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Healing Architecture in Mental Health Facilities in the New European Bauhaus Context

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Abstract: The processes of health building design issues overlap, like the complexity of architecture, technology, and protection of human well-being. It becomes necessary to use a holistic and empathized approach. They meet the concept of the New European Bauhaus (NEB) in terms of attention to the aspects of comprehensive design with a focus on humans and their environment. The investigation focused on psychiatric hospitals with an ever-growing demand for treatment places. Accordingly, this article shows the healing architecture's examination and the environment in healthcare facilities. The POE method was used by investigating the examples. Research contained the technical, functional, spatial, and behavioral qualities of existing psychiatric hospitals. By presenting elements that positively affect the well-being of users, we indicate good practices that bring psycho-physical benefits.

Keywords: mental health facilities; hospital design; healthcare architecture

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1. Introduction

Interest in the relationship between the built environment and human health dates back to 1960 [1], when numerous literature sources on the topic of the relationship between health, humans and the environment began to appear [2–7]. The topic has become pressing due to the existing paradox in the medical world, which says that people live longer but need better care due to their frailties [8]. The first mandatory principle of medical care is 'do no harm' [9], and as research shows, poorly designed surroundings can negatively affect patients' health [4,8,10]. The opposite of poor or bad design are concepts of so-called supportive design [10] and healing architecture [11]. Due to the research topic relating to psychiatric hospitals, the concept assumes that a well-designed building can have a measurable impact on the treatment process. Such function focused on patient treatment should meet these requirements adapted to the profile of a given healthcare facility.

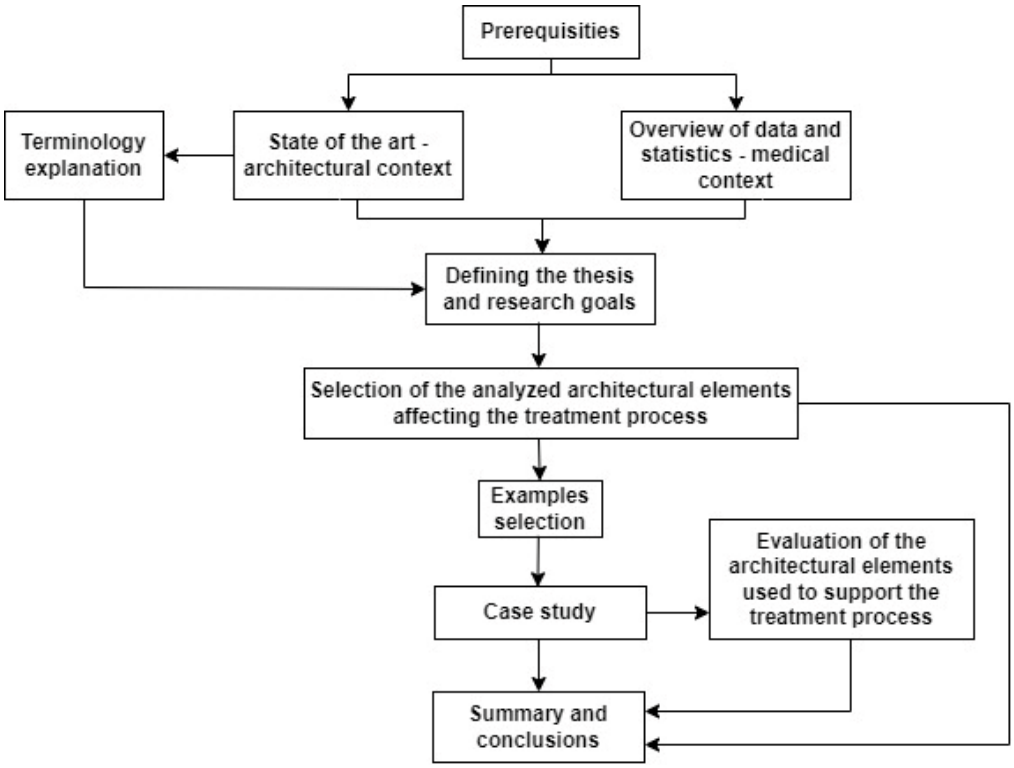
This study focuses on psychiatric hospitals, where the impact of architecture on the patients' mental well-being can have both positive and destructive effects, depending on the design. This effect is the main aim of the presented investigation. Thus, a crucial aspect of the research is to check which architectural elements can be therapeutic and whether they follow the assumptions of the New European Bauhaus. This European Union (EU) initiative meets the assumptions of design, ecology, and the social approach to creating architecture [12]. The NEB ideas force designers to consult the users of the space, which allows for the buildings' designs to be practical and beneficial [13].

2. Materials and Methods

2.1. Research Structure

The presented research aims to investigate which architectural design issues influence the creation of healing architecture in mental health facilities. It consists of several stages presented in diagram (Scheme 1). Firstly, the prerequisites were derived, followed by

the state of knowledge considered within architectural and medical contexts. The review served the purpose of research goals' formulation. Then, we selected the architectural elements that stand out in the literature and are known for influencing a patient's treatment process in psychiatric care facilities. These assumptions required confirmation, which was carried out based on case studies. The final stage of the research is a summary and conclusions.



Scheme 1. Research scheme (prep.: author).

The initial stage of research is as listed:

1. Examining what issues related to architectural design influence the creation of healing architecture;
2. Formulating criteria for designing model buildings that take into account the idea of healing architecture;
3. Assessment of the quality of healing architecture of selected model examples of psychiatric care buildings.

After establishing the goals, planning the strategy for solving the research process began. We used three research methods:

- method of logical argumentation,
- case study,
- post-occupancy evaluation (POE), including three types: indicative—general; investigative—EBD Evidence-Based Design; and diagnostic (for conclusion formulation) [14].

The first one, consisting of logical argumentation, allowed for the achievement of the first research goal. The literature review allowed us to establish the architectural elements that support the patient healing process. Their list is as follows:

- environment,
- lighting,
- thermal comfort and indoor climate,
- acoustic comfort,
- physical comfort.

The research problem that the authors deal with in this article is the lack of comprehensive studies dealing with the impact of architecture on the process of treating patients in psychiatric hospitals. Based on the obtained results, we carried out research using examples. Yet, the methods applied are theoretical, which leads to theoretical results [14]. The research goal was to receive so-called 'good practice' conclusions. Thus, the investigation considered positive examples that meet the idea of healing architecture and aimed at achieving similar results for each case. The analysis contemplated online sources like articles, interviews, descriptions, illustrations, and photographs. We examined and described cases in the context of the six issues considered (environment, lighting, thermal comfort and indoor climate, acoustic comfort, and physical comfort). This process led to the list formulation of healing architecture design criteria, which are presented as tabular summaries. The final point was the qualitative assessment of the examples carried out in the form of POE research. Due to the discussed function of healthcare buildings and mental health, it is crucial to pay attention to quality. It is an elemental research problem in the field of architecture. The focus was on functional and behavioral quality, putting aside technical quality (due to study limitations). Thus, we established quality criteria as a search for connections between the built environment and the sense of well-being [14]. Focusing solemnly on the literature and analysis of buildings allows for the human factor's exclusion. The research techniques used are non-participant observations, interpretive analyses, data collection, sorting, and synthesis [15] as well as a comparison of examples and scaling of assessments. As Niezabitowska describes in her book on research methodology in architecture, the use of qualitative research in architecture is important due to the fact that this type of research focuses on enriching knowledge regarding user needs. Additionally, the relationships between the shape of the environment and people's behavior are identified, which makes it possible to determine the expected level of quality of buildings that will be built in the future [14] with what this article implements. The investigation procedure and structure are summed up in the following graph.

2.2. The Initial Literature Overview

There is considerable literature on the design of healthcare facilities that is worth mentioning. The review focused on sources that directly dealt with the impact of architecture on patient well-being. Preliminary work influenced the built environment field of study on the patient treatment process, which began in 1960. It has been described by Willis, Goad, and Logan in the chapter of his book about the rise of patient experience [1]. This approach is researched and promoted by authors such as Ulrich [4,10,16], Kagan and Levi [2], Antonovsky [3], Barnes and Cooper [5], and Salonen [7]. The studies of the mentioned authors have not become outdated and are still valid, which confirms the most up-to-date literature. The most significant research work about the quality of space in healthcare buildings after 2020 is written by, among others, Garg, Dewan [17], and Bellini [18]. Those works cover a wide range of research on the relationship between architecture and patient well-being.

