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Biophilic Approach in Forming the Landscape Design of Urban Coastal Parks (on the Example of China)

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Abstract. *The aim of the article is to study peculiarities of implementing a biophilic approach in the formation of the landscape design of urban coastal parks in China, as well as to identify key tools that determine features of their artistic and spatial solution. Results.* The analysis of design solutions of modern Chinese urban coastal parks (Changsha Riverside Park, Shenzhen Bao'an Waterfront Cultural Park and Xinghe Mingzhu Bay Park) demonstrates a holistic and multifaceted implementation of biophilic design principles in the landscape environment. It is found out that design based on a biophilic approach grounds on the close interaction of a newly created environment with natural forms, structures and processes. Such an approach involves the formation of images that interpret nature but not reproduce it literally, which contributes to the emergence of emotional connections between a human and space, reducing stress and improving the environment quality. In coastal parks, where the natural landscape and water spaces are an important element of the project object, the appliance of biophilic means ensures not only the preservation of unique ecosystems, but also the disclosure of their potential for organising a certain public space. *The scientific novelty* lies in generalising and systematising means of implementing biophilic design in coastal landscape conditions. This study comprehensively characterises the specifics of form creation, emphasises topographical adaptation as a factor of spatial organisation and substantiates the role of visual-associative and material expressiveness as means of forming a biophilic environment. The obtained results expand the understanding of biophilic design as an interdisciplinary category of architecture, design and landscape projecting. *Conclusions.* The conducted analysis confirms that the biophilic approach in projecting the coastal parks in China is implemented via a set of means aimed at interpreting natural forms, adapting to topography, integrating landscaping, using natural materials and local images. Such a design forms harmonious interconnections between a human and natural environment, improves the ecological quality of the space and defines new guidelines for the sustainable development of urban landscapes.

Keywords: biophilic design; landscape; park; environment; form creation

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Introduction

Modern urban processes are accompanied by the intensive use of coastal areas, which causes increasing pressure on the natural environment. At the same time, there is a growing necessity in creating high-quality recreational spaces that not only satisfy the functional needs of citizens, but also ensure the ecological sustainability of territories. In such a context, the usage of a biophilic approach in architectural and design form creation, as a means of harmonising the interaction between a human and nature within the urban environment, is of particular relevance.

Biophilic design is based on deep connections of architecture with natural forms, structures and processes. This approach involves the creation of images that interpret, rather than copy, nature, contributing to grounding an emotional connection between a human and a place, reducing stress and improving the quality of the environment. In coastal parks, where the natural landscape and water spaces are key elements of the spatial structure, the use of a biophilic approach allows not only for the preservation of unique ecosystems but also for the activation of their potential as the basis for the spatial and compositional organisation of public space.

The relevance of studying the means of biophilic form creation is also related to the need to find new approaches in design that take into account both the natural conditions of the territory and the socio-cultural context. The architectural and design language of objects integrated into the natural environment often appeals to archetypes, local images, and associative patterns inherent in a particular cultural context. In this regard, modern coastal parks of China are of particular research significance, and their architectural and design solutions demonstrate the application of a biophilic approach in practice. Coastal parks serve as a platform for testing such approaches, combining the values of ecological design, regional identity and visual integration of new objects into the natural environment. In China, rivers have not only important ecological, economic and social significance, but also act as a characteristic of cultural identity.

A significant number of parks on the embankments, which are formed both in places with an attractive natural environment and in adapted territories that were formerly industrial zones, provide extensive material for research. The research of such design practices, in particular through the example of the Chinese coastal parks, allows the identification of effective compositional techniques, adaptive forms, and strategies that contribute to the formation of a sustainable urban environment.

Recent Research and Publications Analysis. The lifestyle of modern people testifies to the significant influence of technical progress on its formation. However, alongside positive changes, the technical revolution has led to the emergence of a global ecological crisis, which has manifested itself in climate change, degradation of the natural environment, etc. The response to such challenges was the search for ways of bal-

anced development, the introduction of environmentally friendly technologies, and the awareness of the need to restore the connection between man and nature, which formed the basis of the concept of biophilic design. In such a context, understanding the role of the environment surrounding modern humans becomes particularly relevant. There is a certain orientation towards a biophilic approach, which involves taking into account natural factors in architectural and design planning. The term “biophilia”, which refers to a natural human desire to interact with living nature (Moss & Scheer, 2015), was introduced into scientific discourse by the American biologist Edward Wilson in 1984 in his book “Biophilia” (Wilson, 1984). The author described it as a basic human need to be connected to nature in everyday life. This approach emphasises the importance of creating architectural and design objects that imitate and reinterpret natural forms. Thus, biophilic buildings are able to form an emotional connection with a particular place (Browning et al., 2014; Wang, 2021).

