TEMA
Technologies
Engineering
Materials
Architecture

Journal Director: R. Gulli

e-ISSN 2421-4574
Vol. 7, No. 1 (2021)

Issue edited by Editor in Chief: R. Gulli

Cover illustration: Azulejos, Casa de Pilatos, Seville. © Renato Morganti, 2017

Editorial Assistants: C. Mazzoli, D. Prati

TEMA
Technologies
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Materials
Architecture

e-ISSN 2421-4574
Vol. 7, No. 1 (2021)
Year 2021 (Issues per year: 2)

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Vol. 7, No. 1 (2021)
e-ISSN 2421-4574

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HOSPITAL ARCHITECTURE AND THE CHALLENGE OF HUMANISATION. RESEARCH AND DESIGN

TEMA Technologies Engineering Materials Architecture
e-ISSN 2421-4574
Vol. 7, No. 1 - (2021)

Marco Morandotti, Daniela Besana

DOI: 10.30682/tema0701i

Highlights

Hospital's design cannot disregard the central role of the patient.
The challenge of humanisation will have to deal with the impacts generated by COVID19 still to be explored.
The design of the hospital room is the main testing ground for any strategy of the hospital's humanisation.
Natural elements and light are crucial in the architectural design of patient-centred design.

Abstract

The hospital may no longer be seen as a "health machine" but a complex system where care and training converge, ensuring higher levels of thermo-hygrometric and psychological comfort. The paradigm of humanisation, regarding both hospitalisation and collective and social spaces in the hospital, stimulates a wide range of morphological-typological and technological innovations. The present contribution, starting from this scenario, proposes both a critical analysis of some emblematic design projects and the specific outcomes of some applied research and case studies developed by the authors.

Keywords

Hospital, Humanisation, Flexibility, Innovation, Patient room.

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1. INTRODUCTION

Today the hospital is no longer seen as a "health machine" but as a complex system where care and training converge, ensuring, at the same time, higher levels of comfort, not only thermo-hygrometric but also psychological and perceptual. The paradigm of humanisation, regarding both hospitalisation and more generally collective and social spaces in the hospital, stimulates a wide range of morphological-typological and technological innovations.

2. STATE OF THE ART: THE HOSPITAL IN THE THIRD MILLENNIUM

Within the international debate related to hospital design, the idea that is the hospital to move towards the patient, and not vice versa is generally accepted. This may happen both through the humanisation of traditional hospital spaces, and by means of relocation and territorial distribution of efficient, multi-level, praesidiums focused on specific needs and requirements of a local context [1]. This second strategy, related to an efficient network of

care centres, strictly related to home care, and integrated with main hospital services in a "hub-and-spoke" model has proven to be truly effective also during recent Covid-19 pandemic crisis. Effects generated by this kind of Copernican revolution in healthcare systems are highly complex and show multiple interferences not yet fully explored in all their possible consequences.

Within this national scenario, a global re-thinking of the whole healthcare system seems necessary, although different models have been developed in each region. Even though some differences due to regional models, the system as a whole is characterised by several obsolete hospitals, definitely inadequate concerning performance and dimensions, in comparison with diagnostic, therapeutic and hospitality contemporary requirements. These structures are typologically obsolete and technologically inadequate to satisfy users' needs in terms of functionality, comfort and safety.

On a national building stock of more than 1000 hospitals, 28% has been built in the XIX century and another 29% between 1900 and 1940. Almost 60% of the whole hospital building stock (almost 600 buildings) is more than 60 years old, and therefore well over an average lifespan.

In this context, the proposal for a New Hospital Model was launched in 2000. The need to assess a new generation of guidelines able to meet the latest performance requirements for Italian Health Structures has led the Minister of Health at that time, Umberto Veronesi, to appoint a Ministerial Commission of Study chaired by the same Minister, directed by the architect Renzo Piano and coordinated by Lamberto Rossi. The result of the Commission's work was the creation, with D.M. 12/12/2000, of a "*New Hospital Model*".

