

REVISTA | MAGAZINE

IPH

21

INSTITUTO DE
PESQUISAS
HOSPITALARES
ARQUITETO
JARBAS KARMAN



ENGLISH

november 2024
IPH Magazine

VERSION

IPH Magazine

21th edition
November 2023

Editorial board

Fabio Bitencourt
Jorgeny Catarina Gonçalves
Marilena Pacios
Ricardo Karman diretoria@iph.org.br

Editor

Marcio Nascimento de Oliveira marcio@iph.org.br

IPH team

Erick Vicente erick@iph.org.br
Maria Fernanda Mendes acervo@iph.org.br
Renata Baralle biblioteca@iph.org.br
Rita Moraes secretaria@iph.org.br

Graphic Design

Nathalia Duran

Translation

Spanish Martin y Claudia Cadillo
English Marina Jarouche

Cover Image

3D rendering of the children's radiotherapy waiting room at INCA
Designers: Elisa Bittar, Epitácio Panda, João Vicente Guimarães
and Luiz Aguiar.
Source: INCA, 2023.

ISSN 2358-3630

DOI 10.62558/2358-3630/21.03

Mailing address

IPH - Instituto de Pesquisas Hospitalares Arquiteto Jarbas Karman
74 Vargem do Cedro Street, São Paulo - SP
Zip Code 01252-050
Phone number (+55 11) 3868-4830
e-mail revista@iph.org.br
website www.iph.org.br/revista

Summary

Editorial	142
Marcio Nascimento de Oliveira	
Article	145
Patients with Sensory Processing Disorder in a tertiary pediatric hospital: identifying triggers of discomfort	
Daniela Arruda Guterres Soares and Ana Carolina Cordeiro Correia Lima	
Article	164
Humanization of pediatric radiotherapy at Instituto Nacional de Câncer – Inca	
Fernanda Maia Valotto, Luciana Mattos dos Anjos Galdino and Luiz Fernando Flores Cerqueira	
Article	177
Hospital architecture: the challenge of employing good architecture	
Architect Marcia Elvira Contreras	
Review	197
“Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto” (“Aging at home: how to adapt your home to live safely and comfortably”	
Marcio Oliveira	
Interview	201
Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto (Aging at home: how to adapt your house to live safely and comfortably)	
Authors Vera Helena Moro Bins Ely and Patrícia Biasi Cavalcanti	
Interviewer Marcio N. Oliveira (IPH Magazine editor)	

Editorial

Dear readers,

It is with great satisfaction that we welcome you to the newest edition of our magazine. We greatly appreciate your interest in our undertaking and commitment towards the research and development of healthcare settings in Brazil.

Scientific research is a fundamental aspect for the improvement of hospital settings, and this journal, founded by the late great Jarbas Karman, has been playing an important role in divulging the scientific production and fostering the debate about many different topics related to healthcare infrastructure and management.

In this 21st edition, we bring to you three articles that exemplify the importance of such research for the improvement of healthcare facilities. In the first one, "Patients with Sensory Processing Disorder in a tertiary pediatric hospital: identifying triggers of discomfort", the authors Daniela Soares and Ana Lima explore how the human body perceives the built environment through the senses and how such perception affects our mental and physical well-being. Their study highlights the need to approach the differences between how neurotypical and atypical individuals comprehend the environment, focusing specifically on Sensory Processing Disorder (SPD) patients. After mapping the sensory triggers

of discomfort among children treated in a tertiary pediatric hospital, the research offers guidelines to adapt hospital environments to better assist the needs of these patients.

The second article, “Humanization of pediatric radiotherapy at the Cancer National Institute – Inca”, discusses the humanization strategies implemented at the pediatric radiotherapy department at INCA, one of the most prominent institutions of cancer research and treatment in Brazil. The authors, Fernanda Valotto, Luciana Galdino and Luiz Cerqueira, present the results of such interventions highlighting the positive impact on patient well-being. They conclude that hospital humanization goes beyond care, reaching the physical structure of environments, showing how a more welcoming and adapted environment can make the difference in the recovery and experience of its users.

The third article was written by a guest researcher, architect and professor Maria Elvira Contreras, who is academic coordinator at the Argentinian Association of Hospital Architecture and Engineering – AADAIH. The author presents an interesting discussion in which she argues that although healthcare buildings must follow criteria and methodologies inherent to any architect project, they incorporate specific complexities that are conditioned by a series of factors determined by their intended purposes. Therefore, according to Contreras, hospital projects must abide to the constant technological progress, the scientific advancements in disease treatments, the medical equipment, as well as the pharmaceutical industry, and still provide a good architecture. The author conducts a journey through the conceptual content and work of the main architects from the Argentinian Modern Movement, who have worked with different subjects within the healthcare field and have conceived buildings of great architectural quality across Argentina.

In addition to the three articles, this issue includes a review of the book “Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto” (in English: “Aging at home: how to adapt your house to live safely and comfortably”), which is the result of years of research carried out by professors Vera Moro Bins Ely and Patrícia Biasi Cavalcanti, from Universidade Federal de Santa Catarina (UFSC). Employing a practical and accessible language, the authors show how it is possible to adapt residential settings to meet the needs of an aging population, emphasizing the importance of design and ergonomics to ensure safety and comfort for the elderly. The issue also includes an interview with the authors of the book, offering an in-depth view on the theme and the challenges they faced during the research, as well as the challenges of implementing such solutions for healthy and safe home settings.

We invite researchers and professionals to contribute to future editions of the IPH Magazine by submitting their work and research. Your contribution is vital for us to keep improving our journal and fostering continuous advancement of healthcare settings.

On behalf of the team of IPH Magazine, I wish you a good reading!

Arch. MSc. Marcio Nascimento de Oliveira, editor

Patients with Sensory Processing Disorder in a tertiary pediatric hospital: identifying triggers of discomfort

Authors

Daniela Arruda Guterres Soares Children's Hospital of Brasília - HCB

Ana Carolina Cordeiro Correia Lima University of Brasília - UnB

DOI: 10.62558/2358-3630/21.03.01

Abstract

Introduction: the human body perceives the built environment through the senses, and the interpretation of these things relates to our mental and physical well-being. Previous experiences and their sensory interactions with the environment relate to emotions and memory and to users' comfort. In this context, we must consider the differences in understanding of place between neurotypical and atypical individuals. Identifying triggers of discomfort in patients with Sensory Processing Disorder (SPD) is important to understand how space modifications could alleviate their symptoms. **Objective:** to identify the relevance of the built environment in the comfort of patients in a tertiary pediatric hospital by mapping sensory triggers related to interaction with open spaces in the institution. **Materials and methods:** qualitative, exploratory, descriptive research, with a theoretical and phenomenological approach. The scope of the study included a review of the available literature on the topic and analysis of responses from interviews with patients at the hospital between 2 and 18 years old who presented diagnoses commonly related to SPD. During the interviews, we posed questions to the children's companions about various sensory stimuli. **Results and discussion:** the results of the interviews showed that many children felt discomfort with sensory stimuli, reinforcing the importance of adapting environments to the individual needs of patients. The paper proposes some guidelines for the development of intervention projects in the infrastructure of the hospital that respect the needs of patients with Sensory Processing Disorder.

Keywords

environmental comfort; user-centered design; neurotypical individuals;
evidence-based architectural design; user experience.

Introduction

Sensory Processing Disorder (SPD), also known as Sensory Integration Dysfunction, is a neurological disorder characterized by impairing the comprehension, the processing and responding to sensory information regarding the environment and the human senses – hearing, touch, smell, taste, and sight, vestibular and proprioceptive. SPD might occur in individuals with no previous clinic diagnosis; however, SPD is usually observed in combination with other conditions. According to estimates, between 15% and 20% of the global population fall into the neurodivergent umbrella, meaning that their sensory processing sensibilities often affect their experience in public spaces (Doyle, 2020, p.112). According to Emmons (2006), the diagnosis and conditions most commonly related to the Sensory Processing Disorder are, among others, Neurodevelopmental Disorder (ND), Autism Spectrum Disorder (ASD), Attention-Deficit/Hyperactivity Disorder (ADHD), Down Syndrome, brain paralysis, and intellectual impairment.

The North American occupation therapist Anna Jean Ayres originally identified the alterations in the response to sensory stimuli, in 1972, when she was studying children with learning difficulties. Ayres (1972) linked her knowledge in neurobiology with her detailed observation of children behavior to develop the theory that sensory processing impairment may trigger several functional problems, and she called this condition Sensory Integration Disorder. Nevertheless, SPD is considered a more appropriate term, since it differentiates the clinical condition from the neurophysiological cellular process involved (Miller, 2012, apud Machado, 2017, p.93).

According to Coolen (2006), people who suffer from this disorder are deeply affected by the built environment and its surroundings. Barker (2014) endorsed such discovery in a study that confirms that the built environment has a great impact on SPD children. This population can be hyper reactive or inattentive to sensory stimuli, which may trigger feelings of angst, anxiety, stress, and, occasionally, physical pain.

According to Dzebic (2014), the visual and spatial features of an environment directly interfere how one experiences this space, therefore influencing its use, as well as the presence and behavior of further individuals. This idea corroborates Gage's information (2003) that the changes in an environment affect its user's brain and, consequently, behavior.

According to Unwin (2003), when regarding the physical comprehension and real experience of the architectonic design, the way someone perceives the space can be changed through the following elements: light, color, sound, temperature, air, movement/ventilation, smell, texture, scale,

and time. The manipulation of such design elements might influence the sensory experience of the space and alter the response and behavior of the user (Pallasma, 2011).

Due to the diversity of SPD patients, mainly autistic children, previous studies have presented different results and conclusions regarding how to handle the built space, which suggests that such a definition it is not very clear and the result varies from one person to the next. On that ground, it is clear the need to assess patients within a specific context, covering the unique needs of the children who use the space. This demand is emphasized by Kinnaer (2015), who underlines the difference in perception among people and confirms the need to carry out research within specific subgroups to achieve more concrete results, since previous studies are generic and, therefore, unspecified.

After this introduction, this work proposes the following question: what is the relevance of the built environment for patients suffering from Sensory Processing Disorder at a tertiary pediatric hospital?

Justification

The ground that guided the choice of such a topic was the growing increase in the number of neurological disorder diagnosis, such as autism, with close connection to SPD, justifying the personalized attention such patients must receive. Among the bibliography references studied, there were some works connecting the space and users with sensory disorders, which aimed at defining new orientation and guidelines for architectonic projects. However, since this is still a new topic, there is still a lack of papers approaching this connection. On that ground, Paron-Wildes (2005) explains that, regarding the architectonic design of children environments, it is important to consider the needs of children with neurological disorders and think the space as an experience. So, in this study, the emphasis is on how to identify patient patterns to enable the development of guidelines for the design of environments where the child can feel sensory comfort, considering that most of his/her symptoms might be a manifestation of his/her sensory discomfort (Gopal, 2018). Thereupon, it is justified the need to develop studies such as this one, in which the focus is on the experiences and perceptions of the user towards the built environment.

Goal

The main objective of the study was to identify the relevance of the built environment as it relates to the sense of comfort among SPD pediatric patients in a tertiary pediatric hospital, and to map sensory triggers related to the interaction with the hospital settings.

Methodology

The study was conducted at Hospital da Criança de Brasília José Alencar (HCB), a tertiary hospital that offers integrated and multidisciplinary care for children with rare, complex and chronic diseases, from September 2022 to January 2024, and was approved by the Research Ethics Committees (REC), under CAEE registration number 60818122.2.0000.0144, decision number 5.713.337.

This research is exploratory with descriptive analysis and theoretical and phenomenological approach; it aims at emphasizing the deep involvement, the interpretation and integration of theory with empirical data. The study consisted of two phases: (1) semi-structured interview; and (2) bibliographic review, to connect the findings to the literature.

For the first phase, the group of participants comprised parents and/or relatives (tutors) of the children under treatment in one of the several pediatric specialties at HCB. Companions older than 18 years old who were accompanying patients of any gender, between 2 and 18 years old with diagnosis relating to SPD, were involved in this study. The research did not include companions younger than 18 years and/or those in their first visits to the hospital and/or those whose clinical records were incomplete. After signing the Free and Informed Consent Term, the interviews began following the Interview Form, which included objective questions. We produced a written journal to register companions' reports, nuances of answers and general perceptions. Considering the topic of our research and our investigation goals, we chose the qualitative methodology with thematic analysis, since such approach enables an interpretation of behaviors and social phenomena, prioritizing the personal significance of phenomena, according to Braun e Clarke (2006). The literature review displayed the current recommendations for projects in the field, reports from neurodivergent population, the relevant historical context, and the associated theories as sensitizing concepts. These concepts, identified in the beginning of the research, provided the fundamental "kick-off" for the research and were instrumental to guide a cross-analysis with the results of the study.

Results

Regarding the sampling method, the interviews reached 35 parents and/or adults who were responsible for children receiving care at any of the several medical specialties at HCB, from September 2022 to January 2024. Three interviews were rejected because the patients did not have a conclusive diagnosis. The research analyzed the data from 32 patients. Among those, 18 (56%) were male and 14 (44%) were female. There were 12 (37,50%) interviews carried out with patients who were at the

hospital for an appointment, and 20 (62,50%) with inpatients. There were 9 specialties identified upon the entrance of these patients: neurology (37,50%), oncology (15,63%), allergy, gastroenterology and psychiatry (9,38%), nephrology e pneumology (6,25%), hematology and cardiology (3,13%). Among the 32 patients, 17 (53,13%) were diagnosed with Autism Spectrum Disorder (ASD), 8 (25%) with Down Syndrome, 4 (12,50%) with Neurodevelopment Disorder (ND) and 3 (9,38%) with Attention-Deficit/Hyperactivity Disorder (ADHD). The sampling included patients from 02 to 17 years old. The frequency of ages is shown in Illustration 1.

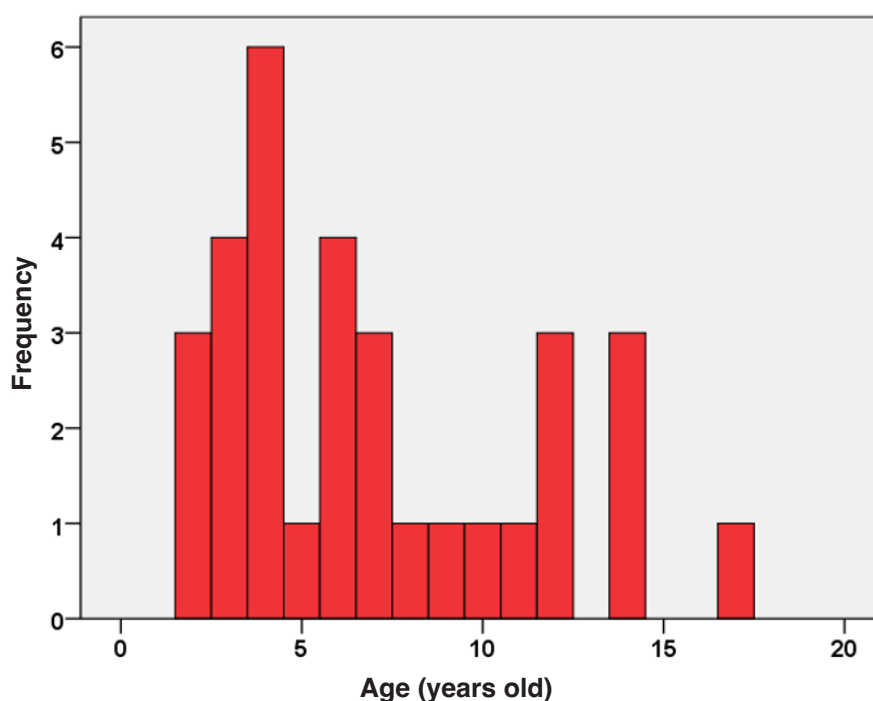


Illustration 1. Histogram of the frequency of ages of patients above 2 years old diagnosed with clinical conditions related to SPD treated at HCB.

It is important to highlight that there was no significant difference in age regarding the patient gender: average age of male patients (AA) = 6,5 (7,0); AA for female patient = 4,5 (8,0), P (U Mann-Whitney Test) = 0,419.

Regarding the age, Table 1 shows there was no significant difference concerning the diagnosis of the studied patients. Moreover, the gender did not show any relation to the triggers assessed in this study.