An increasing number of studies use the concept of 'healing architecture'. In a research work from 1998, Raz, Sasson, and Zohar argue for the positive impact of selected components on patients and staff. The authors also determined that a psycho-environmental approach to the design of psychiatric hospitals may contribute to the prevention of psychopathology [19]. The researcher Lundin, in his book written in 2015, focuses on the use of evidence, intuition, and dialogue in the design of architecture that promotes the treatment and faster recovery of patients. The author's goal was to contribute to the definition of a healing architecture that combines the collaborative culture found in Sweden today with an American influence that argues for evidence-based architecture [20]. When drafting the article by Fricke et al. in 2018, the authors focused on 'healing architecture' in the context of the treatment and recovery of children and adolescents after mental illness. The authors suggest that the correct designation of entrance and territorial zones has a positive impact on patients [11]. The position by Simonsen and Duff from 2020 deals with the impact of

space and its arrangement on psychiatric wards. The authors state that healing architecture influences the nature and organization of psychiatric work and patient treatment [21]. A different approach was presented by Ghazaly et al. in 2022, where they discussed the topic of healing architecture in the spiritual context and the variety of aspects in which the healing process may occur by taking into account the principles of the biophilic effect [22]. The latest study belongs to Simonsen, Brown, and Reavey and is from the beginning of 2024. The study contains research on 'healing architecture' in the context of the influence of nature on the patients' healing. The authors suggest four principles for healthcare design [23].

The above studies indicate a set of guidelines for designing 'healing architecture' in the mentioned context. The concept of 'healing architecture' appears more often in scientific works. However, it requires some systematization and extension. With this study, we try to condense and summarize the elements that influence the 'healing architecture' and examine its quality.

3. The Detailed Literature Overview in Terms of Architectural Features

The discussion chapter elaborates on the issue of healing architecture based on a literature review and analysis. Logical argumentation served to form the summary of this passage. The intuitive understanding of the concept of 'healing architecture' allows us to assume that it is a building enhancing the healing process of patients. Thus, the following sections of this chapter are devoted to explaining how individual elements of the built environment may influence the treatment process of patients. The summary of this chapter presents a set of criteria indicating good practices that will enable the next stage of research to evaluate examples of psychiatric hospitals in terms of verifying whether they are a building that represents the idea of 'healing architecture'.

3.1. Environment

The first element discussed is an environment that promotes patients' well-being. In mental health facilities, the space surrounding the user is an element of the healing process [17]. In the literature on the subject, the environment is considered in the context of the external environment and as the immediate surroundings constituting the interior. In this section, we investigate both the external and internal space. Research on healing architecture shows a direct relationship between the environment and patients' health and well-being [1–3]. Carefully designed natural and built environments accelerate the healing process [16] by applying the following criteria:

- space to spend time outside,
- positive distractions,
- interiors as a peaceful environment.

The first design process element is a building location on a site concerning varied factors. Among them, quietness and greenery stand out [6,8,18]. The construction plot should be large enough to plan a garden and a walking area. It requires considerable distance from busy roads and buildings with burdensome functions to provide peace [18]. The outdoor space supports a sense of independence and freedom, which is extremely important when treating mental illnesses [1,8,10,22]. The designs of psychiatric hospitals also use green patios, which provide places to rest in the fresh air without leaving the building walls. In these outdoor spaces, it is worth offering sliding furniture that will arrange for independence and the possibility of separation [24].

An additional advantage of outdoor green spaces is that they constitute a positive distraction thanks to the multi-sensory nature provided by sights, sounds, and smells [10]. The environment is also crucial to a patient viewing the surroundings from a hospital's inside. Carefully designed frames for external views are significant in patient rooms and daily activity spaces [8,17], where patients spend most of their time. In 1984, Roger S. Ulrich wrote a separate article on the influence of the external view on the recovery process after surgery [4]. An additional issue is the impact of art on patients receiving psychiatric care.

Studies have shown that such positive distractions in space reduce the administration of sedative medications [25].

The environment of a psychiatric care hospital should be visually attractive and calming. It turns out that shapes, colors, and textures can also influence the mood of patients [26]. Colors not only modify behavior and perception, but when used purposely, they can ensure easy identification of the space [17]. Scientific research shows [26] that optically 'warm' colors like orange, red, shades of white, and beige serve well in activity spaces such as living rooms, dining areas, physiotherapy places, and exercise halls. 'Cold' colors (green, blue, white, and beige) in hospitals are worth using in quiet rooms [27]. They are perfect for patient rooms, offices, and therapy zones. In general, interior colors should be light and subdued, with limited dark colors [28]. Exploring color theory and research is extremely important in the case of psychiatric hospitals because their wrong selection may lead to deepening depression, a tendency to self-harm, anxiety, and other negative effects [26]. The way of shaping the rooms is another element that is discussed. Long, narrow corridors should be avoided as they may disturb perception in the case of psychosis [29]. It is recommended to use consistent forms in interiors where people with various mental illnesses appear. Rectangular, natural, round forms based on circles have a positive effect on the mind. Sharp edges and angles, in addition to physical danger, psychologically suggest anxiety and tension [26]. It is worth adopting one coherent and calming motif of forms in the building design, so that instead of suggesting danger, it calms patients down and encourages relaxation [30].

3.2. Lighting

The issue of lighting in the healing architecture environment is another problem that we analyze within the adopted methodology. The purpose of properly designed lighting is to ensure the positive effects of light on the human body and limit the negative ones. In the past, the human body was regulated and adapted to the day determined by the presence of the sun in the sky. Disruption of this rhythm changes the functions of brain areas, and thus emotion regulation is disturbed [31]. Vitamin D deficiency, supplied by sunlight, is also important here, as it influences the development of many psychiatric diseases [32,33].

To ensure patients' comfort related to lighting, three basic issues were adopted that should be explored and met:

- effective use of natural light,
- limiting the unwanted influence of daylight,
- providing proper quality artificial light.

Natural lighting is most valuable because it provides sunbathing [17], known to be beneficial throughout the history of hospitals [33]. Daylight, especially in the morning, has a positive impact on the mental health of patients [8]. It has been shown that in psychiatric hospitals, patients hospitalized in rooms with southern exposure are more likely to be sent home sooner than in rooms with northern exposure [22]. Based on the research, it can be seen that patients' bedrooms and daily activity rooms should have eastern or southern exposures. In the context of these criteria, architecture should be shaped in an appropriate way: using large windows (minimal dimensions define standards) and patios to provide additional light and paying attention to the dimensions of buildings so as not to obscure valuable sunlight.

Light limitation (if needed) can be conducted in two stages: external shutters on the facade or internal elements limiting the access of sunlight to a given unit. A valuable solution in that regard is external automated façade blinds to manage illumination and shadows, thus enabling better access to daylight [34]. Hospital management is very complex, so in some cases, automation makes this task easier. However, patients and staff should also have control over the system elements [35]. The issue is pressing since the daylight is irritating in some diseases, but also at night, external street lamps may produce unwanted glare. Also, polar day and northern lights disturb the human daily cycle in

specific locations. Shutters help to limit the view of a dark 'almost black window'—which may cause anxiety or fear [27].

Research shows that most patients prefer natural light but regardless of weather conditions, everyday functioning should be supplemented with artificial light [22]. In patient rooms, the recommended value is 100 lx, during reading it is 300 lx, and in certain rooms for examinations and procedures, it is 1000 lx [36]. In addition to the intensity, the requirements for artificial lighting should also take into account the color of the light [37], its adaptation to the color of the rooms, and the possibility of adjusting it to a specific patient depending on the disease state.

3.3. Thermic Comfort and Indoor Climate

Thermal comfort and room climate are other issues studied in the healing architecture context. Providing this basic need of the human body allows patients to focus on their well-being and concentrate on treatment without additional negative stimuli. The feeling of thermal comfort is related to cardiovascular activity, which, as research shows, differentiates human emotional states [38]. In the case of mental illness, these processes may be unwillingly distorted. Moreover, the therapeutic environment should provide fresh and good quality air [8,15], as these factors affect the health and well-being of building users [39]. High air quality seems obvious, yet in many locations worldwide, atmosphere pollution is significant. Thus, proper inlet and outlet filtering is a necessity.

A properly designed and maintained indoor climate should meet at least three fundamental criteria:

- thermal comfort,
- air parameters,
- microbiological safety.

The human body experiences thermal comfort when it is in a state of heat balance and registers neither cold nor heat [40]. This issue may vary depending on latitude and cultural differences [41], as well as during disease [42]. Thermal comfort depends on physical, physiological, and psychological factors, which means that the comfort assessment is a cognitive process of a given individual [43]. In contemporary design, the rules for heating and cooling a building are strictly defined and obligatory [44]. To meet these requirements, designers propose heating or air conditioning systems depending on the climate and latitude of localization. These systems, designed correctly, are the basis for ensuring the thermal comfort of building users. Another factor is maintaining the temperature by insulating the building and limiting thermal gaps. The issue of airtightness also includes limiting drafts. Uncontrolled and unwanted airflow may deteriorate patients' health, causing additional diseases and illnesses.

The temperature of the rooms should be adapted to the functions of the rooms, depending on the activities performed there [45]. The minimal temperature values are determined by the standards and legal regulations for specific rooms [46]. As already mentioned, thermal comfort is a relative concept. Hence, contemporary hospitals' heating systems allow patients or the staff to adjust the room temperatures individually [15].

