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The Evolution of the Architectural Image of Floating Structures Through Mobility and Inflatability Themes

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Abstract
The aim of the study is to evaluate the latest developments in floating architecture examples and to show the importance of the themes of mobility and inflatability in the evolution of the architectural image related to floating structures in terms of future architectural products. The scope of the study includes studies of theoretical figures, including floating architecture examples and detailed theoretical explanations about these examples. The method of the study was determined as literature review. In this way, prominent examples and works are evaluated and compared. The original value of the study is important in terms of evaluating a niche subject such as floating structures with the subheading of "architectural image" in terms of two basic topics such as mobility and inflatability. The findings of the study include data that the floating structures image will become widespread enough to be used in all spatial functions in future architectural productions through mobility and inflatability. As a result, the evolution of the architectural image of floating structures through mobility and inflatability themes create a contemporary template for the future possibilities of housing, urban areas, healthcare and educational facilities, accommodation and related functions including the flexible combinations of floatable structures. All of these point to a future where, in near future scenarios, water will be used actively not only at water edges through floating structures, but also in daily life, in many cases where water is associated with crises and natural disasters, but these processes are prolonged. This contains clues that a production area that strengthens the architectural image of floating structures and carries it into the future will gradually spread to a wider area.

Keywords: floating architecture; floating design; floating modularity

1. Introduction

When viewed from the perspective of The architectural image of floating structures, it can be seen that this image has transformed over the years through the themes of mobility and inflatability and has differentiated in terms of its forms of association. In this context, it is understood that the typical image defined by many architectural solutions such as floating islands, floating houses, floating facilities has also transformed, this has given rise to new image sets in terms of architectural librarianship, and this imaginary sequence creates new compositions in a chronological context. Although the main feature of floating structures is that they stay on water, when the works of theoretically prominent figures are examined, it is seen that they actually contain a series of strategies that will find a solution to the problem of association. These strategies are sometimes handled by positioning the structure as a peninsula and sometimes directly as an island. Or, in addition, structures that are attached to the shore but floating on the water continue their functions as aligned structures, attached or close to each other. This distance proximity and functional unity mediates the construction of new marinas, residences, entertainment and socialization units over time, or the transformation of the basic characteristics of existing units. When all these reasons are evaluated together,

first of all, the architectural image of floating structures, and then the themes of mobility and inflatability that mediate the formation of this image, should be examined which critical essences they contain about how floating structures can be carried into the near future.

2. Architectural Image of Floating Structures

Many architectural solutions such as floating islands, floating houses, floating facilities are being designed and implemented with increasing popularity as residential, entertainment, industrial or commercial constructions. This area of use and application, which is very common and popular in the field of architecture, is successful and adaptable to the extent that it can produce up-to-date answers to the problem of rising sea levels and is not affected by the rising water level. Floating structures, which are known to have a successful performance in terms of ecological footprint, are not only used for industrial purposes. These structures can also be used to create an alternative space in case of land shortage in city centres, to rehabilitate wind parks, to create new destinations for tourist routes, to design special viewing points offering new vistas for tourists and local citizens, and to optimize green planning and commercial growth in case of limited agricultural land. They are also used as an auxiliary tool for (Lin et al, 2018, p.881). One of the main planning problems on the subject is that a planning guide for floating architecture has not been drafted through cities and local governments. The guidelines to be planned for floating structures should not disrupt the existing texture of urban life and should be accepted by different user profiles. After the components that can be used as references are identified as a result of the analysis, the components are classified into several categories and the contents of the components derived from different instructions in the same category are compared. Based on previous analyzes and comparisons, if the proposed planning guidelines for the superstructure of floating architecture are successfully detailed, the architectural suitability of the guidelines may be encouraging for the local governments of surrounding cities, and accurate examples of floating architecture may be more easily disseminated (Ko and Song, 2012, p.2).

At this point, examining materials, forms and composition in connection with their use, functions and purposes through case studies is very important in order to correctly understand the future of floating structures. Symeonidou (2008) mentions that star architects such as Alsop, Jiricna, Meier and Partners, Lynn were invited by the 'Landmark Houses' program to submit their own floating architectural proposals that enrich the contemporary architecture exhibited at the RIBA and the Victoria & Albert museum. He emphasizes that the fact that this issue has become widespread among Scandinavian countries should be a criterion that is also taken into consideration by European countries. The spread of modern boathouses in Europe, in addition to floating housing projects, contains various essences that future projects in this regard will be built on a more

