



Healing Architecture for Sick Kids

Concepts of Environmental and Architectural Factors in Child and Adolescent Psychiatry

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Abstract: Scientific data are sparse on hospital design in child and adolescent psychiatry. The present article aims to give an overview of various concepts of hospital design and to develop concepts how architecture can consider the special needs of children and adolescents in their recovery from psychiatric diseases. Literature research is provided from PubMed and collected from architectural and anthroposophic bibliography. Access to daylight and nature, reduced level of noise and an atmosphere of privacy are general principles to support convalescence in patients. Especially in psychiatry, spatial structures and colour can strengthen appropriate social interrelations on both the patient and staff level. Authors suggest that children and adolescents benefit from architectural concepts which consider the issues: Welcome, Path, Territory, Area of Freedom, Outdoor Space, Access to Light, Motion in the Structure and Orientation of Space.

Keywords: Healing architecture, integrative medicine, anthroposophic medicine

Architektur im Krankenhaus für Kinder und Jugendliche – Konzepte zur Gestaltung von Umgebungsfaktoren und Architektur in der Kinder- und Jugendpsychiatrie

Zusammenfassung: Ziel der Arbeit ist es, die architektonischen Konzepte zur „Healing Architecture“ darzustellen und daraus die Anforderungen für ein spezifisches architektonisches Konzept im Krankenhausbau kinder- und jugendpsychiatrischer Kliniken zu entwickeln. In einer Literaturrecherche im System zur medizinischen Literatursuche PubMed und in einer Literatursuche in Bibliographien zur Anthroposophie und Architektur werden Daten und Konzepte zum therapeutischen Krankenhausbau dargestellt. Zugang zu Tageslicht und Natur, Lärmreduktion und eine Atmosphäre der Privatheit sind generelle Prinzipien, die therapeutische Prozesse im Krankenhaus unterstützen. In psychiatrischen Abteilungen profitieren Patienten von Raumstrukturen, die Beziehungen zwischen den Patienten und therapeutische Beziehungen zum Personal fördern. Aus Sicht der Autoren benötigen Kinder und Jugendliche zur Förderung therapeutischer Prozesse insbesondere die Berücksichtigung der architektonischen Variablen: Willkommen sein, Anleitung auf Wegen, Territorium, freien Raum zum Gestalten, Außenbereiche, Zugang zu (Tages-)Licht, bewegungsfördernde Raumstrukturen, die auch Orientierung im Raum geben.

Schlüsselwörter: Architektur im Krankenhaus, integrative Medizin, anthroposophische Medizin

We shape our buildings, thereafter they shape us
(Sir Winston Churchill; Time, Sept. 12, 1960)

Introduction

How do we explain that architecturally designed space expresses emotions and may even alter the internal psychological status in individuals? The architectural historian Heinrich Wölfflin focused on this question in 1886 (Wölfflin, 1886). Although each individual empirically reports her or his personal experience in the designed space, scientific re-

sults are limited to develop a generalized theory on psychological issues in architecture. In the last years our actual perspective has changed on the functional design of hospitals, especially in children hospitals and pediatric palliative care (McLaughlan, 2017; Acton et al., 1997; Downing et al., 2014), because the patient has to be considered as an integral human being that requires social, spiritual and relational aspects to emphasize the process of convalescence in the hospital (Lundin, 2015).

In particular, the design of health care environments has attracted the attention of evidence-based scientists in the last 25 years, since the seminal paper of the environ-

mental and architectural psychologist Roger Ulrich gave evidence that environmental aspects of the hospital influence the process of convalescence on a surgical ward when he published his study “View Through a Window May Influence Recovery from Surgery” (Ulrich, 1984). This study presented the time of recovery from surgery comparing a group with contact to nature via view from the hospital window with a control group without a window view. The surprising result verified the hypothesis that the view into nature accelerated the time of recovery. This study was the starting point to develop the field of “evidence-based design” to establish rules of design which are based on results of evidence based research. By now, scientific data are available on different architectural aspects of health and recovery from diseases in adults in the meanwhile (e.g. “Helende arkitektur” from the Danish researchers Frandsen et al., (Frandsen et al., 2009)), however, data on the effect of architecture in sick children and adolescents are sparse and are especially not available for child and adolescent psychiatry. Lambert emphasizes that the voice of children has to be taken into account for the design of healthcare environments to reflect aspects of psychosocial healing in the medical process of convalescence (Lambert, 2016).

