MORPHO-TYPOLOGICAL RELATIONSHIPS BETWEEN ARCHITECTURE AND PANDEMICS: THE CASE OF PLAQUE AND TB

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ABSTRACT

The present paper considers the correlation between epidemics and the resulting development of architectural response. Pandemic phenomena appear, as well as a healthcare problem, as a social question too causing the need to give an effective response that involves the collective. The analysis uses a comparative morpho-typological method. The study of the building typology starts from the recognition of some features, from whom it is possible to recognize building types. In the case of the 'lazaretto', which became the quarantine place, the building defines an introverted space which tends to eliminate any connection with the town. Another pandemic event is tuberculosis. Patients' needs to be continually exposed to fresh and healthy air and sunlight caused the birth of a specialized building typology: the sanatorium. The purpose of this paper is to define the correlation between architecture and health by analyzing historical phenomena that lead to the codification of these building types.

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Fig. 1. Diagram of trade routes and distribution of lazarets in the Mediterranean basin, drawing by the author

Introduction

Throughout history, the adjustment of humankind to a community lifestyle allowed an incredibly fast development of commercial exchanges, infrastructures and communication networks. Technical progress, in this sense, can only take place within a group with a strong hierarchical structure, which favors a good ability to manage the community resources. However the development of the demographic picture is certainly a stimulating and necessary factor to the constant community progress. In that case, this produces a series of problematic issues to eventually endanger the entire community. For example, with plagues which find fertile ground right inside particularly large demographic groups, where the population is able to grow demographically thanks to the surplus of resources.

An epidemic is a collective manifestation of a disease that rapidly spreads, affecting a large number of people within an extensive territory.

The violence and repetition of the phenomenon are typical features of many plagues which is why human societies had to deal with this issue. However, since ancient times, the lack of medical-scientific knowledge, the impossibility of reaching a definitive solution to the epidemic issue and the need to proceed with community life, led mankind to look for a solution that could at least limit epidemic phenomenon.

The observation of symptomatic phenomena, the method of infection identification and the empirical discovery of rudimentary disease prevention methods were the first

instruments which humankind employed to deal with epidemic phenomena.

The built space represents one of the first instruments that man employed trying to satisfy functional requirements tied to physical health. Human size has always represented the measuring comparison of the space that man had to realize, for example the size of a hole and its frame, his height or width position within a room or the location of fastening. In this sense the built space has played a vital role in the fight against plagues too. Architecture has created formal solutions to practical problems that, over the years, ended up building real compositional paradigms of the Healthcare center. This study will focus on the consequences that the epidemic phenomenon had on the birth of special building typologies associated with the disease: this is the case of the lazaretto for the plague and of the sanatorium for the tuberculosis.

Methodology

The proposed survey aims to study two building typologies that develop in parallel with pandemics. "Building typology can be defined as the heritage of common characteristics which precedes the formation of the organism, ruling from the inside the structure of connections and relationships of needs that constitute it [...]. In other words, building typology is the common heritage of more or less extended cultural areas, from which the building comes from and that precedes the building" (Strappa, 1994). Those analyzed below are two special types that originate from the revision of pre-existing building typologies, which were used for purposes that had nothing to do with epidemics.
Over the years, the matrix type has undergone a characterization that leads it to a clear morphological configuration through a type specialization. This process occurs mostly through a codification of elements characterizing the building typology, called "characters". The architectural "character", from the greek word charaktèr, (mark), identifies the complex of features that distinguish a collection of buildings from another. Buildings which are often identified and sorted by the purpose for which their construction was intended, are now studied through common features which depend on their formation than their constructive, distributive and stylistic features.
Pandemic phenomena, best known for their unexpected severity, force communities to face emergencies rapidly. In the past communities had to intervene in an emergency through the only tool available, the formal construction of space. Ar-