Diagnosis verification	Average Age (AA)	<i>p</i> *
ASD	6,0 (4,0)	0,829
Down Syndrome	5,5 (9,0)	
ND	7,5 (9,0)	
ADHD	9,0 (5,0)	

*Kruskal-Wallis Test.

Table 1. Analysis of age association regarding the diagnosis verification of patients above 2 years old with clinical conditions related to SPD treated at HCB.

The questionnaire divided the triggers into touch, hearing, sight, smell, and temperature, according to Illustration 2. Although not classified as a specific sense, the study identified that the ability to conduct daily tasks was a key factor to prevent agitation. Therefore, it was included among the results of discomfort triggers. It also became clear that the visual and spatial organization has a crucial role in the communication of future activities, enabling a sense of predictability among patients who require well-defined routines. It is noteworthy that the trigger that caused most discomfort for users was regarding the sense of touch (n=21), mentioned by 65,63% of interviewees, followed by hearing (n=18) and sight (n=18).

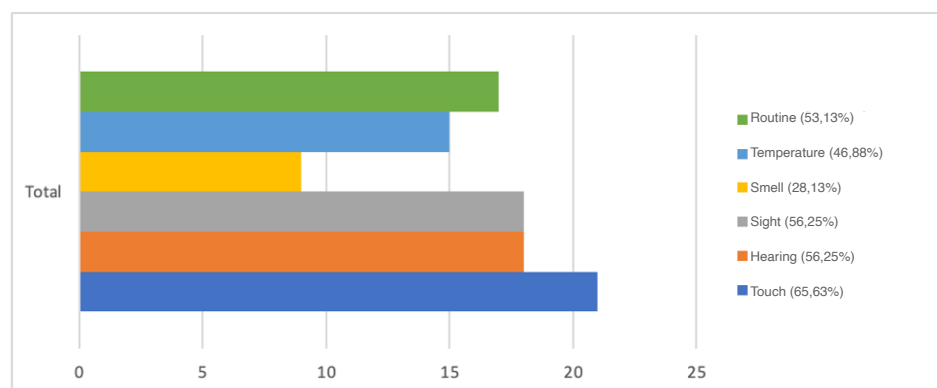


Illustration 2. Total amount of triggers perceived in patients with clinical conditions related to Sensory Processing Disorder.

Only 2 patients (6,25%) did not respond to any trigger, while 3 (9,38%) children conceived discomfort towards 1 trigger, 5 (15,63%) towards 2 triggers, 9 (28,13%) towards 3 triggers, 8 (25%) towards 4 triggers, 4 (12,50%) towards 5 triggers and only 1 (3,13%) patient conceived discomfort towards the six related triggers.

For the trigger of smell, the presence of discomfort considered any type of smell. However, the one most mentioned by companions were the smell of food. For the trigger of sight, it considered the disturbance due to excessive light and an overload of visual stimuli of colors, shapes, and movement of images or people. To deepen the understanding of data, both the triggers “touch” and “hearing” were categorized as shown in Illustrations 3 and 4.

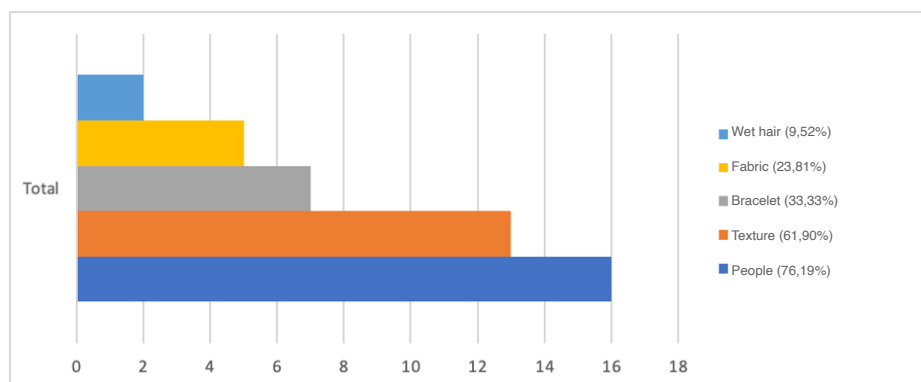


Illustration 3. Total amount of reports of discomfort regarding the categorization of the trigger of touch.

Among the 21 patients (65,62%), who identified the touch stimulus as a trigger of discomfort, 16 (76,19%) mentioned the touch of people, 13 (61,90%) mentioned the texture of toys, food and other objects from daily activities, 7 (33,33%) conveyed discomfort towards the identification bracelet, which was occasionally placed around the child’s ankle after she woke up instead of his/her wrist. Additionally, 5 (23,81%) mentioned discomfort towards the texture used in the fabric of bedlinen, blankets, hospital gown and towels; and 2 (9,52%) patients conveyed intolerance when in touch with wet hair, which hampered child’s personal hygiene.

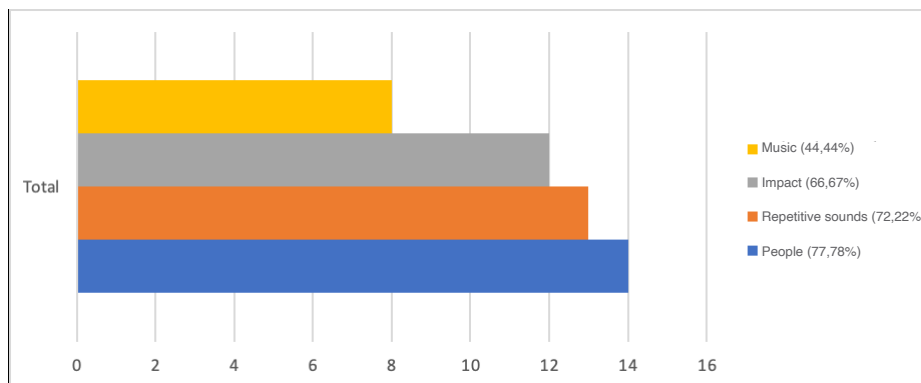


Illustration 4. Total amount of reports of discomfort regarding the categorization of the trigger of hearing.

The hearing stimulus that most impacted patients was the one produced by the presence of people (14 mentions, representing 77,78% of answers), including conversations among the healthcare staff, children crying, the sound produced by other children while playing, noises from TV and from call-out systems. Next come repetitive sounds (n=13, 72,22%) from equipment and HVAC systems. Sudden and resounding noises, such as doors closing, trays falling on the ground, fireworks and motorcycle exhaust system, were mentioned as disrupting by 12 patients, (66,67%), while 8 (44,44%) conveyed disturbance towards music. The study observed that the healthcare team enters patients' rooms singing and playing instruments to distract and cheer them up, however that caused a negative anxiety among some of the children.

The research also identified that 53,1% of patients have light-related preferences, with 35% (6 patients) preferring more luminous environment and 65% (11) less luminous.

Analysis of association

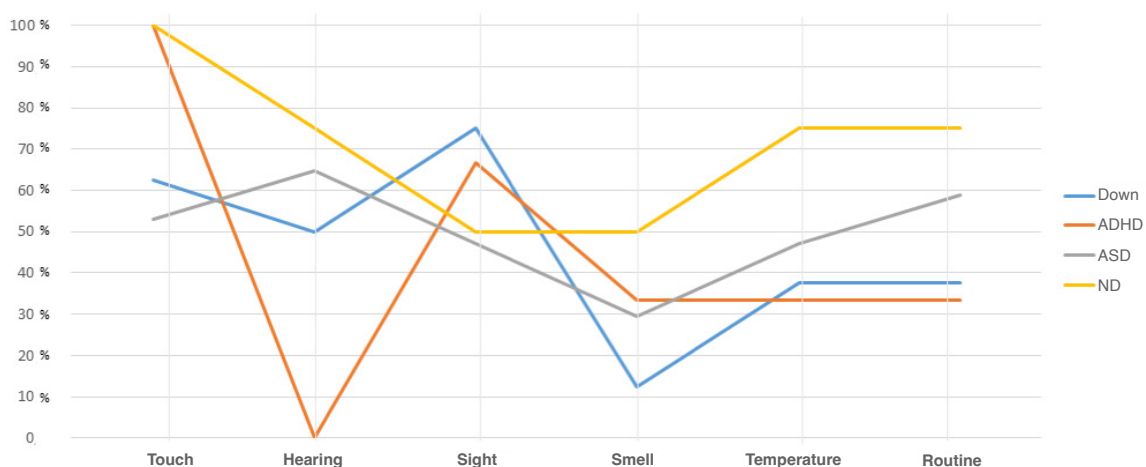


Illustration 5. Incidence rate of related triggers per diagnosis.

Results show that 100% of patients with ADHD (n=3) and ND (n=4) conveyed discomfort towards touch. No ADHD patient conveyed agitation due to hearing stimuli. Among ASD patients, the highest prevalence of discomfort was related to the sense of hearing (64,71%) and the need of routine and predictability (58,82%). The diagnosis that conveyed the highest level of discomfort towards temperature was ND. Among the classification of temperature, ASD patients were the only ones who conveyed discomfort towards cold (n=4), while the other diagnosis showed episodes of agitation with the heat.

Smell was the sense that triggered less discomfort in all patients from the sampling, as mentioned by ND patients (50%). Among Down Syndrome

patients, the sight stimulus triggered the highest level of apprehension (75%), while the smell stimulus had the smallest number of mentions (12,50%).

It is noteworthy the association between the place where the data was collected and the triggers of touch and texture. Inpatients showed 5,600 times more chances to have the sense of touch as a trigger and 6,111 times more chances to have textures as a trigger, when compared with ambulatory patients. Such phenomenon shows that hospitalized children can be more sensible to different materials and food. On that ground, it is likely to consider that, when children are at home, their tutors offer them food that will not trigger as much discomfort; while during the period of hospitalization they will be encouraged to have balanced meals, which may contain food with texture that upset them.

Regarding the identified triggers, an analysis of Illustration 6 indicates a noticeable difference in the relation between the temperature and the age of patients. The study observed that those who identified temperature as a trigger were significantly younger than those who did not. There were reports of nausea and pruritus related to the high temperature of the environment. Such reports highlight the direct impact of sensory experiences over the physical health of patients, endorsing the hypothesis that such stimuli trigger a substantial physiological response.

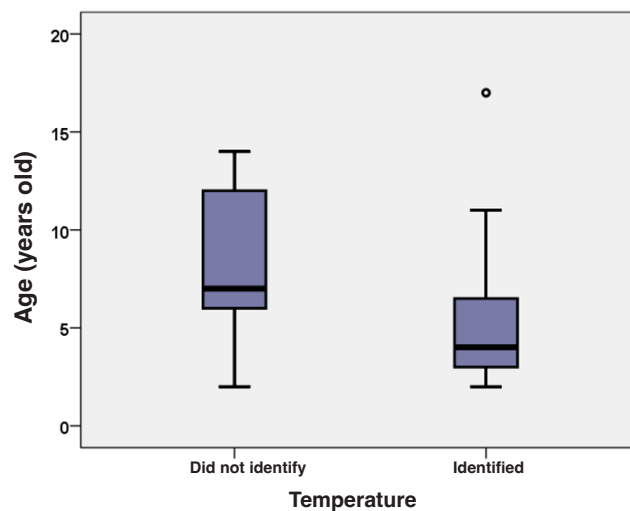


Illustration 6. Boxplot of age (years old) related to the temperature as a trigger among patients diagnosed with clinical conditions of Sensory Processing Disorder.

During the interviews, 27 (84,4%) companions reported that the children they were responsible for preferred open or compartmentalized environments. Among whom, 18 (66,7%) said smaller environments would be more comfortable, while 9 (33,3%) showed preference for ample spaces. The remaining 5 (15,6%) could not provide a definition on this matter.

Discussion

Considering that children's parents and tutor gave the answers, the answers are limited to their perception of the phenomena approached, i.e., they are not a direct report by the patient. Carrying out questionnaires among tutors is nonetheless common (Neumann, 2017 P.150), considering that patients might be either non-verbal or not yet mature enough to describe their own feelings.

The reports given by participants confirm the hypothesis that sensory experiences have significant physiological impact. On that ground, they described physical manifestations, such as stress, irritability, and restlessness in situations of sensory overload.

The findings related to hearing triggers of discomfort conform with the study of Neumann (2017), demonstrating that the impact of high-intensity noises can disrupt the human psychological structure, mainly unexpected and high-frequency sounds, especially for people who process senses differently, like the studied group. The emotional responses reported in the interviews include covering the ears with the hands, shouting, crying, fidgeting, and showing anxiousness and risk of self-harm. Some mentioned feelings of fear, anxiety and even physical pain, in which children use their hands to cover their ears or eyes.

Similarly, regarding light stimuli, considering that more than half of patients showed some preference concerning the level of light; it is deducible that the best way to provide comfort to users is offering them autonomy to choose, since this possibility of manipulation may alter the mood, the behavior and the perception of the neurodivergent patient (Nair, 2022, p.11).

Results from previous studies (Finnigan, 2024, p.12; Nair, 2022, p.09) point that most ASD children prefer LED lights, since shiny and flashy lights tend to trigger fidgety behavior and extreme stress due to luminous sensibility. It is important to emphasize the importance of planning light intensity and its color together, because both factors have an essential role on the perception of the environment (Nair, 2022, p.09).

The study also demonstrated that spatial organization is an important aspect for the sense of familiarity and predictability of the space, since messy spaces lead to an overload of stimuli and the escape reflex (Steinicke, 2022). This can be explained by the importance of routine, order and predictability for this profile of patient (Nair, 2021). Discoveries from this research highlight the importance of adapting spaces aimed at a large public to accommodate a variety of sensory needs, especially at ambulatory waiting rooms.

Reports concerning touch and sight triggers raised a reflection upon proxemics and dynamic elements, mainly in relation to personal space and sensory overload in social contexts. It is noticeable the association between the preference for ample or compartmented spaces and the discomfort resulting from an unexpected physical contact. Compartmented areas offer a safety-controlled zone in limited spaces, while ample areas offer physical distance from other individuals. This issue was raised based on the reports, considering that the lack of specific terminology among some of the participants might have influenced the fully expression of their experiences.

Participants shared the notion that visual discomfort is triggered when there is excessive movement combined with vibrant colors, noises or crowds, resulting in a complex sensorial challenge. Therefore, there is the need to establish different zones that are adapted to unique sensory and spatial needs, which enable autonomy and consider individual preferences.

Considering that visual organization has positive impact on user's perception, it becomes clear that static images offer more comfort. On the other hand, high visual contrast (colors, light, and shadow) is often perceived as negative.

Finally, it is necessary to outline the importance of offering a variety of sensory stimuli in different places, as well as reach a strategic balance between closed and open areas. On that ground, it is positive to have a view to gardens or green areas.

Conclusion and final considerations

Reflecting upon the plurality of users, especially regarding hyposensitivity and hypersensitivity, we understand that the best way to offer comfort to users is giving them the possibility to control the environment, so they do not have to go through an abrupt adjustment when entering the building. In this context, there are some easily controllable elements during hospitalization, like natural and artificial light, room temperature, the speed of air displacement, the production of noise and visual stimuli from television sets, exhaust ventilation systems, and so on.

Homogeneous spaces, where there is no information surplus, convey a feeling of safety and visual comfort. Therefore, for fixed elements, such as colors, shapes, textures and brightness, the recommendation is to use patterns of average contrast, like the guided use of contrast, neutral and unsaturated colors, designed according to spatial and use ordering, giving rise to environments where visual information is clear. For areas where it is not possible to control the source of stimuli, such as the ambulatory

central hall, it is important to offer scape spaces, as well as retreat spaces, according to ASD level of severity. To control the natural light coming from windows, a simple and low-cost solution is to install blinds suitable for hospital environment. It is also possible to separate the artificial light circuit by installing switches for each type of lamp (waking hours, exams, general, and so on).

Employing visual and spatial aid systems to differentiate functions might be a strategy for spatial layout, considering that predictability leads to comfort. In that sense, we may highlight proposals of visual paths to communicate a set of activities, as well as gathering them according to clearly defined functions.