A Decalogue of main criteria was defined that should be applied since then in each newly built hospital, accompanied by a hospital's meta-design with high technological contents, as a theoretical demonstration of the results of a new design approach. The first criterium of the Decalogue is focused on humanisation, expressly declaring that the human being must be placed at the centre of hospital design [2].

All the technological choices are aimed at ensuring the well-being of the patient, intended therefore not only in its original declinations of thermal, visual, light and tactile well-being but also, and above all, to achieve physical, psychological and social well-being. This holistic approach refers both to hospital spaces with a public vocation, such as internal distribution systems, spaces for circulation and rest and to more private spaces, such as hospital rooms. The needs' balance between privacy and sociability in a double room; environmental comfort in its broadest sense; technical aspects such as materials used, colours and furniture solutions, become relevant issues [3].

This aspect is closely related to other points of the Decalogue, such as the second and third: urbanity and sociality. The contemporary hospital must be "urban" or integrated into the surrounding area and daily life. The hospital should therefore no longer be understood, as in the twentieth-century model, as a place of isolation for the sick (therefore very often located outside the city and well delimited by boundary walls) but, on the contrary, as a part of daily social and collective life. It will be therefore necessary, to locate it in urban areas, easily accessible and to provide it with collective services, such as green areas and rest areas accessible to the public. The meta-design, therefore, defines functions not only as bars and restaurants but also as facilities such as auditoriums, theatres, or accommodation services such as hotels and residences.

"Sociality" is related to the idea of an inclusive hospital, socially and culturally integrated with the environment to which it belongs. Therefore, in the collective spaces, should be provided areas dedicated to the organisation of volunteers, civil associations and still receptive, commercial, cultural and entertainment activities [4].

Recent dramatic events related to the pandemic underway by Covid-19, put a strain on urbanity and sociality paradigms. It is clear that, although the demands of patient centrality and functional integration with collective sociality stay true, aimed at making less segregating the experience of hospitalisation, these should in future be mitigated by the necessary design actions aimed at containing the risks of transmission of infectious pathogens.

The design impact, from the typological, distributive and technological point of view, on the existing and new hospital structures will be significant, and to date completely unexplored. Clustering of spaces, segmentation and differentiation of paths, plant confinement through spaces in overpressure, strengthening of spaces and staff

for intensive and sub-intensive care units, the definition of areas of dedicated hospitalisation for Covid affected patients are key issues for the current and future debate [5].

Hospital design is one of the topics with the highest disciplinary intersection in terms of skills involved, from architecture to technologies, from plants to structures. These come together with disciplines such as social psychology and sociology of space and environment. The fields of investigation and the design effects of these disciplinary areas deeply interact with the functional and spatial organisation of hospital structures, as well as their environmental assets. The choices related to colours, materials, presence and graduation of natural light, relational autonomy between spaces and users, can all benefit from the mutual interaction of these skills. In the immediate future, there will also be a renewed focus on issues of environmental health and safety in the presence of potentially infectious biological agents [6].

The design of the hospital room, however, is the main challenge for any strategy of hospitals' humanisation. The following considerations will be mainly devoted to the critical analysis of achievements documented in the literature, along with other research results and design experimentation developed by authors over the years, also dealing with collective spaces and day surgery units.

3. HUMANISATION OF HOSPITAL ROOMS

From the 1970s on, more attention was paid to the relation between design and patients, and in general to users, with the advent of "*patient-centred design*", the topic of a first British study in 1971, with the goal of designing

Fig. 1. *Typological schemes of a hospital room regarding different toilet location (image of the authors).*

the room cell of the sick person to have light, air, soundproofing, good furniture, comfort and, in general, to increase security and to provide a possibility of customisation. The patient-centred design evolved in the 1990s to become the *Evidence-Based Design* (EBD) *Approach* [7], which – always on the basis of interdisciplinary experimental research – shows the connection between design choices and healing time of patients, stating that the quality of the architecture is part of the healing processes. It sees the user as a subject who not only interacts with the therapies and treatments but also with the hospital environment around him [8].