chitecture, in the cases analyzed below, intervenes in a phase in which disease has reached a wide section of the population. Collective knowledge is therefore aware of numerous factors linked to the pandemic phenomenon such as symptoms, spatial propagation and the means of disease spreading. The emergency condition that originated from the pandemic crisis encourages communities to act rationally, trying to optimize available resources to face the phenomenon, through a behavior led through critical awareness. "Critical awareness is the condition of uncertainty as a result of the inherited building reality that forces to perform strongly intentional constructive acts in regard to new interventions, imposing an aware project as a choice and unavoidable moment of the building process". (Strappa, 1994). Evidence of acting through critical awareness can be seen in the adaptation of specific building types to the new need of space to dedicate to pandemics and this phenomenon mostly occurs through a typological variation process. This process displays through the assignment of a specific purpose to some spaces of the building organism, which immediately acquire a very strong functional definition that qualifies them as distinctive features of the building typology.
The analysis method used for this study is based on the codification of the type through the identification of recurring architectural characters, described through phenomenal reality made clear in the building organisms analyzed. Once the main type is identified, this study will try, through the comparison of building structures from different periods, to clarify the modification processes of the type over time through the description of the law of composition applied to type through the ages.

The Black Death and the Lazaretto

The first historical event analyzed in this paper concerns the plague pandemic. From the clinical point of view, the disease is caused by the Yersinia pestis bacterium, which is transmitted to man by rodent fleas. Plague appears in various forms through flu symptoms, whose main symptomatic manifestation is inflammation of the lymph nodes, which causes the typical buboes swelling. Plague began to spread in China over two thousand years ago and would be introduced to Europe by rats coming from the East on board merchant ships.
Due to the severity and the diffusion rate of the plague epidemic, the development of prevention techniques to limit the disease spreading had proved ineffective, white the exception of quarantine. This is a separation and analysis peri-

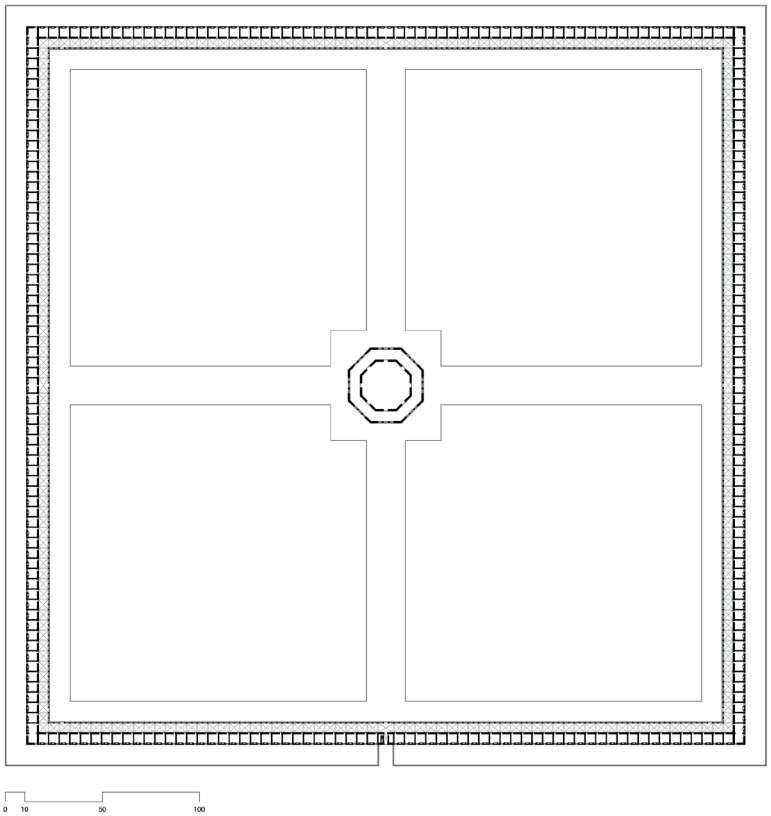


Fig.2. Planimetric reconstruction of the hospital in Milan, drawing by the author

od to which people, animals and objects, which were likely to take the disease with them or retain the germs of infectious diseases, were subjected. This method was applied to protect harbor cities (fig 1), because they more frequently received people for trading purposes, and therefore specific welcoming shelters were built there: this was the case of the Republic of Venice, the western state who first adopted a lazaretto. This building typology draws its name from the lagoon island where the Santa Maria di Nazareth church stood. The effectiveness of quarantine in slowing the spread of plague made the fortune of the building type, so that lazarettos spread alongside the main trade routes, first maritime ones and then in the hinterland.

