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PAVILION HOSPITAL FOR VENICE. WHETHER LE CORBUSIER'S DESIGN IDEAS COULD BE THE ANSWER TO TODAY'S PANDEMIC CHALLENGES

SZPITAL PAWILONOWY DLA WENECJI. CZY IDEE PROJEKTOWE LE CORBUSIERA MOGŁYBY BYĆ ODPOWIEDZIĄ NA DZISIEJSZE WYZWANIA ZWIĄZANE Z PANDEMIĄ

Abstract

The article presents the results of a study on the analogy of the applied functional-spatial solutions in the design of Le Corbusier's unrealized pavilion hospital for Venice, and the assumptions of contemporary pavilion hospitals. This project should be considered as an architectural and urban design, where the urban theme is leading in terms of the concept itself. Nevertheless, it also demonstrates the versatility and functionality of the solutions and the ease of handling different scales at the same time.

Keywords: pandemic, pavilion hospital, health care architecture, hospital architectural design

Streszczenie

Artykuł prezentuje wyniki analiz studyjnych nad analogią zastosowanych rozwiązań funkcjonalno-przestrzennych w projekcie niezrealizowanego szpitala pawilonowego Le Corbusiera dla Wenecji i założeniami współczesnych szpitali pawilonowych. Projekt należy rozpatrywać jako architektoniczno-urbanistyczny, gdzie wątek urbanistyczny jest wiodący w zakresie samej koncepcji. Niemniej jest on również dowodem na uniwersalność i funkcjonalność rozwiązań oraz łatwość operowania jednocześnie różnymi skalami.

Słowa kluczowe: pandemia, szpital pawilonowy, architektura ochrony zdrowia, projektowanie architektoniczne szpitali

1. INTRODUCTION

1.1. VENICE. A CITY – NOT A CITY

In the inland sea, amidst a tiny archipelago rises a remarkable built-up area, considered an architectural masterpiece. It is Venice, located in the Veneto region of northeastern Italy, along with its lagoon, which became a UNESCO World Heritage Site in 1987. Its origins date back to the 5th century AD, when it was founded. Spread over 118 small islands, Venice has been a major maritime power since the 10th century. Almost every islet, from Torcello in the north to Chioggia in the south, had its own settlement, town and artisan and fishing village. At the heart of the lagoon, meanwhile, was one of the largest capitals of the medieval world. The consolidation of a group of tiny islands and their organization into a unique urban system resulted in a network of canals and bridges. The original integrity of the building heritage, settlement structure and its interrelationships in the lagoon was preserved in relation to the city's geographical features, leaving the structure of Venice similar to that of the Middle Ages and Renaissance. The variety of styles and historical layers do not subtract from the coherence of the establishment, and the buildings have organically merged into a harmonious whole[1].

In the case of Venice's architecture, the form of buildings follows function and is closely related to the context and features of the lagoon itself, such as the scarcity of land, soft soils and the impact of brackish waters. These conditions, along with a large population of residents, dictated the burial of many canals and the extension of the shoreline. Due to the quality of the soil, at first, it was impossible to build structures with more than two stories on shallow foundations or deeper ones that reached several meters. Thus, buildings were founded on wooden piles, and the lightness of structural elements became a requirement. The Venetian architectural style was born out of a desire to minimize land consumption and weight, and to maximize available interior space. Thin and perforated masonry walls were used, and where possible load-bearing walls were replaced with columns. Instead of masonry vaults, the ceilings and roof were made of wooden structures. Rooms were arranged to make optimal use of the allotted, often small, space. Average houses were built with a height of three to four stories, but seven-story buildings were also erected. The latter were located in the only part of the city that could be inhabited by Jews[2].

As a result of tourism pressure, there has been a functional transformation of Venice and the historic lagoon centres. Residential function has been replaced by commercial, service and accommodation activities, and the local identity has been threatened. Faced with gradual depopulation accompanied by an uncontrolled influx of tourists, the city is increasingly seen as an open-air museum or historical park[3].

1.2. LE CORBUSIER

Actually, Charles-Édouard Jeanneret-Gris, nicknamed "the pope of modernism", regarded as a key architect and urban planner of the 20th century, considered extremely influential and

[1] *Venice and its Lagoon* [in:] UNESCO World Heritage Centre, https://whc.unesco.org/en/list/394/ (access: 27.06.2023).