Regarding hospital design, one of the most investigated characters, both in literature and in the design experimentation, concerns the rooms' typological choices and some related distributive characters, with particular reference the toilet position and the distribution of the beds in relation to the external views and the mutual visual interferences (Fig. 1).

The placement of the toilet near the entrance to the room, therefore adjacent to the main distribution system is the most widespread distribution scheme. This scheme, widely experimented and tested, allows natural aeration and lighting in bathrooms, without compromising the lighting surfaces of the room, as already expressed, in the 1980s, by Roger Ulrich on the basis of experimental considerations. He stated that looking outside from a bed may improve the possibility of healing. However, this scheme brings two possible technological-constructive and psychological-perceptive limits. The first is due to the impossibility of accessing the sanitary system networks through dedicated paths without interferences with the daily activities of the ward. The second is due to the physical interposition of the spatial entrance system and the toilet between the room and the external corridor, which generates a strong perceptual separation between the room itself and the ward [9].

As it is an extremely classical typological choice, many variations can be identified; among these, for example, the solution adopted in a hospital built in Pavia, where the morphology of the double room is characterised by less than usual dimensional ratios, on an almost

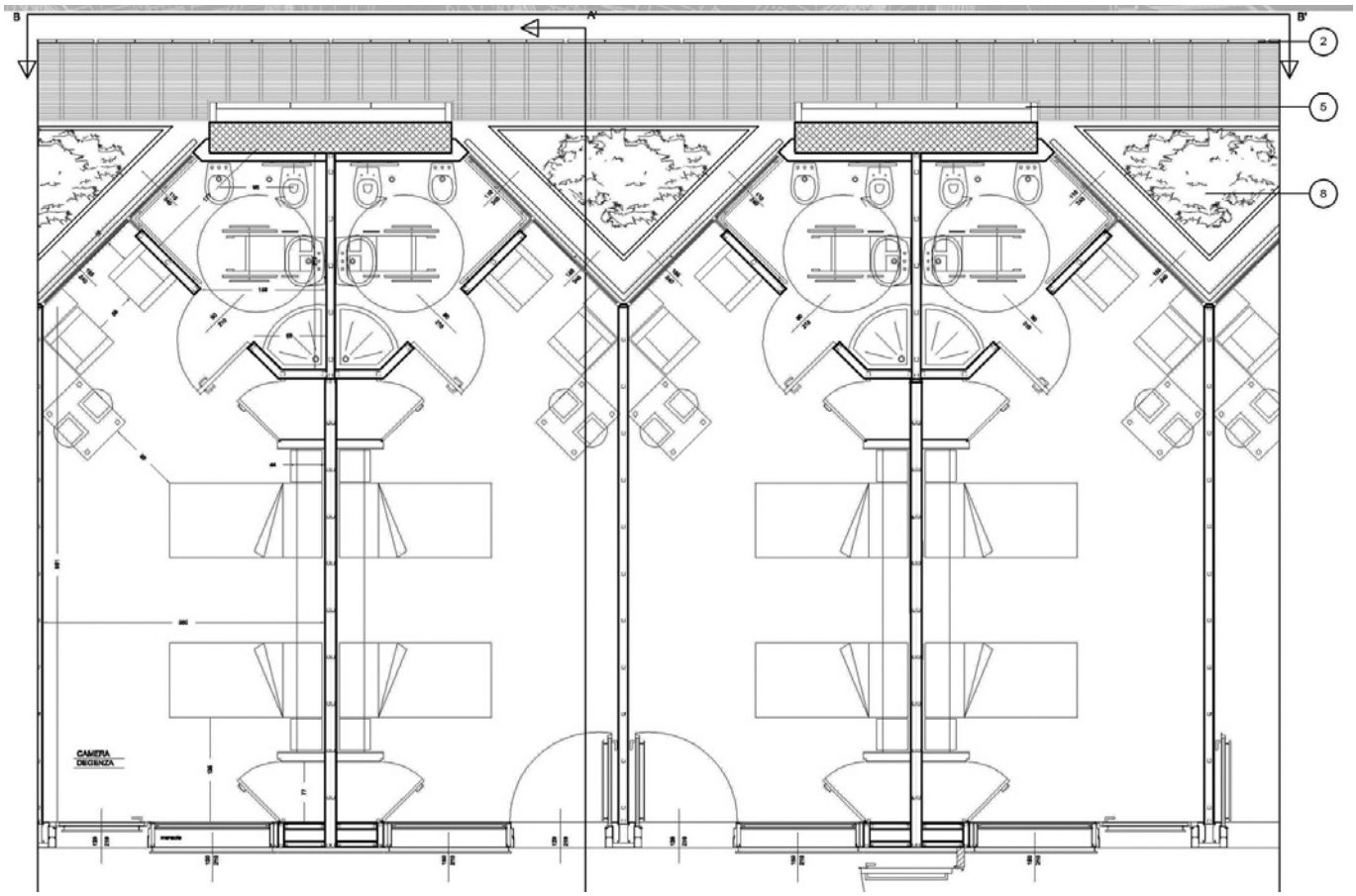

Fig. 2. *The patient room design proposed for the healthcare project of the Policlinico San Matteo di Pavia, 2002 (image of the authors).*

square planimetric footprint. The toilet position and the patients' wardrobe area define a sort of technical zone between the corridor and the room, with a false ceiling at a lower level than the latter, allowing the passage of piping. The two hospital beds are both placed perpendicularly to the facade, so each has his own undisturbed visual perspective outside while being isolated from the hospital ward. Solar glare phenomena are also reduced due to the 45-degree orientation of windows to the wall.

The antithetical strategy to place the toilet near the façade generates opposite strengths and weaknesses. The reduction of the glazed surface of the facade is huge and may limit the internal brightness of the room due to the perimetral location of the toilets, which can be naturally lightened. In the same way, the bathroom position allows the wall between the room and the corridor may be glazed. Therefore a complete though scalable visual permeability between the ward and the room may be achieved [10].