When regarding sound comfort, it is important to point out that every sound can be positive and negative. Sounds from nature, such as running water, in strategic spaces, such as waiting rooms and receptions, might lead to a sense of comfort, enhancing users' independence. Employing sounds at a certain distance brings a sense of orientation and deepness of the space, avoiding inconsistency between what it is seen and heard in that space. However, sounds from machines (continuous vibrational frequency, low and high-intensity frequency), abrupt or unexpected noises and noises of suffering (high-frequency and intensity), such as babies crying, children screaming, horns, balloon bursting, cause discomfort.

Following the safety rules of technical equipment, as well as the noise report, makes it easier to locate the sources of noise when designing the layout, besides being a strategy to ensure that a sound from one specific environment will not interfere negatively with the perception of someone else, avoiding unnecessary annoyance. On that ground, we suggest soundproofing environments and noisy machines. Such a solution, combined with a sound conditioning project, enables more silent transition spaces between appointments and doctor offices.

The study also recommends special attention when specifying reflexive materials, such as porcelain tiles that stimulates environment reverberation, therefore hampering speech comprehension and the communication. To that effect, it is important to emphasize the balance between sound absorption and reflection, by installing vinyl flooring, mineral lining, and sound absorbing panels that enable users to comprehend the environment. The absence of an overload of sound stimuli prevents sound hypersensitivity, which is a barrier to user's function perception. Table 2 sums up some design guidelines and recommendations according to sensory triggers and stimuli, and its expected negative impact.

Sensory trigger	Sensory stimuli with negative impact	Guidelines and recommendations
Hearing	• Incongruence between visual and hearing space • Lack of visualization of the noise source • Abrupt and unexpected sounds • Loud background noises	• Sounds of nature or ambience music at waiting rooms and receptions • Balance between sound absorption and reflection • Sound absorption material in transition areas and corridors • Soundproofing environments and noisy machines
Luminous	• Overshadowing and lights that are bright and flash • Abrupt adaptation and transition between indoor and outdoor environments	• Preference to natural light • User's autonomy to control luminosity and color temperature • Use of LED lights
Vestibular and proprioceptive	• Spatial disorganization • Lack of spatial adaptation for a variety of sensory needs	• Visual paths to communicate set of activities • Cleared defined functions
Touch	• Unexpected touch • Ample spaces with different stimuli	• Balanced zones with ample and compartmentalized spaces • Scape areas and retreat zones located in areas that are bigger and offer more stimuli
Sight	• Spaces lacking orientation • Information surplus	• Average contrast of colors, shapes, textures and brightness • Guided use of contrast, prevalence of neutral and unsaturated colors, designed according to spatial ordering and use • Presence of green areas inside and outside the building

Table 2. Summary of guidelines and recommendations for hospital environments considering sensory triggers and stimuli, and the expected negative impact.

Therefore, implementing individual rooms, located at the end of the corridor, can provide more comfort to patients by reducing the impact of noise and the circulation of people, in addition to offering a diverse range of user experiences. Similarly, there must be special waiting rooms, provided with acoustic treatment, with soft light, controlled temperature and a compartmentalized setting, paying attention to the proximity of an office to the waiting room and the implementation of an affective record, containing information about the patient's preferences and limitations.

One of the main challenges faced throughout this study was the lack of previous studies and norms regarding the subject. However, lessons could be learned from monitoring the satisfaction of patients and their companions through post-occupation evaluation studies, as it is frequently done in architecture-related research and practice.

Despite all limitations, the study has enabled the comprehension of this topic, and the subgroup analyzed, highlighting the need to carry out broader research and innovative design interventions to uphold and meet atypical sensory needs in pediatric hospitals.

This work investigated the sensory discomfort triggers among neurodivergent children in the studied hospital. The findings corroborate with the issue raised in the research, i.e., the built environment is of great relevance to the comfort and emotional response of such patients. The qualitative approach and the semi-structured questionnaire allowed a general understanding of the problems that must be resolved to carry out future spatial adjustments in the environment these patients use. The results of this research, therefore, could provide valuable insights for future recommendations for architects and other professionals responsible for fostering the development of healthier and more comfortable settings for young SPD patients. The guidelines proposed here do not represent the only possible solution for architectonic projects suitable for the neurodivergent population in general, since there is the need to have customized design for different groups. However, they offer a perspective on the needs of this specific subgroup comprising the pediatric patients of the hospital studied, bearing in mind their clinical conditions.

References

BARKER, K. **Sensory Design For Autism**. 2014. Retirado de Ghazali, R. Preliminary Study on Sensory Design for Autism Center. 8th Asia-Pacific International Conference on Environment-Behaviour Studies. The University of Chesterfield, Reino Unido, 2018. Disponível em <https://ebpj.e-iph.co.uk/index.php/EBProceedings/article/view/1392>. Acesso em 5 de junho de 2022.

BRAUN, V.; CLARKE, V. **Using thematic analysis in psychology**. Qualitative Research in Psychology, 3(2), 77-101, 2006. Disponível em https://www.researchgate.net/publication/235356393_Using_thematic_analysis_in_psychology. Acesso em 5 de junho de 2022.

COOLEN, H. **The meaning of dwellings**. Housing, Theory and Society, 23(4), 185-201, 2006. (ISSN 1574-6410; 24).

DEZEBIC, V. **The influence of visual perception on responses towards real-world environments and application towards design**. Intelligent Buildings International, 5:sup1, 29-47, Estados Unidos, 2013. Disponível em https://www.researchgate.net/publication/263494087_The_influence_of_visual_perception_on_responses_towards_real-world_environments_and_application_towards_design. Acesso em 5 de junho de 2022.

DILANI, A. **A Salutogenic Approach to the Design of the Physical Environment in Public Sector**. Revista IPH, nº 11, 2014. (ISSN 1519-14-51). Acesso em 19 de fevereiro de 2024.

DOYLE, N. **Neurodiversity at work: a biopsychosocial model and the impact on working adults**. Br. Med. Bull., v. 135, p. 108-125, 2020. Disponível em <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7732033/>. Acesso em 5 de junho de 2022.

EMMONS, P; ANDERSON, L. **Understanding sensory dysfunction: learning, development and sensory dysfunction in autism spectrum disorders, ADHD, learning disabilities and bipolar disorder**. Jessica Kingsley Publishers, 2005. (ISBN-10:1843108062).

FINNIGAN, K. A. **Sensory responsive environments: a qualitative study on perceived relationships between outdoor built environments and sensory sensitivities**. Land, v. 13, 2024. Disponível em https://www.researchgate.net/publication/380453237_Sensory_Responsive_Environments_A_Qualitative_Study_on_Perceived_Relationships_between_Outdoor_Built_Environments_and_Sensory_Sensitivities. Acesso em 2 de fevereiro de 2024.

GAGE, F. **Neuroscience and Architecture**. AIA 2003 National Convention & Expo. San Diego, Califórnia, Estados Unidos, 2003. Acesso em 21 de outubro de 2023.

GAGE, F. **Academy of Neuroscience for Architecture Conference**, 2012. Acesso em 21 de outubro de 2023.

GOPAL, A; JAYAPRAKASH, R. **Design interventions for Sensory comfort of Autistic children**. Autism-Open Access. 2018. Disponível em https://www.researchgate.net/publication/327180268_Design_interventions_for_Sensory_comfort_of_Autistic_children. Acesso em 21 de outubro de 2023.

JERONIMO, R. M. L.; COSTA, I. R.; LIMA, S. M.; ROCHA, R. C.; CHIATTONE, H. B. C.; SILVA, L. R. L. **Super Mário vai ao hospital**. Hematology, Transfusion and Cell Therapy, v. 44, suppl. 2, 2022. Disponível em <https://www.sciencedirect.com/science/article/pii/S2531137922011439>. Acesso em 4 de maio de 2024.

KINNAER, M.; BAUMERS, S.; HEYLIGHEN, A. **Autism-friendly architecture from the outside in and the inside out: an explorative study based on autobiographies of autistic people**. Journal of Housing and the Built Environment. Heverlee, Leuven, Belgium, p. 1-17, 2015. Disponível em https://www.researchgate.net/publication/275889888_Autism-friendly_architecture_from_the_outside_in_and_the_inside_out_An_explorative_study_based_on_autobiographies_of_autistic_people. Acesso em 18 de junho de 2023.

MACHADO, A. **Processamento Sensorial no Período da Infância em Crianças Nascidas Pré-Termo: Revisão Sistemática**. UFMG, 2017. Disponível em <https://www.scielo.br/j/rpp/a/zYzcpdfox8qyYZ9mSnWFjPN/>. Acesso em 31 de agosto de 2023.

MILLER, L.J.; NIELSEN, D.M.; SCHOEN S.A. **Attention deficit hyperactivity disorder and sensory modulation disorder: a comparison of behavior and physiology**. Research in developmental disabilities, 33(3), 804-818, 2012. Disponível em <https://pubmed.ncbi.nlm.nih.gov/22236629/>. Acesso em 31 de agosto de 2023.

NAIR, A. S; PRYIA, R. S; RAJAGOPAL, P; PRADEEPA, C; SENTHIL, R; DHANALAKSMI, S; LAI, K. W; WU, X; ZUO, X. **A case study on the effect of light and colors in the built environment on autistic children's behavior**. Frontiers in psychiatry, 13, 1042641. 2022. Disponível em <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9748440/>. Acesso em 2 de fevereiro 2024.

NEUMANN, H.R. **Projeto acústico para transtornos sensoriais**. Tese de Doutorado em Arquitetura e Urbanismo. Universidade Presbiteriana Mackenzie, São Paulo. 2017. Disponível em <https://dspace.mackenzie.br/items/2da5352b-2318-4cd8-8c21-79b77e6dd843>. Acesso em 11 de outubro de 2023.

PARON-WILDES, A. J. **Sensory Stimulation and Autistic Children**. Implications, A Newsletter by Informe Design, 6(4), 1-5, 2005. Disponível em: https://www.researchgate.net/publication/323311911_A_Review_of_Sensory_Design_Physical_Learning_Environment_for_Autism_Centre_in_Malaysia. Acesso em 25 de abril de 2023.

PALLASMAA, J. **Os olhos da pele: a arquitetura e os sentidos**. Tradução técnica: Alexandre Salvaterra. Porto Alegre: Bookman, 2011. (ISBN-10: 8577807770).

STEINICKE, N. **Visual perception and autism spectrum disorder: recommendations for inclusive interior design**. Dissertação (Mestrado) – Paris College of Arts, 2022. Disponível em: https://www.researchgate.net/publication/362388529_Visual_Perception_and_Autism_Spectrum_Disorder_Recommendations_for_Inclusive_Interior_Design Acesso em 9 de dezembro de 2023.

UNWIN, S. **Analysing Architecture**. Routledge, Londres, 2003. (ISBN-10: 0415306841).

WILLIAMS, G.; CORBYN, J.; HART, A. **Improving the sensory environments of mental health in-patient facilities for autistic children and young people**. Child Care in Practice, v. 29, n. 1, p. 35-53, 2023. Disponível em <https://www.tandfonline.com/doi/full/10.1080/13575279.2022.2126437>. Acesso em 14 de outubro de 2023.

Authors

Daniela Arruda Guterres Soares Holds a degree in Architecture and Urbanism from the University Center of Brasília (2012) and a Master's degree in Sanitary Architecture Present and Future - Universitat Politècnica de Catalunya (2019). She is currently an architect at the Hospital da Criança de Brasília José Alencar. She has experience in the area of Architecture and Urbanism, with an emphasis on Architecture and Urbanism Project, working mainly on the following themes: hospital architecture, user-centered design, sensory processing disorder, evidence-based architectural design and sustainability.

Ana Carolina Cordeiro Correia Lima Assistant Professor at the Faculty of Architecture and Urbanism of the University of Brasília, Technology Department (FAU/TEC), since 2022. Coordinator of the Night Architecture and Urbanism Course at FAU/UnB, since 2024. PhD in Architecture and Urbanism from the University of Brasília (2021). Coordinator of the Center for Entrepreneurship and Academic Innovation of UDF - Conecta UDF (2021). Coordinator of the Architecture and Urbanism, Interior Design and Graphic Design Courses at the University Center of the Federal District (UDF from 2018 to 2022). Master in Architecture and Urbanism from the University of Brasília (2014). Bachelor's degree in Architecture and Urbanism from the University of Brasília (2011). Researcher at the Laboratory of Sustainability Applied to Architecture and Urbanism - LaSUS/UnB since 2010. Professor in the Postgraduate Course in Sustainable Environmental Rehabilitation Architectural and Urbanism (Reabilita/UnB, UFSC, USP since 2021). She has experience in the area of Sustainable Architecture and Urbanism, working mainly on the following themes and areas in an interdisciplinary manner: sound comfort, user experience,

architecture of the senses, architectural design of high-rise buildings. She participated in research in partnership with the Blood Coordination of the Ministry of Health for the environmental rehabilitation of buildings of the Brazilian Sustainable Blood Network. She is currently researching sound in cities and the soundscape, as well as accessibility and inclusion processes for people with disabilities with the research project “Trilha-UnB” in partnership with the UnB Accessibility Directorate (DACES).

Humanization of pediatric radiotherapy at Instituto Nacional de Câncer – Inca

Authors

Fernanda Maia Valotto National Cancer Institute – INCA.
Luciana Mattos dos Anjos Galdino National Cancer Institute – INCA.
Luiz Fernando Flores Cerqueira National Cancer Institute – INCA.

DOI: 10.62558/2358-3630/21.03.02

Abstract

This article addresses the process of humanization carried out in the pediatric radiotherapy at Instituto Nacional de Câncer – Inca. The main objective is to share and discuss the strategies adopted by the hospital to improve the experience of children and teenagers undergoing daily radiotherapy sessions, besides demonstrating the effectiveness of these actions through evidence and data. The results highlight the impact on users' well-being. The interventions resulted in a decrease in the need for anesthesia, absenteeism and reports of fear at review appointments. The architectural renovation provided a more welcoming and stimulating environment, creating a more positive and less intimidating atmosphere in a scenario of uncertainty and concerns. The results highlight the importance of humanization in the hospital context, not only in terms of care, but also in the physical infrastructure of the spaces.

Keywords

hospital humanization; pediatrics; pediatric radiotherapy.

1. Cancer and pediatric radiotherapy

According to data released from Instituto Nacional de Câncer – Inca, about 700 thousand new cases of cancer will emerge an estimate between 2023 and 2025. Among which, 7.930 will affect children (Inca, 2022).

The same data shows that over the last four decades the progress in cancer treatment throughout childhood and adolescence has been extremely significant. Nowadays, it is possible to achieve a rate of healing around 80% in this group, as long as the cancer is detected early and is treated properly (Inca, 2022).

Within this context, around 40% of pediatric patients will undergo radiotherapy as part of their treatment. During the therapy, patients must go daily to the hospital for about seven weeks, depending on the tumor (Magalhães et al., 2022).

Radiotherapy is a treatment against cancer that uses ionizing radiation to kill cancer cells or prevent them from multiplying. During the radiotherapy session, the patient stays alone in the room, while the machine points to the area of the body that requires treatment.

If the area receiving treatment is head and neck, the patient must use a mask to help sustain the correct position throughout treatment. When treating the rest of the body, a special ink is used to make some marks on the right place, so radiotherapy technicians can position the patient correctly [...]; after being positioned, the patient must stand still, to prevent radiation from going beyond the area limited for the treatment (INCA, 2023).

On that ground, the current radiotherapy procedure demands that children hold steady while on the equipment during the sessions, which can be quite unpleasant and challenging for this age group. Moreover, further aspects of a treatment room might contribute for a negative perception of the environment: low light, low temperature, sizeable equipment, and the absence of an escort.

In that context, according to Magalhães et al. (2022), due to the challenges faced by pediatric patients caused by the singularities of this treatment, between 40% and 50% of children receiving treatment need to be anesthetized or sedated (Khurmi et al., 2018).

2. Humanizing pediatric radiotherapy at Inca

Instituto Nacional de Câncer is located in the city of Rio de Janeiro and has four hospital units dedicated to cancer treatment. The pediatric patients are treated at Hospital do Câncer I – HC I, located on Praça da Cruz Vermelha, downtown.

Every year, there are about 350 new cases admitted in the unit; among which, around 120 children were subjected of radiotherapy treatment. The

amount of time a person must stay in the radiotherapy equipment varies from 10 to 20 minutes, which might double if done under anesthesia (Magalhães et al., 2022).

