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REVITALIZATION PROCESS BASED ON BIONIC ARCHITECTURE AND LIGHT

PROCES REWITALIZACJI BAZUJĄCY NA ARCHITEKTURZE BIONICZNEJ I ŚWIETLE

Abstract

One of the most important trends in contemporary design becomes bionics, also called biomimicry. Its role is adapting principles of living organisms' operation in technical systems. Though bionics is mostly known in design of rather small objects, it is getting very popular also in architecture. The deep impact of this new science is visible in urban planning, since the architects are trying to solve problems of contemporary world such as: increasing energy consumption with simultaneous deficit of natural resources, natural environment pollution caused by human activity, lack of food and drinking water, lack of dwellings for refugees and natural disaster victims, finally the design, production and export costs reduction of material goods indispensable for further development. Simultaneously, future public spaces development will be restricted by development of modern installation systems, i.e. illumination – both natural (sunlight) and artificial (electric light). Its growing role is visible considering the tendencies and trends in external illumination, especially based on LED technology, one of the most dynamically developing domains of artificial illumination. In this paper authors present the contemporary bionic-based processes of cities' revitalization, and define the problems that occur in urban planning through the examinations and analysis of bionic architecture and its illumination.

Keywords: revitalization process, bionic architecture, light architecture

Streszczenie

Jednym z najbardziej popularnych trendów we współczesnym projektowaniu staje się bionika, zwana także biomimikrą. Polega ona na adaptowaniu zasad rządzących światem żywych organizmów do systemów technicznych. Mimo że bionika jest szczególnie popularna w projektowaniu niewielkich obiektów, zyskuje na znaczeniu także w architekturze. Szczególny wpływ tej nowej gałęzi nauki jest widoczny w urbanistyce, w której architekci starają się rozwiązywać problemy współczesnego świata, takie jak: wzrastające zużycie energii z równoczesnym deficytem zasobów naturalnych, skażenie środowiska naturalnego spowodowane ludzką aktywnością, niedobór żywności i wody pitnej, niedobór mieszkań dla uchodźców i ofiar katastrof naturalnych i w końcu redukcja kosztów wytwarzania, projektowania i transportu dóbr materialnych niezbędnych dla przyszłego rozwoju. Równocześnie przyszłe przeobrażenia przestrzeni publicznych będą wspomagane przez rozwój nowoczesnych systemów instalacyjnych, np. oświetlenia, zarówno naturalnego (światło słoneczne), jak i sztucznego (światło elektryczne). Jego rosnące znaczenie można zaobserwować, badając trendy i tendencje rozwoju oświetlenia zewnętrznego, zwłaszcza bazującego na technologii LED, jednej z najbardziej postępowych gałęzi oświetlenia sztucznego. W artykule autorzy prezentują współczesne procesy rewitalizacji miast bazujące na systemach bionicznych, oraz definiują problemy, które występują w urbanistyce, poprzez badania i analizy architektury bionicznej i jej oświetlenia.

Słowa kluczowe: proces rewitalizacji, architektura bioniczna, architektura światła

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1. Introduction

One of the most important trends in contemporary design becomes bionics, also called biomimicry (gr. bios – life and mimesis – to imitate). Its role is adapting principles of living organisms' operation in technical systems. Though bionics is mostly known in design of rather small objects (hook-and-loop shoe fastener inspired by the hooks of burdock, or Mercedes Biome – a car that own its own DNA code, that could be cultivated like a plant), it is getting very popular also in architecture. Moreover, the bionics it is expected to play bigger role in shaping public spaces, as the human ecological consciousness grows. The deep impact of this new science would be visible in urban planning, since the architects are trying to solve problems of contemporary world such as: increasing energy consumption with simultaneous deficit of natural resources, natural environment pollution caused by human activity, lack of food and drinking water, lack of dwellings for refugees and natural disaster victims, finally the design, production and export costs reduction of material goods indispensable for further development.

Simultaneously, future public spaces development will be restricted by development of modern installation systems, i.ex. illumination – both natural (sunlight) and artificial (electric light). Its growing role is visible considering the tendencies and trends in external illumination, especially based on LED technology – the revolution in lightning – one of the most dynamically developing domains of artificial illumination. The basic idea of bionic architecture is to use modern, eco-friendly and organic systems, and that's why their development must be parallel and synchronous.

In this elaboration authors will take a look at the contemporary bionic-based processes of cities' revitalization, and will try to define the problems that occur in urban planning through the examinations and analysis of bionic architecture and its illumination.

