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The relationship between healthcare architecture and nature: interaction with the landscape as therapy

This paper analyses the relationship between healthcare architecture and nature as an effective means for the treatment and therapy of hospital patients. A relationship that has existed continuously since antiquity, but which has been abandoned in the last century in favour of hospital grounds marked by an eminently functional character, in the vicinity of which hostile spaces have been built, most of which are used for parking private vehicles. With our research we seek to recover the introduction of nature into hospital spaces and their context in accordance with the latest scientific advances that allow us to concretely assess the benefits that nature generates in patient therapy. In order to do this, we explain which are the perceptions that facilitate the improvement of patients according to their pathology and the feelings they must perceive in order to obtain these benefits. Likewise, in order to evaluate and illustrate some of the architectural responses that have recently been made in accordance with these criteria, we will use different case studies in which architecture and landscape are appropriately integrated. To this end, we will use a graphic methodology that allows us to identify the aspects that hospital design can contribute to user perceptions, which result in their improvement. In short, the aim is to establish guidelines that support the development of the architectural project and improvement of health spaces as a whole, through architecture and a sustainable and integrating landscape for all citizens.

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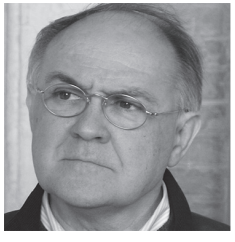

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1. INTRODUCTION

This contribution is part of the work carried out by the "Built heritage and sustainable architecture" research group led by Professor Pilar Chías, whose lines of research include the study of hospital architecture from the perspective of accessibility and the integration of all people. In this case, we focus specifically on the study of natural spaces and their therapeutic capacity as a means of appropriating the benefits of landscape and territorial resources, promoting more sensitive and inclusive spaces for all users. In this sense the integration of therapeutic spaces in nature has been a constant since ancient times, being a fundamental part of the healing processes of patients throughout history. Nowadays, numerous studies have been able to scientifically demonstrate the existence and impact of these benefits, thus reaffirming the efficacy of ancestral methods in terms of the usefulness of this relationship between nature and therapy. All of this reinforces the idea of recovering this spatial encounter through contemporary architecture, supported, in this case, by the various existing studies that have demonstrated the benefits and specific perceptions that patients must experience to obtain an improvement in their treatment.
Therefore, the aim of this contribution is to analyse the relationship between healthcare architecture and the natural environment as a means for the improvement and treatment of patients. Through this, we intend to establish guidelines that favour a better design of hospital environments, more inclusive and with greater relationship with nature, also based on current Case Studies that will allow us to evaluate the degree of adaptability of current buildings to this problem, as well as the quality of the existing architectural and landscape proposals for the treatment of pathologies.
In order to carry out this study, it has been necessary to develop a transversal analysis of the bibliographical sources in order to understand, firstly, the fundamental aspects that, from a current perspective, are taken into consideration with regard to disabilities and illnesses in order to establish which aspects can be influenced by the relationship between nature and the people who suffer from them; and, specifically, how it can actively alter and be a determining element in the treatment of some of these patients. For this reason, it has been necessary to carry out a exhaustive literature review on these aspects which, in principle, are far removed from the references of our own disciplines and which have allowed us to detect and propose architectural design guidelines to be taken into account for the projection of new inclusive healthcare architectures based on the use of nature as a therapeutic element.
Likewise, and once these guidelines had been established, it was essential to carry out a bibliographical review of the architectural works that have been built from a perspective of integrating nature as a means of therapy, although few examples have been found. For this reason, it has been necessary to broaden the field of study to analyse other buildings which, despite not dealing with landscape as an element of therapy, serve from our point of view as a reference in accordance with the previous analysis indicated. Also, due to the complexity of the concepts that we have tried to represent with these examples, the study has focused on the aspects that are highlighted in each section to take these specific guidelines as an example, without having to comply with all of them.

2. BACKGROUND

The relationship between nature and health architecture has been a constant since classical antiquity, when buildings were designed in the form of temples dedicated to the god Asclepius, in which various religious and medical rituals for healing were practised. These buildings were located in peaceful natural landscapes away from urban centres, surrounded by lush vegetation and crystal-clear waters, all of which served as a fundamental part of promoting and developing the different healing processes (Pavli & Maltezou, 2024). Likewise, and although they were in a very different context both in terms of their location and their marked functional character, Roman field hospitals sought to articulate the space around a large central courtyard that favoured the ventilation and illumination of the halls and rooms located around it as a means of favouring the treatment of the sick (Tabanelli, 1956; Nutton, 2012).