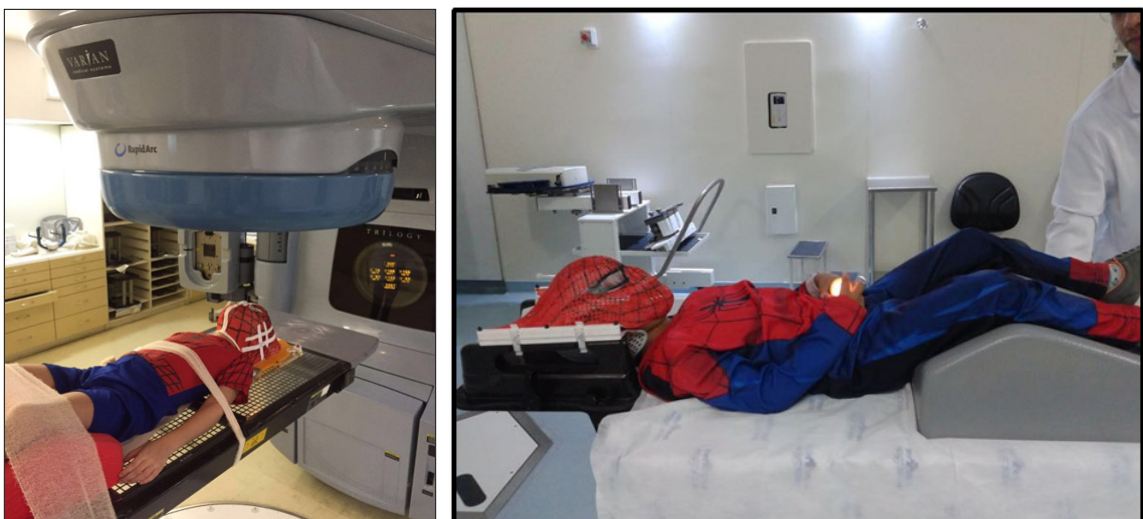
In the sector of childhood therapy, due to intrinsic difficulties, such as adverse environment and the vulnerability of children and their escorts, humanizing initiatives were implemented through low-cost ludic interventions to improve both the well-being of patients and their relatives and the operational flow efficiency.

These initiatives are aligned with Política Nacional de Humanização – PNH (Humanization National Policy) (Brasil, 2004), which presents the guidelines to be implemented in the daily activities of Brazil's public health system to improve the quality of health treatment and management.

The first idea implemented was the use of thermoplastic masks, which help to hold steady children treating head and neck. These masks are shaped specifically for each child, according to his/her physical features and are customized with characters from children's movies and books, following individual preferences.

The team responsible for the sector's attendance observed that pediatric patients have conveyed an excellent sense of acceptance after this first initiative. After that, the universe of superheroes and princesses, among other symbols, has become a part of the radiotherapy environment, which inspired professionals to develop further proposals to offer a sense of coziness in a playful atmosphere.

After a costume donation campaign, children began to undergo treatment in full uniform, dressed in the clothes and masks of their favorite characters (Pictures 1 and 2).



Pictures 1 and 2. Patients ready for the beginning of the radiotherapy session, with their personalized costumes and masks. Source: Radiotherapy at Inca, 2022.

In addition, there were other initiatives that were introduced, such as the performance of short stories and songs in the therapy room, celebration of special dates, celebration of The Incredibles Day, in which characters from the movie give out presents and the donation of a welcome kit for new children, containing a blanket, a glass, hygiene products and toys. When the treatment is over, children receive their personalized mask, a doll of their favorite character and a Certificate of Bravery.

At the same time, the remodeled waiting rooms meant to encourage the act of playing, and also receiving donations of new books, toys, games and drawing materials.

The implementation and the results of such intervention were the focus of the research carried out by Magalhães et al. (2022). From May 2016 to December 2017, there was the assessment of 188 children under 18. Among them, 144 were in contact with some type of humanization intervention during treatment. Most aged between 4 and 7 years old (35,2%), and the average age was 8,5 years old. As a result:

It was possible to verify that small attitudes were able to change the way of understanding and facing a problem. The sizeable, and so far, scary, equipment was named spaceship, and entered a playful universe where superheroes got stronger and more confident, and fear was transformed into an adventure. Upon receiving the custom matching the mask of choice, imagination did its part to complete the transformation. The change in behavior was evident for everyone involved. A treatment that used to be so feared was then requested by these young patients, who began to ask to go to the hospital even on weekends. The trust between family members and the care team increased, and parents were able to offer their support and participate more actively in their children's treatment, adding to a more welcoming environment. Such a playful environment enabled an increased adherence to the treatment, with rare absences; the need to hold still became part of the game, speeding the treatment in the equipment (Magalhães, et al., 2022, p. 4).

Statistically, after the intervention, 33,8% of the children from the study needed to be anesthetized, less than the value of reference (de 40% a 50%) pointed by Khurmi et al. (2018).

Moreover, 7,7% of the patients followed by the study were able to forsake the need for anesthesia during the sessions, a fact that is associated with the acquisition of confidence towards the process. The number of absentees was also reduced, and the fear of the treatment was no longer reported during follow-up appointments.

3. Humanization through architecture

To continue improving the quality of the service offered to the families who visit the radiotherapy sector daily, the team responsible for the assistance established a new goal to develop the humanization process: remodeling the physical space.

To get the necessary funds for that, it was necessary to submit the proposal to Banco do Bem's funding project, which, since 2007, is released every year by INCAvoluntário to enable projects that will improve the quality of life of patients and their escorts (INCAvoluntário, 2024).

INCAvoluntário is the area responsible for planning, carrying out, and promoting volunteer actions at Instituto Nacional de Câncer with money received from donations. This area became official in 2003 aiming at: humanization of the hospital environment; improving the self-esteem of patients and their escorts; giving patient the necessary support so the treatment is not interrupted due to lack of resources; organizing fundraising activities (INCA, 2022).

In 2022, the project chosen to receive the funding from Banco do Bem was the proposal to carry out the humanization of Inca's pediatric radiotherapy space.

The next step was to hire a team of architects to conceive the project to remodel the childhood radiotherapy. The starting point for these professionals was children's perspective of the radiotherapy equipment as a spaceship and their passion for superheroes and princesses.

The areas included in the remodeling project were the waiting room, the therapy room, the post-anesthesia care unit (PACU), and the dressing room (a room where children go prior to receive radiation to choose their costumes and get dressed).

Considering the reality of a public hospital, the remodeling project had to face the limitations of a tight budget, which would not allow a complete makeover of the involved areas. Besides, the solutions given to workmanship and furniture had to be easy to maintain so it would not comprise the performance of installations throughout the years.

The conversations regarding such an endeavor, from the basic to the executive project, involved a multidisciplinary team comprised of Inca's employees and outsourced architects. As a result, the areas gained a space atmosphere, with heroes, astronauts, stars, among other elements, as can be seen on the following pictures.

The changes carried out in the waiting room encompass the color of the walls (which used to be red), the layout of the row of chairs and the

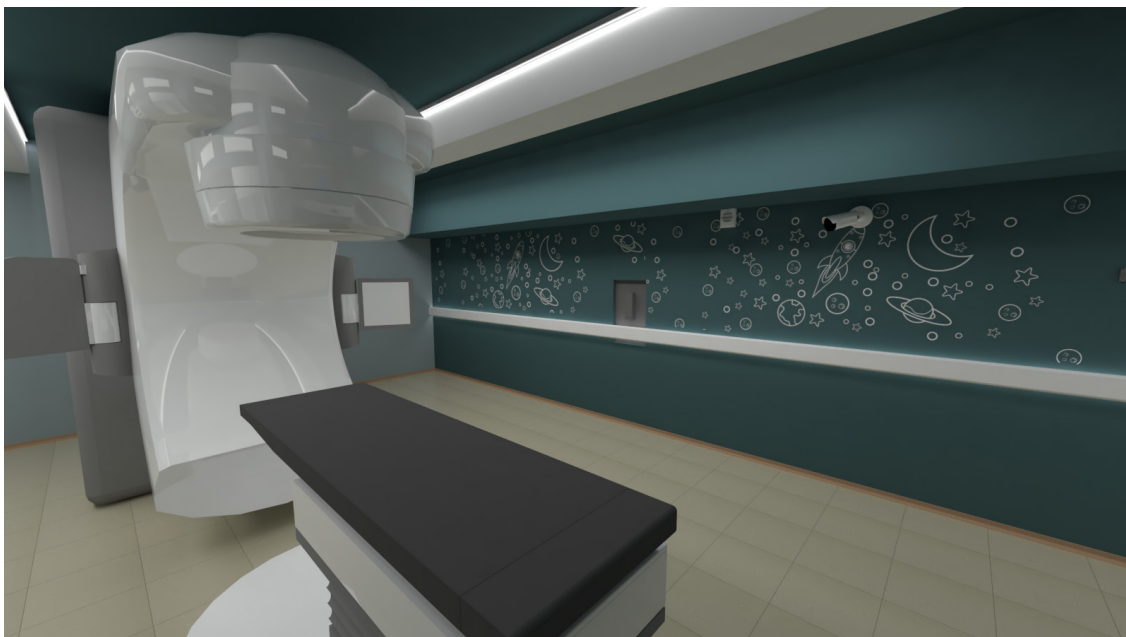
impersonal lighting. The new colors applied to the walls convey a feeling of coziness and relaxation; the U-shaped sofa encourages interaction and sharing of experiences among people; the lighting gained a particular emphasis, valuing the elements around the environment (Picture 3).



Picture 3. Electronic model of the pediatric radiotherapy waiting room. Designed by Elisa Bittar, Epitácio Panda, João Vicente Guimarães and Luiz Aguiar. Source: Inca's Radiotherapy, 2023.

The area was designed in a way to encourage children to explore the decoration and all available spots. Moreover, the door that gives access to the therapy room was planned in a way to suggest they are entering an alternative universe, allowing a more playful and less intimidating experience for young patients.

Within the therapy room, the colors blue and white prevail to soothe its users. On the walls, drawings of elements representing the galaxy combined with stage lighting enrapture patients in the atmosphere and encourage them to explore it. Therefore, it is possible to offer an environment that sparks children's interest and curiosity while conveying a sense of coziness (Pictures 4 and 5).



Picture 4. Electronic model of the pediatric radiotherapy room. Designed by Elisa Bittar, Epitácio Panda, João Vicente Guimarães and Luiz Aguiar. Source: Inca's Radiotherapy, 2023.



Picture 5. Electronic model of the therapy room entrance. Designed by Elisa Bittar, Epitácio Panda, João Vicente Guimarães and Luiz Aguiar. Source: Inca's Radiotherapy, 2023.

4. The challenge of carrying out the project

After finishing the design, the key challenge was to carry out the work without compromising patient care. The radiotherapy section runs from Monday to Friday, from 6:30 am to 10 pm, and receives 50 to 60 people a day. The biggest concern was regarding the radiation equipment, which

is extremely sensitive and could have its operation disrupted due to the slightest interference.

It was established then that the work should be carried out between 10 pm and 4 am. The starting time for patient therapy was delayed to 8 am to allow time to correct possible problems regarding equipment calibration and clean the area properly before resuming sessions.

During this process, every day, before work began, every moveable element had to be removed from the room and the radiation machine needed to be isolated. Afterwards, the items would return to their original positions and the equipment would resume its operation.

The remodeling was successfully concluded in April 2024. Its execution was thoroughly planned and included the management of costs, time, risks, among other factors, and the commitment of everyone involved in the process. Because of this endeavor, we achieved the goals initially established in the humanization project.



Picture 6. Therapy room after remodeling, with star projection.

Source: authors' personal archive, 2024.

Picture 7. Dressing room ready to receive children after remodeling.

Source: authors' personal archive, 2024.

Although there are still neither quantitative nor qualitative studies to endorse the results, the team responsible for childhood radiotherapy daily attendance reported the immediate effect that the architectonic intervention has caused. It was possible to decrease even further the number of children who need anesthesia to undergo radiotherapy. Additionally, some of the inpatients went to the waiting room just to play, evidencing that the new concept of design has been well received.



Pictures 8 and 9. Waiting room being used after remodeling.
Source: authors' personal archive, 2024.

5. Final considerations

The humanization of hospital environments can be achieved by approaching the care being provided as well as the building architecture. The care factor means how healthcare professionals receive each patient. The architecture factor involves how the physical and aesthetic attributes of an area might have a positive influence over someone's well-being, adding to the good evolution of the therapeutic process.

Toledo (2006) believes that a humanized hospital must value and respect the dignity of patients and family members, as well as of its staff, through its physical, technological, human and administrative structure. At the same time, Ulrich (1990) lists three requirements for humanization: control of the environment; social support; and positive distractions.

The Brazilian Ministry of Health launched two projects to establish guidelines for the implementation in the national public health system,

to ensure humanized healthcare: Programa Nacional de Humanização da Assistência Hospitalar – PNHAH (Hospital Care Humanization National Program) (Brasil, 2001) and Política Nacional de Humanização da Atenção e da Gestão no Sistema Único de Saúde – PNH (Humanized Care and Management within Sistema Único de Saúde National Policy), also known as HumanizaSUS (Brasil, 2004).

Regarding humanized architecture, from 1980's onwards, substantive research has shown that the hospital physical environment can influence patients. Within this context, we highlight the outstanding work of Roger S. Ulrich, a researcher known internationally for his work in health design based on evidence and that have enhanced discussions globally concerning architecture and health.

The design of a hospital must comply with matters of technology and function, respect the normative demands and budget limitations, uphold individual physical and psychological needs, and, above all must ensure health promotion.

The initiatives implemented at Inca's pediatric radiotherapy sector show that, despite limited resources, it is possible to have a patient-driven therapeutic process by developing customized actions and designs for his/her needs. Besides, it shows that this can be achievable neglecting neither the functionality nor further aspects inherent to architectonic design and cancer treatment protocol, helping to change the idea that hospitals are places of pain and suffering.

On that ground, Desiderata Institute (2015) concludes that the interest to remodel an area of a hospital comes from realizing that such environments can be more empathetic and enhance the relationships established among professionals, patients and caregivers, somehow alleviating the impacts of treatment.

Culturally, hospitals are often perceived as hostile, unpleasant and impersonal places, which convey feelings of fear and discomfort among people. For the case study presented here, it was fundamental that children and their relatives could feel welcomed and confident, especially during a time of uncertainty, fear of the unknown, anxiety, and stress, common feelings in the life of people dealing with cancer.

Escorts must feel safe to offer patients the emotional support they need. A child that is calm and not afraid might reduce the need of anesthesia, reducing the risk of side effects due to the medication and the duration of the therapy, which will also allow more children to be treated on one day, according to Magalhães (2020).

Scientific health and cancer research has been enabling significant evolutions in the healing rate of childhood cancer, showing that, together,

medicine and architecture are able to contribute to the improvement of the therapeutic process of cancer treatment.

As next steps, it is necessary to carry out a Post-occupancy Evaluation (POE) to exam in detail the efficacy of remodeling Inca's childhood radiotherapy, identifying what needs improvement, sharing lessons learned, encouraging new interventions in the institution, contributing for the reality of other hospitals, especially public institutions, where it is still difficult to employ the concept of humanized architecture.

It is important to ensure that the improvement of health building designs is not limited to Brazil's private institutions. According to a study carried out by Brazilian National Confederation of Industry, the number of Brazilians who sought care in a public hospital over the period of 12 months went from 51%, in 2011, to 65%, in 2018 (CNI, 2018). This data shows that Brazilian Public Health System (SUS) must get ready to receive an increasing number of patients, and that includes having a suitable physical structure for the demand.

References

BRASIL. Ministério da Saúde. **HumanizaSUS: Política Nacional de Humanização**. Brasília: Ministério da Saúde, 2004. Disponível em: <https://redehumanizasus.net/acervo/humanizasus-politica-nacional-de-humanizac%cc%a7a%cc%83o-a-humanizac%cc%a7a%cc%83o-como-eixo-norteador-das-praticas-de-atenc%cc%a7a%cc%83o-e-gesta%cc%83o-em-todas-as-insta%cc%82ncias-do-sus/>. Acesso em 16 de março de 2024.

BRASIL. Ministério da Saúde. **Programa Nacional de Humanização da Assistência Hospitalar**. Brasília: Ministério da Saúde, 2001. Disponível em: <https://bvsms.saude.gov.br/bvs/publicacoes/pnhah01.pdf>. Acesso em 16 de março de 2024.