The present article aims to present the state of scientific knowledge on the influence of architectural and environmental factors on convalescence in hospitals and primarily focuses on their effects on the recovery from psychiatric diseases. Thereby, concepts of integrative medicine are separately discussed. The article further discusses whether the present knowledge may be usefully applied in the design of children hospitals, especially for departments of child and adolescent psychiatry. Literature research was provided by PubMed and used for the process of search keywords (healing architecture, hospital & architecture, psychiatry & architecture, child & architecture, psychiatry & colour, hospital & colour, hospital & day light, psychiatry & day light).

Scientific Methods in the Analysis of Architectural and Environmental Effects on Health and Convalescence

Architecture is not primarily a scientific discipline, even though architects are dependent on science when dealing with engineering aspects in architecture. Thus, to date, designing buildings is still mainly an artistic process based on the individual experience of the architect and his reference to architectural history. Research on architectural factors is difficult when the general perception of different users is the focus of the investigation. These difficulties are comparable with research in other artistic disciplines, such as describing the factors of a painting, statue or piece of music that are responsible for a distinctive psychological ef-

fect in the reviewer or listener, with a view to making generalisations which are applicable to all or most consumers of the artistic presentation. This concept is supported by Lundin in his thesis “Healing Architecture: Evidence, Intuition, Dialogue” (Lundin, 2015a).

The creative and constructive work of an architect is based on individual experience, capability to respond on determining factors and reference to the architectural history. This concept is supported by Lundin (Lundin, 2015b). Lundin argues that evidence alone cannot be expected to lead to healing architecture because the process of designing space claims intuition to conceptualize buildings which are beneficial for the maintenance and recovery of health. Nevertheless, the recent literature provides several approaches to tackle the problem of understanding why buildings have specific effects in the user and which structural elements are responsible for these effects. These techniques were also applied in the evaluation of effects of architectural design on their users (staff and patients) and its influence on the process of healing and convalescence. Lorenz reviewed 18 studies in an integrative approach over an interval of 22 years to present a synthesis on design of the patient room in acute care hospitals supporting health recovery (Lorenz, 2007). Thereby Lorenz divided the reviewed studies into the three categories clinical outcomes, patient perception and staff perception. Quantitative and qualitative designs were included into the review process. Lorenz pointed out that the three variables light, views of nature and decreased noise are mainly responsible for improvement of convalescence in acute care hospitals. Moos and Houts developed the Ward Atmosphere Scale (WAS) to measure the psychosocial atmosphere of treatment environments (Moos & Houts, 1968). This instrument is a questionnaire which comprises 100 items and focuses on the three dimensions relationship, treatment and system maintenance. A different approach is the Behavioral Environment Assessment Technique which derives from ethological sciences and which was also applied to measure behaviour in psychiatric wards in relation to environmental conditions (Holahan & Saegert, 1973; McGuire et al. 1977; McGuire et al., 1979).

General psychological aspects of architecture in the hospital

Ulrich summarized relationships between 11 design factors and healthcare outcomes (Ulrich et al., 2008). Thereby, single-bed rooms mainly improved patient sleep, privacy and confidentiality. Access to daylight and appropriate lighting reduces depressive mood, views of nature reduce pain and stress, and noise reduction also decreases stress as well (Ulrich, 2008). Lundin condenses the review into

four main factors to improve health in hospitals: Single-bed rooms, access to daylight, views of nature, and noise reduction (Lundin, 2015a). This result is in concordance with the analysis of Lorenz who pointed out that the three variables of an appropriate light design, views of nature and decreased noise are mainly responsible for improvement of convalescence in acute medical care (Lorenz, 2007). Concepts of applied colours in hospitals are presented by Lundin (Lundin, 2015a). Red and yellow colours support activation of the patient and also reinforce aggressive behaviour. In contrast, green and blue colours enhance emotional balance of the patient. Although architects may be influenced by the results of these studies or even be explicitly asked to pay heed to them in their planning their choices and design will very much depend on their individual experience and context in architectural history.

Psychological aspects of architecture in psychiatric hospitals

The design of psychiatric hospitals can be organized according to various principles. Psychiatric hospitals were developed according to the panoptical system in the United Kingdom in the 19th century. The “Kreis-Irrenanstalt Erlangen” was designed by this principle and opened in 1846 in Germany (Braun & Kornhuber, 2013). The building was designed in the shape of a cross to enable psychiatric wardens to observe their patients with a minimum of staff members. At this time, the predominant architectural principle given to psychiatric hospitals was an H-shape, yet the focus of the architectural design often reflected a non-esthetic, rather crude utilitarianism.