Fig. 1 - Aerial view of the Temple of Asclepius on Kos (Greece). Source: Discover Greece.

During the Middle Ages, in the West, it would be the monasteries that would host the majority of healthcare functions, incorporating into the functional programmes of these buildings the architectural spaces destined for this purpose - the infirmary - which, once again, would be related to nature through the cloisters, incorporating plant elements and water fountains (Thommen, 2012). It was not until the 15th century that the projection of a new type of building destined for health care began, the hospital, which was separated from the religious and charitable enclosures to become a unitary and autonomous form. Among these, the Ospedale degli Innocenti in Florence, designed by Brunelleschi in 1419, and especially the Ospedale Maggiore in Milan, designed by Filarete in 1456, stand out (Grassi & Finoli, 1972). This building is articulated through a set of nine cloistered landscaped courtyards, which contributed to the care and recreation of the patients through the integration of nature. Likewise, the interior spatiality of the typology was shaped through a unitary system in the form of a Greek cross at whose intersection, and in a dominant role, was the altar to which all the patients had visual access, recovering the

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link between spirituality and healing (Bonastra, 2012). This archetype laid the foundations for the typological expansion throughout Europe, taking on its formal, functional and natural characteristics, especially in Spain, where the construction of new sanitary buildings founded by the Catholic Monarchs contributed to the consolidation and dissemination of the type (Suárez Quevedo, 2012).

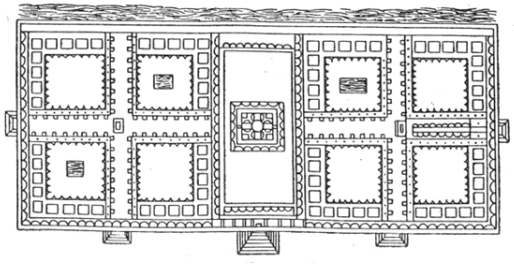

Fig. 2 - Floor plan of the Ospedale Maggiore in Milan. Source: Filarete, Trattato di Architettura (c.1464).

During the seventeenth and eighteenth centuries, there were new hospital proposals of greater dimensions (in line with population growth) that took on board the new architectural languages and scales and went beyond the cruciform model, although they consolidated the structures of landscaped courtyards as a means of dispersion and approach to nature (Zhu & Sarah, 2024). These include the Greenwich Hospital in London (1632-3), the Invalides Hospital in Paris (1670) and the General Hospital in Vienna (1784), where there is a greater proportion in the size of the courtyards compared to the building and, therefore, where a greater integration of nature into the sanitary spaces can be observed (Bronza, 2021).
During the Enlightenment and the nineteenth century, a typological evolution took place based on the use of pavilions, most of which were structured in a radial or reticular form and were configured in any case through courtyards; all of which allowed the segregation of patients by differentiated diseases that reduced the risk of contagion (Thompson & Goldin, 1975). These courtyards

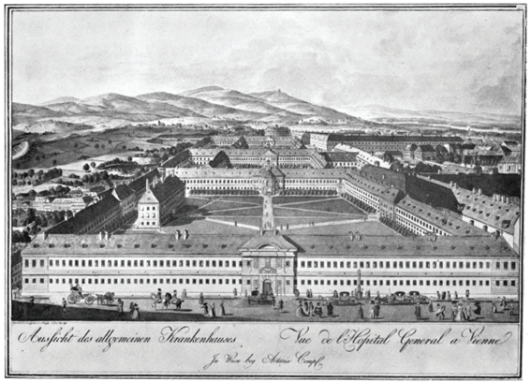

Fig. 3 - Vienna General Hospital. Source: Josef & Peter Schafer (1965).