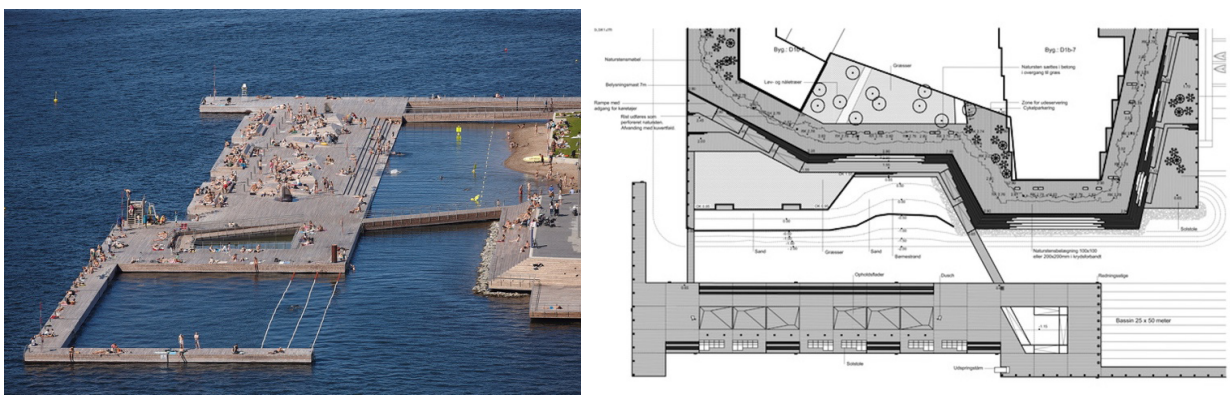

Image 1. Sørenga Sjøbad / LPO arkitekter, 2015, Photo(left): MK AS, Floor plan (right): LPO arkitekter (URL 1).

systematic and consistent basis (Symeonidou, 2008, p.5). Land scarcity and rising sea levels are known to make lightweight concrete an attractive material choice. Using the durability and buoyancy of untreated wooden shell in addition to foam concrete seems to be decisive in the floating architecture technology of the future. Determining the optimum values measured during a series of hardening periods is also very important in terms of determining the positive and negative effects of sea water on the usage processes. The compressive strength of each model is measured by immersion in seawater, and this controlled experimental process covers very important steps for the development of floating architecture examples (Fuad et al, 2023, p.84).

In addition to planning pedestrian access planning, public facilities and community space planning, and planning systems for fire prevention, modular system planning, which includes the manufacturing, transportation, and installation of the modular house, are also among the key topics for floating architecture (Song, 2023, p). .2). One of the least talked about issues regarding floating structures is the possibility of providing a contemporary proposal for solutions in slums. In order to increase the welfare of slum dwellers, it may be possible to eliminate the basic criteria that lead to low living conditions by establishing simple models of floating architectural units in relation to the sea. In this context, evaluating the problems arising from lack of infrastructure and polluted environment with basic variables such as deprivation and overcrowded households leads to drawing pessimistic scenarios for the areas. On the other hand, when the architectural deficiencies of the slums located on the coasts are evaluated together with their marginal history, it can be understood that these changes are extremely normal and the users of the slums are completely open to architectural change. Detailed analysis studies, which consider the field methodology and consider the possibilities of developing a floating building in successive scenarios, show that these slum structures, which have been historically deemed worthless, can be converted into modular floating architectural units to increase the welfare of households and can provide an improvement in the texture of the area by increasing the architectural quality among the slums (Youssef and Tarabay, 2019, p.119).