The colour and light design in hospitals is one of the architectural principles for which data are more frequent available than for other architectural aspects and which have been investigated for not psychiatrically but physically ill patients on several occasions. Gbyl et al. (2016) reported that depressed patients are discharged earlier from the hospital when they were hospitalized in southeast-facing than northwest-facing rooms. The result opens speculations as to whether the higher intensity and longer access to natural light was transmitted by light therapy or primarily psychological effects on the mind by the direct contact to natural light. Differences in vitamin D levels were not reported between the groups. This is not astonishing since UVB, the part of the light spectrum that induces Vitamin D production in the skin, does not pass through glass windows. Nevertheless, the survey of actual data on light concepts displays that the access to day light and the daily rhythm of day light is probably a more effective light concept than the use of artificial light in hospitals (Lundin, 2015a).

Gross et al. (1998) report in their analyses the pioneering design of the psychiatric hospital in the Chaim Sheba Medical Center at Tel-Hashomer, Israel. The design was developed under the guidance of a multidisciplinary team of architects, mental health professionals and administrators. A comparable concept was chosen by Sivadon and Amiel (St. Clair, 1987; Amiel, 1970; Sivadon, 1970) and was realized at La Verriere Hospital in France (Gutkowski & Guttman, 1992). The psychiatric hospital in the Cahim Sheba Medical Center can be characterized by eight aspects on which the process of planning was based:

1. The psychiatric hospital is localized in a general hospital enable interaction between patients with physical and mental disorders. This should reduce stigmatization of psychiatric disorders that can otherwise be augmented by spatial separation of physical and mental disorders. This co-localization also serves to support the process of medicalization in psychiatry which counteracts popularly mystical aspects of psychiatric diseases.
2. The building is nevertheless structured in a way that patients should not be forced to interact with too many people.
3. The architectural structure of space should enable the psychiatric patient to retreat physically.
4. Psychiatry patients should have easy access to nurses on the ward.
5. Day-light should be sufficiently available on the wards and the building.
6. Structures should support daily and prompt maintenance of the wards and the building.
7. The space structure should cater for staff needs and easy observation of the patients easy for nurses.
8. Staff working and resting areas should be segregated to reduce stress by a non-intended interaction between staff and patients (Gross 1998). Thereby, Gross points out that designing the hospital in a way that facilitates the congruence of environmental perception between staff and patients can have a beneficial effect in psychiatry (Corey et al., 1984; Whitehead et al., 1984; Main et al., 1991).

Ulrich, Bogren and Lundin suggest several ways to reduce stress for patients in psychiatric wards (Ulrich et al., 2012) which were also proposed for the Cahim Sheba Medical Center. These included single patient rooms on wards with small patient numbers, low noise, access to natural light and art, spacious dayrooms and staff stations close to activity areas. Thereby, recommendations are not provided on the specific amount of space per patient inside the hospital and the optimal number of patients on the ward in the child and adolescent psychiatry. Regarding specific psychiatric diseases, the recent literature provides evidence for the influence of architecture on behavioural changes and decreasing violence and psychopathology in

schizophrenic patients (Higgs, 1970; Gabb et al., 1992; Christenfeld et al., 1989; Whitehead et al., 1984). Gross et al. suggest that these effects are primarily explained by stabilizing social interactions inside the ward which includes interactions between staff and patients as well as interrelations between patients (Whitehead et al., 1984). Thereby, even minor changes in the furniture and their arrangement in the ward induce alteration of pathological behaviour (Minde et al., 1990; Sommer & Ross, 1958; Corey et al., 1984). A special focus was put on the organization of the ward to create appropriate structures for psychosocial purposes. Structuring a psychiatric ward into smaller psychosocial units reduced vandalism, stealing and violence in a psychiatric hospital for adolescents (Wilson et al., 1983). Dresler and Rohe reported a project of architectural restructuring a psychiatric ward with equivalent results (Rohe et al., 2017 and Dresler et al., 2015). They restructured the ward under architectural issues to improve quantity and quality of patient interrelations and relations between patients and staff members. The naturalistic study design enabled a 48-84% reduction of coercive measures after implementation of the architectural changes. The importance of architectural issues to reduce suicidal behaviour was also emphasized by Becker et al. This issue is supported by space structures which facilitate the contact of patients to staff members which excludes the separation of the patient and staff by closed doors. Although evidence-based design delivers guidance for general issues on the structure and colour of space in psychiatric hospitals, relatively little emphasis is put on the requirements for special entities of psychiatric diseases such as psychosis or depression. Patients with different psychiatric diseases may have different individual needs in terms of their respective architectural environment. For example, the acute psychotic patient benefits when the architectural structure of the ward shields him or her from an overflow of external stimuli, especially an acoustic overstimulation which can be reduced by geometrical design of the space and surfaces of the interior. In contrast, a depressive patient requires activation and social stimulation on the ward. Actually, recommendations on gender differences are not provided for the architectural design in child and adolescent psychiatry. The reason might be due to the implementation of co-educative wards in psychiatric hospitals.