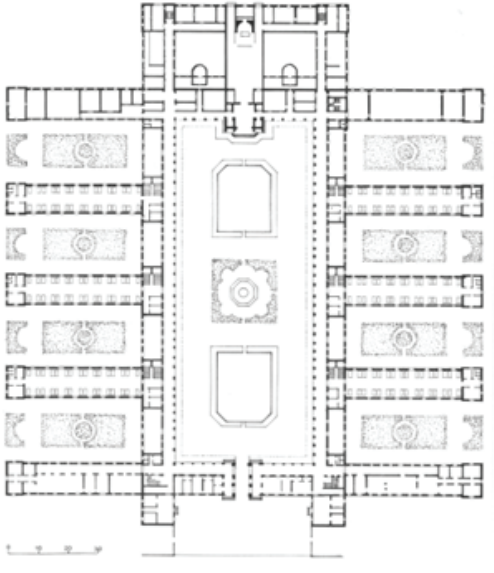

Fig. 4 - The Lariboisière Hospital in Paris. Source: Rossi Prodi & Stocchetti (1990).

-both the larger ones and the smaller ones- were designed and landscaped with large plant coverings, fountains and flowerbeds. The most recognised proposal is the Lariboisière Hospital in Paris (1850), which assimilates other previous unrealised projects, and which is structured around a large central landscaped courtyard on the sides of which are perpendicularly formed brush-shaped pavilions, between which there are new smaller landscaped courtyards (Hoet, 1993).
At the beginning of the twentieth century, there was a shift away from the pavilion hospital towards compact block buildings, especially in the American context (Kisacky, 2017). In Europe, and influenced by the proposals of the modern movement, hospital city projects were proposed, and new buildings were constructed, conditioned by the boom in the transmission of infectious diseases in the inter-war period (Iglesias Picazo, 2011). A significant and paradigmatic example of this period in the context of modern hospital architecture is the Paimio Anti-Tuberculosis Sanatorium (Finland), designed between 1929 and 1932 by Alvar Aalto. This large sanitary complex is integrated into a forest clearing by means of different concatenated blocks and opens up through large patient galleries towards the midday sun and the landscape as specific elements of medical therapy (Morganti, Bartolomei & Mazzoli, 2021).

Fig. 5 - Sun terraces on Paimio Sanatorium by Alvar Aalto. Source: Gustav Welim (A. Aalto Foundation).

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From then on, and with few notable exceptions, the integration of nature in healthcare facilities began to disappear because of the important medical advances that took place during the twentieth century and which eclipsed other types of therapeutic processes that required a long period of time to be sustained (Santos Guerras, 2003). Consequently, the new hospital centres take on a functional character that allows the admission of a large number of patients, and the urban context that houses them is destined for the frenetic parking of private vehicles made up of large paved surfaces of a hostile nature that are a clear departure from the landscaped and peaceful spaces of previous times (Sánchez-Jáuregui Descalzo et al., 2024).

