Sara Boyte

Hans Herrmann

Paimio Sanatorium, Maggie’s Yorkshire, Butaro District Hospital,

Bendigo Hospital

Mississippi State University | Architecture

Biographical Sketch

Sara Boyte, a native of southern Mississippi, is a fourth-year architecture student at Mississippi State University. She is interested in the link between health and architecture.

In her hometown of Brookhaven, Sara found her passion to create. Interlinking her love for art and mathematics, Sara chose to study architecture. Aydelott has fused her love of architecture and passion to travel. Since her time at Mississippi State University, Sara has found ways to be involved. She has been an active member of Alpha Rho Chi since her second year, and now serves as president of the fraternity. She works in the the Laser Cut and 3D fabrication lab. Sara appreciates the power of architecture and design to connect to our collective imaginations, identities, and histories to create environments where we feel we belong.

"Architecture is a human act that invades and displaces the natural ecosystem." [i]

Without question, health is a critical concern-now more than ever. Architecture arguably plays a role in this, not only in providing basic shelter but also providing spaces that allow us to thrive. Light and comfort are often cited as aspects of this, but what is the connection between our health and the environment? What kinds of designs respond to health and healing?

Architecture and medicine have always been tightly interlinked. In the first century BC, Vitruvius launched western architectural theory. He insisted all architects study medicine and devoted a large portion of the first book in his Ten Books of Architecture to the question of health. He believed "those who are unwell can be cured more quickly through design." [ii]

What led me to interest in these hospitals is observing the hospitals around my area and how design can play a role in healing. In the south, hospitals are usually characterized by massive parking lots with a brick or concrete structure that is unclear directionally, and the design can get in the way of the healing process.

Yet it is possible to identify health care buildings that have a different approach. By reviewing four structures that seem to respond to the environment in a particular way, there are four projects that offer insight. The Paimio Sanatorium in Paimio, Finland was the first building I looked at. Designed in the 1920s, at that time period, modern science was beginning to be integrated into buildings and Aalto

synthesized these ideas with his collaborative innovations. In Leeds, United Kingdom, Maggie's Yorkshire Cancer Care Centre was finished at the start of COVID-19 and is beautifully encapsulated in nature and focuses on the integration of. Biophilic design played a part of the design to promote healing. In MASS Design Group's Butaro District Hospital in Rwanda, community, from concept to life cycle of the building, was the forefront of design. Using raw materials, giving access to patients to quality design in healthcare, MASS created a foundation for a hospital campus to last for years to come surrounding by the breathtaking Rwandan landscape. The Bendigo Hospital in Bendigo, Victoria, Australia, the hospital is massive, but legibility and wayfinding through the hospital. It creates an approachable scale by fragmenting the massing and making indoor and outdoor pockets throughout the building. Each of the hospitals forefront healing and take human experience into their design, but they show it is possible to do in different scenarios.

Hospital design in the United States has improved drastically over time. It is still, in some ways, underfunded and poorly designed, leading to possibilities that can make patients sicker. The hospitals analyzed in this paper represent innovative design, biophilia, community focus, and legibility. Seeing these hospitals and being interested in design led me to wonder what the possibilities of good healthcare design are, what should change, and how it is done in wildly different circumstances.

Today, a storm of forces are increasing the frequency and intensity of disease outbreaks. Disease ecologist Peter Daszak stated, "Pandemics are like terrorist attacks: we know roughly where they originate and what's responsible for them, but we do not know exactly when the next one will happen." [iii] Populations are becoming denser, and urbanization is rapid. The expansion of mega-cities leads to struggle in providing basic services like adequate housing, clean drinking water, and removal of waste. In the 19th century around the world, building codes and zoning laws were implemented to provide better living conditions.

Designers and planners play a huge role in shaping public health into habitable and resilient spaces. The American Institute of Architects (AIA) embrace these principles and support design solutions that "put doctors out of business."[iv] AIA advances the idea that a core goal of architecture is to promote the health and well-being of architects. There are a growing number of programs in cities like New York that are employing architectural design strategies dedicated to improving public health; encouraging physical activity to combat obesity and diabetes, mitigating environmental hazards in hopes to reduce non-communicable diseases, for example. The Leadership in Energy and Environmental Design (LEED)'s green building certification program has also been a catalyst for architects to create energy conserving spaces.[v]

Hospital design flaws are a prevalent problem in infection control today. Hospital acquired infection and diseases are an

enormous contributor to illness and death that affect up to 30% of intensive care unit patients.[vi] It is urgent that we change the way we build hospitals to promote rest and healing while preventing infection. [vii]

The aim of this paper is to recognize that the design of health care facilities needs to account for its connection to the environment. With the possibility of more frequent and severe disease outbreaks, how can designers can address these challenges becomes critical.