As mentioned, hospitals' design also focuses on air quality, and to regulate this issue, sustainable ventilation and air conditioning systems are used [47]. In support of filters—or instead of them—the designers should focus on the location of the intake vents and exhaust terminal. Devices should draw air from clean places, preferably enhanced by nature like greenery and far from pollution and odor-generating elements (kitchens and waste collection rooms) [48]. Systems that remove stale air and exhaust terminals are best placed in secluded areas and away from utilities. The distance of these devices from buildings and specific rooms is regulated by legal standards [49]. If climate conditions and wind directions allow, windcatchers allow for the enforcement of natural ventilation. This zero-energy passive system is described in detail, i.e., by Chohan and Awad [50]. These authors stress that building shape is crucial to provide proper natural ventilation—especially in courtyards, atriums, and roof forms. Air quality requires (if possi-

ble) natural cross-ventilation, and the design of the rooms should respond accordingly [17]. Spaces excluded are due to sanitary requirements like operating theatres, contagious patients' isolation rooms, recipe chambers, etc. Also, in psychiatric hospitals, the access to open windows may require limitations due to patients' personal safety. The key building design elements influencing natural cross-ventilation are dominant wind directions, building orientation, and window size. The literature indicates that the ventilation coefficient reaches its highest value when the architecture of the building ensures that the openings face north [51]. Providing such a solution is extremely important in hospitals because, in the event of mechanical ventilation failure, it ensures the airing of the rooms.

Microbiological safety is a critical aspect of medical facilities. The in-purification of the air from microorganisms may have a beneficial effect on the health of patients by reducing the likelihood of the spread of diseases [52]. Illnesses such as colds or psychiatric patients can significantly lower the mood and thus slow down the treatment process. Firstly, an appropriate number of air changes is needed to reduce the time the particles remain in the inhaled air, and this aspect is also standardized. Additionally, medical facilities use UV lamps, which, thanks to UV-C radiation, destroy bacteria, viruses, fungi, mold, and other pathogens [53]. Antibacterial materials are used as interior finishings in hospitals. It is worth using this technology on frequently touched materials such as elevator buttons, door handles, and handrails. Currently, it is standard to use antibacterial paints, floors, and furniture upholstery.

3.4. Acoustic Comfort

Another aspect of hospital design is architectural acoustics [54,55], aiming to decrease negative impacts, namely noise, and increase positive ones, like sounds of nature, conversation, or gentle music [56–58]. Positive acoustic reinforcements speed recovery, while unwanted sound disturbs sleep and concentration and contributes to diseases [59,60]. Proper healthcare soundscape design should take into account several factors:

- external noise sources,
- internal noise sources,
- building compartment isolation properties,
- in-room noise limitation,
- reverberation noise limitation [61,62].

In light of these aspects, the proper hospital design starts with site selection, preferably distanced from traffic roads, airports, railways, industrial buildings, and other possible loud noise sources. Broad greenery belts favor a decrease in acoustical energy, according to the rule that the intensity of sound is inversely proportional to the square of the distance [61], and allow for the creation of patient parks and recreation areas. The described design limits the negative impact of external noise sources on healthcare buildings.

The next step consists of the identification of cardinal internal noise sources, namely technical and service rooms; diagnostic areas with medical apparatus; vertical and horizontal communications, such as stairs, elevators, escalators, and corridors; as well as pipes and ventilation ducts. Best practices of spatial functional plans assume their distancing from patient rooms, where chapels, meditation spots, green courtyards, and waiting zones serve as spatial buffers.

Adding building compartments like ceilings, walls, and partitions designed with high sound isolation properties helps to provide better in-room acoustic conditions. Moreover, all factors matter, also in detail, like the soundproofing of the construction wreath, the airtightness of doors and windows for both their structure and mounting, and the lack of gaps connected to electric slots and air ventilation inlets and outlets. Pipes of HAVAC installations, water, sewage, and heating systems undergo sound insulation, especially in the patient's room's vicinity, with mounting systems of those fittings that must also eliminate vibrations. Such design depends on many factors, which the architect considers individually for particular cases.

In-room noise limitation depends on the interior appliances and apparatus's careful selection, complicated with patients' requests like TVs or radios. Moreover, the sound impulses from medical apparatus are crucial for patient monitoring [63], and their elimination is impossible. Apart from that, selected HAVAC appliances, light sources, and installations of medical gases should be quiet and free from vibrations. The limitation of reverberation noise comes in handy with overall in-room noise limitation and prevents the transmission of sound pollution from one room to the other. Since floors, walls, and furniture undergo a daily process of intensive cleaning and disinfection, acoustic energy-absorbing elements usually occupy ceilings. Yet, upper room elements must also be easy to clean and disinfect and cannot be prone to dust absorption or fire hazards. Elastic but robust flooring limits the noise from steps, falling objects, and cartwheels.

Limiting excessive acoustic energy is beneficial, but as mentioned, the sounds of indistinct conversations and nature help in recovery. Also, too short reverberation time is unpleasant and dangerous for human organisms. The highest permissible equivalent sound level in dBA is 25 for patient rooms in hospitals and healthcare buildings and 35 for operation theatres and doctor's offices [64], with a Reverberation Time under 0.5 s for intensive care units [63] and under 0,8 s for doctor's offices, treatment rooms, and offices [65]. These recommendations may vary depending on the country, yet they show the frame requirements and are rather strict.

3.5. Physical Comfort

The following step in psychiatric hospital design is to ensure patients' physical comfort. The space should be coherent and unambiguous to counteract the feeling of loss, discomfort, and anxiety. The architecture should provide a sense of privacy, confidentiality, and security, yet medics need to oversee patients. In terms of healing architecture research, three elements stand out that are important in terms of designing an environment that ensures physical comfort:

- building layout
- rooms size
- furnishings

One of the first issues analyzed when designing a building is the functional layout of the rooms. In the case of psychiatric hospitals, there are a number of elements to which designers pay special attention. The first one is accessibility, which helps patients to feel independent [8,17]. The patient's ability to get into certain rooms on one's own provides a sense of dignity [17], but in order to make this possible, it is worth linking this issue with the zoning of rooms. In such a case, patients have close access from their rooms to the daily activity space, from which they can quickly go back and separate themselves from unwanted contact. The solution provides a sense of security but allows staff to oversee patients [17]. On the other hand, privacy is achieved by separating individual therapy zones and places for meetings with loved ones.

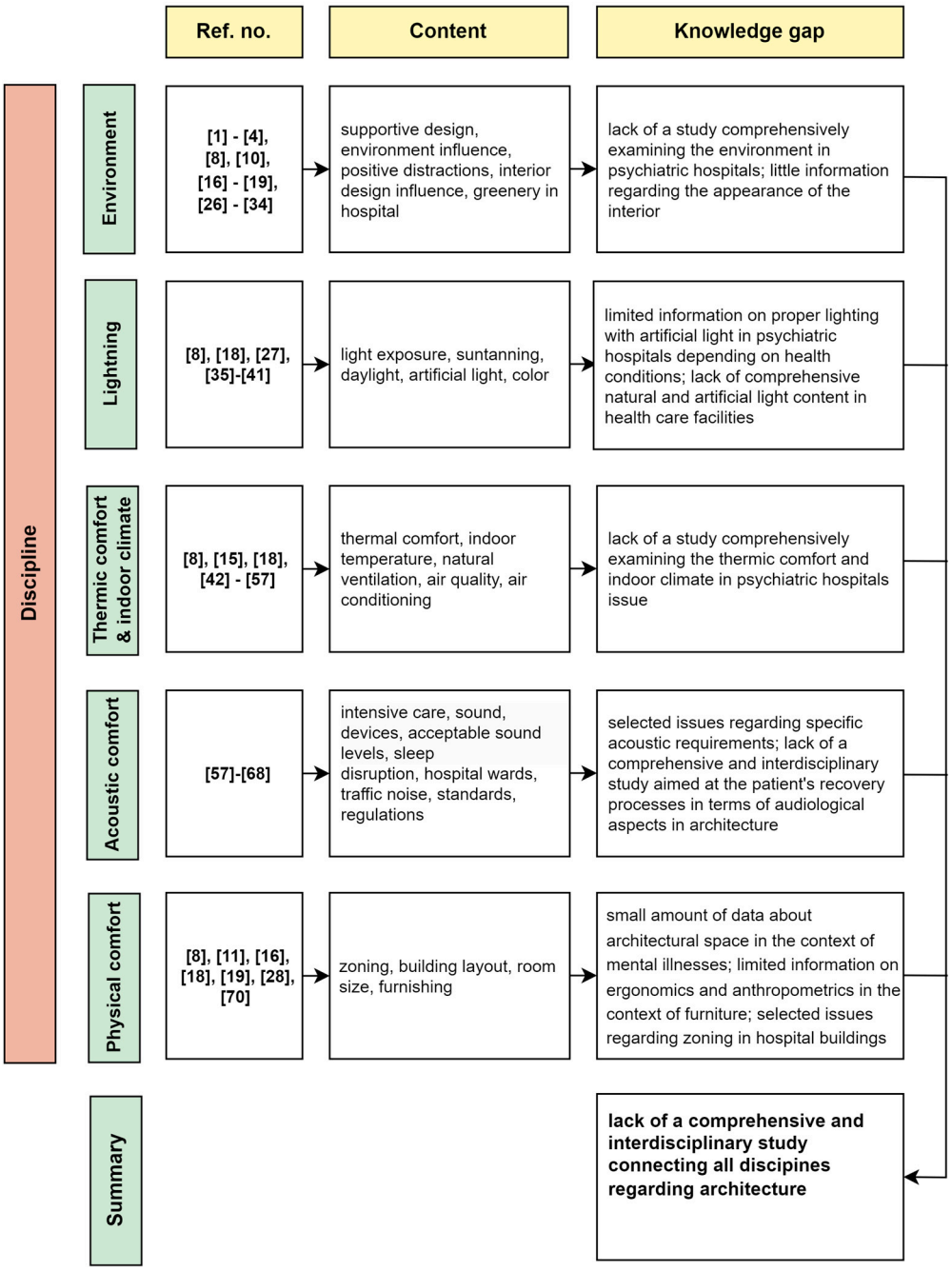
Another issue in healing architecture design is adjusting the room size to the specific function. The rooms should be spacious [17] but not claustrophobic while maintaining moderation and paying attention to the coziness. In the common space, rooms should be large enough to accommodate all the elements that fulfil the necessary functions and should be easy to access while providing safety, privacy, and independence. According to space standards for psychiatric hospitals, activity areas can accommodate 7.5 m^2 per person [66]. Free access (min. 80 cm) from at least two sides of the bed is obligatory.