3. BENEFITS OF THERAPEUTIC GARDENS FOR INDIVIDUALS AND VULNERABLE GROUPS

The simple presence of nature has been shown to be beneficial to humans, since the mere fact of being able to enjoy views of landscapes in which there is vegetation has an impact on the health and wellbeing of those who contemplate these landscapes (Ulrich, 1979; Kaplan, S. & Kaplan, R., 1989). Among the positive effects that individuals experience when observing these scenes where greenery is predominant are the reduction of stress and negative feelings in the mood (Ulrich, 1984; Ulrich, 1979), the improvement of wellbeing and humour, the regulation of emotions (Bratman et al., 2015) and other cognitive recovery processes, such as the recovery from mental fatigue (Kaplan, S. & Kaplan, R., 1989; Staats et al., 2003). In the specific case of the implementation of green spaces in healthcare facilities, numerous articles have been published demonstrating the benefits of gardens for patients. These favours provided by nature to hospitalised people translate into a reduction of care costs (Ulrich, 2002) due to a lower demand for pain relief medication, a shorter hospitalisation time, which is also softened by the improved mood of the patients (Ulrich, 1984).
Having compiled the positive effects on people's health, there are few studies that focus on vulnerable groups, studying the benefits of gardens in relation to their more specific needs.
Hospitalised children are one of the groups favoured by therapeutic gardens, with a positive influence on systolic blood pressure, which decreased significantly, mental health, wellbeing and attention span (Whitehouse et al., 2001; Maryam & Fatemeh, 2020).
For older people, decreased stress, improved attention, modulation of agitation, reduction of PRN and antipsychotic medication and reduction of pain have been reported in people who have been active in healing gardens, as well as other benefits of physical activity such as increased strength, a better immune system or a healthier physical condition, and therefore a reduction of falls (Kim et al., 2024; Detweiler et al., 2008).
In the case of cancer patients, nature has been shown to have a positive impact on the user's immune response, promoting cancer-fighting cells, as well as increasing the molecules that accompany the cancer-fighting NK protein. Lower adrenaline and stress levels are also observed (Li, Q. et al., 2008).
The concept of the therapeutic garden begins to appear in the publications of Ulrich (Ulrich, 1999) and Marcus, C. & Barnes (Marcus & Barnes, 1999) who lay the foundations of the term. For Ulrich "The term "healing garden" is used here in a fairly broad sense to refer to a variety of garden features that have in common a consistent tendency to foster restoration from stress and have other positive influences on patients, visitors, and staff or caregivers." (Ulrich, 1999). Marcus, defines gardens as "a space for passive or quasi-passive activities such as observing, listening, strolling, sitting, exploring, and so on. While some healthcare facilities do have spaces, programs, and staff where patients can engage in horticultural therapy..." (Marcus & Barnes, 1999). Therefore, the main objective of these spaces is to reduce the stress of their users and to influence them in a positive way by offering different activities, from more passive ones, such as observation, to more interactive ones, such as horticulture. In addition to these first two definitions, the concept is taking shape as the characteristics of these spaces are specified and described in the various publications on the subject (Cooper-Marcus & Barnes, 1995; Ulrich, 1999; Naderi & Shin, 2008; Tseung et al., 2022; Wang & Tzortzi, 2023 and Ulrich & Vollmer, 2023).
After the bibliographic review of these articles, the main sensations that are sought to generate in individuals are extracted, replicating as best as possible the way in which they are generated in a natural environment. The emotions are as follows:

- The feeling of retreat, seeking to bring about a disconnection between the hospital centre and the garden.
- The feeling of security, being protected from external stimuli.
- Serenity, being a place of calm.
- The possibility of distraction, which is achieved with the feeling of fascination that nature gives when observed.
- Belonging to the place, in such a way that it is possible for users to leave their mark on the garden and feel that the space belongs to them.
- The feeling of control, being able to choose between different areas and the desired degree of privacy.
- The feeling of social support, produced by the opportunities to interact with different people and to carry out group activities.

All these sensations are what are sought when determining the characteristics of therapeutic gardens, so that the qualities of these spaces respond directly to these needs. These characteristics do not respond, in many cases, to a single emotion, among them we can highlight: the contrast between the hospital centre and the garden, with the help of a transition threshold; easy access to the garden, making patients aware of the possibility of visiting this space; universal accessibility; clarity in design and simple paths, based on the theory of wayfinding; protection from outside gazes; variety of areas, giving the possibility of choice, such as areas dedicated to groups, including horticulture, or more private; flexible furniture that can be modified by the users; placing one or two mile-

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stones that mark the spaces and attract attention and, of course, the importance of vegetation, the preferred vegetation being native vegetation, accompanied by water features (Cooper-Marcus & Barnes, 1995; Ulrich, 1999; Naderi & Shin, 2008; Tseung et al. , 2022; Wang & Tzortzi, 2023; Ulrich & Vollmer, 2023).
As can be seen in the Fig. 6, these sensations are what determine the design strategies and the different characteristics of the spaces, since generating them in the users of the gardens is the main objective and purpose of the design of these spaces.

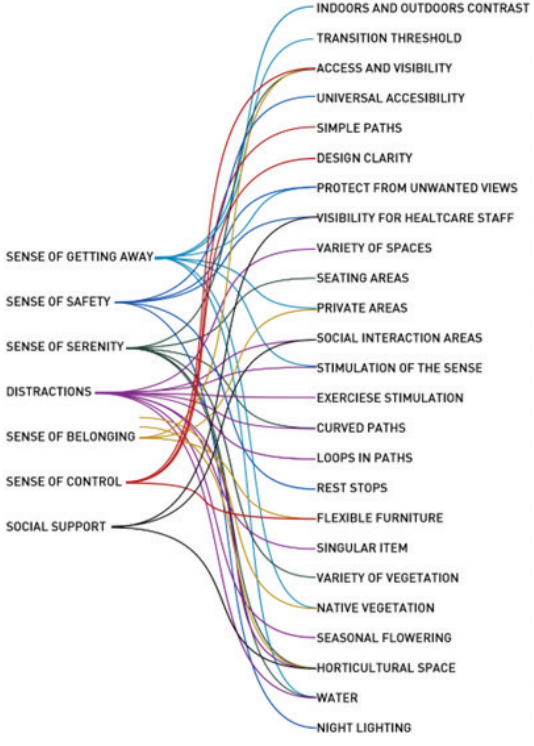


Fig. 6 - Diagram on the relationship between the positive feelings that therapeutic gardens bring and the characteristics of the gardens that promote it. By the authors.