Paimio Sanatorium

“Building art is a synthesis of life in materialized form. We should try to bring in under the same hat not a splintered way of thinking, but all in harmony together. “

Alvar Aalto

View from terraces

Designed by the renowned Finnish architect, Alvar Aalto, the Paimio Sanatorium is considered a key work and has been an emblem of empathetic design from the time it was designed until now, almost 100 years later. The building was of key importance to the international career of the architects Alvar and Aino Aalto and is one of the most significant International Modernism projects. Alvar Aalto enjoys the unmitigated status of a national hero in Finland and is regarded as a master of form-giving and working at different scales. At this time, European Architecture was undergoing a large shift in the face of increasingly rapid industrialization and urbanization. With this project, Finnish architecture was no longer the receiver of exterior influences. Aalto was a part of an avant-garde architecture organization, Congrès Internationaux d'Architecture Moderne (CIAM), from 1929 onwards. With his new approach to architecture and unanimous win in the open architectural competition, construction began in 1929. The state-of-the-art sanatorium, completed in 1933, collided inseparable elements of architecture and practicality. Tuberculosis sanatoriums were designed on the objective that patients should have easy access to fresh, healthy air outside of the cities. These institutions were viewed as "oases of health," removed from the noise, illness, and contagion of everyday life. Aalto used modernist techniques such as ribbon windows, roof terraces, and the machine aesthetic synthesized with seeds of his own approach like the nebulous shaped lobby. The cure at the time for tuberculosis was good hygiene, clean air, and light therapy.

Alvar Aalto was a faithful supporter of modernist theories. He and his wife, Aino Mandelin, founded the Artek company in 1935 which produced furniture, textiles, and lamps of their design. In this age of design, many architects, designers, and intellectuals of their generation, such as Le Corbusier and Sigfriend Gidion, felt they were on the cusp of a new golden age, one that emphasized the importance of social responsibility. Monuments of the new age were schools, factories, power plants, and hospitals; they were replacing palaces, temples, and cathedrals of the past; science and technology were the new religion. The general idea was that a simple, austere style was best suited to convey these new age ideals. Aalto and his team designed the furniture and fittings for the building; this was entirely in line with the concept of "gesamtkunstwerk, a German word describing a process where different art forms interact together to create a single entity as a total work of art, that fiercely led design and architecture in the period around 1900."[viii]

An Austrian architect of this age, Josef Hoffman, presented an early version of an aesthetic movement that is presently associated with the health sector of typical laboratory and hospital environments: white surfaces and nickel-plated metal, simple designs with ascetic ornamentation. The clinical interior has become the symbol of health, treatment, cleanliness, and convalescence. Why?

The development of modern medicine and bacterial science during this period is part of the explanation. Hospitals transitioned from a place of repositories for society's outcasts to a place where patients

could receive advanced treatments and recover from their illness. It became standard practice to decorate hospitals in white or green, colors associated with calmness, light, and cleanliness. The practical aspect was that white looked clean and free of bacteria because dust and dirt were easily visible when daylight flowed into large windows and filled the white interior. Simplicity and lack of ornamentation were easy to clean in the battle against bacteria. The simplicity of design became even more clearly a symbol of cleanliness.

Another Austrian architect, Adolf Loos, gave a lecture in 1910 called 'Ornament and crime'; he described the "primitive" desire for decoration and regarded the elimination of ornament as a notable element in the development of a modern design culture. Loos's argument was easily understood, so it became normal to refer to simple, unornamented forms as 'clean.' Simplicity was equated to health and rationality; aesthetic and hygienic health merged into two sides of the same coin.

This reasoning permeated professional journals and magazines far into the 20th century. Everything was to be simpler: door handles, breakfast dishes. Bacterial science paved the way for the acceptance of broader modernist views. Tuberculosis is transmitted by bacteria, calling for all surfaces to be easily cleaned and spaces easily airs. Any spaces that could collect dust were eliminated and materials used were durable against wear and washing. The question of design evolved into a moral question; creating something 'clean' was producing something that was healthy and good. Architects and designers chose to

take the moral high road. The only form of treatment available for tuberculosis was to improve the general condition of the patients, as there was no pharmacological treatment available.

"The sanatorium was not architecture in the service of medicine, but integral to medicine as such"[ix] – an apparatus devised as a means of treatment. Dramatic terraces visually alluded to ribs in an X-ray, the primary diagnostic tool for tuberculosis. The stylistic idiom of functionalism reflected the ideals of science and mathematics; design and architecture were to follow the logic of clarity and rationalism.