Indoor and outdoor furniture requires adjustment to the needs of staff and patients, room functions, and purposes. It must always be ergonomic and comfortable [1,18]. The seating chairs must be comfortable and movable with blocking possibilities for the safety of people with disabilities [24]. Regarding the patient's need for free will, a key aspect is the autonomous choice of the place of rest. Furniture arrangement in a room forces certain behaviors, especially in community spaces, i.e., excessive density may cause aggressive behaviors, or a restricted layout may induce reserved manners. When designing, the

architect must pay attention to the fact that mentally ill people may have different spatial requirements depending on the condition they struggle with [11].

3.6. Summary

The literature review allowed for locating gaps in knowledge, which are presented in the diagram (Scheme 2).



Scheme 2. The literature review and identification of research gaps (prep.: author).

As explained, there is a direct relationship between architecture and the satisfaction experienced by hospital users [17]. As Chohan and Awad advise [67], due to technological advancement and the growing needs of clients, architectural design becomes an interdisciplinary domain, connecting diverse creative and engineering fields. In line with this idea, individual design disciplines were considered to then analyze the criteria. To summarize, the table (Table 1) illustrates issues connected to the environment, lighting,

thermal comfort, indoor climate, acoustic comfort, and physical comfort in the context of healing architecture.

Table 1. Table with design criteria for creating the healing architecture in mental health facilities [prep.: author].

Environment	**Criterium**
Outdoor space	1. Spacious area around the building. 2. Far from busy roads and railways. 3. Garden/park. 4. Green patios. 5. Movable garden furniture.
Positive distractions	1. Greenery. 2. The view from windows of the rooms facing greenery/art. 3. The view from windows of the common areas facing greenery/art.
Visually appealing and calming surroundings	1. Warm colors in activity spaces. 2. Cold colors in quiet zones. 3. Bright colors. 4. No dark colors. 5. Coherent and nonaggressive form of the building interior.
Lighting	**Criterium**
Effective use of natural light	1. Face patients' rooms to the east or south direction. 2. Face daily activity rooms to the east or south direction. 3. Use of large windows. 4. Use of lightening patios. 5. Adjust the height and size of the building so that it does not limit access to daylight.
Limiting the unwanted influence of daylight	1. External façade covers. 2. Internal shutters allowing adjustment to patients and staff needs.
Providing artificial light	1. Ability to adjust the color and intensity of lighting. 2. Color and intensity of lighting adapted to the function of the rooms. 3. Adjusting the light to the interior colors used.
Thermic Comfort	**Criterium**
Thermal comfort	1. Use of central heating (depending on the location's climate). 2. Use of air conditioning system. 3. Selecting appropriate thermal insulation. 4. Reducing drafts. 5. Adapting heating to the function of the room. 6. Providing ability to adjust the temperature—thermostats.
Air parameters	1. Use of ventilation system. 2. Use of air conditioning. 3. Air intakes located in a clean environment. 4. Launchers located away from rooms intended for patients. 5. Natural cross-ventilation (when possible)
Microbiological safety	1. Use the appropriate number of air changes (standards). 2. Use of UV lamps. 3. Use of antibacterial materials.
Acoustic Comfort	**Criterium**
Limitation of external noise sources	1. Building distanced from traffic roads, airports, railways, industrial buildings, etc. 2. Broad greenery belts (parks and recreation areas).
Limitation of internal noise sources	1. Distancing patient individual rooms from noisy technical rooms/spaces. 2. Distancing patient common rooms (chapels, meditation spots, and green courtyards) from noisy technical rooms/spaces.

Table 1. *Cont.*

Building compartment isolation properties	1. Use of acoustic ceilings (for sound absorption). 2. Use of acoustic walls and partitions (for isolation and sound absorption). 3. Use of acoustic insulation of the building structure. 4. Use of tight joinery. 5. Use of installations sound insulation.
In-room noise limitation	1. Use of quiet and free-from-vibration appliances. 2. Use of quiet and free-from-vibration building installation. 3. Use of acoustic ceilings (for sound absorption). 4. Use of elastic flooring limiting reverberation noise.
Reverberation noise limitation	1. Use of balanced reverberation time—adaptation to the standards used in a given country.
Physical Comfort	**Criterium**
Building layout	1. Availability and independence. 2. Zoning. 3. Safety. 4. Privacy.
Room size	1. Cozy but not claustrophobic patient rooms. 2. Spacious daily activity rooms.
Furnishing	1. Comfortable and ergonomic, adapted to human anthropometry. 2. Possibility of customization. 3. Possibility of rearrangement.

4. Discussion

To investigate the issue of healing architecture in mental health facilities, we selected three model examples for case study research:

- Elsinore Psychiatric Hospital,
- Young Women's Care Home for Mental Health Problems,
- Kronstad Psychiatric Hospital.

The selected examples were tested using the POE method in accordance with the adopted methodology.

4.1. Elsinore Psychiatric Hospital, BIG (Bjarke Ingels Group), 2005

Elsinore Psychiatric Hospital was designed by the Bjarke Ingels Group (BIG) design studio in 2005. A characteristic element of architectural concept is the building's form and its relationship with the landscape. The hospital consists of four parts that radiate from a central point. The ground floor crosses the area slopes to which it adapts. The first floor protrudes above the ground and functionally houses patient rooms. An additional element of the structure is an extended connector to the hospital's first floor [68]. The functional connections discussed are included in the image (Figure 1).

The external environment of the building consists of two groups. Extensive green areas with a water reservoir occupy the southeastern part of the plot [69]. The north and west areas are dense with buildings and host a hospital, office, and multi-family facilities. There is also a glass factory nearby and a large housing estate of single-family houses. The area with the hospital is distanced approximately 220 m from a busy road and separated by the mentioned buildings [70,71]. The substantial surface of green areas allowed designers to group patient rooms on one wing's side, providing a therapeutic view of tall trees and the water. The daily activity spaces occupy the center of the building. Since the view from here cannot be direct, architects fitted them with a patio. Mobile garden furniture adapts to the needs of patients [69,72,73].

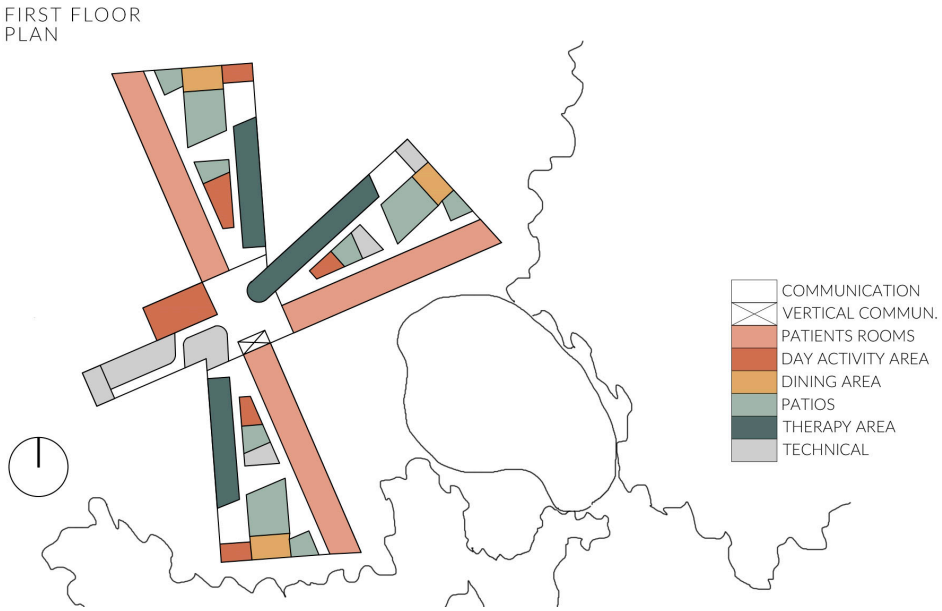


Figure 1. Elsinore Psychiatric Hospital functional plan (prep.: author).