[2] J. Foscari, *Elements of Venice*, Lars Müller Publishers, Zürich 2014.

[3] P. Foraboschi, *Specific structural mechanics that underpinned the construction of Venice and dictated Venetian architecture*, "Engineering Failure Analysis" 2017, vol. 78, pp. 169–195. DOI: https://doi.org/10.1016/j.engfailanal.2017.03.004.

charismatic. Author of Purism and Late Modern Brutalism, two innovative artistic directions, responsible for the introduction of 50 new "words" in architecture and art, an artist with many faces and a complex personality. He represented the belief that architecture and design did not respond to the needs of modern users, and did not keep up with the technical revolution. The controversial creator of 50 fully realized buildings, 47 books, and finally the famous notion of the "house as a machine for living", had both supporters and critics[4].

1.3. PANDEMIC AND HEALTH CARE PROJECTS – THE LATEST RESEARCH

Since the outbreak of the COVID-19 pandemic, a variety of publications have emerged, including those covering research at the intersection of design and health care during a pandemic. A review of the literature points to studies focusing on the analysis of European temporary hospitals used during the first wave of the pandemic. The authors (F.J. Candel, J. Canora, A. Zapatero, R. Barba, J.G. del Castillo, G. García-Casasola, J. San-Román, R. Gil-Prieto, P. Barreiro, M. Fragiel, F. Prados, P. Busca, J. Vázquez-Castro, & J. Marco) focus on the function, structure and performance of selected facilities. They compare hospitals among themselves in terms of bed distribution, but also in terms of patient admission criteria. The importance of the flexibility of the structure, which should be able to accommodate surplus patients in emergency situations, is emphasized[5].

On the other hand, L. Chen, C. Zhai, L. Wang, X. Hu, and X. Huang, are investigating the use of a modular integrated structure for a coronavirus-infected emergency hospital[6]. The primary structure was created using steel modular buildings. An intelligent platform was built to manage operation and maintenance. 5G, artificial intelligence, Internet of Things, cloud and other technologies were used. A BIM model was also created for site plan evaluation and comparison, among other things. The results of the research showed that the interaction of information and data is crucial for the rapid design and construction of buildings. The results of the research can be used to build comparable buildings faster using modular construction techniques.

In contrast, the article by G. Kucan, K. Graser, D. Grossmann, and D.M. Hall, explores how hospitals can achieve greater flexibility and adaptability using the modular adaptable hospital design (MAHD) methodology[7]. MAHD can be used to improve hospital operations across the life cycle. This paper proposes a MAHD design methodology framework formulated on the basis of 27 semi-structured interviews and design review sessions with 19 international groups of experts, specialised in the areas of design, engineering and

[4] A. Flint, *Le Corbusier. Architekt jutra*, Grupa Wydawnicza Foksal, Warszawa 2017.

[5] F.J. Candel et al.. *Temporary hospitals in times of the COVID pandemic. An example and a practical view*, "Revista Española de Quimioterapia" 2021, no. 34(4), pp. 280–288. DOI: 10.37201/req/041.2021.

[6] L. Chen et al., *Modular Structure Construction Progress Scenario: A Case Study of an Emergency Hospital to Address the COVID-19 Pandemic*, "Sustainability" 2022, no. 14(18), art. no. 11243. DOI: 10.3390/su141811243.

[7] G. Kucan et al., *Modular Adaptable Hospital Design (MAHD): Proposing a Design and Construction Methodology for Flexible and Adaptable Hospitals* [in:] F. Jazizadeh, T. Shealy, M.J. Garvin (eds.), *Construction Research Congress 2022: Project Management and Delivery, Controls, and Design and Materials*, American Society of Civil Engineers 2022, pp. 627–637, https://ascelibrary.org/doi/10.1061/9780784483978.064.

construction, and healthcare. The assessment framework consists of five design categories and 23 subcategories supplemented by a set of design guidelines. The resulting design guidelines clarify the design and construction process for hospitals using the new MAHD technologies.

2. METHODOLOGY

This paper presents the unrealized hospital project of architect Le Corbusier for Venice, relating its main formal and functional principles to contemporary pavilion hospitals under construction. A literature review was carried out, followed by a field search in Venice. Available sources, including press articles and websites of design offices, were used to gather information on the design of contemporary developments.

Reference was made to:

- Cura Hospital in Turin, Italy;
- COVID Modu-Care, France;
- The 'Deformable' modularised Covid-19 Epidemic Prevention Hospital, Shanghai, China;
- Modular emergency hospital, Norway.