In this regard, assessed from a psychological perceptual point of view, this solution guarantees an advantage in terms of reducing the patient's segregation, but also a potential limitation of individual privacy that can be mitigated by the use of mobile hiding systems inside the transparent wall between corridor and rooms, controlled directly from the patient's bed. Finally, the location of the toilet can allow an external distribution path dedicated to maintenance activities, which therefore makes it possible to inspect the room's system without any interference with the daily activities of the ward. This solution is also proposed within the consulting activity developed by the STEP Laboratory in 2002 at the Policlinico San Matteo for the hospital design of a new building (Fig. 2).

Many other typological experiments may be developed concerning the best location of the toilet compared to the patient room. Some projects have located the toilet alongside the hospital room with the consequent

Fig. 3. *The patient room design proposed for the healthcare project of the Policlinico San Matteo di Pavia, 2002 (image of the authors).*

creation of some spaces (clusters) serving the life of the ward: storage of equipment and medical-health supplies rather than small social spaces for patients closeness of their own room; other solutions have instead proposed the location of the toilet not only outside the room but also at the façade perimeter, allowing a volume design recognisable also from the outside. A less widespread but interesting solution is to place the two toilets of adjoining rooms lined up between them (Fig. 3).

This solution involves a piping optimisation thanks to the combination of a common wall equipped between the two modules of the toilets. From a typological point of view, this solution allows a greater morphological room layout, while ensuring the possibility of glazing the separation wall between the room and the corridor, without significantly compressing the view towards the outside of the room itself. In this solution, the two bathrooms, being aligned, are one facing the corridor and the other facing the external front. Often, both to uniform the internal distributions and to not introduce distinctions between adjoining rooms, both toilets are kept artificially ventilated and lightened. This solution requires a wider area for the same number of rooms, which may become a critical consequence when it comes to medium and large hospitals.