Lazarettos were built outside the cities, quite often near the city gates. The most famous example of lazaretto is located in Milan (fig. 2), built in 1489 by Sforza dukes which stood until the second half of the 19 th century. In the first phase, these buildings show some features inherited by the cloister, which is the mother building typology. Structures were built according to a series of rooms, a courtyard that is generally closed on all sides, and a central element represented by the altar, where religious celebrations were made. The essential elements of the type acquire a strong functional characterization: the room becomes the serial element of the structure which displays restrained sizes strictly functional for one sin-

gle person; the uncovered courtyard, on which cells look out, was used as a storage area for goods subject to quarantine; eventually, the altar was located in a position that could be seen from all cells. The Milan structure shows how building complexes initially turned out to be very large in size, as well as symmetrically oriented structures with no connection with solar orientation.

In Verona a lazaretto which displays some innovations was built. The project of the architect Michele Sammicheli, this was created with a cloister structure, in this case on a rectangular shape. The complex was realized outside the city, along the Adige river, where there is a bight, and is currently in a state of ruin following severe damage the Second World War. A century later than that of Milan, the lazaretto in Verona shows a greater awareness of the disease. A compartmentalization in four areas of the courtyard is introduced through dividing walls. This clear division enabled people to distinguish protective quarantine, the one people and goods considered as infectious were subject, from the precautionary one, intended for the confinement of the sick.

During the 16th century, it was evident that the presence of lazarettos in trade cities allowed the continuation of commercial exchanges. Therefore these buildings were built in many trade cities. The building of the seventeenth-century lazaretto in Genoa, near the Bissagno river mouth is an example. The building structure, realized beyond the city walls, turned out to be south-oriented, toward the sea. The concept of compartmentalization is here realized through the redoubling of the corral which the rooms of the plague victims, or presumed such, overlooked. Furthermore, the doubling of the structure allowed a major specialization of the central section, which is constituted by a series of larger rooms, exclusively dedicated to the treatment of goods.

The same phenomenon occurred in the harbor city of Messina, in Sicily, where a lazaretto was built on an artificial island in the Zona Falcata area. The harbor basin of Messina was organized with a series of strictly functional buildings. In the lazaretto took placer the health check of the ships, which docked only after the authorities' approval. During this mature phase, it is now clear that the lazaretto mainly fulfills the role of a building for good treatment rather than a place to contain infected people. Despite the structure losing its symmetry, it still displays a scheme that revolves around a courtyard. Perpendicular arms to the uncovered part consist of docks for goods storage, whereas a taller building with multiple levels, contains cells for the sick quarantine.