By analysing floor plans, visualisations and photos of the realised facilities, the following conclusions were drawn regarding the main similarities with Le Corbusier's design. It was also pointed out that the prioritised context, is not reflected in contemporary so-called covid hospitals.

3. LE CORBUSIER IN VENICE

3.1. LOCATION

Le Corbusier was commissioned very late in the project. In the first instance, it should be taken into account that the hospital project for Venice should be considered as an architectural and urban design project, where the urbanist theme is leading in terms of the concept itself. The project has opened up a new thread in the discussion on urban regeneration, based on the hospital project.

The hospital was planned in the Cannaregio district, between Saint Lucia station and the Cannaregio canal. The hospital was to be located on the northern promontory. Cannaregio is the northernmost district of Venice, 500 years old. It was formerly home to a Jewish ghetto (known as the oldest ghetto in the world). The area is distinguished, if only by its much taller buildings and much more modest housing. The facility itself was designed for 1,200 beds, reflecting the scale of the whole establishment. Due to the fact that the plan remained open-ended and included extensions, this figure cannot be taken as definitive.

The project is evidence of the importance that Le Corbusier attached to the versatility and functionality of his solutions, and the ease with which he operated with different scales at the same time (building scale vs. quarter scale vs. city scale). One gets the impression that he designed a structure with great sensitivity, which was intended to exist very subtly in the fabric of the city. On the other hand, the functional solutions – the topography of the hospital, indicate that it is thinking of the function of the building as a machine, but this



Ill. 1. City of Venice, source: StockAdobe.com.

time a machine for healing. Functionalism was an important determinant in the design. He designed almost identical modules, each consisting of 28 patient rooms that overlooked square courtyards. The design took into account the separation of functions, the administration being on the ground floor, the patient rooms on the first floor. Very controversial is the lack of windows and the illumination of the rooms only by skylights. This limits the possibility to admire the lagoon and creates a rather claustrophobic effect. On the other hand, this was probably an intentional measure to create a space that inspires contemplation. It is important to realise that Corbusier also drew on his own experiences.

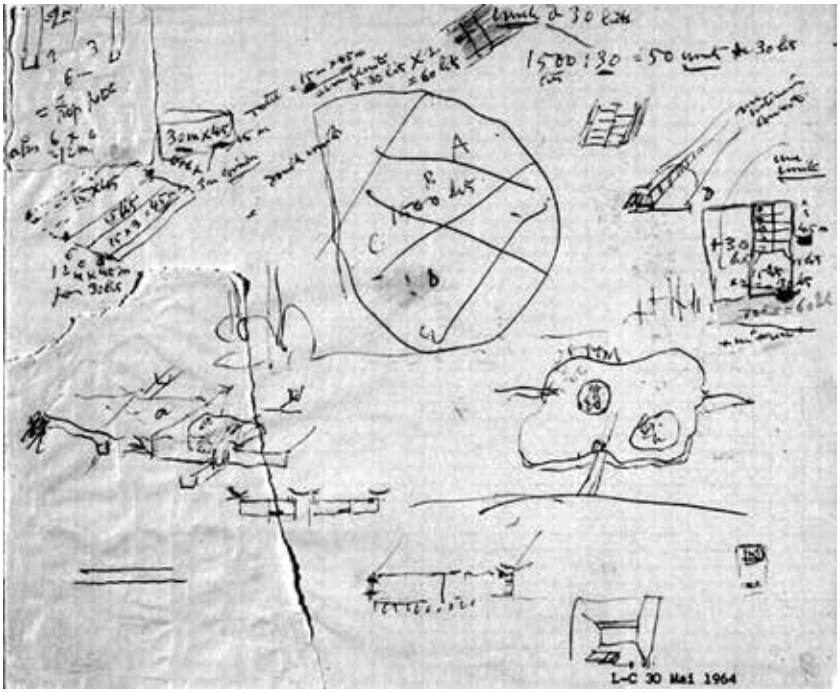
3.2. PROJECT FOR VENICE

The hospital was supposed to be a project for very seriously or incurably ill patients. Surprisingly, it was not intended to be a prominent building in the old fabric – a postulate of modernism – but quite the opposite. In a way, it reproduced the original canal-based layout of Venice, in such a way that it organised a network of interconnected modules clustered around a number of square courtyards. Le Corbusier consulted on design solutions for contemporary hospitals, including analysing the Copenhagen hospital, as one of the most modern at the time. By contrast, absolutely denied any possibility of erecting a tall building in Venice, despite the fact that modern hospitals of the time were built as 10- to 14-storey structures[8].