CONFEDERAÇÃO NACIONAL DA INDÚSTRIA - CNI. **Retratos da sociedade brasileira. Saúde pública. Avaliação da saúde pública é ruim e vem piorando**. Ano 7, n. 44. – Brasília, junho de 2018. Disponível em: https://static.portaldaindustria.com.br/media/filer_public/18/7f/187f1473-2603-4b06-a8a1-070486293e98/retratosdasociedadebrasileira_44_saude.pdf. Acesso em 1º de março de 2024.

FONTES, M. **Humanização dos espaços de saúde: contribuições para a arquitetura na avaliação da qualidade do atendimento**. 2007. Tese (Programa de Pós-graduação em Arquitetura – PROARQ) - Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2007.

INCAvoluntário. **Conheça o projeto Banco do Bem e seus resultados em 2023**. Disponível em: <https://www.INCAvoluntario.org.br/fique-por-dentro/>

conheca-o-projeto-banco-do-bem-e-seus-resultados-em-2023/. Rio de Janeiro: INCAvoluntário, 2024. Acesso em: 04 julho 2024.

INCAvoluntário. **Revitalização da Radioterapia Infantil**. Disponível em: <https://www.INCAvoluntario.org.br/fique-por-dentro/revitalizacao-da-radioterapia-infantil/>. Rio de Janeiro: INCAvoluntário, 2024. Acesso em 4 julho 2024.

INSTITUTO NACIONAL DE CÂNCER (BRASIL). **Estimativa 2023: Incidência de câncer no Brasil / Instituto Nacional de Câncer**. Rio de Janeiro: INCA, 2022. Disponível em: <https://www.INCA.gov.br/sites/ufu.sti.INCA.local/files//media/document//estimativa-2023.pdf>. Acesso em 1º de março de 2024.

INSTITUTO NACIONAL DE CÂNCER (BRASIL). **INCAvoluntário**. Rio de Janeiro: INCA, 2022. Disponível em: <https://www.gov.br/INCA/pt-br/acesso-a-informacao/institucional/voluntariado/INCAvoluntario>. Acesso em 4 de julho de 2024.

INSTITUTO NACIONAL DE CÂNCER (BRASIL). **Manual do INCAvoluntário**. Rio de Janeiro: INCA, 2014. Disponível em: https://www.INCA.gov.br/sites/ufu.sti.INCA.local/files/media/document/INCA2014005_INCAvoluntario_manual_22_completo_1.pdf. Acesso em 4 de julho de 2024.

INSTITUTO NACIONAL DE CÂNCER (BRASIL). **Radioterapia**. Rio de Janeiro: INCA, 2023. Disponível em: <https://www.gov.br/INCA/pt-br/assuntos/cancer/tratamento/radioterapia#:~:text=Sendo%20na%20C3%A1rea%20de%20cabe%CC%A7a,antes%20de%20iniciar%20o%20tratamento>. Acesso em 15 de julho de 2024.

INSTITUTO DESIDERATA. **Humanização em oncologia pediátrica: uma experiência de ambientação de hospitais públicos no Rio de Janeiro / Instituto Desiderata**. Rio de Janeiro: O Instituto, 2015. Disponível em: https://desiderata.org.br/wp/wp-content/uploads/2019/01/humanizac%CC%A7a%CC%83o_oncologia_pediatria_para_Experiencia-1.pdf. Acesso em 17 de julho de 2024.

KHURMI, N. *et al.* **Anesthesia Practice in Pediatric Radiation Oncology: Mayo Clinic Arizona's Experience 2014–2016**. *Pediatr Drugs* 20, 89–95, 2018. Disponível em: <https://doi.org/10.1007/s40272-017-0259-8>. Acesso em 4 julho 2024.

MAGALHÃES, D. **Radioterapia pediátrica: experiência clínica e humanização**. 2020. Dissertação (Mestrado Profissional em Saúde Materno-Infantil) – Universidade Federal Fluminense, Niterói, 2020.

MAGALHÃES, D.; MAGALHÃES, G.; GRIGOROVSKI, N.; FIGUEIREDO JUNIOR, I. **Dinâmica da Implantação de Humanização no Serviço de Radioterapia Pediátrica do Instituto Nacional de Câncer José Alencar**

Gomes da Silva, Brasil. Revista Brasileira de Cancerologia, Internet, 10 de maio de 2022. Disponível em: <https://rbc.INCA.gov.br/index.php/revista/article/view/1662>. Acesso em 1º de março de 2024.

TOLEDO, Luiz Carlos. **Humanização do edifício hospitalar, um tema em aberto.** 2006. Disponível em: https://www.redehumanizaus.net/sites/default/files/humanizacao_edificio_hospitalar.pdf. Acesso em 16 de julho de 2024.

ULRICH, Roger S. **View through a window may influence recovery from surgery.** Science, 1984, v. 224, p. 420-421. Disponível em: https://www.researchgate.net/publication/17043718_View_Through_a_Window_May_Influence_Recovery_from_Surgery. Acesso em 16 de julho de 2024.

ULRICH, Roger S. **Effects of healthcare Interior Design on Wellness: Theory and recent scientific research.** In: Symposium on Healthcare Design, 3, 1990, San Francisco. Innovations in Healthcare Design: selected presentations from the first five Symposia on Healthcare Design. New York: Sara O. Marberry, 1995. p. 97 – 108. Disponível em: https://www.researchgate.net/publication/13173950_Effects_of_interior_design_on_wellness_Theory_and_recent_scientific_research. Acesso em 16 de julho de 2024.

Authors

Fernanda Maia Valotto Architect and urban planner graduated from the Federal University of Viçosa – UFV, with a master's degree from the Postgraduate Program in Architecture and Urbanism at the Federal University of Fluminense – UFF and an MBA in Project Management from the Getúlio Vargas Foundation – FGV. She works in the area of projects and execution of hospital works, and is dedicated to studying the influence of architectural space on the well-being of its users.

Luciana Mattos dos Anjos Galdino Graduated in architecture from FAU/UFRJ, with a postgraduate degree in occupational safety engineering from GESTORE/UFRJ and a master's degree in environmental engineering from PEAMB/UERJ. Works in the field of contract, project and infrastructure management in the area of hospital engineering at the National Cancer Institute – INCA.

Luiz Fernando Flores Cerqueira Master in environmental engineering and PhD in environment, working in the field of hospital infrastructure management at the National Cancer Institute – INCA. In addition, he works as a university professor at the engineering school of the Celso Lisboa University Center - UCL.

Hospital architecture: the challenge of employing good architecture

Author

Marcia Elvira Contreras University of Buenos Aires - FADU UBA

DOI: 10.62558/2358-3630/21.03.03

Abstract

Healthcare buildings have design criteria and methodologies similar to those of any work of architecture, but also incorporate complexities that are inherent to their function, and conditioned by a series of factors related to their purpose. They must comply with the constant technological progress, the scientific advances in the treatments, the medical equipment and the pharmaceutical industry.

However, at the same time, these building should provide good architecture. For that matter, it is necessary to know the past to design the future, which involves a process of reflection that allows us to rescue cultural, formal and constructive values that once were successful.

This study develops a journey through the conceptual contents and works of some of the main architects of the Modern Movement in Argentina, who have worked on different health themes, creating buildings of great architectural quality.

These works, carried out in different provinces of the Argentine Republic, are the result of health planning processes carried out in the public sector at different historical moments, within the framework of public policies of hierarchization of the health sector.

This study analyzes different aspects that are always present when designing a building: typology, geographical location and climate, as well as other topics that are considered of great value when approaching the construction work of a hospital in the current days.

Keywords

design, typology, geography, climate, culture.

Introduction

The modern movement in Argentine architecture developed mainly between the 1930s and 1960s. French-Swiss Architect Le Corbusier visited Argentina in 1929, and his theories influenced a generation of local architects, who already got impacted by the ideas coming from the famed school Bauhaus and from Corbusier himself. This movement sought to break with traditional and academic styles to promote a functional, rational and austere architecture, one that could meet with the social and economic needs of the moment.

As stated in an article published in the Journal of the Central Society of Architects of Argentina:

There are, in our architecture of the 1940s and earlier, examples of resolutions in which the rise of new formalization procedures, like the abandonment of French pseudoclassicism, is associated with a renewal and purification that does not reject modern models, but understands them as design procedures closely linked to the places, the customs of its inhabitants and the availability of materials and techniques. Sacriste (Eduardo), Vivanco (Jorge) and Bonet (Antonio) are some of their representatives in Argentina, but also other Latin American countries have notable examples; it is enough to mention two: Luis Barragán, in Mexico, and Oscar Niemeyer, in Brazil (MOLINA Y VEDIA, 1995, p. 57).

Although the proposals of international architecture have generated a linguistic change in the new projects in Argentina, it is necessary to clarify some points that help to clarify the character of these new forms, by stating that it was not a matter of replacing one form with another, but rather of reinterpreting and adapting these ideas to the specific needs and conditions of the country. Three aspects were considered: LOCATION, USE and CLIMATE, in addition to a fourth one that is a detailed and adjusted constructive resolution.

In this context, when analyzing the production of health-centered buildings, architect Wladimiro Costa, due to his theoretical contributions and designs, and architect Mario Roberto Álvarez, due to his spatial quality and complete constructive resolution, stand out.

The first stands out for his attitude towards the proposals of the modern movement, stating: "One cannot make a genuine modern architecture only as the result of imitations, without strong local roots" (ACOSTA, 1966, p.15).

Mario Roberto Álvarez was a pioneer in proposing a "modern architecture" within the Carrillo Plan (which we will analyze later). In this plan, he suggests, among other things, that "the style of the buildings should be colonial". However, his work was built with another language, managing to respect the place and its people.

Both architects carried out their works in the public sector, one during a local government, and the other one during a national term, with political aspects related to healthcare that determined the rise of new programs in buildings intended for health.

1. Health Agenda for the province of Santa Fe – health as a public policy

In this topic, we analyze the work of architect Wladimiro Acosta and, specially, the public health endeavor carried out in the province of Santa Fe (1938/1939). It is also interesting to highlight the political-institutional framework that enabled a strong investment in construction works that were part of a pioneering plan to improve health in this province, anticipating a similar process implemented, years later, nationally.

Regarding the work of Wladimiro Acosta, architects and researchers Noemi Adagio and Luis Müller highlighted in their book that the administration of Dr. Manuel María de Iriondo (1937-1943) was driven by a moment of economic prosperity and was characterized by endeavors aimed at urban improvements and the construction of public buildings, especially for education and health.

From the beginning of his administration, Dr. Iriondo insisted on the need to improve the province's health system, particularly by assessing the requirements to face diseases such as cancer, leprosy, tuberculosis and the needs of mental healthcare (ADAGIO-MÜLLER, 2009, p.17).

In 1939, the Department of Public Health of the Province was created to centralize and unify all health services (Law Number. 2,858, from October 28, 1938), concentrating and coordinating all actions regarding health matters in the province.

In 1940, Dr. Abelardo Irigoyen Freyre was appointed president of the General Health Council. He was an advocate of preventive medicine, conceived as an exclusive responsibility of the state, whose benefits should reach all inhabitants, regardless of their economic and social conditions. It is worth mentioning another member of the body, Dr. David Sevlever, known for his work related to the association between medicine and physical education, and who was responsible for the hiring of architect W. Acosta.

The new council underpinned that health policies should be organized around three axes:

- 1** Updating treatments regarding mental problems.
- 2** Contagious diseases.

3 Preventive health.

The medical team put architect Wladimiro Acosta, who had significant previous experience, especially in the theoretical investigation, in charge of the most important projects, finding a suitable environment to develop his proposals.

The health program was innovative for the time and was conducted by physicians who were updated on theories, treatments, and technologies of the time, with an emphasis on disease prevention and the use of hygienist concepts for procedures.

The architect Acosta carried out four works in which he proposed buildings that met with particular climate conditions and specific functional requirements, namely:

- Psychiatric Hospital – city of Santa Fe
- Leprosário – Rodovia 5 – Campo Crespo
- Colônia de Alienados in Oliveros – Rodovia 11, km 356 – Oliveros
- Estação Sanitária Rural

1.1. Wladimiro Acosta

To understand this work it is important to mention Wladimiro Acosta's background, an architect who was born in Odesa (now Ukraine) on June 23, 1900, and died in 1967. He belonged to a Sephardic family¹ and began his education in Russia. He studied and worked in Italy, where he graduated in Architecture, and worked as a professor of Architectural Design between 1920 and 1921. In 1922, he moved to Germany, where he stayed until 1928, when he decided to emigrate to Argentina, settling in Buenos Aires until his death on July 11, 1967. From 1957 to 1966, he was a full professor of Architectural Composition at the University of Buenos Aires, also working in Uruguay, Chile, Venezuela and the United States.

Wladimiro Acosta was an architect with a solid cultural background and a strong desire to carry out researches. Moreover, although agreeing with the content of a new architecture (rationalism), he understood that it should not be achieved by imitating formal vocabularies, but rather incorporating local roots. This restlessness led him, in his own words, to manifest:

There was still a third rather uncertain and random path to take: starting everything from the beginning, studying the physical and humane geography of the place, its characteristics, its construction techniques, the most authentic ways of living, to find not just a kind-of-

¹ Descendants from Jews who came from Spain or Portugal (Note from the editor).

appropriate architecture to this place, but one that is representative of this place. I started from two perspectives: attentively studying the local geometeorological conditions and carefully advancing on the empirical solutions presented on buildings from a colonial past, the orientation of their environments and their primitive, although efficient, tools to handle adverse climate agents, especially excessive sun radiation (ACOSTA, 1976, p.16).

Through his theoretical works, research and projects, Acosta expresses concern with the relationship between man and the physical environment. His book *Vivienda y Clima* proposes that man's physical environment is made up of habitation + nature, that is, habitation + landscape + climate, and that habitation creates an environment that must possess beneficial properties for health, such as clean air and sunshine.

He states that housing must have a) a certain orientation; b) a specific architectural conformation, including size, shape and operation strategies of its openings; and c) in some cases, special tools to 'control' and 'correct' the climate within environments. Acosta concentrated his studies and wrote a theory on the adaptation of architectural forms to the climate, giving rise to the proposition of the Helium Principle, developed in his works of housing, urbanism and in public works in the areas of health and education.

Acosta also says that it is important to consider everything involving the surface of buildings, i.e., thermal insulating and waterproof walls, ceilings and floors. The building however must not be a closed environment, isolated from nature. On the contrary, it must allow insolation, lighting and ventilation, enabling visual communication with the landscape.

The search for an architectural conformation that, by itself, ideally provides the elements to regulate internal temperature and, therefore, thermal comfort, was the reason that led the author to use constructive resources that would allow the use of the sun and, at the same time, avoid excessive heat, regulating the entrance and exposure of the building to the sun. This proposal to adapt the architectural form to the climate was called the Helium Principle.

Several projects and constructions with this architectural concept were carried out in different zones and latitudes, adapting it to different types of works, such as individual houses, collective houses and institutions. Here, we will study its use in health projects carried out within the scope of the Health Agenda of the province of Santa Fe.

The Helium system is not an auxiliary mechanism attached to the building, but rather an organic part of its architecture, which gives the work a definite expression. It is perfectly flexible and adapts to the conditions of

the terrain, the landscape, the altitude and the latitude, as well as varying according to the theme, the magnitude of the building and the material used.

The architectural device consists of a slab in the shape of a visor, with a determined width and height, the result of studies translated into schemes to represent and verify the vertical and horizontal entrances of the sun in winter and summer, following the diagrams prepared by the architect.

In his book *Vivienda y Clima*, it is possible to access the graphs where he analyzes the insolation conditions of a house and its architectural control elements.