In closing, one of the last realized buildings is that of the

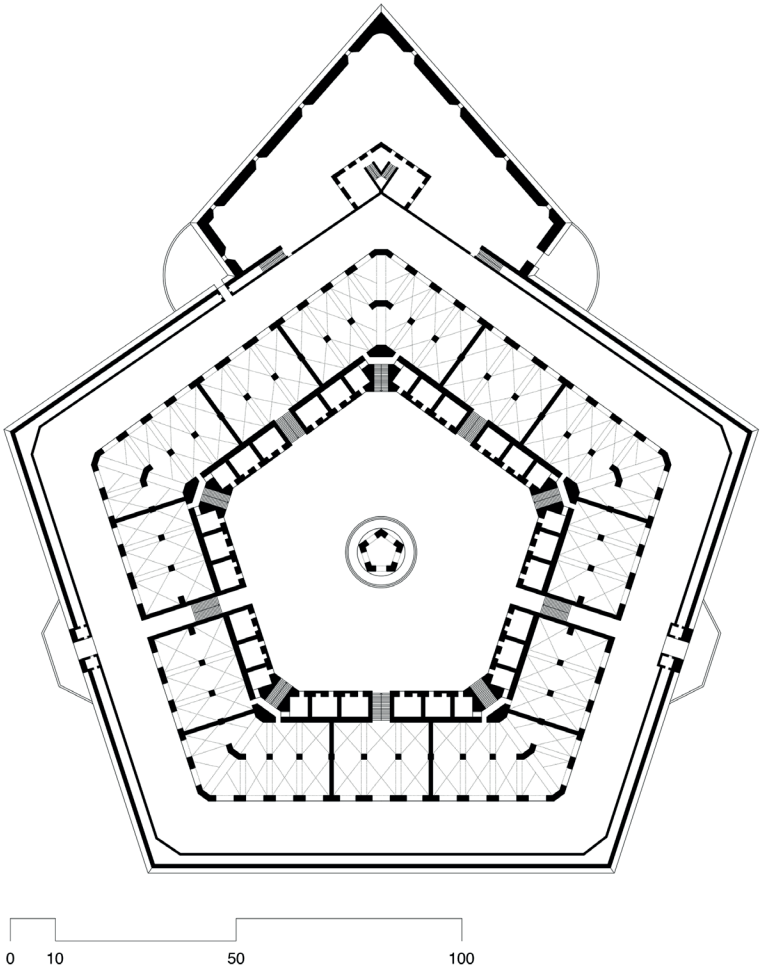


Fig.3. Planimetric reconstruction of the Lazzaretto of Ancona, drawing by the author

Mole Vanvitelliana in Ancona (fig. 3). It was built for this important Papal harbor, on the Adriatic Sea to be competitive with Venetian trading ports. Built on an artificial island and pentagonal in shape, it is composed of two concentric rings: goods were placed in the outer part, whereas some rooms for sicks were located in the inner part. In the central section, according to the canonical scheme, the pentagonal courtyard and the altar dedicated to Saint Roch are located. The central element of the church becomes the generating part of the polar structure. In this case, the lazaretto displays more specialized features, with bastions and fortifications, to protect the harbor, which suggest a multi-funcional nature of the building. The lazaretto building typology fell into disuse because of medical discoveries, which enabled a more effective treatment of the disease that brought the plague to became harmless for western country.

Tuberculosis and the Sanatorium

The second case analyzed concerns the tuberculosis epidemic. Tuberculosis, also known as TB, is an infectious disease

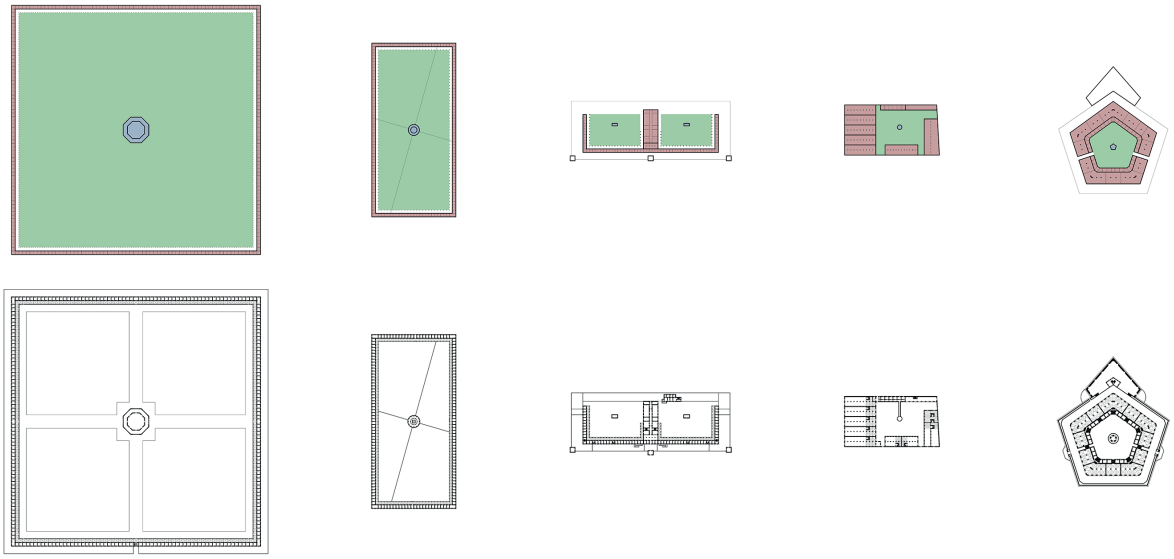


Fig.4. Comparative table of the analyzed lazarets, drawing by the author

caused by a mycobacterium, the Mycobacterium tuberculosis. TB attacks lungs, gradually destroying pulmonary alveoli and causing breathing difficulty or "air hunger". The disease, well-known since ancient times, leads the infected person to death, and that is why TB was considered incurable until the 1940s, when the first antitubercular drugs were discovered. Early medical studies, in the second half of the 19th century, show the efficacy of patients' exposure for long hours to air and direct sun. During the 19th century in Alpine areas, a phenomenon attributable to medical tourism developed. As only the upper class could access treatments, because of the high cost of long stays in suitable places for light and air exposure, medical tourism was initially reserved to a very small portion of the population, those who could financially pro-