Architecture from the Organic and Anthroposophic Perspective and the Integrative Approach of Health Care Design

The most widely found form of holistic architecture has its roots in anthroposophy and could, if there were a school for it, which the authors' current knowledge there is not,

be called "anthroposophic architecture". The term "anthroposophic architecture" does exist however, and denotes a grass-roots movement that has sprung around the world over the past century. Its many variations can be seen in over 5000 buildings in over 70 countries (the 2017 update of the growing Waldorf World list counted 1.092 registered – there are more non-registered – schools, 1.857 Waldorfkindergartens and 646 curative education and social therapy facilities, in addition to associations, training centres, banks, agricultural initiatives, therapy centres, hospitals, countless private habitations etc.). There are no set guidelines on how "anthroposophic architecture" should be, and Rudolf Steiner, the founder of anthroposophy, used a large spectrum of sizes, shapes, colours and materials in his works. A search of the scientific literature reveals that, as with architecture altogether, very little is found on anthroposophic architecture, especially in biomedical databases (a PubMed search using "Anthropos* AND "Archi-te*" leads to 5 hits). Thus, it was necessary to engage with anthroposophic architects and study books, journals and Steiner's lectures to access principles behind their work. The following text offers some basic principles, which may seem rather common sense but are approached in a particularly intense way:

Hundertwasser is said to have called architecture our "third Skin", anthroposophic architects see it as our "third pedagogue", after the parents and the teachers. And since child and adolescent psychiatry also comprises aspects of pedagogy, architecture is given significance in this field. The child develops from the periphery inwards. This can be seen on many levels, starting from the fact that the embryonic sheaths of the placenta initially take care of all bodily, metabolic and hormonal functions, and slowly passes them on to the child's body. After birth, the same gesture is found again: the child is totally dependent on its surroundings – and its development will highly depend on the social, cultural and physical quality of these surroundings. In fact, it takes many months until the child even differentiates itself from the surroundings, and many years, if ever, to develop mature interdependence.

Anthroposophy emphasises that good sense are to the soul what good food is nutrition to the body. Soul health is seen as supporting body heal and vice versa. Beauty engenders good feelings and is therefore healthy for soul and body. A healthy body and soul development is rooted in a healthy development of the so-called lower senses of touch, balance, movement and life (vital well-being in one's own body). These senses are affected by the architectural impressions of the surroundings, not only through how we move and the quality of the materials we touch, but also because we project these lower senses into our sense of sight. "Living" forms enliven the soul and that enlivens the body. Forms are "living" when they enliven

human beings. Living involves growth, metamorphosis and sublation in the context of polarities, leading to evolution (full development) and involution (seed development). From the perspective of anthroposophy, the basic polarity in living nature is the male and the female. Without this polarity and sublation of these two principles, no new, higher life can arise. The basic polarities of all design are the straight and the curved as a line; the square and the circle as area; the cube and the sphere as spatial formations. And without synthesis and enhancement of these two polar principles, there can be no organic architecture. In nature, for example, the cube is only found very seldom, and almost exclusively in the crystalized mineral forms. The polygonal and curved forms of organic architecture (e.g. Gemeinschaftskrankenhaus Herdecke; Figure 1) are an enhancement of the polarities “square and circle”, leading with increasing dynamism into lemniscates, spirals, vortices, tauruses etc. When talking with anthroposophic architects one begins to understand why each building is qualitatively different and why they sometimes really do turn out to look quite comforting and organic.