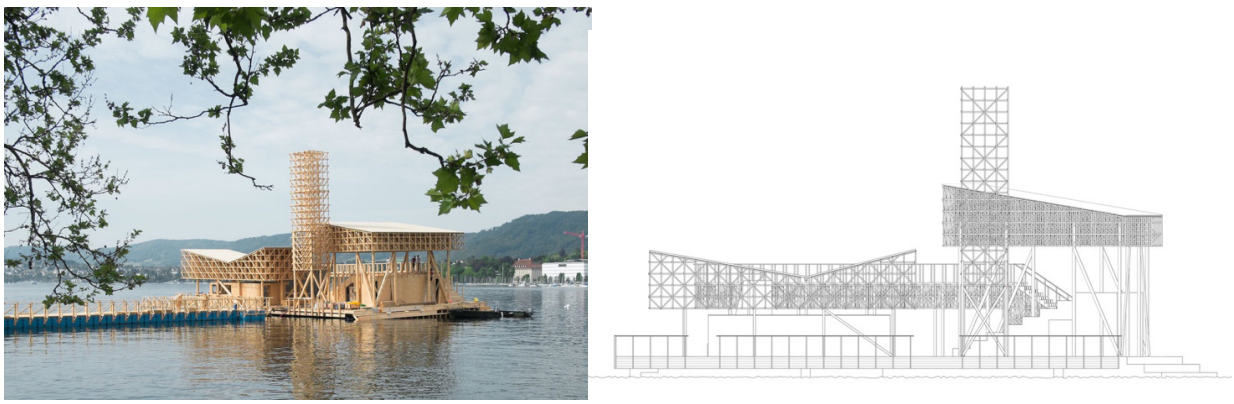

Image 2. Pavilion of Reflections / Studio Tom Emerson, 2016, Photo (left): Courtesy of Studio Tom Emerson. Elevation (right): Courtesy of Studio Tom Emerson. (URL 2).

The current connotations of floating architecture also have important potential in terms of tourism. From this perspective, in order for floatable architecture, which is positioned as a special experience, a landmark, a maritime culture pleasure, a tourism and regional development center and an environmentally friendly area that solves global warming, to offer a unique spatial experience to the public, spatial demands such as commercial, cultural and marina facilities should be reflected in the program. It is understood (Pak, 2015, p.329). In addition to all these variables, it is not correct to consider floating architecture as a completely independent and easily applicable solution partner. Lack of available land can define limited spaces within floating architectural examples. On the other hand, it may be considered positive that floating architecture encourages some innovations aimed at changing the traditional reflex of building only on terrestrial land. Flotable architecture will help determine the character of contemporary architecture by providing unique solutions in basic areas such as sustainability, green building, modular structure, use of local raw materials, dual-purpose use, long-term and repositionable use (Moon, 2013, p.3).

When modular system application examples in Europe were analyzed, it was seen that many of them had modular constraints and the types of modular systems applied needed to be classified. As a result, this study can be classified into three types of modular systems: building unit modular, space unit modular and planning concept modular, and defining the features of the three types by comparing them with each other can be developmental for new studies (Song, 2012, p.4). In this context, one of the least mentioned issues is the idea that a set of guidelines can be used in approaches to site selection for floating architecture. If this subject is sufficiently detailed, a rational guide can be proposed for the site selection of floating architecture, with the help of systematic criteria and basic inputs such as rational standard, structural safety, use of facilities, economics of construction and management. It is possible for individual businesses and local governments to benefit from these results (Lee et al, 2012, p.3). The impact of climate change on the architecture of Baltic cities provides an important example for cities that will face high intensity extreme weather events and changes in precipitation levels. While rising sea levels force the search for an alternative construction method, the design and development of floating architecture, which can be inspiring in the face of climate change challenges, offers attractive examples of adaptability to economic conditions (Bradecki and Konsek, 2020, p.2).

In the case of Vietnam, which is another similar example, the existence of floating villages faces many negativities in terms of environment, socio-culture and economy, which stands out as a negative perspective. On the other hand, this should not mean that this field is closed to innovations, on the contrary, the problems here should be evaluated as case studies and evaluated in terms of whether it is possible to develop them. Aiming to ensure a safe, stable and permanent life on water for those living in regions such as Vietnam, the guides stand out as solutions that aim to guide the applicant in the planning and principles of floating building designs according to social, economic and environmental sustainability issues and can easily find a place in future projects (Trang , 2022, p.461). The development of a wide range of engineering proposals for purifying sea water and processing floating debris accumulation together with alternative engineering technologies to support sustainable architecture and food safety will allow floating architectures to be used in more areas. The transformation and recreation of forests and drained swamp areas will also be decisive in the architectural scenarios of the near future, both in terms of biodiversity and the provision of new accommodation areas and shelters (Sapyrykina, 2023, p.2).

The durability of floating systems made of composite materials, the experiments carried out in open sea conditions, the balancing of the components of a constantly moving system with both large temperature changes and difficult weather conditions can be listed as the most basic criteria for carrying the floating architectural systems that stand out in this regard into the future (Ene et al, 2023, p.199). Considering parametric design methods, stability, purpose of the building, spatial configurations, floating structures and the advantages and disadvantages of existing floating settlement configurations in terms of purpose, physical

and architectural comfort, floating structures are not only a modular necessity but also an original design proposal. It means that it will find a place in architectural literature. Finding which spatial configuration is suitable, that is, taking advantage of all geometric parameters in the parametric design process, also means new combination possibilities in terms of floating architecture (Tomić et al, 2011, p.210).