Fig.5. Diagram of the distribution of Alpine-type sanatoriums in Europe, drawing by the author

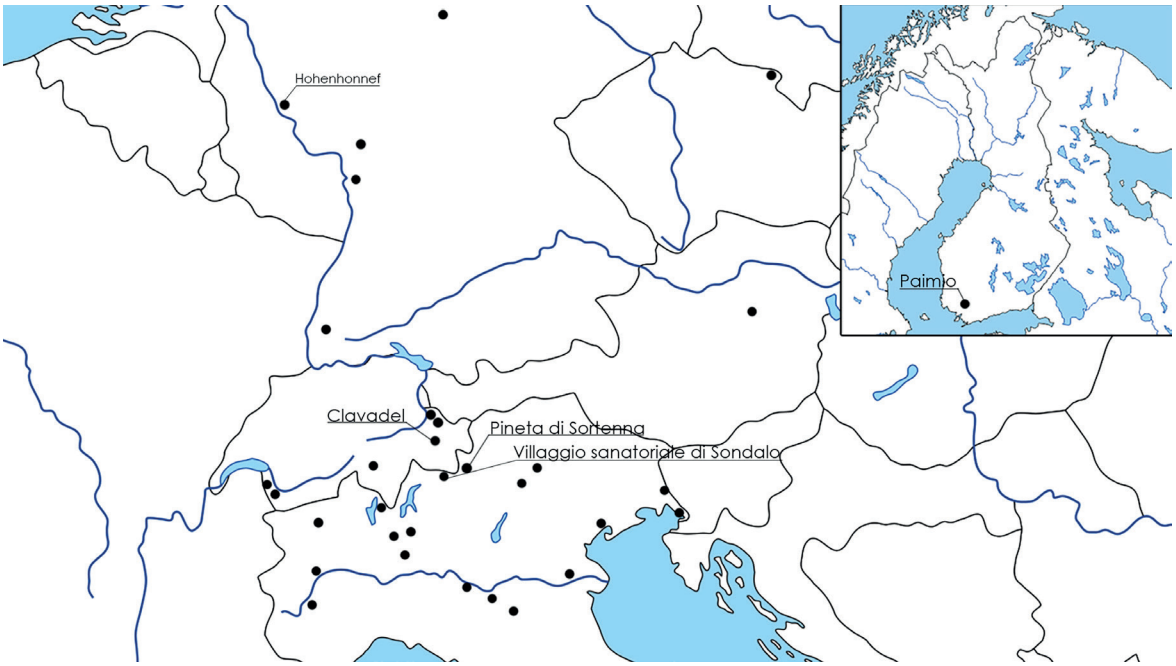
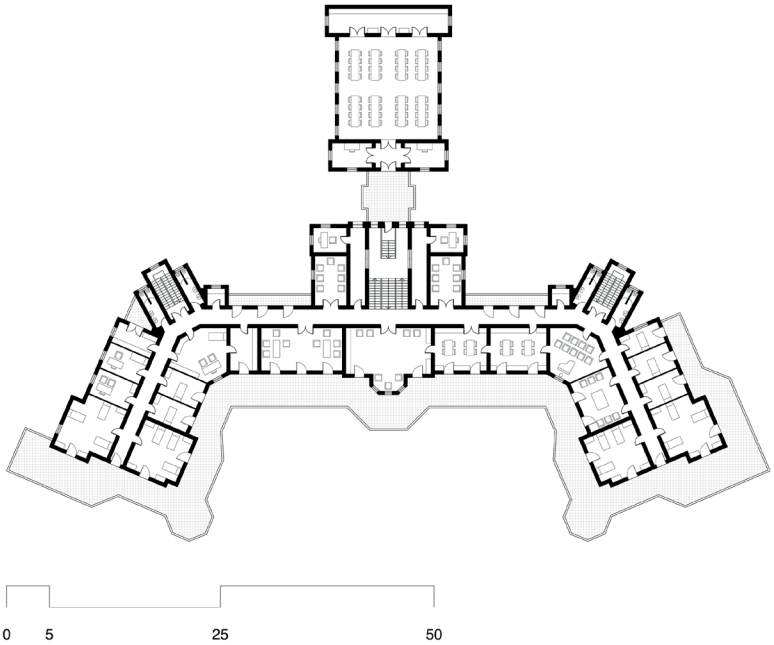