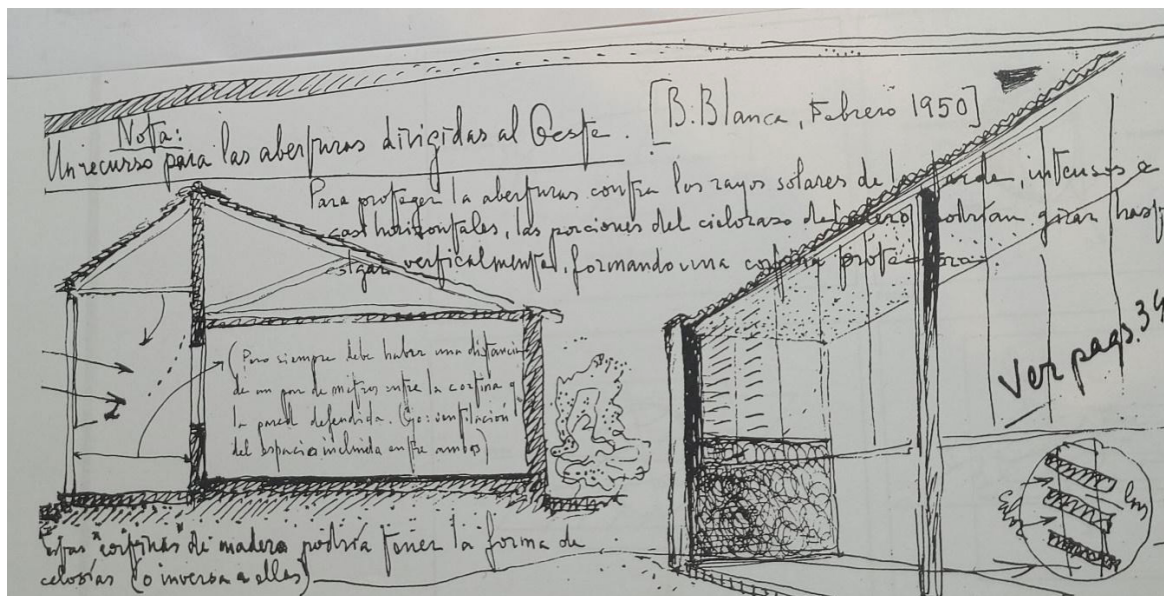


Illustration 1. Draft of openings heading west; the proposal for vertical protecting curtains came after analyzing eaves heading this direction (ACOSTA, 2013).

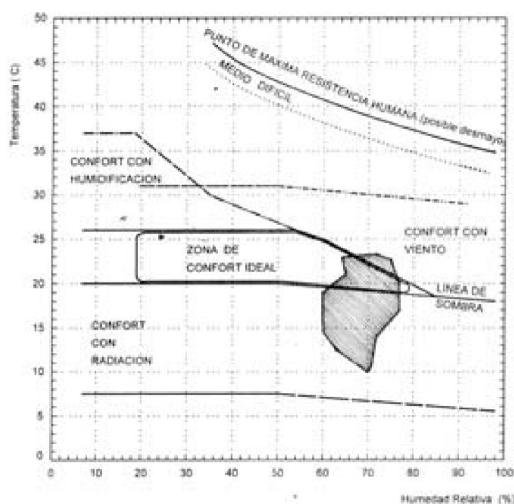
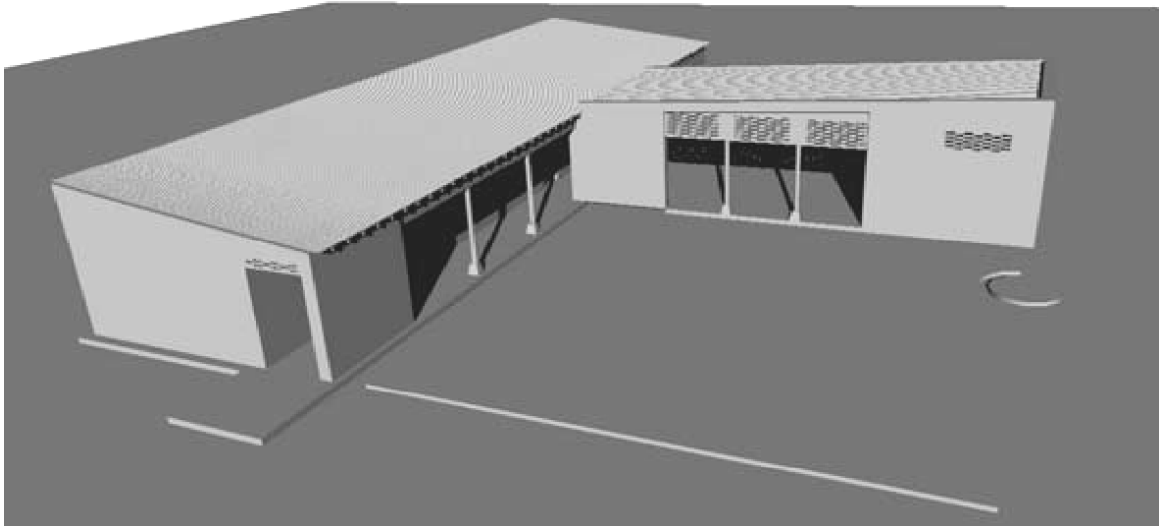
Time has helped to understand the concerns that motivated national functionalist architects, which were reinterpreted and verified using current tools, including programs to verify solar use.

On that ground, according to the work *Edificios Proto-Bioclimáticos en la Argentina*, in chapter 7, he says:

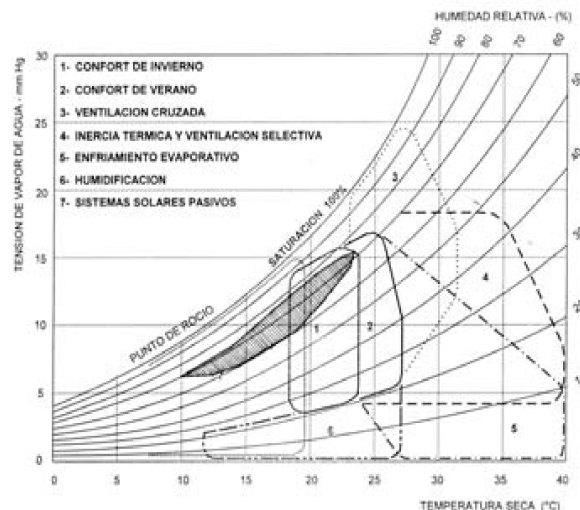
In the 1930s, some of the most prominent modern architects, such as Walter Gropius and Le Corbusier, incorporated insolation studies into their production. At the same time, solar diagrams and specific tools such as Insolation Tables, heliotransporter diagrams and the heliodon have emerged in several countries. Similar elements were produced in Argentina. In the 40s, the works of E. De Lorenzi, W. Acosta, J. Servetti Reeves, J. Borgato and E. Tedeschi stand out.

In the following decade, F. Beretervide, E. Sacriste, A. Williams and E. Tedeschi produced remarkable works or projects that can be inscribed in a 'protobioclimatic' orientation. Although they were carried out with rigor and great intuition, they did not use the techniques for predicting helioenergetic behavior. Consequently, it is appropriate to propose a scientific evaluation of their performance (SAN JUAN, 2013, p.116).

The aforementioned work uses as case study a house designed by Acosta, describing his methodology and procedures with present-day assessment tools, to verify the behavior of the project.



Virtual model, June 21, 2 pm



Bioclimatic diagrams, from Givoni and Olgyay

Illustration 2 . Virtual model and graphics used throughout the bioenvironmental behavior analysis of a project from Wladimiro Acosta (SAN JUAN, 2013).

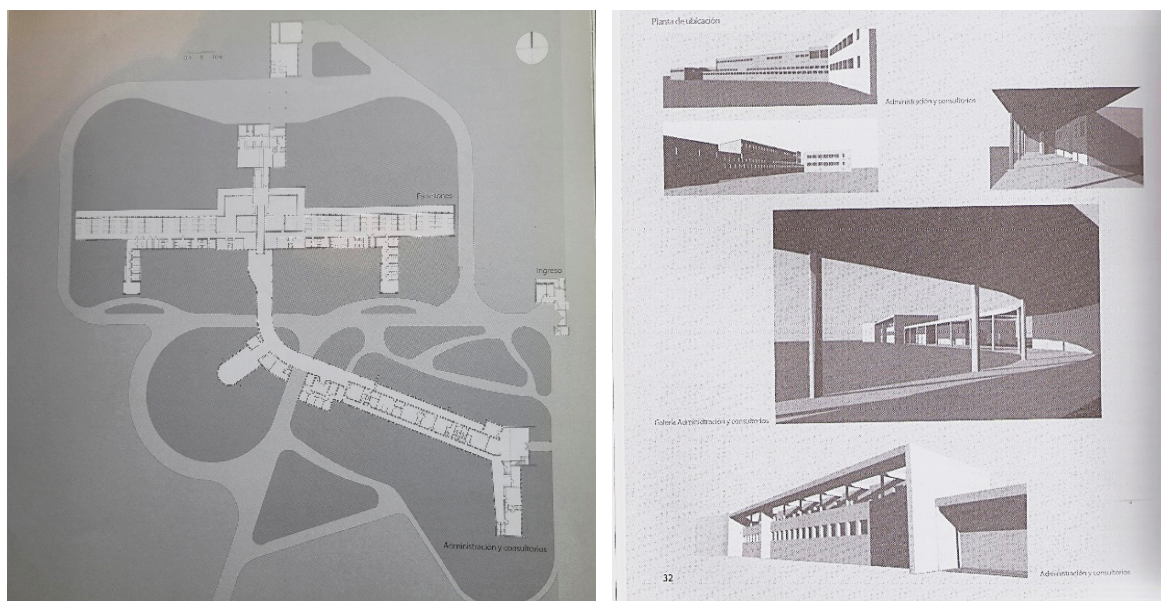
The study concludes that, “in this case, the Givoni and Olgyay diagrams demonstrate that the strategies implemented for the bioenvironmental zone are adequate. It is verified that the insolation meets the necessary requirements and denotes that a careful study of this aspect has been carried out. In summary, we are facing a correct and valuable proto-bioclimatic work, taking into account the instrumental means used” (SAN JUAN, 2013, p.122).

1.2. The designs carried out in the province of Santa Fe – the principle of the Helium System applied to public institutions

As mentioned earlier, Acosta studied in depth the organization of housing and the elaboration of an architectural tool called the Helium System. These studies are present in his works designed for Santa Fe: Psychiatric Hospital – City of Santa Fe; Leprosário – Rodovia 5, s/n, Campo Crespo; Colônia de Alienados – Rodovia Prov. 11, Oliveros; both prototypes of rural health centers carried out within the scope of the Health Agenda planned for the province of Santa Fe.

Psychiatric Hospital

This hospital was intended for patients in severe conditions. It was built a few kilometers from the city of Santa Fe and offered one hundred beds (total for both genders). It was intended for severe cases requiring short-time hospitalizations; chronic cases would be transferred to the Colônia de Alienados, in Oliveros.



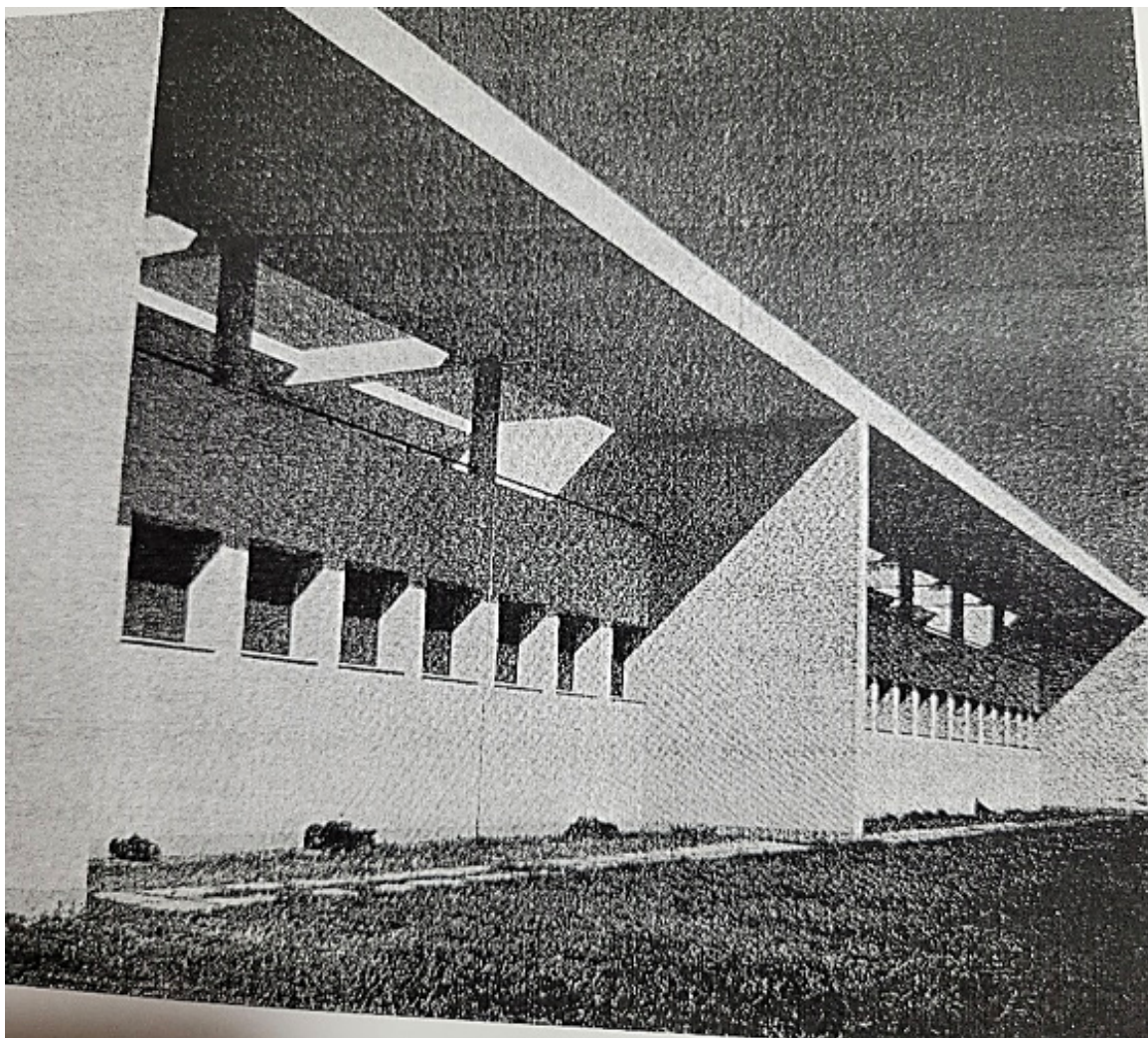


Illustration 3. General floor plan / Images of galleries / Pavilions / North partial view of the Administration Room / Offices. Source: Vivienda y Clima.

Colônia de Alienados in Oliveros

Colônia was conceived as a home and residence for those with chronic mental diseases, and as a rehabilitation center. It was built on a plot of more than 200 hectares in a rural area (at the time), 5 km from the city of Oliveros. The treatment of chronic patients was guided by a medical concept which believed that patients who were able should develop some type of labor therapy, which would allow them some integration with the environment where they were. The proposal included arousing the interest of the owners of neighboring properties to count on the collaboration of patients who could provide some service, under the supervision of the institution. It is necessary to highlight that the proposal was innovative for the time, as it aimed at a certain integration into the environment and contradicted the current isolation criterion.