[8] E. Sicignano et al., *A model flexible design for pediatric hospital* [in:] G. Amoruso (ed.), *Putting tradition into practice: heritage, place and design*, Proceedings of 5th INTBAU International Annual Event, Springer, Cham 2018.



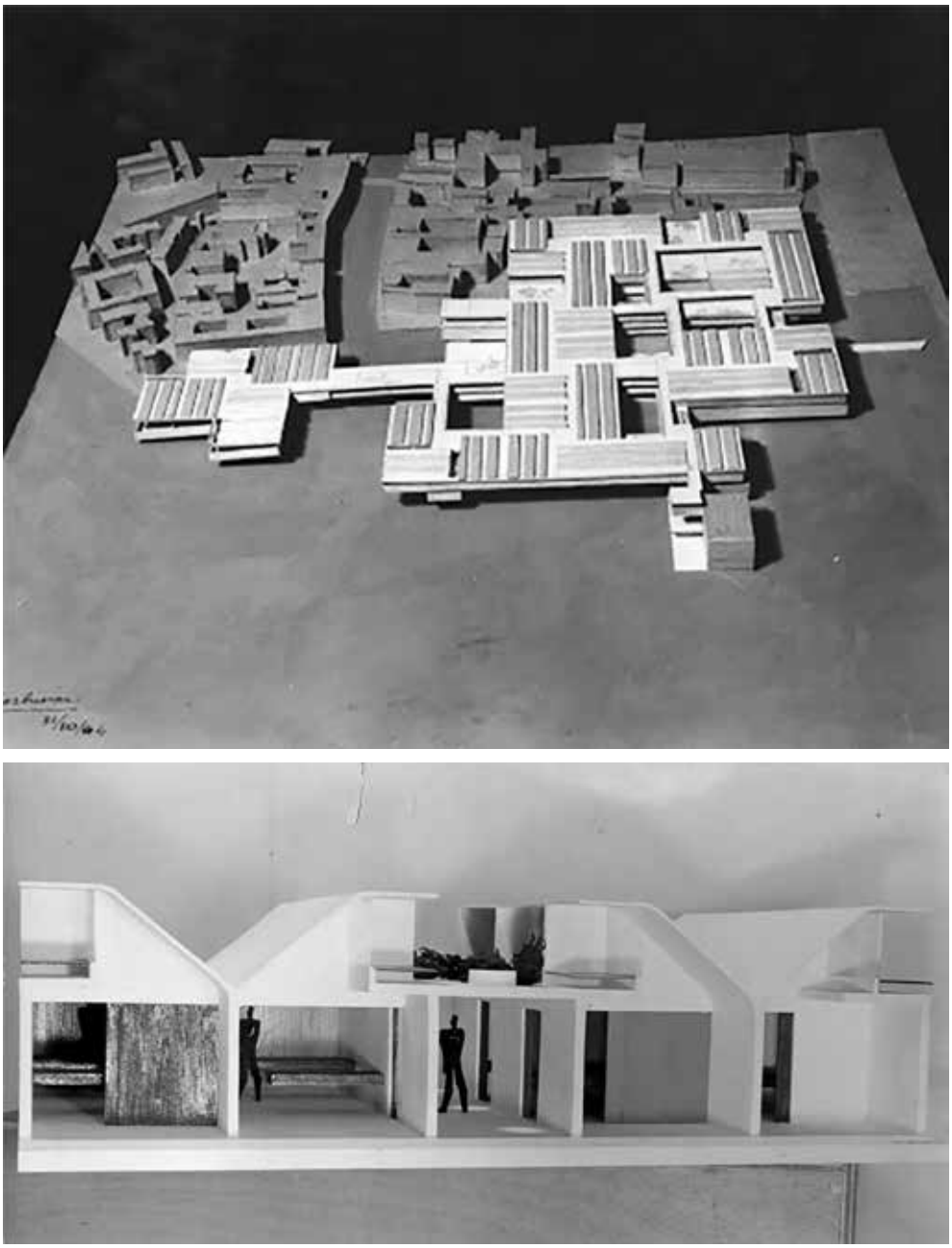
Ill. 2. Canareggio district, San Giobe canal. Photo by A. Gawlak.