Architectural solutions are aimed at deepening relationships between a human and natural environment, where architecture is not opposed to the environment but becomes a part of it. Scientific research in environmental psychology confirms that the environment in which a person is present every day has a significant impact on their perception and, consequently, on their behaviour (Bonnes et al., 2009; Kornilova, 2024). Modern research shows that biophilic design serves as a theoretical basis for interpreting nature in architecture (Zhong et al., 2022).

The concept of biophilia is based on the fact that humans have a biological need to connect with nature on physical, mental, and social levels. Such a connection impacts feelings of well-being, work productivity, and social relationships (Montes, 2009). The fundamental work in the field of biophilic design is the monograph “Biophilic Design: Theory, Science and Practice of Embodying Life in Buildings”. The authors provide theoretical foundations, scientific studies confirming the positive impact of nature on health, as well as practical recommendations for integrating natural elements into architecture and design. The source systematizes the principles of biophilic design, dividing them into direct (light, plants, water) and indirect (images of nature, natural materials, forms) experience (Kellert et al., 2008).

In the context of biophilic architectural and landscape design, local natural and cultural peculiarities of the environment play an important role in forming a sense of place (Dias, 2015). The ability of landscape design to influence the physiological and psychological state of people is an extension of the biophilic connection with nature (Hartig et al., 2003). The visual and figurative language of biophilic design does not involve direct imitation of natural forms but instead generates aesthetic structures that are inherently related to the natural environment. This interpretation allows objects to integrate organically into the surrounding landscape, defining a new quality of space based on the harmonious coexistence of the natural and the artificial.

The idea of “biophilic cities” is grounded by the American Researcher Timothy Beatley (2011), where nature is not just present, but deeply integrated into the urban environment. The author provides examples from different cities around the world, showing how green spaces, water bodies and wildlife can improve the quality of life, promote environmental sustainability and create healthier communities.

The advantage of the biophilic approach is its involvement in the processes of sustainable landscape development, which, through ecosystem services, allows for the

achievement of effects such as air and water purification and the improvement of the natural environment (Rinaman et al., 2013; Bondarenko et al., 2019).

Thus, currently, there is a lack of analytical works that would examine in detail the principles of biophilic design using the example of individual, well-known landscape objects.

Aim of the article

The aim of the article is to study the implementation of the biophilic approach and identify the leading techniques that determine the design of these landscapes, based on studied examples of urban coastal parks in China.

Main research material

Design strategies for interacting with the landscape are diverse. They include the use of a number of compositional techniques aimed at adapting the architectural object to the existing relief. In particular, this involves harmonising the object with the natural environment in terms of colour scheme, texture structure, materials, and visual characteristics. Under conditions of growing anthropogenic pressure, the beauty of the natural environment acquires special value, which highlights the importance of creating urban recreational spaces that not only coexist with natural landscapes but also enhance their aesthetic expressiveness.

A bright example of the use of biophilic forms in the creation of a park zone is the riverside park in the city of Changsha (2016), located on the west bank of the Xiang River. The recreational zone, 2.45 km long, creates an environment that combines recreation, commerce, cultural and ecological restoration. The design of the landscape environment offers creative solutions for activating the embankment and reveals the features of local culture through a variety of spaces organised for people to stay (*Changsha Riverside Park*, n.d.) (Fig. 1).

In the process of designing the Changsha Riverside Park, a complex of modern landscape and architectural approaches was applied, combining ecological design, biophilicity and regional identity. Among the leading design tools applied in the creation of the park space is the biomorphic formation of individual components. For example, the shapes of benches, the outlines of terraces and platforms have organic contours, similar to the shorelines, bends of the river and landforms. Such curves are not only aesthetic but also provide intuitive orientation in space and comfortable immersion in the natural environment. The design solution involves the use of natural motifs in grounding small architectural forms and art installations. The theme of aquatic plants, waves, shells, and wood texture is reflected in the design of benches, railings and lighting structures. Sculptural compositions inspired by local fauna and flora further support a biophilic perception of space.

The design solution of the park grounds on the use of the technique of designating transitions between functional zones (rest, observation, eco-education) by creating so-called “landscape thresholds” in the form of specific topographic accents, such as em-

bankments, concrete waves, earthen mounds and floating platforms. These elements do not form rigid boundaries and contribute to a sense of spatial openness. Another means is the gradation of levels and the plasticity of space, seen in the placement — in accordance with the natural slope and water level — of park components such as stairs, platforms, ramps and an amphitheatre. With the help of terracing, a smooth transition occurs from the urbanised city space to the natural coastal landscape.



Figure 1. Changsha Riverside Park (2017).

Source: (*Changsha Riverside Park*, n.d.)