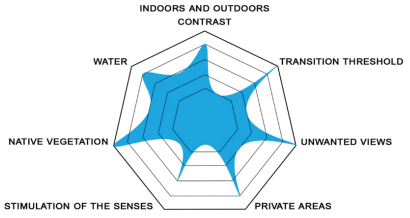
4. NEW HEALTHCARE SPACES FOR THE TREATMENT OF PATIENTS THROUGH NATURE

In this section we will deal with recently built architectural projects that respond to the guidelines studied in the previous section, although, in most cases, we cannot affirm that these studies have been considered during the design process; rather, the benefits for patients can be interpreted afterwards. With this, and by means of an evaluative graphic methodology, we can establish relationships between the architecture and landscape projects and the positive actions or project strategies that we can detect in the works, which serves to be able to extract design solutions for the projection and reform of public care spaces in the future. To develop it, we have structured the headings around the feelings and emotions that patients can experience as therapy, specifying in each case, the benefits of a successful architectural response in accordance with the student characteristics in the previous section.

4.1. SENSE OF GETTING AWAY

Fig. 7 - Photograph and floor plan of Snøhetta's Friluftssykehuset Outdoor Care Retreat project. Photograph by Ivar Kvaal and floor plan by Snøhetta. Source: Snøhetta.

One of the most representative examples that comes closest to the aim of generating a sense of retreat is Snøhetta's Friluftssykehuset Outdoor Care Retreat project. In it we can see how a cabin is built away from the hospital and located among the trees, in such a way that the contrast between the hospital and the cabin is generated by the path that has to be followed through nature, this being the perfect transition threshold. Moreover, as it is situated in the undergrowth, unwanted views are practically eliminated, making this project a single private area. The senses are soothed, but there is no active stimulation, rather a calm nature is chosen, making use of the native vegetation and the river that passes close to the cabin.



Concepts	Characteristics assessed to generate the graph				
Contrast with the hospital	Vegetation	Materials	Shapes	Colors	Scale
Threshold	Variation between Hospital and project		Path or "In Between"		Enough time to disconnect
Unwanted views	Vegetation		Distance		Opaque elements
Private areas	Number		Tiny scale		Enclosed space
Stimulation of senses	Sight	Hearing	Smell	Taste	Touch
Native vegetation	Native				
Water	Can see it		Can hear it		Can touch it

Fig. 8 - Graph and table of the design strategies analysed in relation to the feeling of retirement where each of them is evaluated. By the authors.

4.2. SENSE OF SAFETY

Fig. 9 - Photograph and plan of Therapeutic community Can Zariquiey by MIAS Arquitectes. Photograph and floor plan by MIAS Arquitectes. Source: MIAS Arquitectes.

The Can Zariquiey Therapeutic Community is a place where the garden is exposed to the building in such a way that the health staff or the users themselves have complete visibility of the garden. Universal accessibility is well resolved and it is

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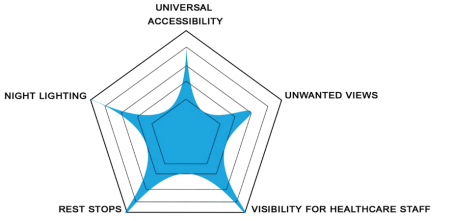
possible to find spaces in which to shelter from unwanted views. In addition, it is equipped with seating and good lighting at night to provide safety for users.