Ill. 3. One of the first sketches of the hospital. Source: Shah M., *Le Corbusier's Venice Hospital Project. An Investigation into its structural formulation*, Ashgate, London 2013, p. 24.



Ill. 4. Giovanni Favaretto Fisca Mayor of Venice and Le Corbusier. First official meeting on the design of a new hospital for Venice. Source: Shah M., *op. cit*., p. 14.



Ill. 5. Hôpital, Venice, Italy, 1964. Source: Hospital, Venice, Italy, 1964 [in:] Fondation Le Corbusier, https://www.fondationlecorbusier.fr/en/work-architecture/projects-hospital-venice-italy-1964/ (access: 23.04.2023).



Ill. 6. Modern visualization by Dionisio Gonzales, source: *Counterfactual Venice II – That time Le Corbusier was about to transform the city* [in:] Venice Design Biennial, 14.12.2021, https://www.venicedesignbiennial.org/the-platform/that-time-le-corbusier-was-about-to-transform-venice (access: 4.06.2023).

He designed a building with an open plan, horizontal proportions, where the role of the lighting in the side elevation is secondary. He justified this not so much by technological requirements, but by the assumed need for tranquillity, given his own hospital experience. He wanted no element of the city's external vitality to interfere with the contemplation and recovery process[9].



Ill. 7. Current development of the proposed hospital site. Foscari University. Photo by A. Gawlak.

[9] E. Yoon, Y. Lim, *A Study on the Connection between Nature and Architectural Space in Le Corbusier's Venice Hospital Project*, "Architectural Research" 2020, vol. 22, no. 4, pp. 113–122. DOI 10.5659/AIKAR.2020.22.4.113.

Ultimately, for financial reasons, the Venice authorities decided not to go ahead with the hospital project[10]. Just as the bold designs of Louis Kahn or Frank Lloyd Wright were not realised. Today, the site where it was planned is now home to Foscari University from post-industrial buildings.

4. CONTEMPORARY PAVILION HOSPITALS VS LE CORBUSIER

Modular architecture is a potential solution to meet the urgent need for hospital infrastructure as opposed to the insufficiently rapid conventional construction method. Segmented units are able to provide, in a short period of time, isolation wards, test laboratories, diagnostic rooms, as well as rest rooms for medical staff.

Pavilion hospitals are one of the traditional forms of hospital organisation, in which the various functions and departments are arranged in separate pavilions or buildings. They have several distinctive features.

Dispersal: Pavilion hospitals are characterised by a dispersed layout, where different departments, such as the surgical ward, paediatric ward or intensive care unit, are housed in separate pavilions. This allows for better patient segregation and specialisation of the different departments.

Flexibility: thanks to their distributed structure, pavilion hospitals are more flexible and easier to expand. Pavilions can be added or removed as required, allowing the hospital to adapt to changing medical requirements.

Connectivity: although the wards are dispersed, pavilion hospitals are usually designed to allow easy communication between pavilions. Corridors, bridges or tunnels may be used to allow medical staff to move quickly and conveniently between different wards.

Outdoor space: pavilion hospitals often have well-landscaped outdoor spaces, such as gardens or courtyards, which can serve as recreational areas for patients, medical staff and visitors. This open space can contribute to creating a welcoming and relaxing environment.

Individuality of the pavilions: each pavilion can have its own distinctive architecture and appearance, which can facilitate orientation for patients and medical staff. Separate pavilions can also be dedicated to different medical specialities, making it easier to organise work and provide a suitable environment for patients.

Pavilion hospitals have their advantages and disadvantages, and although their popularity has declined with the development of larger hospital units, they are still used in certain regions or for specialised wards.

It is certainly not difficult to disagree that the modernist and ideological design principles are reflected in the structures of the pavilion hospitals being erected today. A similarity can be found in the horizontal body layouts with flat roofs, the lighting, the white surfaces and the illumination by large windows.

At the same time, this comparison can only be applied to newly constructed buildings and not to those adapted as temporary hospitals, such as stadiums or exhibition halls.

The development of pavilion construction technology based on container solutions is due to its availability, mobility, price and adaptability.

[10] S. Gzell, *Wenecja – interpretacja historycznego krajobrazu na tle Międzynarodowych Wystaw Architektury*, "Wiadomości Konserwatorskie" 2021, no. 67, pp. 7–21.