An important aspect is the appliance of materials for newly created park forms that relate to the natural and historical environment. These include wood, natural stone, perforated concrete and gravel. The textured surfaces of such objects, often with natural or artificially aged finishes, integrate harmoniously into the natural environment and absorb visual noise. The usage of light and spatial effects in projecting the park environment is also an effective approach. Objects that provide the park with multi-functionality are designed with consideration of the play of light and shadow, using perforated structures, canopies and light-shadow elements. This enhances the expressiveness of the elements and creates a changing atmosphere throughout the whole day.

A tool directly related to using natural components is the integration of living vegetation with functional park equipment. For example, some elements (canopies, pergolas, bridges, etc.) are wrapped in vegetation or include vertical landscaping, which contributes to the integration of the built environment into the natural one. Thus, the use of biophilic design tools enables the boundaries between the artificially created elements of the park and the natural environment (water, terrain, humans) to be blurred, maintaining ecological balance and aesthetic expressiveness.

The design solution of the Shenzhen Bao'an Waterfront Cultural Park (Shenzhen) is also characterised by applying the biophilic approach to the design of the recreation-

al environment, which contributes to strengthening the connection between humans and the natural environment (SWA Group & Aube Conception, 2021). This primarily concerns the creation of forms based on nature-like outlines and is evident in the design of paths, platforms, terraces, and bridges, which have smooth, wavy contours. They resemble the curves of the coastline and sea waves, thus creating a natural rhythm of space. Additionally, the metal-rope sculpture installations are inspired by marine life (jellyfish, shells, etc.), which organically fit into the coastal context. The plastic white construction of the shadow pavilions, made of steel in the form of “jellyfish”, provides visual lightness, transmits light, and creates dynamism in visual perception through the play of light and shadow. The “jellyfish” installations and wavy terraces associatively refer to the ecosystem of the sea, focusing attention on the natural landscape form (Fig.2).



Figure 2. Shenzhen Bao'an Waterfront Cultural Park (Shenzhen) (2018-2020)

Source: (Bulut, 2021)

It is worth mentioning the compositional and functional system of the park's environment organisation and multi-level interaction with water. The promenade, observation bridges, and platforms allow visitors to interact with water in various ways: this occurs at different levels — from direct access to the water to spaces for relaxation and observation. Coastal fortifications made of stone and platforms create a gradual transition to the water, which corresponds to the principle of integration of the water-landscape environment. The design of the territory includes the integration of “sea basin” structures and channels for water filtration.

In the formation of the landscape environment, plants adapted to the coastal ecosystem were used: trees, shrubs, and coastal grasses, which form a multilayered compo-

sition. The sense of naturalness is supported by the use of materials with natural stone, gravel and wood in combination with rusty steel dominating.

Shenzhen Bao'an Waterfront Park is an example of the application of a biophilic approach to design, where organic forms, a material sense of nature, cultural symbolism, and waterscape create a multi-level, ecologically integrated space. This solution helps to establish a deep connection between visitors and the coastal environment and contributes to the sustainable development of coastal urban space.

An interesting example of the application of a systemic approach to biophilic design is Xinghe Mingzhu Bay Park (Puning) (Nair, 2024). The formation of the park components is characterised by a deep integration of natural motifs, ecological functions and modern landscape plasticity. The park space is organised with the consideration of water dynamics, smooth topography and metaphorical imagery. The park area includes soft relief variations that create micro-landscapes: hills, depressions and terraced steps. Terracing is applied as a compositional and engineering technique, allowing both coastal protection and the formation of recreational areas.

The compositional scheme of the park grounds on the curves of the coastline and the natural channel of the bay, which emphasises its organic character. Walking routes, a bike path, and a fitness activity zone are integrated into the natural relief. The planning scheme is based on using winding contours for pedestrian routes, platforms and terraces, which imitate natural channels and coastal bends. The shapes of bridges, observation decks, and pergolas are also plastic and rounded, without hard corners. Tiered zoning by relief enables interaction with water (during flooding) on the lower level, while the upper level is used as a recreational area. The park space is organised without rigid boundaries: "landscape bridges" connect the zones, and additional waterways create the effect of an "open" natural environment.

The park's design actively uses the contrast of colour planes. The bright colours of the orange bridges and the blue and green areas emphasise these functionally significant objects within the aquatic and plant environment, conveying figurative and symbolic meanings associated with local tradition. The combination of smooth surfaces and the natural textures of wood, concrete, and stone further creates multilayered visual depth. The ecological solution of the park grounds on the use of local plants and the formation of landscape buffers. Landscape "cleaning zones" serve as both decorative and ecological components: greenery filters water and supports biodiversity. The design solution of Xinghe Mingzhu Bay Park is built on a dialogue between a human, water and landscape, where the curvature, smoothness and adaptability of forms create a comfortable environment.