2. Bionics and light in revitalization process

The form of bionic architecture – for sake of its organic genesis as well as problems it is suppose to solve – has usually a huge impact on traditional spaces it is located in. However considering such projects one could gain an impression, that the

urban context is usually treated superficially, and it loses its role for modern technologies. The question appears whether the architects that try to solve problems do not forget about the right space quality, they create. What is the impact on a human as its main user? Can the attempt of solving problems be an excuse for subordinating the space to single buildings, as it happens often right now? Finally, what are the connotations of bionic architecture and light? Authors are looking for answers to above stated questions, through the examinations and analysis of revitalization processes based on bionic architecture and its illumination.

In August 2008 eyes of the world were focused on Beijing and the opening ceremony of the Games of the XXIX Olympiads. People all over the world were astonished by the amazing sport arenas being built. Two of these buildings were especially interesting because of their extraordinary shapes: Beijing National Stadium, and National Aquatics Center. The first one – colloquially known as Bird's Nest was in fact inspired by original Chinese ceramics. This giant object with capacity of 80,000 visitors was designed by Swiss architects Herzog & DeMeuron and brings attention through form created with a steel frame combined together in seemingly chaotic way. However unique, organic form, created with an untypical detail sets new directions in future stadiums' design.

At least as extraordinary as National Stadium was the new Beijing National Aquatics Center which form was inspired by the natural foam formation called the Weaire–Phelan structure. This initial form of the shapeless foam was then cut into cuboid shape which was more symbolic to Chinese culture. The structure designed by Australian architecture company PTW Architects was finally build with a steel frame with 4000 ETFE membrane pillows in between. The ready form is even more breath-taking during night-time, while it is illuminated with a blue floodlights.

The advantages of modern Beijing Olympic architecture in relation to its technical advancement and visionariness that became a reality must be appreciated. However the appearance of these buildings had also its darker side. Few years before opening ceremony, newspapers were full of terrifying news that thousands of Beijing's traditional courtyard houses have been demolished to make place for new sport arenas. It is estimated that approximately 1,5 million inhabitants were forced to leave their homes before Olympic Games. The

question appears, what are the borders of pursuit for success, and is such architecture still a bionic one? This question is even more important watching the new, impressive buildings that have been built for a few last years in United Arabs Emirates, or Qatar for a price of thousands low-paid Pakistani and Indian workers'. The example of Beijing also shows that it is very dangerous to overestimate the capacity of sport facility, just to reach the impressive forms, because it is hard to find the next event similar in relation to number of visitors as Olympic Games.

As visionary as Beijing's one, but a little bit less controversial is the bionic architecture of Belgian Vincent Callebaut. In 2003 he was asked to design the new Leisure Centre in Busan, South Korea. The lack of such a function in old city districts had an influence on quality of life in the city, its development, and its inhabitants. He quickly realized that creating the large volume objects in specified location could cause damages to existing historical landscape. The inspiration came from the coral reef, which shape and underwater location allowed Callebaut to hide all large scale objects under sea level. Moreover, using the solar energy collectors consisted of thousands photovoltaic cells allowed to collect the energy for night life of the center, as well as to create a new landscape element, that imitates the real atoll through its appearance and the way of operating. During night time it creates fluid lines that seem to illuminate the ocean like luminescent organisms that settled on the surface of coral reef. It is a good example of innovative and energy saving idea implementation to contemporary design as well as indication for bionic architecture design together with its illumination. This example could be in principle an inspiration for creation of new trend for the architectural objects to gain the energy needed for their operation.

In totally different direction – considering spatial role of bionic architecture – went previously mentioned Vincent Callebaut – in his 2004 project for 8 Lighthouses of Light Rail Transit in Port Louis, Mauritius. He proposed a ring of trestle bridge for a railway that surrounds the whole city with 8 lighthouses disposed uniformly that contain railway stations in the ground floor.