4.1. COVID-MODUL CARE

Responding to the shortage of medical infrastructures needed to combat COVID-19, the French Ministry of the Armed Forces initiated a call for projects to help combat COVID-19 in an innovative way. In response, La Chaîne de L'Espoir (LCDE), La Salle Blanche (LSB) and architect Maria-Noel Garcia (NEL architecture) collaborated to create a reliable and effective solution, focused above all on the safety of medical personnel and patients.

Through a combination of diverse experiences and reflections, the architectural team developed a design called COVID Modu-Care, a hospital concept based on structures housed in modules that can be adapted to specific functions and are easy to replicate. A key aim of the project is to provide facilities tailored to the needs of SARS-Cov-2 patients at all stages of the disease course.



Ill. 8. COVID Modu-Care, modular hospital, source: La Salle Blanche, https://www.lasalleblanche.com/en/covid-modu-care-modular-hospital/ (access: 24.05.2023).

The hospital was divided into five functional sectors:
- COVID screening and diagnostic module,
- COVID monitoring module,
- COVID intensive care module,
- COVID radiology module.

The COVID screening and diagnostic module includes a fully equipped and fully autonomous molecular biology laboratory.

The COVID monitoring module is equipped with 2-bed rooms for patient monitoring. Space has been provided in all rooms for the necessary apparatus and each room is fully autonomous.

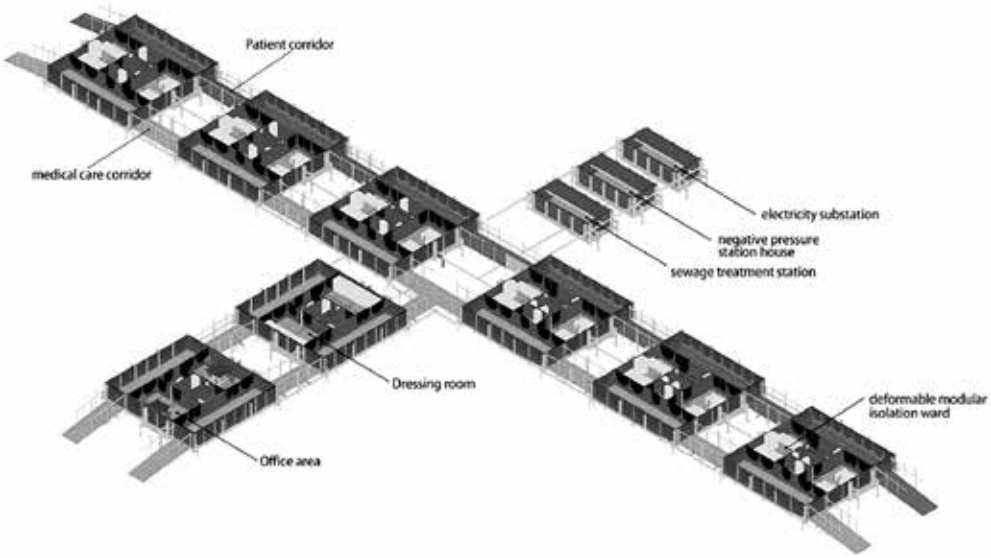
The COVID intensive care module is designed to provide medical care to the most needy patients. The project includes its own air treatment system in the patient rooms. Auxiliary modules have been added to this member to provide the necessary utilities to support the intensive care beds.

The COVID radiology module is equipped with an integrated CT-scan. This radiology technique is the fastest COVID-19 diagnosis, especially in countries where the test kit is not widely available. The module provides follow-up examinations of patients every three to five days, which are highly recommended for reporting on disease evolution.

The main advantage of the solution is that each of the modules listed above can operate independently. The replicability and ease of adding modules enable the creation of

a customised field hospital in a quick and easy-to-implement manner. In addition, COVID Modu-Care can be adapted to any geographical area. The designed modules are fully autonomous and therefore no failure will affect the functioning of the hospital as a whole. The use of easily decontaminable HPL panels is also a fundamental aspect of the design. However, the design provides for irregular forms and therefore the above solution is much more difficult to transport than the container examples cited so far.

4.2. THE DEFORMABLE



Ill. 9. The Deformable Hospital, source: *The Deformable modularized COVID-19 Epidemic Prevention Hospital* [in:] German Design Award, https://www.german-design-award.com/en/the-winners/gallery/detail/39860-the-deformable-modularized-covid-19-epidemic-prevention-hospital.html (access: 24.06.2023).