For example, this typological solution was tested within the consulting provided by the STEP Laboratory at the Fondacion Juan de Castellanos in Tunja (Colombia), for the design of a maternal and child hospital (Fig. 3). In this specific case, this solution has allowed working with a "flexible" structure to meet the client's needs regarding the number of beds [11]. Starting from a room module, by means of the iteration of the two-bedroom and two-bathroom module, it is possible to replace the room module with other functions, at the service of the patient himself. The module not occupied by the room may be used for play areas for children divided by age groups, rather than small greenhouses or external terraces. These open spaces are designed to be saturated

Fig. 4. *Patient room module used as a playroom for young patients distinguished by age (image of the authors).*

Fig. 5. *Patient room module used as a playroom for young patients distinguished by age (image of the authors).*

over time in relation to a possible variation of the users' needs [12] (Figs. 4, 5).

4. HUMANISATION OF PUBLIC SPACES

As previously stated, the idea of a modern hospital is a building closely connected to the city and the social life of its citizens, according to openness and permeability to daily life declared in the Piano-Veronesi model.

This topic translates into design and functional research regarding the typological choices of the hospital that best guarantee the porosity of the building itself also in relation to the functions that are settled there. Starting from the latter, the same model suggests that the hospital may include different services for citizens (kindergartens, shops, restaurants, hotels, conference rooms, auditoriums, etc.). Therefore, the ground floors or, in any case, the main access floors increasingly seem large halls, where colours and furnishing solutions, generate a fluid flow of people inside and outside the hospital. At the same time, this generates well-being not only for the visitor or the citizen but also for the patient who enters and lives a more welcoming and friendly space. Often, double-height spaces along the commercial streets are provided, where vegetation and light become crucial for overall architectural quality [13]. Large windows along the Rue Hospitaliére (see Hôpital Européen Georges-Pompidou, Paris, 2000, arch. Zublena) become not only the backbone of the complex spatial articulation but also real resting and meeting spaces equipped with benches, bars with tables, shops and filter environments between the city and the hospital.

Sometimes, such as in tunnel hospitals, the typological and distribution system pursues the search for these humanisation characteristics, by means of large horizontal full-height distribution systems, often characterised by glazed roofs and strong natural lighting, often enriched by the presence of vegetation and by formal characters and materials more similar to those of an urban

commercial gallery, than to those of a traditional hospital facility, such as in the Waterland Hospital, in Pumereend, in the Netherlands and the McKenzie Health Sciences Center in Edmonton, USA.

It is also considered relevant to address the issue of humanisation even in high technological areas: for example, spaces dedicated to first aid, the operating blocks, or all those workplaces where the priority is often to guarantee the life of a patient who is generally in critical conditions. This may happen, for example, where the patient is prepared for surgery but also where a woman waits for her childbirth in the labour rooms, or where a surgeon or his team conduct an operation for hours without ever have contact with the outside. It is, therefore, believed that even in some of these spaces, it is necessary to provide forms of humanisation.

For example, the solution proposed for the project mentioned above of the Maternal and Child Clinic in Tunja, Colombia, is shown (Fig. 6). The clinic is made up of two distinct buildings, connected only by aerial walkways, and crossed by an external public access road which houses all the hospital and reception functions (bars, shops, etc.).

The buildings are different both typologically and functionally. The largest one, as stuck layers typology, houses the emergency room, labour rooms, intensive care, diagnostic imaging and, at the level of the hospital road, spaces serving the community and medical staff. The second building instead is dedicated exclusively to hospital wards. This building is conceived entirely underground to guarantee a minimal impact of the structure on the surrounding landscape. In order to equip the building with direct lighting and respond to the principles of humanisation mentioned above, it was decided to create a cavity in the side of the hill aimed to illuminate the two functional floors of the building. At the same time, two patios were designed: the first, larger and one storey, around which the labour rooms are arranged along the perimeter, so as to allow the woman waiting to have constant contact with the outside, whether bedridden or standing. A second, double-height patio allows to illuminate, starting from the top, the emergency block, in particular at the waiting and triage space and, on the floor below, the diagnostic imaging department, always at the pre-examination waiting rooms (Fig. 7).

