places to rest in the sun shade Places to rest in quiet and solitude 3.2. Promotion of Physical Activities Sports and recreational infrastructure Community gardens Addressing the needs of people with disabilities 3.3. Catering for basic needs Safety and security (presence of guards, cleanliness, maintenance, etc.) Places to sit and rest Shelter Restrooms Drinking water Food (possibility to buy food in the park or in the closest vicinities)	4.1. Architectural design Human scale Focal points and landmarks Structure of interior connections Framed views Long vistas (Extent) Pathways with views Invisible parts of the scenery (Vistas which engage the imagination) Possibility to watch other people Possibility to see wildlife 4.2. Salutogenic design Optimal levels of complexity Engaging features Risk Mystery/Fascination Movement 4.3. Sensory stimuli design Sensory stimuli: Sight Sensory stimuli: Hearing Sensory stimuli: Smell Sensory stimuli: Touch Sensory stimuli: Taste Sensory path	5.1. Enhancement of Social Contacts Organization of events Meeting places for groups 5.2. Human perception -spiritual & symbolic Sacred places Works of Art Monuments Culture and connections to the past Thematic gardens Personalization

The field study focused on attempts to create health-promoting places in modern eco-neighbourhoods. Eco-neighborhoods were chosen because they are to promote a healthy lifestyle for both people and our planet. They are funded on principles of environmental, ecological, and social responsibility. Site observation of modern sustainable neighbourhoods in Europe confirmed that majority of attributes of health promoting places are present in their design.

2.3. Material aspects – physical and built environment conducive to health-promotion

2.3.1. Accessibility

Eco-neighbourhoods have a larger proportion of natural open spaces comparing to traditional urban tissue – approximately one third of their urbanized surface. Usually, they are designed with centrally located urban park.

• *Walking distance to points of interest*

The frequency of walking was found to depend upon the distance to a local points of interest. A Danish study showed that respondents living closer than 300 meters to open green space are more likely to be physically active and less likely to be stressed than those living further away from parks [56], [57]. Researchers confirm the importance of attractive walkways [27], [28], [77]. Eco-neighbourhoods are designed as multi-functional neighbourhoods, where all the basic everyday needs could be fulfilled within walking distance. Eco-neighbourhoods propose a multifunctional dense urban tissue that promotes walkability.

2.3.2. Amenities

• *Psychological and physical regeneration*

Health promoting landscapes are often associated with places to rest in silence and solitude away from the noise and the hassle of everyday struggles [45], [46], [66]. The majority of eco-neighbourhoods are designed with a centrally located public park i.e. Hammarby Sjöstad in Stockholm, ZAC Clichy-Batignolles in Paris, ZAC Trapeze Boulogne-Billancourt, etc.

• *Window view of greenery*

In the eco-neighbourhoods visited, it was assumed that each apartment should have at least one window overlooking the greenery (Fig. 13).

Fig. 13. Public space with tree planters. ZAC Trapeze, Boulogne-Billancourt, France, *Source:* Author

• *Promotion of physical activity*

Careful design of public open green space can promote moderate to vigorous physical activity. Physical activity is directly linked to health promotion, well-being and longevity [77], [78] (Fig. 14).

Fig. 14. Sport field. Gdynia-Zachód, Poland, *Source:* Author

2.2.3. Design

• *Architectural variety*

The field study of modern sustainable neighbourhoods in Europe demonstrated the creation of architectural variety. Each of the building blocks or even individual buildings were designed by a different architect in accordance with specific requirements stipulated by the general masterplan: not only the building dimensions and setbacks but also choice of materials, textures, and colours (Fig. 15).

Fig. 15. Modern courtyard with visible architectural diversity and sustainable planting design. Gdańsk, Poland, *Source:* Author

• *The physical beauty of the environment*

Contact with natural physical beauty is believed to be a salutogenic experience. Magnificent scenery is associated with the therapeutic landscape. The therapeutic landscapes of well-established reputation e.g. Lourdes in France or St. Anne de Beaupre in Quebec, Canada, or Epidaurus in Greece – unite the natural physical beauty of the landscape with sacred and symbolic qualities.