Fig.6. Planimetric reconstruction of the Hohenhonnef sanatorium, drawing by the author



vide for treatments. The sanatorium was born in the German and Swiss context, deriving from mountain hotel structures. All such buildings are located in suburban contexts and are surrounded by nature, such as parks and woods (fig.5). Alpine hotels ensure personal space to each patient, because they are multi-storey blocks, they have a dedicated floor for the lobby and common facilities, and rooms located along the walkways or distribution corridors. The sanatorium, derived from the Alpine hotel, introduces some functional distinctive features for lung treatments. First and foremost is the introduction of a space dedicated to the exposure of patients to direct air and sunlight: the balcony located in each level of the building structure and always south-oriented with a privileged sun exposure.

A first example of such a building is the Hohenhonnef sanatorium (fig. 6), in the center part of Rhineland. This building displays a floor plan typical of winged hotels. At the ends of the two side arms, a series of spaces used as rooms were located. In the first phase, rooms display a different composition and are set up both as a single room and communal apartments. The Balcony is located along the south facade and represents a quite deep space, of almost three meters, useful to contain beds where patients were positioned. Medical services and collective spaces are located in the central block and towards the northern part of the building.

The first sanatorium in Italy was developed in 1903, in the small alpine town of the Valtellina area where the sanatorium of Pineta di Sortenna is located. It is clear that the building typology shows the same features of those originating in

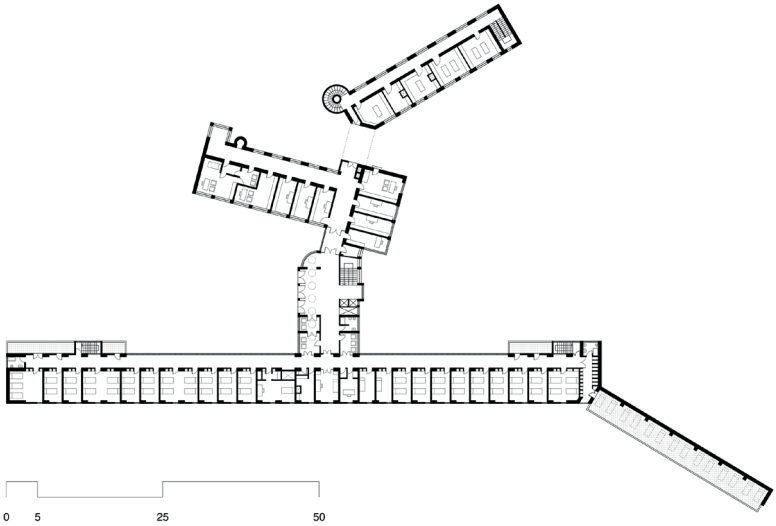
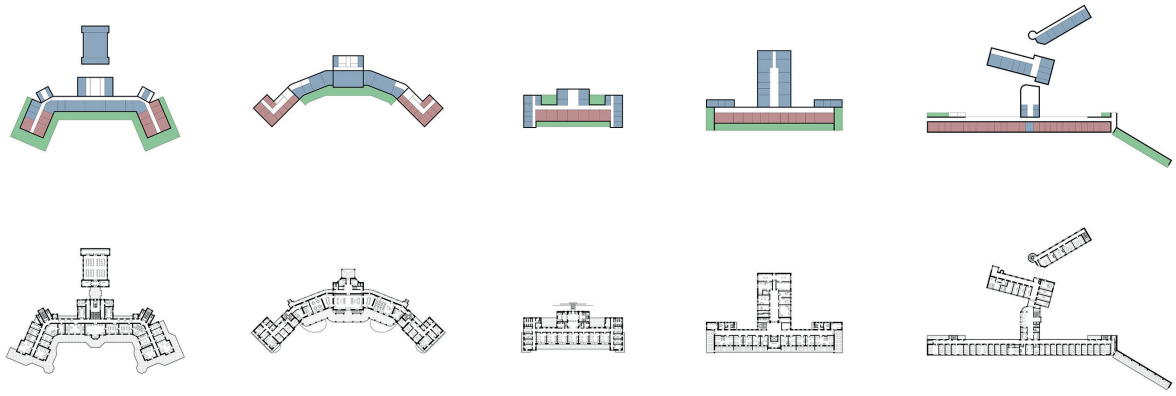