The patients' internal environment varies in color. All of the space is bright, but some rooms are monochromatic, while others are vivid. The color of the exercise room is intense and total aquamarine green, as opposed to the general recommendation to use warm shades in activity zones. Interestingly enough, yellow and orange cover the corridors. In zones requiring silence, the colors are subdued, bright, and monochromatic. It is worth stressing that the building's interior varies in terms of form. The rounded shapes of the reception furniture, staircase railings, and particular walls complement triangular structures and sharp angles. This inconsistency also appears in internal patios, which contain acute angles in their construction [70].

Lighting in the Elsinore Psychiatric Hospital building is another element that is discussed. Patient rooms face south, east, and west. The daytime activity spaces occupy places on the sides of each wing and in the center. Dedicated spaces face south and east. The windows in the building run along the full height of the rooms, are large, and have narrow frames, allowing a lot of light to enter the interior. Another merit here is the low height of the building, which facilitates the illumination of the rooms [68,69].

The acoustic comfort of a psychiatric hospital building is an important aspect. The first issue is the distance from busy roads, airports, and other external noise sources. The elaborated plot is green and screened from the road by high structures. In terms of functional layout, patient rooms are grouped along corridors and away from noisy places. The entire first floor of the building, intended for patients, is devoid of burdensome technical rooms. Green patios and other relaxation areas are the same. The cross-sections and photographs show suspended ceilings, which constitute acoustic equipment. It was assumed that due to the construction time and applicable regulations, acoustic aspects such as the use of structural and installation insulation and the tightness of the joinery were met [70].

Aspects of physical comfort were analyzed. The layout of the rooms relative to each other ensures accessibility and independence. Patient rooms are located along the corridor, and daily activity rooms occupy the middle of each row. This allows users to quickly move between these zones. The large number of nooks, building plan openness, and long corridors allow patients to get lost in space, which at occasions may not be safe. Looking at the floor plans and their layout, it is clear that the patient rooms are compact but also leave space for free functioning. The furniture is adapted to anthropometry and, therefore, human comfort [68].

Based on the presented data and examples, it was concluded that, in principle, Elsinore Psychiatric Hospital designed by BIG meets most of the criteria of healing architecture. Based on the above research, such an environment is conducive to the treatment of patients and allows for faster recovery.

4.2. Young Women's Care Home for Mental Health Problems, LDA.iMdA Architetti Associati, 2016

The building, which serves as a Young Women's Care Home for Mental Health Problems, was designed in 2016 by LDA.iMdA Architetti Associati. The building is located in the Italian city of San Miniato near Florence. This project refers to the broadly understood 'greenery'. It is surrounded by it, reflects it in the form of the building, and respects it in the context of optimal energy consumption [74].

The free-standing building occupies a large area covered with tall vegetation, serving as a buffer separating it from other buildings and roads. It is also visible from the windows of all rooms. Additionally, inner patios provide light and a view of the internal gardens. The colors in the interior are warm, monochromatic, and unsaturated. The building's form consists of cuboid shapes, as does the plan and layout of the rooms. The adopted scheme is used consistently and coherently throughout the building [75].

The building's functional plan (Figure 2) illustrates the orientation of the building in relation to the cardinal directions. Most of the first-floor patient rooms have windows directed towards the eastern and western exposure. Activity rooms are illuminated mainly by southern and western light. Some of the openings in the building cover the full height of the rooms. In patient rooms, the windows are traditional with sills, but they provide the appropriate amount of light considering the size of the room (depth of the room—6 m). The building also has a patio that illuminates the corridors between the routes. The designers also focused on limiting the access to light. Due to the geographical location of Italy, such treatments are necessary. The light entering the building is filtered by the facade and internal blinds [76].

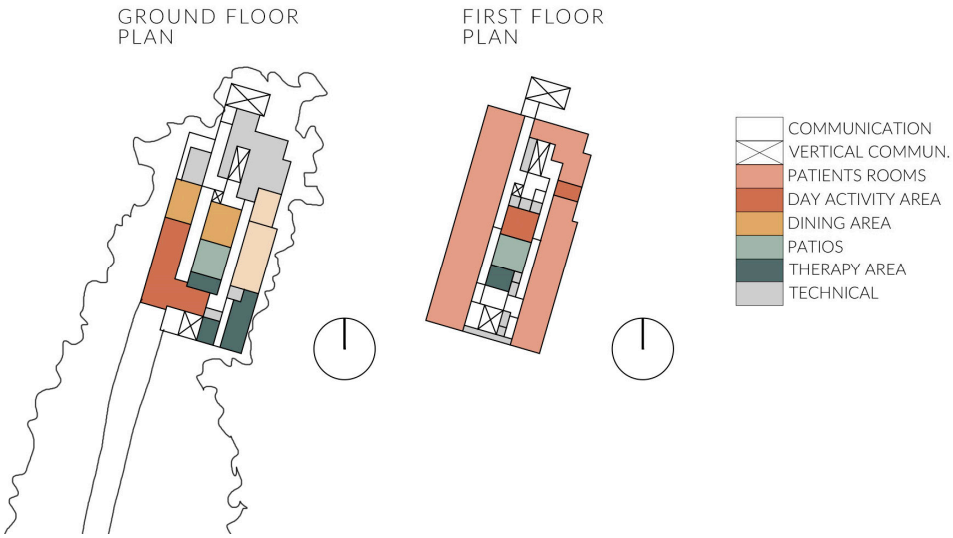


Figure 2. Young Women's Care Home for Mental Health Problems functional plan (prep.: author).

Thermal comfort in Italy is crucial. Therefore, the solutions for reducing heat and cooling the interior are a necessity. Façade curtains play the role of limiting the influence of heat on the building [77].

In terms of acoustics, the surroundings are an advantage in this example. The building is 250 m from the access road and approx. 950 m from the expressway. It is surrounded by a greenbelt 160–500 m wide. Patient rooms and quiet areas are grouped together and placed away from technical rooms that may generate noise [73].

Physical comfort considered in terms of spatial arrangement is high. The living spaces intended for patients are close to the rooms, so moving between these zones is safe and gives a sense of independence. Users can quickly escape to a room where they can isolate themselves from their surroundings. At the same time, staff can easily overlook patients since the corridors have short sections. The rooms intended for sleeping and relaxation are double-person, and their size allows for single beds (accessible on three sides) and a wardrobe. The rooms are small, but there is also unarranged space to move freely. In some rooms, the bathroom is accessible directly from the sleeping area and in others from the corridor. When a patient has to leave the room to go to the bathroom, the staff has greater control over the period of time a specific person stays in the toilet. Daytime activity rooms are spacious and are adaptable to specific needs [77].

This psychiatric care home for young women is an example of implementing the healing architecture idea. Analyses of the way the architecture, function, and furnishings are formed allow us to conclude that this project assumes most of the defined criteria.

4.3. Kronstad Psychiatric Hospital, Origo Architekt Gruppe, 2013

Kronstadt Psychiatric Hospital represents an example of healing architecture implemented in 2013 in Norway (design by Orgio Architekt Gruppe) [78]. The functions of the rooms are shown in the building plan diagram (Figure 3).

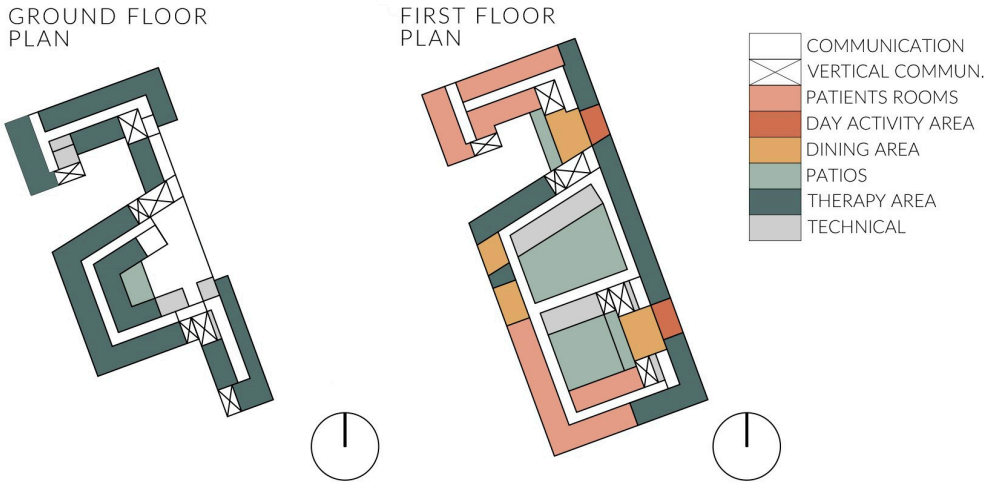


Figure 3. Kronstad Psychiatric Hospital functional plan (prep.: author).