Conclusions

The analysis of modern urban coastal parks in China, in particular Changsha Riverside Park, Shenzhen Bao'an Waterfront Cultural Park and Xinghe Mingzhu Bay Park, demonstrates the holistic and multifaceted implementation of biophilic design in the landscape architecture. The biophilic approach application is evident not only in the choice of forms, materials or vegetation, but also in the structural and compositional

solution of space, which creates an emotionally comfortable and ecologically balanced environment for humans.

It is established that the implementation of the biophilic approach occurs through the following leading techniques:

- the creation of curvilinear contours of paths, terraces and platforms that imitate natural forms of relief, coastline and water flows;
- gradation of levels and adaptation to topography (terracing and vertical connections between the elements provide a smooth transition between the urban environment and the natural landscape);
- interpretation of natural motifs in small architectural forms and art installations, where aquatic plants, shells, fauna, etc., act as prototypes;
- integration of landscaping into the functional structures of the park (canopies, platforms, and pergolas that grow with vegetation and create a “living” environment);
- use of mostly natural materials with expressive textures that harmoniously fit into the natural environment;
- multi-level interaction with the aquatic environment (organisation of observation, recreation and direct contact areas with water, adapted to seasonal changes);
- visual imagery and colour that reflect local identity and create emotional immersion in space.

All these examples demonstrate that biophilic design in the Chinese context is not a decorative stylisation of nature, but functions as a full-fledged integrative method that combines architecture, ecology, culture and emotional perception. As a result, coastal parks are transformed into sustainable and aesthetically valuable spaces that ensure harmonious interaction between a humans and natural environment, contributing to a new quality of urban landscapes.

The scientific novelty grounds on the generalising and systematising methods for implementing biophilic design in the coastal landscape, in particular: the specifics of form creation are comprehensively characterised; the emphasis is placed on topographic adaptation as a factor of spatial organisation; the role of visual-associative and material expressiveness as means of forming a biophilic environment is grounded. This expands the idea of biophilic design as an interdisciplinary category of architecture, design and landscape design.

The topic of biophilic design is currently relevant and multifaceted. *Further research* on applying such an approach in landscape design may focus not only on studying and generalising design experience in parks located in other regions, but also in those with different typological characteristics.

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Conflict of interests

The authors declare that there is no conflict of interests.

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Біофільний підхід у формуванні ландшафтного дизайну міських прибережних парків (на прикладі Китаю)

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Анотація. *Мета статті* — дослідити особливості реалізації біофільного підходу у формуванні ландшафтного дизайну міських прибережних парків Китаю та визначити ключові засоби, що зумовлюють особливості їхнього художньо-просторового рішення. *Результати дослідження.* Аналіз дизайнерських рішень сучасних китайських міських прибережних парків (парку Чанша Ріверсайд, Культурного парку набережної Шеньчжень Баоань і парку затоки Сінхе Мінчжу) засвідчив цілісне та багатоаспектне впровадження принципів біофільного дизайну в ландшафтне середовище. З'ясовано, що проектування на основі біофільного підходу ґрунтується на тісній взаємодії новоствореного середовища з природними формами, структурами та процесами. Такий підхід передбачає формування образів, які інтерпретують природу, а не відтворюють її буквально, що сприяє виникненню емоційного зв'язку людини з простором, зменшенню стресу і покращенню якості середовища. У прибережних парках, де природний ландшафт і водні простори є важливими елементами об'єкта проектування, використання біофільних засобів забезпечує не лише збереження унікальних екосистем, але й розкриття їхнього потенціалу для організації публічного простору. *Наукова новизна* полягає в узагальненні та систематизації засобів реалізації біофільного дизайну в умовах прибережного ландшафту. У дослідженні комплексно схарактеризовано специфіку формотворення, акцентовано на топографічній адаптації як чиннику просторової організації, а також обґрунтовано роль візуально-асоціативної та матеріальної виразності як засобів формування біофільного середовища. Отримані результати розширюють уявлення про біофільний дизайн як міждисциплінарну категорію архітектури, дизайну та ландшафтного проектування. *Висновки.* Здійснений аналіз підтвердив, що біофільний підхід у проектуванні прибережних парків Китаю реалізується через комплекс засобів, спрямованих на інтерпретацію природних форм, адаптацію до топографії, інтеграцію озеленення, використання натуральних матеріалів і локальних образів. Такий дизайн формує гармонійний зв'язок між людиною та природним

середовищем, підвищує екологічну якість простору та визначає нові орієнтири для сталого розвитку міських ландшафтів.

Keywords: біофільний дизайн; ландшафт; парк; середовище; формоутворення