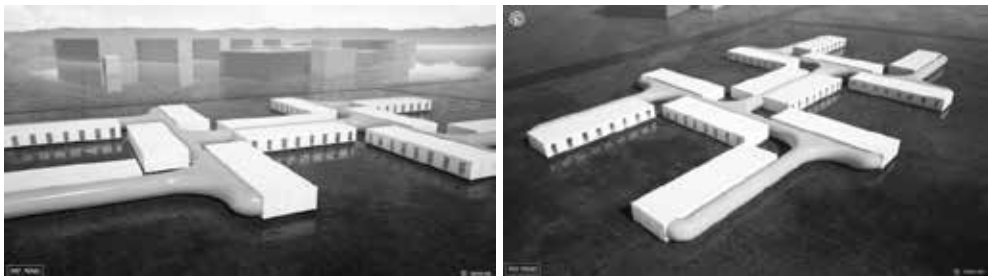
'The Deformable' modularised COVID-19 Epidemic Prevention Hospital, architecture by Prof. Chenping Han and his team from School of Architecture and Design, China University of Mining and Technology, Minhang District, Shanghai, 2021. An example of a temporary container hospital, retaining features such as high adaptability. The module covers an area of 76.15 m^2. It is equipped with negative pressure ventilation, sufficient daylight, separate channels for the infected and non-infected patients and medical staff, toilets, and two standard isolation wards with four beds. Its space design meets the design specifications and requirements of hospitals for infectious diseases. Architects considered also two future options for the post-pandemic disposal of the building: one is to take it down and store it for future use and the other is to give it new uses and functions on site, such as hotels, bars, and cafes.

4.3. MODULAR EMERGENCY HOSPITAL

Working with partners, MMW Architects created an efficient, flexible, yet affordable modular hospital in response to the plight of the COVID-19 pandemic. The aim of the project was

to provide protection against the spread of the virus and to increase the capacity for intensive care on not only a national, but also an international level.

The envisaged system is to be an emergency hospital, functioning as a satellite hospital of a physically larger hospital. The designed modular hospital makes use of recycled shipping containers, as well as inflatable fabrics that enable air hygiene to be maintained at the highest level.



Ill. 10. Modulbasert beredskapssykehus, source: https://www.mmw.no/emergencymodularhospital (access: 2.06.2022).

The system shown is flexibilised so that it can be adapted to meet changing needs. Modules can be used as isolation rooms, as well as rooms for more patients, depending on needs and circumstances. The horseshoe-shaped plan allows ambulances to access patient rooms directly, so patients can be transported without having to move through the hospital corridor.

In addition, the horseshoe-shaped plan ensures maximum efficiency in room layout and also minimises the spread of virus.

The proposed composite containers have well-equipped intensive care rooms with their own bathroom and sluice room. The system has been designed with ecology in mind, as it uses solar energy to operate the necessary technical installations.

The flexibility of the modules proposed by MMW Architects makes it possible to ensure preparedness for emergency situations, while guaranteeing the highest level of protection. However, the project can only be used as an extension of a larger hospital facility nearby, severely limiting the possibilities of locating temporary medical units.

5. SUMMARY

Looking for parallels between Le Corbusier's daring and at the same time highly context-sensitive unrealised project for Venice and the temporary pavilion hospitals under construction 70 years later may seem like over-the-top thinking geared towards a priori conclusions. Even if the starting assumptions for the project were diametrically opposed, the formal and functional convergences cannot be underlined. These are first and foremost the horizontal layout of all the reviewed projects, which are usually buildings with one or a maximum of two storeys. They are open-plan assumptions in design with potential for both expansion and adaptability.

The often diffuse and free-flowing layouts also fit well with the context in which they were designed. Natural light is not of great importance in either case. By contrast, there is absolutely no doubt that Le Corbusier's design is the result of a careful and sensitive analysis

of the urban fabric, whereas contemporary buildings are entirely devoid of it. Instead, they are calculated to maximise the efficiency of medical processes and technologies.

In conclusion, the authors assume, after analysing the project documentation, that it is possible to identify a certain topos that has been incorporated into contemporary temporary hospital settings. Certain features that stemmed from the landscape context of the original concept, including the scale of the development, modularity or open plan, are integral to today's design solutions and a common thread in the facilities analysed.

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