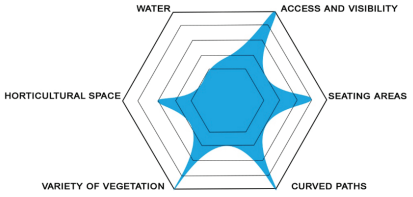
Concepts	Characteristics assessed to generate the graph		
Universal Accessibility	Cognitive accessibility	Sensory accessibility	Physical accessibility
Unwanted views	Vegetation	Distance	Opaque elements
Visibility for Healthcare Staff	Opaque elements	Vegetation obstructing view	Clear view
Rest stops	1-5 meters	6-10 meters	11-20 meters
Night lighting	Existing	Tactfully made	

Fig. 10 - Graph and table of the design strategies analysed in relation to the feeling of safety in which each of them is evaluated. By the authors..

4.3. SENSE OF SERENITY

Fig. 11 - Photograph and plan of Santa Rita Geriatric Center by Manuel Ocaña. Plan by Manuel Ocaña. Source: Manuel Ocaña.

The search for serenity is accentuated with age, which is why projects whose main users are the elderly are good examples of these design guidelines. The garden can be seen from any area of the old people's home designed by Manuel Ocaña, tempting users to make use of it. There are plenty of seating areas for resting along the routes. A study of the variety of vegetation and an intentionality in differentiating the different interior courtyards, creating different atmospheres, can be observed.



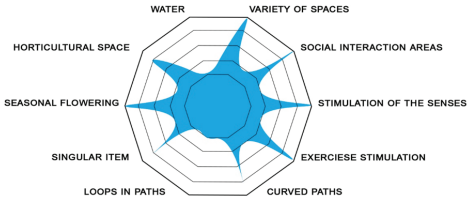
Concepts	Characteristics assessed to generate the graph				
Access and visibility	To know of its existence	Accessible access	Physical accessibility		
Seating areas	1-5 meters	6-10 meters	11-20 meters		
Curved paths	Existing	Loops			
Variety of vegetation	Autochthone vegetation	Different colors	Different textures	Different odors	Different height
Horticultural space	Existing	$2m^2$ per person			
Water	Can see it	Can hear it	Can touch it		

Fig. 12 - Graph and table of the design strategies analysed in relation to serenity where each of them is evaluated. By the authors.

4.4. DISTRACTIONS

Fig. 13 - Photograph and plan of Comer Children's Hospital Play Garden by site design group. By site design. Source: site design.

Projects for hospitalised children often focus on distractions and a good example is the Comer Children's Hospital Play Garden project by site design group. In it we can see that a variety of spaces are deployed even though they have a limited area. These spaces promote social interaction, stimulation of the senses and exercise. We can also find a space dedicated to horticulture and the careful landscaping of the project.



Concepts	Characteristics assessed to generate the graph				
Variety of spaces	Privates	Publics	Physical activity		
Social interaction areas	Existing	With seats	multi-purpose		
Stimulation of senses	Sight	Hearing	Smell	Taste	Touch
Exercise stimulation	Existing	A few elements	Different body parts		
Curved paths	Existing	Loops			
Loops in paths	Existing				
Singular item	Existing	A few singular elements	Too many elements can confuse		
Seasonal flowering	Summer	Autumn	Winter	Spring	
Horticultural space	Existing	$2m^2$ per person			
Water	Can see it	Can hear it	Can touch it		

Fig. 14 - Graph and table of the design strategies analysed in relation to the distractions where each of them is evaluated. By the authors.

4.5. SENSE OF BELONGING

Fig. 15 - Photograph and plan of Le Village Landais Alzheimer in Dax by NORD Architects. By 11h45. Source: 11h45.

When it comes to creating a sense of belonging, the crucial points of the design are the access to the gardens and that the existence of the gardens is in the minds of the users. There should be private areas to choose solitude. Flexible furniture is also important, so that users can choose the location and the use they make of it, being able to experience the space in their own way. The vegetation should be indigenous to remind people of the landscapes of their territory, making them familiar. Spaces dedicated to horticulture will make

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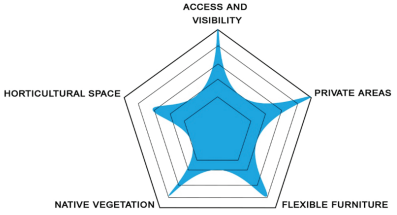
users interact with the space and leave their mark on it, thus generating a sense of belonging.