The building's surroundings have dense urban fiber, so there is no greenery in the immediate vicinity. The hospital roofs and terraces developed as urban gardens compensate for this lack. Fitted with sliding furniture, spaces can adapt to varied users' needs. It is a short-stay institution, and therapeutic rooms outnumber patients' bedrooms. Moreover, the central location provides patients with easy access to the hospital. The rooms have a direct view of the city buildings. The view from the common areas extends to the high mountains nearby. The colors in the interior reflect the tints of the materials used and the additions of concrete, wood, and greenery. Common spaces are bright, and their forms are coherent and organized [69,79].

Daylight accesses patient rooms from the west, south, and north. Designers placed therapeutic rooms on the ground and first floors. On a lower level, they occupy both sides of the building, while on the upper floor, they face east. The windows in the building are large, most of them covering the full height of the rooms. The sculpting of the shape and light-emitting patios made it possible to ensure a substantial penetration of sunlight. There are no external sunshades here. In the interiors, you can see curtains that serve adjustments according to the needs of patients [69,78].

Thermal comfort was ensured by central heating. There are low but long radiators near the windows. In addition to heating, air conditioning was also used. The cross-sections

of the wall layers show thermal insulation that protects the building against cooling and overheating [79].

In terms of acoustics, the location of the building is disadvantageous. The facility is located in the city center, which lacks dense vegetation. Patient rooms are grouped together and away from louder functions. The entire ground floor is intended for patients who come for appointments, while the first floor holds rooms for patients who stay for a few days. Thanks to the use of suspended ceilings and acoustic partitions of rooms, the acoustic comfort of sleeping and recreation rooms was increased despite the initial difficulties [78].

Physical comfort mainly concerns patients staying in the hospital longer than for a consultation or therapeutic visit. In these cases, it is crucial to ensure accessibility and independence. A spatial layout with centralized common spaces, patios, and terraces surrounded by rooms provides easy and safe communication. The corridor divisions allow for clear spatial orientation. Accommodation is single occupancy, ensuring privacy. Spacious rooms for one person's needs include a bed, wardrobe, armchairs, and a coffee table. Each guest has access to a private bathroom directly from the room. The design of common spaces and rooms is careful and appealing, and the furniture responds to the assumed function [78].

Kronstad Psychiatric Hospital, as the presented arguments show, is a place that meets the criteria of healing architecture.

5. Results and Conclusions

This research focused on mental health facilities and building features supporting patients' recovery. Based on a literature review, we created a list of criteria for healing architecture. They consider the main issues affecting the creation of the built environment of hospitals: environment, lighting, thermal comfort and indoor climate, acoustic comfort, and physical comfort. Detailed research within publications and existing cases revealed dependencies that later on could be analyzed within three selected hospital examples (Table 2). These criteria can provide guidelines for the design of mental health care buildings. They constitute a direct contribution to the discipline of architecture in the field of hospital design. In the table, the "+" sign indicates that the criterion has been met, and the "−" sign indicates that the criterion has not been met.

Table 2. The cases' analysis summary in the healing architecture criteria table (prep.: author).

	Environment Criterium	Case Study 1	Case Study 2	Case Study 3
1.	Spacious area around the building.	+	+	−
2.	Far from busy roads and railways.	+	+	−
3.	Garden/park.	+	+	+
4.	Green patios.	+	+	+
5.	Movable garden furniture.	+	No data	+
6.	Greenery.	+	+	+
7.	The view from windows of the rooms facing greenery/art.	+	+	−
8.	The view from windows of the common areas facing greenery/art.	+	+	+
9.	Warm colors in activity spaces.	−	+	+
10.	Cold colors in quiet zones.	+	+	+
11.	Bright colors.	+	+	+
12.	No dark colors.	+	+	+
13.	Coherent and nonaggressive form of the building interior.	−	+	+

Table 2. *Cont.*

	Lighting Criterium	Case Study 1	Case Study 2	Case Study 3
1.	Face patients' rooms to the east or south direction.	+	+	+/−
2.	Face daily activity rooms to the east or south direction.	+	−	+
3.	Use of large windows.	+	+	+
4.	Use of lightning patios.	+	+	+
5.	Adjust the height and size of the building so that it does not limit access to daylight.	+	+	+
6.	External façade covers.	−	+	−
7.	Internal shutters allow adjustment to patients and staff needs.	−	+	−
	Thermic Comfort Criterium	**Case Study 1**	**Case Study 2**	**Case Study 3**
1.	Use of central heating (depending on the location's climate).	+	No data	+
2.	Use of air conditioning system.	−	+	+
3.	Selecting appropriate thermal insulation.	+	+	+
4.	Use of ventilation system.	+	+	+
5.	Air intakes located in a clean environment.	No data	+	No data
6.	Launchers located away from rooms intended for patients.	No data	+	No data
7.	Possibility of natural cross-ventilation (only if it is safe).	+	+	+
8.	Use of UV lamps.	−	−	−
9.	Use of antibacterial materials	+	+	+
	Acoustic Comfort Criterium	**Case Study 1**	**Case Study 2**	**Case Study 3**
1.	Building distanced from traffic roads, airports, railways, industrial buildings, etc.	+	+	−
2.	Broad greenery belts (parks and recreation areas).	+	+	−
3.	Distancing patient individual rooms from noisy technical rooms/spaces.	+	+	+
4.	Distancing patient common rooms (chapels, meditation spots, and green courtyard) from noisy technical rooms/spaces.	+	+	+
5.	Use of acoustic ceilings.	+	+	+
6.	Use of acoustic walls and partitions.	+	+	+
7.	Use of quiet and free-from-vibration appliances.	+	+	+
8.	Use of quiet and free-from-vibration building installation.	+	+	+
9.	Use of acoustic ceiling.	+	+	+
10.	Use of elastic flooring limiting reverberation noise.	+	−	+
11.	Use of balanced reverberation time—adaptation to the standards used in a given country.	+	+	+
	Physical Comfort Criterium	**Case Study 1**	**Case Study 2**	**Case Study 3**
1.	Availability and independence.	+	+	+
2.	Zoning.	+	+	+
3.	Safety.	−	+	−
4.	Privacy.	+	+	+
5.	Cozy but not claustrophobic patient rooms.	+	+	+
6.	Spacious daily activity rooms.	+	+	+
7.	Comfortable and ergonomic, adapted to human anthropometry.	+	No data	No data
8.	Possibility of customization.	+	No data	−
9.	Possibility of rearrangement.	+	+	+

Environmental issues discussed included exteriors and interiors. Providing an appropriate external environment, quiet and surrounded by greenery, was met with most criteria. Only Kronstad Psychiatric Hospital stands among dense urban tissue. The location of the building and the view from patient rooms and daily activity areas were carefully designed and preserved. In two out of three cases, the colors and consistency of interior forms were subdued and calm. In Elsinore Psychiatric Hospital, there are more vivid forms and colors.

In all cases, we found great attention to providing natural light in patient rooms and common spaces. Most of the accommodations have windows facing east or south, as do the daytime activity areas. The buildings feature large windows and patios. In the Young Women's Care Home for Mental Health Problems (Italy), a case from warm climates, we observed sunshades. Central heating, air conditioning, and ventilation are now a standard in contemporary healthcare architecture, designed with legal requirements in mind.

Building acoustics, like thermal comfort, are defined in regulations and standards. However, we found that there are benefits of the location and functional layout. Apart from the example from Kronstad, the remaining buildings are situated far from noisy roads, airports, or railways and are separated from noise generators by wide green belts. Patient and recreation rooms are planned at a distance from noise-inducing places. Each building has acoustic ceilings.

The physical comfort of patients was crucial in the examples discussed. The building plans use zoning and ensure accessibility, independence, privacy, and security. The size of the space adapts to the functions of the room.