3. Architectural Technology for Floatability through Mobility and Inflatability

Stating that floating architecture is the most effective way to adapt to the rise in sea level due to climate change (Pak, 2011, p.407), he also emphasizes that floating architecture is one of the most effective models to offer new spatial experience through a water-friendly environment. Mentioning that floating architecture is divided into different types in terms of variables such as program, form, scale, floor, location, access, mobility and energy, the author describes these as two-storey, wide deck, rectangular plan and balanced mass, prioritizing the view, interacting with water, surface architecture, respectively. divides it into different groups as examples that care about usage areas and highlight modulation (Pak, 2011, p.408). It is known that durability, portability, long-term use, use of local materials and various applications of renewable energy sources are decisive for the sustainability of floatable architecture. All these values also affect variables such as economic efficiency, psychological comfort of the inhabitants, strengthened security against crime and a high sense of community on the social dimension, allowing great successes in terms of floating structures. These structures, which seem to have some basic mobility problems today, will be accepted as much more contemporary architectural solutions in the future with their approaches that prioritize these basic variables. In addition, thanks to prefabrication and modular structure, basic advantages such as economic advantages and the development of a sense of community will be provided (Moon, 2014,

Table 3. Render(left): Floating Settlements, Baca Architects, 2017, Dezeen x MINI Living video series, Photo (right): Floating Home on Chichester Canal (URL 3).

p.123). One of the main highlights about floating structures is shaped around the theme of mobility. It is known that, unlike traditional buildings, mobility and the conveniences it brings enable the construction of public floating facilities. Beautiful structures that can move in harmony with water allow investors to increase the suitable areas for projects even without more hard ground, as they can provide both shelter and accommodation space for investors and allow private public space design. In addition, mobility allows these structures to be diversified or transformed to suit current decisions determined by local governments and their own scenarios that change over time (Simovic and Lovric, 2019, p.38).

An important impact of modularity in this regard is that perceived benefits such as improved adaptation and environmental sustainability are key factors in the problems faced by riverine communities in countries such as Indonesia (Ratodi, 2023, p.11). Since water, buoyancy and mobility expand the scope of movement both in and on water, infatability or modularity become features commonly used as transformation tools (Piątek, 2016, p.273). The fact that shared mobility systems have become a frequently used option in urban mobility offers many features for the identification and evaluation of profitable options in terms of shared systems that offer free floatability opportunities. By taking into account basic features such as customers' maximum walking distance and zone sizes, modularity mediates the ability to update the dominant and immutable features of floating architecture in a diversified and expandable way and transfer them to next year's production markets (Soppert et al., 2022, p.1194-1214).

It is known that one of the most important issues for inflatable architectures is their potential to contribute to floating architecture. Examples in this context are valuable in the sectoral context because they indirectly contribute to floating technology, even if they are not directly inflatable. Using the logic and advantages of the air ribbed inflatable mold construction method, the numerical simulation optimization process based on the Grasshopper platform and the structural performance calculation of the ABAQUS platform, the restaurant in an example stands out as a successful input to prove the applicability of the collaborative design method in the building design of the shell. The shell has evolved and developed over the years as the intersection of floating and inflatable structures in terms of design and coordination (Luo et al, 2021, p.38). Another study examining a cybernetic adaptive space model based on prefabricated inflatable modules and physical interaction manipulation shows that an adjustable and performance-based space system aims to redefine a smart and organic tendency to live and work. Evaluating the unity of human-space interaction with soft and hard architectural elements that adapt to dynamic lifestyles and environmental conditions is important in this context and provides strong clues about how these inflatable pieces can change the face of floating structures over the years. The data collected through IMU sensors is also important as it shows that the future architecture offers an unlimited configuration (Wang, 2023, p.453).

Regarding these issues, it is known that rigid inflatable boat (RIB) manufacturers are going through difficult processes in terms of modularization of their product architectures. Modularization techniques developed to support these processes offer solutions that enable focusing on large organizations and complex product systems. In this process, a learning framework focusing on project and process perspectives is detailed and emphasized to facilitate the systematic extraction of lessons from the implementation experience (Silva and Santos, 2023, p.847). Considering the direct relationship between the basic areas that directly affect architecture and the housing problem, it is understood that the relationship of floating structures with inflatability can also play a role in solving the slum problem. Making sense of the attempt of slums, which cannot develop an adequate strategy against the effects of climate change, epidemics and socioeconomic problems, to offer a sustainable, self-sufficient and integrated urban settlement that is resistant to climate change challenges and epidemics such as Covid-19, through smart architectural solutions, is possible by correctly evaluating the inflatability opportunities. In the solutions where unit designs are considered