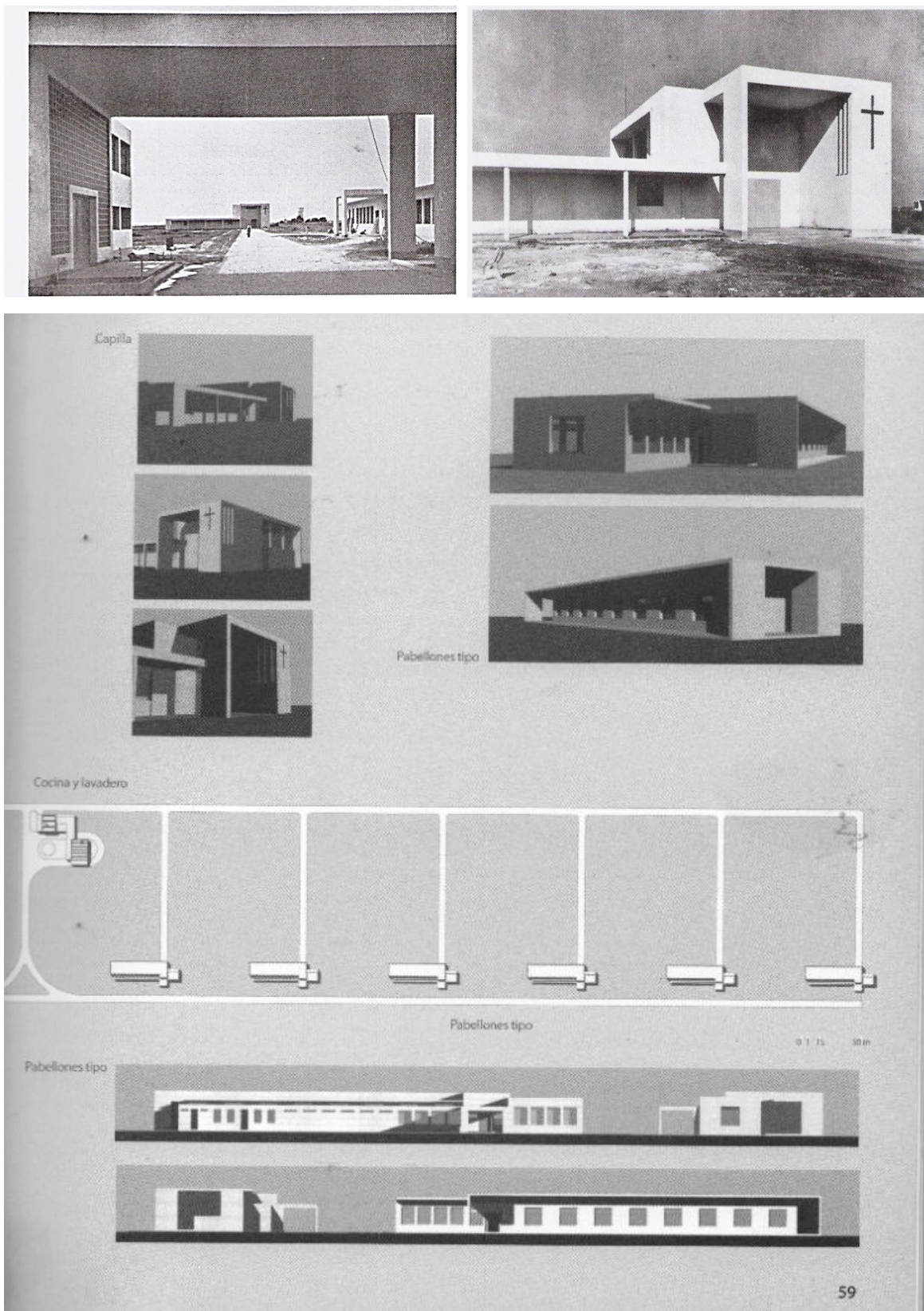


Illustration 4. Access to Colônia / General Floor Plant / Location of staff lodging / Inpatient pavilions / Chapel. Source: Wladimiro Acosta, Noemi Adagio, Luis Müller-*Vivienda y Clima*.

To sum up, we may conclude that Acosta, through his theoretical work, shows to have studied thoroughly the organization and distribution of housing, thus conceiving his works under the concept of “housing for health”. He believed that the concept of “housing” related to the concept of “habitat”, as he wrote:

Housing, in the sense I use it, it is not just a place to live in. It comprehends all the livable space, where man, permanently or temporarily, stays part of his time, where he lives, where he works, where he rests. A man’s house is both his room and his office, his studio, his university, his dining room, his restaurant, his theater or his movie theater (ACOSTA, 1976, p.11).

With the previous statement, the author conceived the Psychiatric Hospital, the Leprosário and the Colônia de Alienados as spaces where patients lived, at rest or in activity, with daily and periodic therapies. This way of thinking about human life, not centered on a single activity, but with a more integral conception, humanizes the spaces where patients, doctors and people in general come and go. We can say that his definition of health buildings constitutes a discovery for the historical moment.

The proposal of the Helium System, the result of his research, complemented with a careful study of the geography and materials of each of the zones where he erected his works, expresses a new conception of the architectural language that accompanies innovation in medical treatments.

The quality of the buildings he proposed shows his adherence to a “new architecture”, which, in his words:

...essentially, it is the art to create highly habitable spaces aiming at offering coziness and sheltering to a man’s life, the final beneficiary of this work. Acknowledging such an obvious and elemental truth was neither an easy nor simple process. On the contrary, it required years of struggles and enlightenment (ACOSTA, 1976, p.11).

Acosta resolved his commissioned projects based on a whole interpretation: cure, prevention, education and community life. His way of conceiving architecture and his innovative contribution, during a stage of change, makes it necessary to highlight and study his proposals when thinking about a building.

2. National Health Agenda

2.1. Carrillo Plan

After carrying out the Health Agenda for the province of Santa Fe (1937-1943), an ambitious process of planning and execution at national level was carried out: the Carrillo Plan, implemented by the national state during the Peronist government, from 1943 to 1955.

The Peronist government was characterized by a strong investment in community issues, as a result of the emergence of new social actors, due to the incorporation of a significant number of people into the labor market and the recognition of social rights to the neediest popular sectors. This led to the inclusion of new architectural themes, such as summer camps, tourist hotels, hospitals, polyclinics, health centers, nursing homes, children and student towns, etc., which signaled the government's social sensitivity and willingness to respond to needs.

In this context, in 1946, the Ministry of Health was created, and Dr. Ramón Carrillo was appointed to lead it. During his mandate (1945 to 1951), Carrillo carried out a true revolution in healthcare, which resulted in the doubling of hospital beds, from 66,300 in 1946 to 134,000 in 1954, 230 inpatient establishments, 50 specialized institutes, 3 thousand dispensaries, besides the creation of health centers throughout the country and EMESTA (State Medical Specialties), the first national drug laboratory managed by the State.

Carrillo Plan establishes planning as a horizon and model of action, creating a relationship between health, architecture and management. The mentor of this process states in the conference given at the headquarters of the League for the Rights of the Worker, in 1949:

This conference could serve as an introduction to hospital architecture studies; the new discipline was incorporated into the study program of the Faculty of Architecture, a discipline that is correlative to an analogous discipline that was also created at the Faculty of Medicine: that of Sanitary Organization and Hospital Planning.

Hospital architecture, in short, presents certain principles to architects. The same principles are presented to physicians by the Health Planning. Two distinct objectives, but so closely united that, together, they constitute a single matter of specialization (CARRILLO, 1974, p.48).

This concern, which leads him to propose the need for specific training to participate in the planning of the health system, centered on the management of medical, physical and human resources, arises from a conception that summarizes as follows:

What is architecture? It is the art and science of building. What is medicine? It is the art and science of healing. Both architecture and medicine are born as needs, evolve as art and are organized as sciences (CARRILLO, 1974, p.21).

The health policy proposed by Carrillo was truly revolutionary as it standardized and executed actions based on the following principles:

- Every man has equal right to life and health.
- There cannot be a health policy without a social policy.

- Medical technique discoveries are useless if do not reach population via appropriate means.

With such fundaments, Carrillo emphasize preventive medicine, since, according to his conception, it should concern health and healthy people, instead of aiming at diseases and the sick.

In this context, the paradigmatic device was the health center, whose program was aligned with the health policy implemented. It was conceived as a basic regional cell, which develops a **preventive action** – mandatory annual examination, periodic and organized vaccination, preparation of statistics; a **social action** – through visitors who locate foci of human insalubrity and bring the action of the Center to them; and a **curative action** – which covers the diagnosis and treatment of outpatients.

To fulfill this program, the Centers have, in addition to the specific services of offices, laboratories, pharmacy, social assistance, statistics and archives, an auditorium, kindergarten, nurseries, public bathrooms, cafeterias for staff (with the possibility of extending them to the community) and employee lodging, not interfering with the operation of the Centers.

Carrillo, in his book *Teoría del Hospital*, presents, with a rational and modern view of hospital architecture, that hospitals are not static buildings, but dynamic ones. He incorporates the need to think about evolution and growth, flexibility, differentiation of circulations and functional sectors.

His work constitutes a true compendium on hospital buildings, without leaving aside any aspect, from the typological proposal to the study of the costs of construction, qualification and operation.

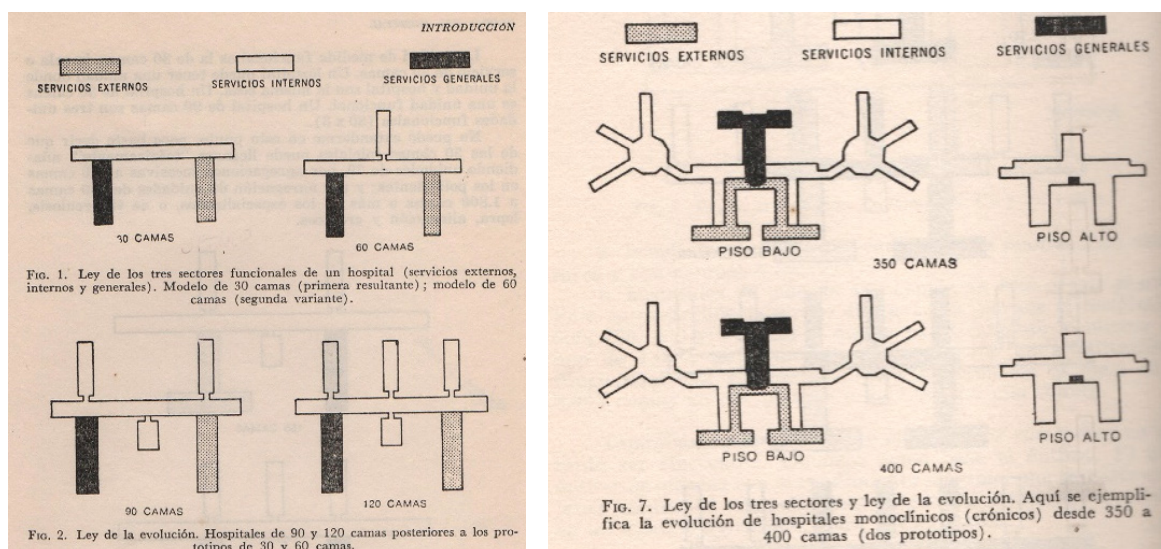


Illustration 5. Evolution of diagrams for hospitals according to the number of beds and diversity of typology. Source: *Teoría del Hospital – Obras Completas*, Ramon Carrillo.

In his effort to predict everything related to the hospital building, the Minister of Health also refers to the “style of the buildings”. As an example, it is enough to consider the explicit specifications adopted for hospital constructions. It was planned that “the style of our rural hospital construction will be colonial, Spanish style or rural type, with gable roofs, with pergolas or with external and internal galleries for any climate and geographical location. Perimeter galleries are mandatory”.

It is stated that “the pergola, the tiled roof, the white walls, the sober lines are unmistakable characteristics left by the Spanish colonial style, already adapted to native style”. However, in another article, he states that “the architects will have these general guidelines, being able in each case to suggest all the reforms or changes in style that they find convenient to adopt” (CARRILLO, 1974, p.500).

2.2. The works of Carrillo Plan’s Health Centers – Mario Roberto Álvarez

In 1948, the country’s Ministry of Health put out to tender projects for the construction of Health Centers in the provinces of Tucumán, Santiago del Estero, Salta, Jujuy, Corrientes and Catamarca. The condition was that the style should be colonial, with tiled roofs and Solomonian columns. The competition was won by architects Mario Roberto Álvarez and Macedonio Oscar Ruiz. They proposed projects with a language of the modern movement, generating a simple and economical architecture that used local material, and a clear climate strategy applied according to the location of the work.

In his proposal, MRA knew how to interpret the minister’s concern, who expressed that the architectural proposal should “coincide with our idiosyncrasy, with our way of being, with our concept”. He reinterpreted, with a formal language typical of rationalism, the spatial devices characteristic of the country’s buildings, reformulating in each region the guidelines of the “colonial style”, respecting the courtyards, gardens, galleries, simple roofs of tiles with soft slopes, with thin columns replacing the robust orders of columns or pillars of colonial masonry.

The architect’s task generated a work, carried out between 1948 and 1951, of great magnitude (60,000 m²) and quality, which constitutes a contribution of the Modern Movement that is not enough widespread in our country.

2.3. The work: Health Center in Catamarca’s capital

The Center is located in the capital of the province of Catamarca, in northwestern Argentina, and has 4,800 m². According to the Carrillo

Plan, it functioned as a basic regional cell, developing preventive action, social action and curative action. To accomplish these objectives, the architectural program included areas for external offices, a laboratory, a nursery, offices for preventive medicine, an auditorium for to the community, and employee lodging.

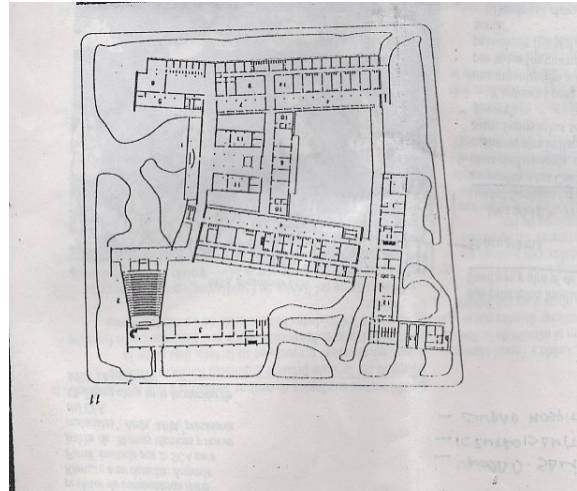


Illustration 6. General floor plan. Source: Revista S.C.A. Arq. Juan Molina y Vedia.



Illustration 7. Pictures taken by the author

This work has buildings with different functions, articulated through large semi-covered galleries that constitute intermediate spaces between indoor and outdoor spaces. These galleries allow the organization of the set and improve the environmental quality, considering that the climate of the region is hot and arid.

The definition by the authorities to consider the Centers as buildings, both for the healthy and the sick, makes it possible to propose a building permeable to the life of the cities, which contributes to enrich the daily life of the community, since it develops prevention and recreation

activities by proposing an auditorium for public use. These aspects of the program result in buildings that convey a feeling far from what is normally attributed to a hospital: that of a prison behind a wall.

In this case, the modernity of the programmatic proposal contributes to the quality of the solution presented, typical of the architecture of the Modern Movement, both aspects being an innovation for the time.

2.4. Health Center in Tucumán's capital

The 4,640 m² building is located in the capital of the province of Tucumán, in the northwest of the country, and has a subtropical climate with very hot summers and mild winters. In the lowland region, there is a severe dry season and very high temperatures in the summer, with very dense vegetation.



ACCESO AUDITORIUM



VISTA EXTERIOR HALL



ESCALERA, EXTERIOR



PATIO INTERIOR

Illustration 8. Gallery that gives access to the auditorium / Outside view of the hall / Indoor courtyard with native vegetation. Source: S.C.A Magazine, issue 173.

Complying with functional matters does not halt the use of new language, which is expressed in the large galleries (the pergolas of “colonial architecture”), constituting a transitional space between outdoor spaces, with high temperatures, and indoor spaces; in the internal courtyards, which allow contained spaces and allow cross ventilation; and in the presence of perimeter galleries in the different blocks, respecting the requirement of the Ministry of Health.

These are buildings designed with the new language, which proposes a sober style stripped of sophisticated resources. This synthesis is the result of the knowledge of the region’s climate, the solid technical training, demonstrated in the design of the construction details, and the use of local materials. These aspects, together with an appropriate functional solution, result in high-quality buildings.

Conclusion

We would like to highlight that the two processes analyzed had health as a public policy and were carried out by governments of different ideological orientations: in the case of the province of Santa Fe, during the administration of Dr. Manuel María de Iriondo (1937-1943), with a conservative orientation; and later during the presidency of the Argentine Republic of Gen. Juan Domingo Perón, with the administration of Dr. Ramón Carrillo as the first Minister of Health of the Nation (1946-1951), with a progressive ideological orientation.

However, we can highlight that, as political programs of massive public achievements with a strong social and collective content, these processes made it possible to train architects such as Wladimiro Acosta and Mario Roberto Álvarez, who were willing to face tasks that require effectiveness, speed, systematization and formal quality.

In this sense, we can observe that, in the moments of coincidence between the strategic responsibilities and objectives of the political power, the rules and imperative needs of the time constituted an indispensable terrain, which enabled a strong and healthy architectural response, and which was incorporated into the precedents and was necessary to know in order to advance in the consolidation of a sustainable architecture in the national cultural field.