In summary, while preparing or evaluating the environment for healing design, the following elements of architecture require detailed consideration:

- Outdoor space:
  - Positive distractions (i.e., urban elements, minor architectural solutions)
  - Visually appealing and calming surroundings (also views from inside)
- Lighting:
  - Effective use of natural light
  - Limiting the unwanted influence of daylight
  - Providing artificial light
- Thermic and thermal comfort
- Inner and outer air parameters
- Microbiological safety
- Acoustic comfort:
  - Limitation of external noise sources
  - Limitation of internal noise sources
  - Building compartment isolation properties
  - In-room and reverberation noise limitation (also a pleasant soundscape)
- Physical comfort
- Building layout and room sizes (in line with functions)
- Furnishing (in shared areas and adjustable to users' needs)

The presented examples discussed meet most of the criteria of healing architecture, and as such, their environment is valuable in the healing process. This approach to design is consistent with the idea of the New European Bauhaus, where beauty, sustainability, and togetherness meet safety, health, and balance.

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References

1. Willis, J.; Goad, P.; Logan, C. *Architecture and the Modern Hospital. Nosokomeion to Hygeia*; Taylor & Francis: Abingdon, UK, 2019.
2. Kagan, A.R.; Levi, L. Health and environment—Psychosocial stimuli: A review. *Soc. Sci. Med.* **1974**, *8*, 225–241. [CrossRef] [PubMed]
3. Antonovsky, A. Health, stress, and coping. *New Perspect. Ment. Phys. Well-Being* **1979**, *2*, 12–37.
4. Ulrich, R.S. View Through a Window May Influence Recovery from Surgery. *Science* **1984**, *224*, 420–421. [CrossRef] [PubMed]
5. Cooper, M.C.; Barnes, M. *Healing Gardens: Therapeutic Benefits and Design Recommendations*; John Wiley & Sons: New York, NY, USA, 1999.
6. Becker, F.; Douglass, S. The ecology of the patient visit: Physical attractiveness, waiting times, and perceived quality of care. *J. Ambul. Care Manag.* **2008**, *31*, 128–141. [CrossRef] [PubMed]
7. Salonen, H.; Lahtinen, M.; Lappalainen, S.; Nevala, N.; Knibbs, L.D.; Morawska, L.; Reijula, K. Design approaches for promoting beneficial indoor environments in healthcare facilities: A review. *Intell. Build. Int.* **2013**, *5*, 26–50. [CrossRef]
8. Singha, S. *Future Healthcare Design*; RIBA Publishing: London, UK, 2019.
9. Singh, V.K.; Lillrank, P. *Planning and Designing Healthcare Facilities*; Taylor & Francis Group: Abingdon, UK, 2018.
10. Ulrich, R.S. A theory of supportive design for healthcare facilities. *J. Healthc. Desing* **1997**, *9*, 97–109.
11. Fricke, O.P.; Halswick, D.; Längler, A.; Martin, D.D. Healing Architecture for SickKids Concepts of Environmental and Architectural Factors in Child and Adolescents Psychiatry. *Z. Für Kinder-Und Jugendpsychiatrie Und Psychother.* **2023**, *47*, 27–33. [CrossRef] [PubMed]
12. Sadowski, K. Implementation of the New European Bauhaus Principles as a Context for Teaching Sustainable Architecture. *Sustainability* **2021**, *13*, 10715. [CrossRef]
13. Torchia, D.; Fresta, J.; Corazza, L.; Certomà, C. New European Bauhaus for a Circular Economy and Waste Management: The Lived Experience of a Community Container Garden at the University of Turin. *Sustainability* **2021**, *15*, 914. [CrossRef]
14. Niezabitowska, E. *Research Methods and Techniques in Architecture*; Wydawnictwo Politechniki Śląskiej: Gliwice, Poland, 2014.
15. Groat, L.; Wang, D. *Architectural Research Methods*; John Wiley & Sons: New York, NY, USA, 2002.
16. Ulrich, R.S. Effects of interior design on wellness: Theory and recent scientific research. *J. Health Care Inter. Des. Proc.* **1991**, *3*, 97–109.
17. Garg, A.; Dewan, A. Manual of Hospital planning and Designing for Medical Administrators. In *Architects and Planners*; Springer: New York, NY, USA, 2022.
18. Bellini, E.; Macchi, A.; Setola, N.; Lindahl, D. Sensory Design in the Birth Environment: Learning from Existing Case Studies. *Buildings* **2023**, *13*, 604. [CrossRef]
19. Gross, R.; Sasson, Y.; Zohar, J. Healing environment in psychiatric hospital design. *Gen. Hosp. Psychiatry* **1998**, *20*, 108–114. [CrossRef] [PubMed]
20. Lundin, S. *Healing Architecture: Evidence, Intuition, Dialogue*; Chalmers Tekniska Hogskola: Gothenburg, Sweden, 2015.
21. Simonsen, T.P.; Duff, C. Healing architecture and psychiatric practice:(re) ordering work and space in an in-patient ward in Denmark. *Sociol. Health Illn.* **2020**, *42*, 379–392. [CrossRef] [PubMed]
22. Ghazaly, M.; Badokhon, D.; Alyamani, N.; Alnumani, S. Healing architecture. *Civ. Eng. Archit.* **2020**, *10*, 108–117. [CrossRef]
23. Thorben, P.H.S.; Brown, S.D.; Reavey, P. Vitality and nature in psychiatric spaces: Challenges and prospects for 'healing architecture' in the design of inpatient mental health environments. *Health Place* **2024**, *85*, 103–169.
24. Ulrich, R.S.; Cordoza, M.; Hazen, T.; Perkins, S. ICU patient family stress recovery during breaks in a hospital garden and indoor environments. *HERD Health Environ. Res. Des. J.* **2020**, *13*, 83–102. [CrossRef] [PubMed]
25. Nanda, U.; Eisen, S.; Zadeh, R.S.; Owen, D. Effect of visual art on patient anxiety and agitation in a mental health facility and implications for the business case. *J. Psychiatr. Ment. Health Nurs.* **2011**, *18*, 386–393. [CrossRef]
26. Naglaa, E.S. The Impact of Architectural Psychology on the Interior Design of Psychiatric Hospitals. *J. Des. Sci. Appl. Arts* **2021**, *2*, 41–59.
27. Dalke, H.; Little, J.; Niemann, E.; Camgoz, N.; Steadman, G.; Hill, S.; Stott, L. Colour and lighting in hospital design. *Opt. Laser Technol.* **2006**, *38*, 343–365. [CrossRef]
28. Sorensen, W. *Designing for Mental Health Facilities: Two Major Factors That Promote Occupant Wellbeing*; Utah State University: Logan, UT, USA, 2018.
29. Karlin, B.E.; Zeiss, R.A. Best Practices: Environmental and Therapeutic Issues in Psychiatric Hospital Design: Toward Best Practices. *Psychiatr. Serv.* **2006**, *57*, 1376–1378. [CrossRef]
30. Connellan, K.; Gaardboe, M.; Riggs, D.; Due, C.; Reinschmidt, A.; Mustillo, L. Stressed Spaces: Mental Health and Architecture. *HERD Health Environ. Res. Des. J.* **2013**, *6*, 127–168. [CrossRef] [PubMed]
31. Bedrosian, T.A.; Nelson, R.J. Timing of light exposure affects mood and brain circuits. *Transl. Psychiatry* **2017**, *7*, e1017. [CrossRef] [PubMed]
32. Humble, M.B. Vitamin D, light and mental health. *J. Photochem. Photobiol. B Biol.* **2010**, *101*, 142–149. [CrossRef] [PubMed]
33. Randle, H.W. Suntanning: Differences in Perceptions Throughout History. *Mayo Clin. Proc.* **1997**, *5*, 461–466. [CrossRef] [PubMed]