5. DAY SURGERY AND HUMANISATION

The term "day surgery" means the clinical, organisational and administrative possibility to carry out surgi-

Fig. 6. *Plan of the Maternal-Infantile Clinic where it is possible to identify on the left the double-height patio designed for the block, on the right the largest one-story patio in correspondence with the labour rooms and the cavity to bring direct light to the excavated side of the hill (image of the authors).*

Fig. 7. *Cross-section of the Maternal-Child Clinic in Tunja, Colombia (image of the authors).*

cal operations or invasive and semi-invasive diagnostic or therapeutic procedures, in a treatment limited to the time of the day, in local, loco-regional or seldom general anaesthesia. Day surgery is welfare, and organisational model widely spread in Western countries as it effectively reduces treatment costs, optimises fixed resources, reduces expenditures of hospitality, reduces the recovery time of patients [14]. What a hospital ward, dedicated to day-surgery should be recognisable for, is a character of high familiarity with the patient, by means of a careful study of the patient's comfort, not only with regard to the parameters of physical well-being but also psychophysical and psychological well-being [15], for example providing living spaces with a low visual aggressiveness, also thanks to the limited visual impact of medical devices required. Starting from the seemingly paradoxical principle that a day surgery patient is a healthy patient, characterised by an overall good clinical picture, it is necessary to stimulate the early ambulation process effectively. Both designing within a day surgery ward large living spaces, graduating the levels of privacy guaranteed to patients, and providing an adequate mix of beds and armchairs are solutions intended to achieve this result. Armchairs are equally comfortable and fully reclinable and require less linen than that a conventional bed, occupy less space and facilitate accelerated autonomous walking of treated patients.

The provision of medical facilities and head-to-bed monitoring can also be considerably streamlined (the provision of a remote call device for nursing staff is generally considered enough) for day-care beds compared to conventional ones since the patient admitted to a day surgery treatment is in good general physical condition, does not suffer from congenital or previous diseases, and is generally subjected to non-invasive surgical treatments. Only a percentage of the beds provided can be prepared with more complex medical equipment [16].

The typological choice for an autonomous day surgery unit, developed in previous research developed at the STEP laboratory, and here briefly reported, is a one-floor compact plate unit with a continuous circular distribution path [17]. This solution allows the patient, ideally placed at the centre of the process, to constantly maintain his position perception in space, not only through the paths clarity inside the structure but also through visual contact with some natural elements, placed in the centre of the plate, within an internal patio.

The living spaces are placed on the left side of the unit, articulated in a room with armchairs and two single rooms with one bed and toilet. The percentage of recovery seats, with respect to the general capacity of the structure, is high, not only due to the consequent reduction of the spatial needs of the structure but also as this is expected to be the most efficient way to manage post-operative recovery for a day-surgery patient. Finally, it should be noted that the hospital room has a double view, both towards the outside and the internal patio, due to the transparent internal wall in the corridor. This allows not only more effective control of the patients by the staff and a more pleasant direct lighting of the interior spaces, but also reduces the psychological feeling of constriction of the patient, also stimulating early ambulation process (Fig. 8).