The hospital work should not be an uncritical response to a functional program that only contemplates the organization of production units (the different services), but rather supported by a systemic conception, both functional and spatial, criticizing theoretical constructions, as proposed by the architect Juan Molina y Vedia:

For this reason, we propose to 'see and touch' the buildings we want to talk about, to be able to continue designing and building others. Theorizing, but not in a vacuum, but from the works that are seen, touched, lived. So, let's try to build a trajectory that undoubtedly seems rich to us to work on the theme (MOLINA and VEDIA, 1988, p. 14).

Before starting a new project, it is recommended to know, study and analyze the collection of previous architectural production, in order to identify those works that serve as examples of good architecture. In this sense, the health projects mentioned in this article should be considered, both for solutions related to location, their uses, climate, and for a resolution that contemplated the different regions of an extensive and complex country such as Argentina.

References

ACOSTA, Wladimiro, **Vivienda y Clima** - Editorial Nueva Visión-Argentina, 1976.

ADAGIO, Noemi y MÜLLER, Luis. **Wladimiro Acosta Del City Block a La Pampa**. Cámara de Senadores – Colegio de Arquitectas de la Provincia de Santa Fe, 2009.

ALZUGARAY, Rodolfo A. **Ramos Carrillo el fundador del sanitarismo nacional**. Editorial Colhue. Buenos Aires, 2009.

ALVAREZ, Mario Roberto & Asoc. Obras entre 1937-1993, Autoedición. Buenos Aires, 1993 Buenos Aires- 1974.

CARRILLO, Ramon. **Teoría del Hospital- Obras Completas I** – Editorial EUDEBA, FLORES, María Elena, **Una política de salud basada en derechos sociales: la propuesta sanitaria del Dr. Ramón Carrillo**, Argentina. VII Jornadas de Sociología. Facultad de Ciencias Sociales, Universidad de Buenos Aires, Buenos Aires, 2007.

LIERNUR, Jorge Francisco. **Arquitectura en la Argentina del siglo XX, la Construcción de la Modernidad- Editorial**. Fondo Nacional de las artes, 2001.

MOLINA y VEDIA, Juan- **"Arquitectura para la Salud, Situación Actual"**. Revista Trama, n° 21. Buenos Aires- 1988.

MOLINA y VEDIA, Juan- **"Mario Roberto Álvarez, Centros Sanitarios del Plan Carrillo, 1948-1950"**. SCA, Revista de Arquitectura de la Sociedad Central de Arquitectos, núm.173. Buenos Aires- 1995.

MÜLLER, Luis, **Arquitectura moderna en la obra pública: un catálogo para Santa Fe**. 9º seminário DOCOMOMO Brasil - interdisciplinaridade e experiências em documentação e preservação do patrimônio recente. Brasília, junho de 2011.

PARERA, Graciela-**Arquitectura pública: entre la burocracia y la disciplina** Editor: Universidad Nacional de La Plata. Facultad de Arquitectura y Urbanismo-La Plata, 2012. <http://bdzalba.fau.unlp.edu.ar/greenstone/cgi-bin/library.cgi?e=d-01000-00---off-0postgrad--00-1----0-10-0---0---0direct-10---4-----0-1l--11-es-50---20-home---00-3-1-00-0--4--0--0-0-11-10-0utfZz-8-00&a=d&c=postgrad&cl=CL1.1&d=TE17>.

SAN JUAN, Gustavo Alberto (Org.). **Diseño bioclimático como aporte al proyecto arquitectónico**. Autor: Rosenfeld, Elías et al. Editora: Universidad Nacional de La Plata, 2013.

SISTEMA HELIOS: **Clima y tradición en la arquitectura de Wladimiro Acosta**. ArchDaily – Disponible en: <https://www.archdaily.cl/cl/958410/sistema-helios-clima-y-tradicion-en-la-arquitectura-de-wladimiro-acosta>

UNAV. **Miradas Cruzadas: intercambios entre Latinoamérica y España en la Arquitectura española del siglo XX**. España, 2008. Disponible en: <https://www.unav.edu/documents/29070/378131/pv-acosta.pdf>.

Author

Marcia Elvira Contreras Architect - Faculty of Architecture, Design and Urbanism FADU - UBA. Specialist in Health Systems and Services Administration. Faculty of Medicine - UBA. Professor at the Faculty of DADU - UBA. Scholarship holder of the Government of France (ACTIM), INDES Course, Washington, D.C. Director of the AADAIH- IFHE Management and Design Course. Speaker at conferences in Argentina, Spain, Uruguay, Brazil, Colombia, Chile, Mexico and Costa Rica. Since 1986 she has been working in the health sector within the framework of projects with multilateral organizations (IDB - WORLD BANK). Head of the Contreras & Asociados studio.

Book review

“Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto” (“Aging at home: how to adapt your home to live safely and comfortably”)*

Author

By Marcio Oliveira, editor



Publication details:

Authors Vera Helena Moro Bins Ely and Patrícia Biasi Cavalcanti

Publication in pre-launch phase, will soon be available in printed and digital format (e-book).

The book “Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto” is a product of years of research carried out by Vera Helena Moro Bins Ely and Patrícia Biasi Cavalcanti, professors at Universidade Federal de Santa Catarina (UFSC). With accessible, simple and practical language, this publication is a great contribution to a theme of growing relevance: the aging of the population and its implications to residential design and ergonomics.

* Available only in Portuguese

Adapting residences to improve safety and comfort is a pressing need globally, considering the continuous increase of life expectation, and

especially in Brazil, where the elderly population is growing at a rapid pace. That substantiates the importance of works such as this one, which can already be considered a must-read for anyone who needs practical and current solutions to adapt their homes for a safe and healthy aging.

Abundantly illustrated, the book is organized in three parts. The first part focuses on the aging process itself, exploring how physical, perceptive and cognitive changes that normally occur with age affect the need of having an ergonomic suitable environment. The book presents and discusses the transformations that an aging body and mind go through and how they might impact mobility, sight, hearing, balance and cognition, increasing the risks of falls and other domestic accidents. The authors then provide both general and specific orientations, listing strategies on how to build or adapt a home to the needs of its user.

The second part includes detailed orientation on how to plan and design different types of residential environments. Each chapter aims at one specific room, covering outdoor spaces and entrances to living rooms, kitchens, bathrooms and bedrooms, offering practical and accessible solutions to adapt these spaces to the need of the elderly. The authors apply illustrations and diagrams to make it easier for readers to understand solutions that include the importance of a good lighting, the use of slip-resistant flooring and support bars, the adjustment of furniture and worktop heights, among others, to prevent accidents and falls. They also suggest ergonomic features of furniture, and provide links for products currently available in the market, advising the reader on how to organize spaces to improve the flow of activities within the house, making it easier to reach routinely used tools and accessories.

The third section introduces a catalogue of products that can be used to remodel and adapt residential settings for elderly people, including a glossary with the main terms used in the book. The catalogue of products itself is a great contribution and a valuable tool for those in search of products that are available on the market and might add to the safety and comfort of elderly people's homes. The glossary helps to explain technical terms and concepts discussed throughout the book, making it accessible even for those without previous design and architecture knowledge.

One of the best attributes of "Envelhecer em casa" is its humanized and holistic approach. Vera and Patrícia do not treat the elderly population homogeneously. On the contrary, they acknowledge the variety of needs and preferences of people in this group. Each suggestion is followed by a clear explanation and by practical examples, illustrated with pictures and diagrams that make it easy to be understood and employed even by people with no architectural background.

Another relevant aspect of the book is its interdisciplinary approach. The

bibliography employed confirms that the authors based their book on knowledge from different correlate areas of expertise, such as geriatrics, psychology, physiotherapy, and engineering, to offer a range of integrated solutions. This bolsters the idea that designing safe and comfortable environments for the elderly is a responsibility that must be shared with professionals from different fields and, above all, the elderly and their families.

To summarize, “Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto” is an excellent and timely contribution to the topic of healthy aging and provides an essential manual for those willing to understand and face the challenges of aging in a more informed and proactive manner. This book is therefore a valuable resource of knowledge and inspiration for health, architecture and design professionals, as well as for anyone interested in providing a safer and more nurturing home for themselves or for their loved ones.

About the authors:



Professor Vera Helena Moro Bins Ely, Ph.D., has dedicated most of her career to the study of universal design, a topic she pioneered in Brazil with her work at Universidade Federal de Santa Catarina – UFSC, where she also has had a prominent work coordinating studies and research

projects concerning accessibility and environment psychology. She has authored several publications and contributions regarding both the urban scale, with works about accessibility in public and leisure spaces, and the building scale, with a special emphasis on healthy aging.

Professor Patrícia Biasi Cavalcanti, Ph.D., is an assistant professor at UFSC, where she has been working since 2011 with topics concerning architectural graphic expression, as well as topics regarding the role of architecture and urbanism to people's health, employing in her studies the tools and techniques of environmental psychology and post-occupation evaluation (POE). A highpoint in her career is her participation and orientation in several research projects and activities related to healthy aging, as well as her three-year contribution as an academic advisor for the PETARQ, a research group at UFSC.

Envelhecer em casa: como adaptar seu lar para viver com segurança e conforto (Aging at home: how to adapt your house to live safely and comfortably)

Authors Vera Helena Moro Bins Ely and Patrícia Biasi Cavalcanti

Interviewer Marcio N. Oliveira (IPH Magazine editor)

1. What were the biggest challenges you faced while drafting the book?

One of the main challenges was the Brazilian context, where there are neither large-scale solutions nor public policies established for residences aimed at the elderly. Comparatively, in Europe and North America, public and private initiatives have been developing a variety of housing alternatives to meet the needs of an ever-growing elderly population. Besides, these regions have produced a vast bibliography to offer home adaptation guidance to both the elderly population and professionals of the building industry. Our goal with the book is to contextualize and adapt the international solutions to our local reality, introducing such a knowledge with a simple and easy-to-understand language, with several illustrations and examples, especially for the elderly.

Another challenge is that large residential environments tend to offer more advantages for accessibility. However, in Brazil, a significant part of the population lives in minimum habitable spaces, where it is already difficult to accommodate comfortably the everyday activities. Such spatial restrictions might impose obstacles to the development of suitable conditions of accessibility and adaptations to the new needs that come with aging. Due to our time restriction, we were not able to focus the book on social housing, which would include residences with extremely reduced

areas. To compensate that, we provided a great variety of solutions considering different sizes and shapes of environments, including their costs. There are several costless recommendations, like how to place light and heavy objects inside cabinets, as well as more sophisticated and expensive ones, like the ceiling hoist system. We understand that each reader has his/her own conditions and needs; therefore, we wanted to give enough information so they can all choose the most suitable environment strategy according to their interests and resources.

2. What has inspired you to explore this topic and write such a comprehensive book on how to adapt residences to the elderly population?

One of our main motivations was our previous research experience, especially from the personal practice of Professor Vera Helena Moro Bins Ely, who has dedicated great part of her academic career to universal design, accessibility and aging.

Moreover, Brazil has already one of the biggest elderly populations in the world, which makes it vital to adapt and improve residential environments to enable a better quality of life. Although there are interesting housing alternatives for the elderly in great urban centers, they are usually private and aimed at a group with high purchasing power. Besides, most people would rather stay in their own house for as long as possible, keeping their own routine and family relationships. Our book intends to be an upholder of this yearning.

3. What are the main obstacles families endure to adapt their homes for the elderly, whether for relatives or themselves, and how can this book help them overcome such challenges?

One of the main challenges is the fact that the population is unaware of the variety of adaptations that can be employed to promote more safety and comfort at home. During our previous research, we realized that most elderly people were indeed unaware of the importance of revamping their home to make it more suitable for their new needs, even the simplest and cheapest ones, such as moving a slippery mat from a pathway.

We believe professionals of the building industry have better access to information, mainly concerning solutions aimed at accessibility and physical and motor impairment, due to the regular publication of papers and studies focusing on this topic. However, they seem to lack information regarding further impairments that might happen during aging, such as cognitive and perceptive. For instance, the

importance of communicating the same environment information through more than one sensorial channel (redundant information), like a doorbell with both sound and luminous signs, which flashes, besides sounding, in an indoor environment when someone triggers it, so people with hearing impairment can notice it.

Our book aims at fulfilling such a void by presenting a broad array of limitations that might occur due to aging, with different spatial solutions for each one of them. We have dedicated one chapter to the process of aging, so readers can understand and reflect upon their own individual challenges, as well as choose the best solutions to their needs.

4. What is your perception regarding the customization of residential adjustments to meet individual needs and preferences of the elderly? Can one adjust the solutions presented by the book to fit different profiles?

Our goal when conceiving the book was to present a great variety of alternatives and solutions for projects, considering that aging is a process that varies according to the person, just as vary the houses and socioeconomic contexts. Therefore, the adjustments required in a room will be unique for each person. In that sense, we included in the book a specific chapter about ergonomics, in which we introduce this knowledge for laypeople through an accessible language and several illustrations. Among other topics we approach throughout the chapter, we suggest that furniture should not be designed just following standard measurements or those foreseen in accessibility guidelines, which although fundamental aims at the majority of people. We understand that a residence must respect the measurements and specific skills of its owner, and not those of most population. On that ground, our purpose is to help readers make their decision on which changes are important and how to conduct them according to their body dimensions and needs.

5. In the book, there is a catalogue of products available in the market to adapt residences according to aging needs. Could you briefly explain the idea behind the catalogue?

Above all, the purpose of the catalogue is to show readers, mainly those not trained in the field, the countless products available today in the market that can help elder people with their daily activities and improve their life at home. Just like in the rest of the book, we offer as many examples and illustrations as possible to all the possibilities of adjustments, avoiding solely theoretical or abstract orientations, to facilitate their understanding. In the catalogue of products, we give examples and present illustrations of products

currently available for sale – these are the same products we show in the orientation and illustration of each environment presented in the second part of the book. We also give a brief introduction of how each product works, with its more common name and the most-searched brands online.

As there are countless products and manufacturers, it was not possible to test and evaluate them comparatively. Therefore, we chose to introduce the readers the possibilities available, suggesting that, before purchase, they appraise the products carefully and search for as much information as possible concerning manufacturers.

6. Could you share a personal story, or one experienced by an acquaintance, showing the positive and practical impact of some of the adjustments suggested in the book?

We have employed some of the design strategies mentioned in the book with friends and families. In Belgium, for instance, a friend of Vera has moved to an institution for the elderly population that allows residents to bring furniture from home, a strategy that shows incredible respect towards the resident's history. However, the bedrooms do not accommodate the sizeable furniture typical of this generation, such as wardrobes and dressers. Therefore, it was necessary to buy new and compact furniture that would fit the local dimensions and be multifunction. In this specific situation, the resident works frequently on his computer and needed an appropriate desk. Nevertheless, due to the limited size of the room, the desk would also have to serve as a table for his meals. The knowledge from our research helped us choose a comfortable, safe and ergonomic furniture, suitable for the user's new needs and anthropometric measurements, as well as for the limitations imposed by the dimensions of the environment.

7. To conclude our interview, could you give our readers some tips of topics, procedures or resources that are currently available for those also interested in carrying out projects and research in the field of healthy aging?

In Brazil, we believe there is still a shortage of innovative models for housing suitable for the elderly population. Overseas, however, such models are becoming more and more usual, such as multifamily residential buildings planned to accommodate different generations and functions. This housing model, planned by public and private initiatives, offers apartments and houses adapted to the needs of an aging population, encourages a sense of community, due to the

multigenerational coexistence, and reduces social isolation, since it is usually close to urban centers. In Brazil, there are excellent examples of multifamily institutions and residential buildings carefully planned for the elderly. However, they are usually located in big cities and focus on a range of income that does not contemplate most population. We believe endeavors concerning architecture planning and execution for housing, public and private institutions aimed at the elderly population is a market in expansion, still not enough explored and in which architects, engineers, designers and entrepreneurs will find growing professional opportunities.

Regarding the field of research, a promising topic, which we were not able to develop further in the book, is how to adapt minimum habitable spaces and popular residences to the elderly population. Moreover, there are post-graduation programs across Brazil, such as POSARQ, at UFSC, that offer research scholarships to study universal design and accessibility, enabling a fruitful field for studies and research in the area.

IPH

INSTITUTO DE
PESQUISAS
HOSPITALARES
ARQUITETO
JARBAS KARMAN