34. Aries, M.B.; Aarts, M.P.; van Hoof, J. Daylight and health: A review of the evidence and consequences for the built environment. *Light. Res. Technol.* **2015**, *47*, 6–27. [CrossRef]
35. Winkel, G.H.; Hlahan, C.J. The environmental psychology of the hospital: Is the cure worse than the illness? *J. Prev. Interv. Community* **1985**, *1–2*, 11–33. [CrossRef]
36. Ferrante, T.; Villani, T. Pre-Occupancy Evaluation in Hospital Rooms for Efficient Use of Natural Light—Improved Proposals. *Buildings* **2022**, *12*, 2145. [CrossRef]
37. How Color Affects Architecture. Available online: https://www.archdaily.com/930266/how-color-affects-architecture (accessed on 16 November 2023).
38. McKinney, M.E.; Gatchel, R.J.; Brantley, D.; Harrington, R. The impact of biofeedback-manipulated physiological change on emotional state. *Basic Appl. Soc. Psychol.* **1980**, *1*, 15–21. [CrossRef]
39. Pieczara, J. *Naturalne Przewietrzanie i Komfort Termiczny w Budynkach Użyteczności Publicznej*; Teka Komisji Architektury Urbanistyki i Studiów Krajobrazowych: Warsaw, Poland, 2016.
40. Butera, F.M. Principles of thermal comfort. *Renew. Sustain. Energy Rev.* **1998**, *2*, 39–66. [CrossRef]
41. Wang, Z.; de Dear, R.; Luo, M.; Lin, B.; He, Y.; Ghahramani, A.; Zhu, Y. Individual difference in thermal comfort: A literature review. *Build. Environ.* **2018**, *138*, 181–193. [CrossRef]
42. Alotaibi, B.S.; Lo, S. Thermal environment perceptions from a longitudinal study of indoor temperature profiles in inpatient wards. *Buildings* **2020**, *10*, 136. [CrossRef]
43. Djongyang, N.; Tchinda, R.; Njomo, D. Thermal comfort: A review paper. *Renew. Sustain. Energy Rev.* **2010**, *14*, 2626–2640. [CrossRef]
44. Brown, D.; Martiskainen, M. How sociotechnical norms shape transition pathways: The co-evolution of three European heating, ventilation, and cooling (HVAC) regimes. *Energy Res. Soc. Sci.* **2024**, *107*, 103–346. [CrossRef]
45. Verheye, J. Thermal comfort of patients: Objective and subjective measurements in patient rooms of a Belgian healthcare facility. *Build. Environ.* **2011**, *46*, 1195–1204. [CrossRef]
46. Brelih, N. Thermal and acoustic comfort requirements in European standards and national regulations. *Fed. Eur. Heat. Vent. Air Cond. Assoc. (REHVA) J.* **2013**, *4*, 16–19.
47. Rey, F.J.; Velasco, E. Experimental study of indoor air quality, energy saving and analysis of ventilation norms in climatised areas. *Energy Build.* **2020**, *33*, 57–67. [CrossRef]
48. Ülar, P.; Kurnitski, J.; Voll, H. Design criteria for outdoor air intakes and exhaust air outlets located on an external wall Jarek Kurnitski. *E3S Web Conf. EDP Sci.* **2020**, *172*, 09008.
49. Kuborn, X.; Pecceu, S. A Study of the Influence of the Position of a Chimney Terminal on the Vertical Walls of a Building on the Air Quality of the Ventilation Air Supply. In Proceedings of the 40th AIVC—8th TightVent—6th venticool Conference, Ghent, Belgium, 15–16 October 2019.
50. Chohan, A.H.; Awad, J. Wind Catchers: An Element of Passive Ventilation in Hot, Arid and Humid Regions, a Comparative Analysis of Their Design and Function. *Sustainability* **2022**, *14*, 11088. [CrossRef]
51. Aldawoud, A. Windows design for maximum cross-ventilation in buildings. *Adv. Build. Energy Res.* **2017**, *11*, 67–86. [CrossRef]
52. Pibiri, M.C. Indoor air purification and ventilation systems sanitation with essential oils. *Int. J. Aromather.* **2006**, *16*, 149–153. [CrossRef]
53. Lualdi, M.; Cavalleri, A.; Bianco, A.; Biasin, M.; Cavatorta, C.; Clerici, M.; Galli, P.; Pareschi, G.; Pignoli, E. Ultraviolet C lamps for disinfection of surfaces potentially contaminated with SARS-CoV-2 in critical hospital settings: Examples of their use and some practical advice. *BMC Infect. Dis.* **2021**, *21*, 594. [CrossRef] [PubMed]
54. Leone, M.J.; Dasht, H.S.; Coughlin, B.; Tesh, R.A.; Quadri, S.A.; Bucklin, A.A.; Aoor, A.; Krishnamurthy, P.V.; Ye, E.M.; Hemmige, A.; et al. Sound and light levels in intensive care units in a large urban hospital in the United States. *Chronobiol. Int.* **2023**, *40*, 759–768. [CrossRef] [PubMed]
55. Lindborg, P.; Lenzi, S.; Han, N.; Spagnol, S.; Kamphuis, D.J.; Özcan, E.; Quek, A. Disturbed Sleep: Estimating Night-time Sound Annoyance at a Hospital Ward. In Proceedings of the Forum Acousticum, 10th Convention of the European Acoustics Association, Torino, Italy, 1 January 2023.
56. Juraszyński, J.; Nitsch, A.; Porębowicz, S.; Radwański, Z. *Projektowanie Obiektów Służby Zdrowia*; Arkady: Warsaw, Poland, 1973.
57. Freire, S.; Gomes, N. Advancing Environmental Noise Pollution Analysis in Urban Areas By Considering the Variation of Population Exposure in Space and Time. *Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci.* **2013**, *40*, 155–160. [CrossRef]
58. Cai, M.; Lan, Z.; Zhang, Z.; Wang, H. Evaluation of road traffic noise exposure based on high-resolution population distribution and grid-level noise data. *Build Environ.* **2019**, *147*, 211–220. [CrossRef]
59. Peris, E. *Noise Pollution is a Major Problem, Both for Human Health and the Environment, Interview with Peris. E.*; European Environmental Agency (EEA): Copenhagen, Denmark, 2020; 01.
60. Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 Relating to the Assessment and Management of Environmental Noice, 18/07/2002 ed. Official Journal L 189. pp. 0012–0026. Available online: https://eur-lex.europa.eu/eli/dir/2002/49/oj (accessed on 4 September 2019).
61. ArAc-Multibook—Multimedia textbook for architectural acoustics, International Partnership ArAc-Multibook. 2015. Available online: https://arac-multibook.com/ (accessed on 27 January 2024).
62. Everest, F.A.; Pohlmann, K.C. *Master Handbook of Acoustics 2014*; Mc Graw Hill: New York, NY, USA, 2014.

63. Beldam, M.B. Short reverberation time in critical care is not enough. In *Acoustic Bulletin, Ecophon*; Acoustic Bulletin: Helsingborg, Sweden, 2018; Available online: https://www.acousticbulletin.com/short-reverberation-time-critical-care-not-enough/ (accessed on 9 November 2023).
64. *PN-B-02151-2:2018-01*; Polish Norm Building Acoustics—Requirements Regarding Accept-Able Sound Level in Rooms Determines the Maximum Noise Level A of Noise in Rooms Intended for Human Stay—In Residential Buildings and Public Buildings. Polish Normalization Committee (PKN): Warsaw, Poland, 2018.
65. *PN-B-02151-4*; Building Acoustics. Protection from noise in buildings. Part 4: Requirements for reverberation conditions and speech intelligibility in rooms with guidelines for conducting research. Polish Normalization Committee (PKN): Warsaw, Poland, 2015.
66. Carthey, J.F. Australasian Health Facility Guidelines: Results of a user survey. *Facilities* **2013**, *31*, 574–590. [CrossRef]
67. Chohan, A.H.; Awad, J. Shaping the Architects of Tomorrow, Interplay of Teaching Philosophies and Practice Requirements: An Empirical Taxonomy of Professional Architectural Practice in the UAE. *Buildings* **2023**, *13*, 1231. [CrossRef]
68. Big—Bjarke Ingels Group, Jds. Julien De Smedt Architects. Available online: https://divisare.com/projects/218546-big-bjarke-ingels-group-jds-julien-de-smedt-architects-ellsinore-psychiatric-clinic (accessed on 5 February 2024).
69. Google Maps. Available online: https://www.google.com/maps/ (accessed on 27 January 2024).
70. Helsingør Psychiatric Hospital. Available online: https://www.archiweb.cz/en/b/psychiatricka-klinika (accessed on 27 January 2024).
71. Psychiatric Hospital, Helsingør. Available online: https://arquitecturaviva.com/works/hospital-psiquiatrico-4#lg=1&slide=2 (accessed on 27 January 2024).
72. Elsinor. Available online: https://arquitecturaviva.com/tag/elsinor (accessed on 5 February 2024).
73. Psychiatric Hospital Helsingor. Available online: https://architizer.com/projects/psychiatric-hospital-helsingor/ (accessed on 5 February 2024).
74. Casa Verde. Available online: https://divisare.com/projects/375231-lda-imda-architetti-associati-simone-bossi-casa-verde-young-women-s-care-home-for-mental-health-problems (accessed on 6 February 2024).
75. Casa Verde Young Women's Care Home for Mental Health. Available online: https://www.archdaily.com/886409/casa-verde-young-womens-care-home-for-mental-health-ldmda-architetti-associati (accessed on 27 January 2024).
76. Casa Verde Young Women's Care Home for Mental Health Problems. Available online: https://architizer.com/projects/casa-verde-young-womens-care-home-for-mental-health-problems/ (accessed on 6 February 2024).
77. Two Layers of Microperforated Aluminum for the Façade of LDA.iMDA's Casa Verde. Available online: https://www.floornature.com/architectural-solutions/two-layers-microperforated-aluminium-facade-ldaimdaas-casa-v-16458/ (accessed on 6 February 2024).
78. Kronstad Psychiatric Hospital. Available online: https://www.archdaily.com/451158/kronstad-origo-arkitektgruppe (accessed on 6 February 2024).
79. Kronstad Psychiatric Centre, Bergen. Available online: https://www.architecturenorway.no/projects/working/kronstad-2013/ (accessed on 7 February 2024).