Mauritius towers – as opposed to “hidden” architecture of artificial coral reef in Busan, S. Korea – dominate the space resolutely. They seem to scream of their brightness. On one hand it allows to quickly locate the railway station which makes the public transport a privileged one (towers contain

multistorey car parks that allows to minimize the car traffic in the city center). On the other hand it subordinates the landscape with identical and spacially neutral objects. With this project the city would probably extend its prestige, after investments in ecological architecture with a modern, organic shape inspired by the plant's stalk. It would also gain a new symbol, seen from the seaside like a real lighthouse. However the spatial role of this project is not so unequivocally positive. 8 identical light towers disposed on the plan of circle could also bring some deterioration in human spatial attitude and after few years – a formal fatigue. Moreover, there is a real threat of blinding glare effect from different directions, which is unacceptable in such an advanced project. Usage of trestle bridge is also connected with some risk. It provides the city and communication development, but it could cause a worsening of life condition in the neighbouring areas and create the runaway spaces under the bridge. Similar conclusions were made by architects from Diller Scofidio + Renfro that proposed – in cooperation with James Corner Operations – substitution of existing railway trestle bridge in New York with a green area dedicated for pedestrian users only (The High Line Project). 2 500 meters long object was redesigned to keep the original architectural form, with simultaneous substitution of degenerated space with a human friendly one. The bridge became a veritable green island in the city landscape.

The idea of lighting towers was also proposed by Vincent Callebaut – but in a different way – in 2004 in Beirut, Lebanon. The architect created the Time Axis that crosses the old, seaside districts of the city and leads toward the sea. Walking this long path, visitors have an opportunity to consider the history of this extraordinary city and draw the conclusions for future. The Time Axis is filled up with 12 towers made of light that point out the most important archeological sites of Beirut. Such a use of light towers seems to be much better for a landscape and society than similar ones in Port Louis, Mauritius. The received forms are less importunate, and more volatile, heavily connected to the place through the historical conditions. In consequence the interesting element of the landscape becomes a connector, that referring to the past, orders the look into future with hope – future without the war, with no occupation, future compatible with the nature, portrayed by the lead towards the sea. The lighting used to build the towers becomes a marker of time,

as well as changing political, economical and social agreements. It plays its unique role connecting water and ground, past and future, history and culture with a modern civilization and progress.

It is worth to touch one more problem. The inspiration taken from living organisms causes often the limitation of form's spatial impact. It is especially observed in landscapes not transformed, or slightly transformed by human. However the bionic architecture concerns often densely built areas. In these places we could usually observe intensified problems of contemporary world. Putting it together with 'concrete jungle' as we often call cities, these forms could contrast to much. On one hand it is hard to negate the idea of green city, opened to everybody. On the other hand the fears relating to huge costs appear, as well as possibility of transforming the space into enclosed, separated with water area, accesible for rich people only.

3. Conclusions

As it was pointed out in above elaboration, the bionic architecture provides brand new possibilities in revitalization process. In theory it should result in introducing more natural solutions in landscape planning, replacing degenerated forms with human friendly ones. Such architecture should take care of its own energetic needs, what could partly solve some problems of contemporary world. It could then compete with conservative vision of usable architecture design and its illumination. In practice some problems connected to people's habits could occur, what could cause the preferential treatment of traditional architecture. Secondly the bionic architecture is, in a way an example of global architecture that hardly could be combined with specific spaces. It is caused by the fact that bionic architecture doesn't usually refer to local conditions, but is the result of inspirations from fauna and flora – sometimes having nothing to do with the building area. Other important aspect of bionic architecture is a scale of designed objects. Smaller ones are usually neutral to the space, but these are the high volume objects that require the huge skills in spatial planning. The answer to the question – can the attempt of solving problems be an excuse for subordinating space to single buildings – could not be positive. The architecture is the science of shaping the space. For this space architects are fully responsible. Simultaneously they are

responsible for people present in these spaces, and their decisions could impact their behaviour, their mood and even their health. If these aspects will be considered during design process, surely very valuable objects would appear. Then, such objects would have a possibility to solve the global problems of mankind and could bring changes into the life of local communities.

Unequivocal valuation of contemporary solutions in artificial lighting relating to bionic architecture is not easy. On one hand we can observe modern, energy saving, and technically sophisticated solutions, on the other hand there is a lack of studies on electric lighting in bionic architecture. That's why no regulations, standards and rules that relates to that problem are in force right now. Moreover, there is a need for examine this phenomenon just to be sure that the good architecture is never refused.

In authors' opinion, the process of urbanization and commercialization of contemporary cities based on bionic architecture and artificial lighting is complicated, but worth to be examined deeper. This innovative tendency is right now in the basic stadium of development and that's why not investigated properly.

To recapitulate, the spatial role of bionic architecture and light could be observed in presented projects. The meaning of smart, energy saving and self-sufficient architectural forms will definetelly grow up. However examples presented in this elaboration can be treated as a beginning of further discussion only.

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