Fig.7. Planimetric reconstruction of the Paimio sanatorium, drawing by the author;

the German area: the arrangement of patient rooms alongside the two wings of the building, the existence of the porch and accessory rooms in this case in the central block. Here, rooms occupy the end of the building wings and they do not adjoin the balcony.

A substantial type evolution occurs with the creation of the Italian sanatorium network, where the government, through INPS, the main entity of the Italian public retirement system, financed the building of sanatorium colonies for low cost treatments, in order to eradicate the disease even among the lower classes. Therefore, the construction of health colonies began, such as the one of Sondalo in Valtellina area. This large complex made up of several pavilions, is essentially composed of a model repeated in layout and orientation, rigorously privileging the southern exposure. Focusing on the single pavilion, in the new-concept building structure, two things can be seen: rooms appear to be modular and repeated in series through the identification of one type of single room; in addition, the block of rooms and the porch are closer. The consequence is that there is a progressive moving of the common and general facilities toward the end of the building.

Fig.8. Comparative table of the sanatoriums analyzed, drawing by the author.



Swiss areas were also provided with sanatorium colonies, such as the one in Davos. The Clavadel could be considered as the most canonical example of the sanatorium type. The building provided a characterization of the southern facade, which houses the balcony directly connected with the rooms, whereas the north facing facade amounts to an orthogonally rotated wing, in which common areas and medical services are located. This type is also called the "T shaped" sanatorium, due to the presence of two straight wings intersected by the north-facing services block.
The T - shaped type represents the rapid evolution of the Alpine sanatorium. Paimio sanatorium (fig. 7), which was designed by Finnish architect Alvar Aalto, proposes the same layout of what was codified from the typological point of view in the European cultural field, according to the architectural language of the designer. Specifically, building structure breaks up into parts which are tied together in a relationship between recognizable parts. They are clearly recognizable as connected blocks: the block of the rooms facing the south, the porch adjacent to the rooms and patients' services system divided between medical and general services arranged, according to the T - shaped building scheme, with northern exposure. The sanatorium building typology later fell into disuse because of medical discoveries which allowed a more effective approach to the therapy.

Conclusions

The two circumstances discussed here, although different, lead to conclusions on relationships between building typology and care. The homogeneity of the condition, resulting from the absence of therapies and the fact that both building types fall into disuse with the subsequent discovery of pharmacological treatment, make it possible to recognize a quite analogous evolutionary process.
Specifically, throughout history, the lazaretto building type changes dramatically in scale, moving from very large buildings to smaller ones, making use of multiple levels in height. However, through times, the room appears to have an almost homogeneus size, around 12 square meters. Features characterizing this typology are unchanged through their development, by changing only the size on the basis of the relationship between the parts within the organism (fig. 4).
On the other hand the sanatorium, being purely a residential type, keeps an almost unchanged scale in buildings size, but a remarkable room typology variation is noticeable, which tends to type modularity during later stages. In this case,

the typological identification process consists in the proper placement of the elements in the spatial composition and in the definition of the right relationship between the different parts (fig. 8).
The cases analysed represented attempts to provide for the lack of medical knowledge through the formal construction of the space. In these cases, the planning approach occurred empirically only, because of very poor medical knowledge. Despite this, the space generated made possible, although in a limited way, the treatment of these diseases. This analysis has highlighted the powerful tool of the project was as part of therapy setting and that, empirical observation and design techniques, it surely could confer a great therapeutic value to built space.

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