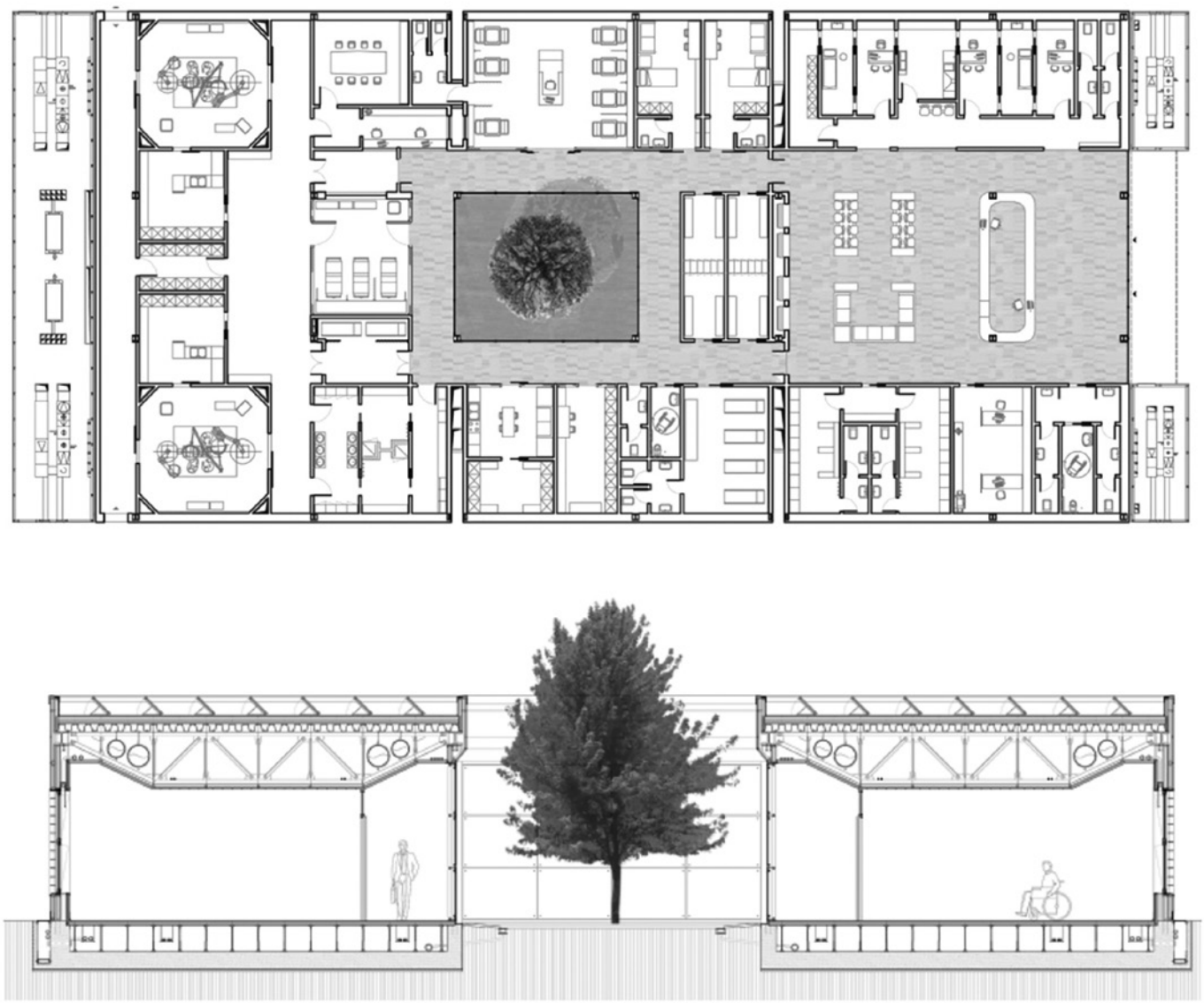

Fig. 8. *Thypological solution for a day surgery unit at Policlinico San Matteo of Pavia (image of Marco Morandotti).*

6. CONCLUSIONS

The paper aims to underline that humanisation of hospitals is strategic not only from the point of view of medical care and therapeutic rehabilitation of the patient but also in relation to the impact of this topic within the design process. The designer can explore different paths of experimentation; for example in the study of spatial and typological solutions, in the use of architectural composition issues such as the use of light or in technological and constructive research aimed at achieving the quality of construction, defined as the fulfillment of users' expressed and implicit needs. This can, therefore, be done through the use and experimentation of technological and construction solutions aimed at the requirements of flexibility, plant integration, and reversibility.

The examples here summarised show how the field of experimentation of the theme related to the humanisation of hospital structures is widely applicable to many functions of a hospital and is equally open to further design experiments, also as a result of the paradigm shift that the on-going pandemic from Covid-19 is already imposing.

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