• *Legibility*

Eco- neighbourhoods are structured in a coherent pattern. Our brain needs a certain hierarchy of open spaces, landmarks and central points, etc. to construct mental maps, facilitate orientation and wayfinding. The urban form of eco-neighbourhoods is quite traditional [17].

• *Optimal level of complexity*

If we look at the successful modern neighbourhoods, we can recognise patterns of complexity of construction elements, symmetry and repetitious rhythms. Human mind needs a certain level of complex composition, orderly frames and intricate details to stimulate our brains.

• *Attributes which promote social contacts*

One of the key elements of health promotion is to facilitate the social contacts. Even superficial contacts, like saying hello to a stranger or sharing a bench, can have a beneficial influence on human health [79]-[86]. That factor is especially important for the potentially isolated and disadvantaged social groups (elderly, disabled, etc.) The therapeutic properties of a landscape depend on the social context of the place [2].

• *Attributes related to human perceptions – spiritual and symbolic*

Many researchers documented the spiritual meaning of healing and the positive relationship between spiritual activity and good health and well-being [27], [28], [42], [48]. Modern planning with randomly scattered large blocks of flats deprived people of details. Today, we can observe how the urban regeneration projects are working towards implementing architectural variety of details once again. Building facades and openings are getting decorated by more or less intricate individualized ornaments to help create architectural diversity and individual qualities of urban places. The biophilic city, like the traditional city, is full of details, materials and scents, which facilitates the creation of mental maps.

• *Integrating health in urban and territorial planning: A sourcebook*

A new sourcebook by UN-Habitat was published in 2020 during the COVID-19 pandemic. It can be regarded as a sourcebook resulting from Health in all policies paradigm, putting forward the objective of sustainable development and promotion of human health. UN emphasize the need to put human health in the centre of urban and territorial planning. This work is divided into nine chapters. One of the chapters is dedicated to health impact assessment as one of the methods for environmental justice protection. The sourcebook starts with words "*the way we plan and build our cities defines our quality of life*" [87]. Today, it defines our health even more than before.

3. Conclusions

The history of urban design seems to be a revolving theme. After almost a century of modernist designed suburbs, the new approach returns to traditional urban forms. Nonetheless, there are new imperatives e.g. the presence of open green spaces, daylighting and affordance of views of greenery, which make the difference between the ninetieth century urban blocks

and the eco-neighbourhoods of today. The sustainability and new concepts of biophilic cities and health-affirming urban landscapes are novelty in contemporary urban planning.

Urban health-affirming landscapes are everyday places which unite the qualities of therapeutic landscapes to promote physical, mental and spiritual healing [88]. The concept of therapeutic landscapes stipulates not only environmental, but also social factors. A psychological grid of social contacts and connection with the place of living are important therapeutic factors.

Therefore, modern planning of a healthy city is more oriented towards developing processes of town growth, not only on designing the structures [89]. The participation of inhabitants is crucial to create place identity and bonds with place of living. We might see that it is a revolving theme because, from the ancient times, the city dwellers were actively developing their own houses and often they were taking part in local municipal governments. The large scale modernist urban planning lost that dimension which triggered negative effects. Today, we are trying to rebuild that connection.

This study resulted in the development of the conceptual framework that can be consolidated into the universal standards for health-promoting places. The evaluation tool could help designers to fully include the research evidence in modern eco-neighbourhoods. It could also be helpful in creating a strategy for urban regeneration projects. The identified limitation of use of this tool for assessment comes directly from the subjectivity of individual perception. While the majority of therapeutic attributes can be assessed objectively, some are subjective. Therefore, the universal pattern should not be used as a tool for statistical comparison of therapeutic values of different parks, but rather as an assessment one.

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