Anthroposophic architects seem to place a large emphasis on starting things. Before they even start planning anything, the architects try to meet the future users of the building and engage in a social process of examining the purpose of the building in the most open way possible – as if this were the first time anything of the kind would ever be built. Thus, together with the stakeholders, they create a new idea out of the shared contextualized ideals, and only do they begin incarnate (flesh out) the idea with shape, ecological substance, colour and light.

Perspective: A Concept of Hospital Design for Child and Adolescent Psychiatry from the Architects View

The individual requires movement for perception and orientation in space. The multimodal perception of space is characterized by visual and acoustic stimuli and also the airflow which pervades the space from different directions in a building. The integration of these different stimuli contributes to a positive or negative assessment of the architectural environment by its users. Thereby, the assessment is dependent on the specific psychological condition of each individual who experiences the architectural characteristics of a building. Therefore, buildings will be more likely to be appreciated by their users if the latter's specific psychological requirements are realized. Especially, children and adolescents require an architectural environment which facilitates social, emotional, motor and intellectual development. These aspects have to be integrated into general requirements which have to be implemented in psy-



Figure 1. Gemeinschaftskrankenhaus Herdecke, Herdecke, Germany.

chiatric hospitals when the building is used for the treatment in child and adolescent psychiatry. The successful treatment in a hospital of child and adolescent psychiatry needs an adequate range for the individual requirement of transparency vs. protection and activation vs. privacy. The current knowledge of evidence-based design for adults has to be adapted to children and adolescents when hospital buildings are designed for them. From personal experiences the required elements for the architectural design of a child and adolescent psychiatry hospital are:

1. “Welcome” to facilitate the entrance into the therapeutic process. The first impression of a place has great influence on the expected milieu. An appropriate architectural structure enables an open attitude for all further therapeutic measures. Therefore, the access to day light, warm colours and the use of natural materials such as wood support the child and adolescent that they feel accepted with their needs in the hospital
2. “Path” to give children and adolescents an orientation in the building which is appropriate to their development. Independent orientation of the patients will help to activate the well-being and reduce stress.
3. “Territory” to give children and adolescents a space for development and social interaction. Besides security issues the desire both for identity and community should be satisfied by space design (e.g. Children's Centre for Psychiatric Rehabilitation, Hokkaido, Japan; design by Sou Fujimoto Architects, Tokyo, Japan; Figure 2). Children and adolescents should have the possibility to implement individual details in their personal architectural surrounding. This aspect could be provided by an area on the wall of the ward on which personal drawings and photographs of patients are displayed.
4. “Area of freedom” to support creativity in the therapeutic process.

5. “Outdoor space” to support freedom in the therapeutic process (e.g. Child and Adolescent Psychiatry Genk, Oscar Architects, Antwerpen; Figure 3). Secured and easy access to landscaped designed outdoor areas is important to enable the experience of nature by wind, sun and plants.
6. “Access to light” to satisfy basic environmental needs of children and adolescents. The proved influence of daylight on well-being and the recovery process has to be handled sensible by sufficient access to daylight as well as protection against direct radiation or glare. Complementary is a sufficient, differentiated and client-specific artificial lighting planning.
7. “Motion in the structure and orientation of space” to support the guidance and experience of motor activity in therapy and child development. Space design should support free motor activities such as running and climbing under safe conditions on the ward and related areas.



Figure 2. Children's Centre for Psychiatric Rehabilitation, Hokkaido, Japan; design by Sou Fujimoto Architects, Tokyo, Japan.



Figure 3. Child and Adolescent Psychiatry Genk, Oscar Architects, Antwerpen, Belgium.

Concluding Remarks

The recent literature presents evident data that architectural structures of hospitals affect mental processes in patients. These effects interact with the process of recovery from diseases. Access to daylight and nature, reduced level of noise and an atmosphere of privacy are general principles to support convalescence in patients. Especially, psychiatric patients benefit from structures of space that strengthen appropriate social interrelations to co-patients and to staff members. Actually, data are not available on special architectural needs to support therapy in child and adolescent psychiatry in general and specific therapeutic issues in particular. Therefore, the assessment of the actual architectural structures in child and adolescent psychiatry is necessary to frame design concepts which can be evaluated empirically after their implementation. The purpose should be in analogy to Winston Churchill's aphorism (1960) that *the needs of psychiatrically sick children and adolescents shape our concepts of buildings. Thereafter, these buildings shape the process of convalescence and development.*

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Conflict of Interest

Prof. Dipl.-Ing. D. Halswick is affiliated to H2M Architects, Munich. H2M Architects are commercially involved in the planning and construction of hospitals.

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