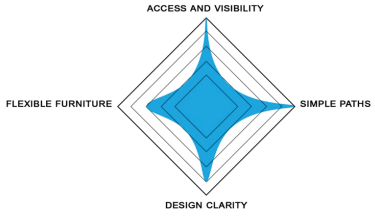
Concepts	Characteristics assessed to generate the graph		
Access and visibility	To know of its existence	Accessible access	Physical accessibility
Private areas	Number	Tiny scale	Enclosed space
Flexible furniture	Existing	All elements are flexible	
Native vegetation	Native		
Horticultural space	Existing	2m² per person	

Fig. 16 - Graph and table of the design strategies analysed in relation to sense of belonging where each of them is evaluated. By the authors.

4.6. SENSE OF CONTROL

Fig. 17 - Photograph and plan of Maggie's Southampton Centre by AL_A. Photograph by Hufton+Crow. Source: AL_A

One of the cancer support centres developed by the organisation Maggie's stands out for its simplicity in plan, being a centrally located building with the outline of paths that, in their essence, surround it. The floor plan divides the surrounding garden into four spaces, providing a variety of places. The user gets the feeling of control by understanding the different spaces, favouring the choice between them, thanks to the clarity of the design.



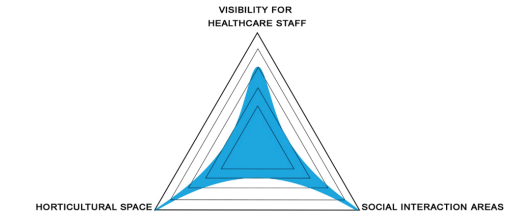
Concepts	Characteristics assessed to generate the graph		
Access and visibility	To know of its existence	Accessible access	Physical accessibility
Simple path	The building is always in sight	Clear design	Loops
Desing clarity	Simple geometry	Symmetrical or asymmetrical	Totally symmetrical or asymmetrical
Flexible furniture	Existing	All elements are flexible	

Fig. 18 - Graph and table of the design strategies analysed in relation to the feeling of control where each of them is evaluated. By the authors.

4.7. SOCIAL SUPPORT

Fig. 19 - Photograph and plan of Maggie's West London by RSHP. By RSHP. Source: RSHP.

Maggie's is an emotional support network that uses architecture to provide social support for people with cancer. Many centres have been built across the UK, although there are examples outside the UK. These centres, dedicated to emotional support, have different areas of social interaction within their centres in which they promote group activities, including horticulture. Their main objective is to foster this social activity, the feeling of support and belonging to a social group. However, they do not pretend that the health care staff or the staff in charge of the centre always see their users, so this is not one of the strengths of this example.



Concepts	Characteristics assessed to generate the graph		
Visibility for Healthcare Staff	Opaque elements	Vegetation obstructing view	Clear view
Social interaction areas	Existing	With seats	multi-purpose
Horticultural space	Existing	2m² per person	

Fig. 20 - Graph and table of the design strategies in relation to the social support analysed where each of them is evaluated. By the authors.

5. CONCLUSIONS

In this contribution we have been able to point out the coexistence and integration of nature in healthcare buildings throughout history, a relationship which, however, has been gradually disappearing in recent times. For this reason, through our research we have determined the benefits that the integration of vegetation in healthcare buildings has on human beings, exposing the positive effects that it produces on the health of patients based on existing scientific studies. With this, we have identified the sensations that therapeutic gardens can produce in users according to current pathologies to enable and promote new responses for a new, more inclusive and sustainable architecture. Through different case studies, and using an analytical methodology, we have studied how different healthcare buildings already constructed respond to the feelings that patients must experience to improve their treatment, differentiating them through the sensations that they can provoke: retreat, security, serenity, the possibility of distraction, belonging to the place, control and social support. However, after this analysis we can conclude that the design guidelines are not applied in all cases, tending to focus on some of them and leaving aside the rest of the possible benefits, which could be introduced with slight improvements. In short, this paper aims to

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contribute to the improvement in the design and refurbishment of healthcare facilities using therapeutic gardens as a fundamental element for the benefit and treatment of patients.
Although current hospital practice seems to have forgotten about the benefits of nature for the human being, there are already different examples that implement nature as an assistant and companion for the recovery of patients. Moreover, it seems that the current trend is inclined towards the inclusion of these spaces from the beginning of new projects and there are many reforms in courtyards lacking greenery that advocate new spaces where nature is the protagonist.

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