"floating architecture"		"floating architecture with modularity"		"floating architecture with inflatability"	
Water	Confidence: 100 %	Art	Confidence: 99 %	Art	Confidence: 100 %
Waterfront	Confidence: 100 %	Collage	Confidence: 99 %	Collage	Confidence: 100 %
Transportation	Confidence: 100 %	Water	Confidence: 97 %	City	Confidence: 99 %
Vehicle	Confidence: 100 %	Plant	Confidence: 96 %	Water	Confidence: 99 %
Yacht	Confidence: 100 %	Potted Plant	Confidence: 96 %	Waterfront	Confidence: 99 %
Arch	Confidence: 99 %	Nature	Confidence: 95 %	Architecture	Confidence: 97 %
Architecture	Confidence: 99 %	Outdoors	Confidence: 95 %	Fountain	Confidence: 97 %
Ice	Confidence: 98 %	Sea	Confidence: 95 %	Boat	Confidence: 96 %
Boat	Confidence: 97 %	Land	Confidence: 87 %	Transportation	Confidence: 96 %
Art	Confidence: 95 %	Architecture	Confidence: 86 %	Vehicle	Confidence: 96 %
Collage	Confidence: 95 %	Building	Confidence: 86 %	Outdoors	Confidence: 84

Table 1. Image recognition percentage values for the top ten images extracted by top four browsers with using the terms of " "floating architecture", "floating architecture with modularity" and "floating architecture with inflatability". Created by author by using Image Recognition (URL 4).

together with biomimicry as a portable, changeable and temporary living space, a modular structure that expands, changes, is inflatable and is resistant to floods is highlighted. In this context, combining local and recycled materials with innovative systems for renewable energy sources such as photovoltaic printed sheets becomes important and offers solutions that can give insight into the architectural productions of the future (Elhadidi et al, 2023, p.266).

4. Conclusion

As a result, the evolution of the architectural image of floating structures through mobility and inflatability themes create a contemporary template for the future possibilities of housing, urban areas, healthcare and educational facilities, accommodation and related functions including the flexible combinations of floatable structures. All of these point to a future where, in near future scenarios, water will be used actively not only at water edges through floating structures, but also in daily life, in many cases where water is associated with crises and natural disasters, but these processes are prolonged. This contains clues that a production area that strengthens the architectural image of floating structures and carries it into the future will gradually spread to a wider area. If it is necessary to create a list, it can be ensured that the architectural image developed through floating architecture always remains in line with the needs of the age by developing the following emergency strategies with the help of modularity and inflatability themes for floating structures in near future architecture:

- The determination of criteria and rational standards should be evaluated and analyzed not only in terms of structural safety, but also with the help of basic inputs such as the use of facilities, construction and management economics.
- While the rising sea level brings to the fore the search for an alternative construction method, modularity and inflatability engineering processes should be operated together and flexibility and articulation should be actively used in order for floating architecture products to remain relevant to the age.
- The fact that problems arising from a polluted environment occur due to deprivation and overcrowded households should not be used as an excuse by local governments. Instead, gradual transitions between public spaces and private spaces should be created by creating modular floating spaces in problematic areas.
- In order to increase the openness to special experiences and to share the pleasure of marine culture as a widespread approach and to build the working area as a tourism and regional development center, it should be examined whether the numerical efficiency opportunities offered by modularity options and the aesthetic values of inflatable pavilions and units offer an iconic contribution to the city.
- The role of shared mobility systems in urban mobility should be understood and analyzed. In this way, floating spaces can be configured as autonomous stops or consecutive stations.
- Considering the design of special viewing points that offer special and valuable vistas within the city and the limitation of agricultural areas, inflatability can use all its formal flexibility to create a viewing point and can be integrated into the city by interpreting the prominent and defining forms in the city in a contemporary language.
- By incorporating the logic of prefabrication and modular construction into floating architecture processes, a series of public spaces can be built for economic advantages and the development of a sense of community.
- A learning framework focusing on project and process perspectives helps integrate inflatability and modularity strategies into the floatability contingency plans of local governments and architectural offices.
- Numerical simulations shorten the optimization process of floating architecture products in the city.
- In the solutions to be proposed for cities that will be faced with weather events and changes in precipitation levels, associating floating architecture with modular products that are waterproof and positioned and resistant to water allows flexible use of cities in a daily context.
- Floating architectures, which can both provide accommodation space and stand out with their special public space designs, help the masses to adopt new technologies in terms of floatability.

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