Finland gained independence from Russia in 1917 and started to invest in nationwide programs of public construction including regional hospitals, old people's homes, mental health facilities, and tuberculosis sanatoriums. As tuberculosis was the country's most pressing national health issue, there was an acute demand for sanatoria in Finland. The disease spread through urban and rural areas. Local authorities assumed responsibility for the care of tuberculosis patients from the 1910s onwards, by the 1920s, a whole movement emerged for disease prevention. Through the 1929 Act on State Aid for tuberculosis hospitals, eight new, large hospitals were built in Finland that provided 2,500 new hospital beds. Daily care routines for patients included rest, fresh air, and a healthy diet that ameliorated the disease. Aalto was 30 years old when he won the open architectural competition, while he had already established himself through projects such as the Workers' Club and Defence Corps Building in his home city, Jyväskylä, Finland. The competition was commissioned

for the Southwestern Finland Tuberculosis Sanatorium between the years 1928 and 1929. Although Aalto had established himself as a bold, young architect in Finland, this was an unprecedented challenge and his experience in hospital design was modest. The Federation of Municipalities of Southwestern Finland set a Building Board and Building Committee to handle all of the decision-making processes during construction. The Building Board was strongly committed to go through with the work for three reasons: tuberculosis was considered the greatest threat to public health by the state, the Parliament legislated financing with the new Act, and because Aalto's architectural solution convinced the Building Board. Aalto became a specialist member of these bodies and high rank supervisor; in return, Aalto contracted notable specialist engineers and manufacturers. Aalto vigorously promoted this project in the architectural press where articles revealed his areas of interest and design efforts. Close reading of the minutes of the Building Board and Building Committee meetings documented the critical questions that caused debates.

In 1929, Aalto and his firm started work on the design. Construction broke ground in 1930 and finished completion in 1933. Construction of the 296-bed sanatorium in Southwest Finland is in the Preitilä area of Paimio which could barely pass as a town on the extent of a few intersecting streets. The sanatorium, slender and majestic, stands three kilometers away in a vast expansion of forest that blocks the view up until the main part of its drive on the highest point of a pine forest. Approaching the sanatorium, the visitor will pass through the outlying housing for the staff. It

continues with the same language of white painted concrete with brightly colored offset metalwork; both a dramatic contrast from the surrounding environment. The large windows encasing the views were not only to allow patients to see outside, but to allow others to see signs of life within the building.

What made this project innovative were some of the technological systems of construction. The concrete frame, electricity, air conditioning, and lifts were rapidly developed in the inter-war period in Europe. During this period, full structural systems of reinforced concrete were not commonly present in public buildings; Aalto's articles noted his engagement in working with this relatively new material. Architects were not trained to make structural calculations, so in May 1930, Aalto convinced the Building Board to contract an independent expert as a structural designer, Emil Henriksson. At this time, it was more of a widespread practice for contractors to make structural calculations. The construction of the frame was completed in November. Although the reinforced concrete frame exceeded the budget, the Building Board did not debate Aalto's solution to allow sunlight to flow deeply into the frame. Shown through section drawings, the sun reached the farthest corner of the structure and appealed to medical experts.

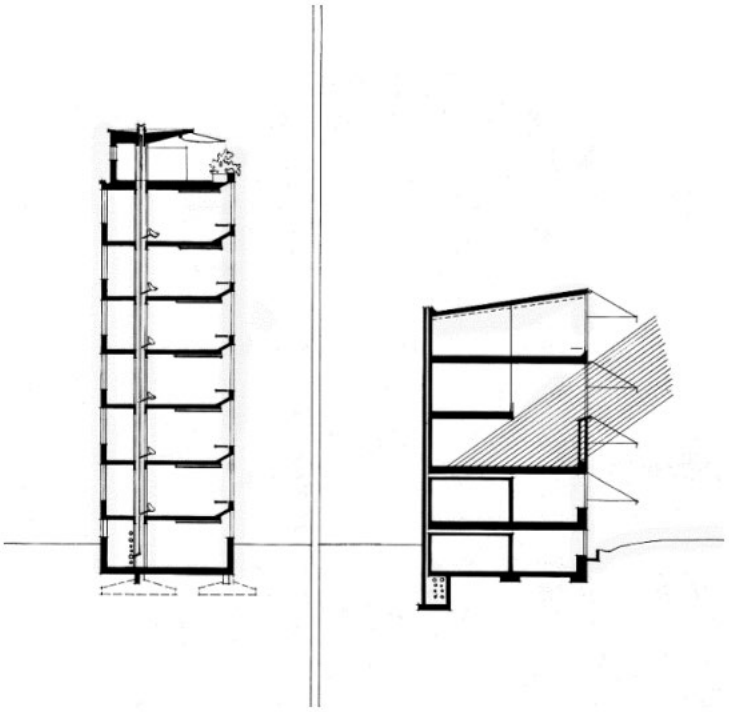


Figure 1. In this section diagram, sun rays penetrate deeply into the B-wing. Drawing No. 50-764. Alvar Aalto Museum. Material used for educational or research purposes permitted.

The building is divided into separate functions acting as different buildings, a single unit, a wing of the building. Aalto separated different functions into wings to maximize the use of sunlight throughout the day for the patients. The wings are joined together around central cores, with functions such as vertical inclines. The programs of the rooms within each wing decides the position in the terrain. The complex consists of the main building, the senior physician’s house, row houses, the morgue, garages, and technical spaces.

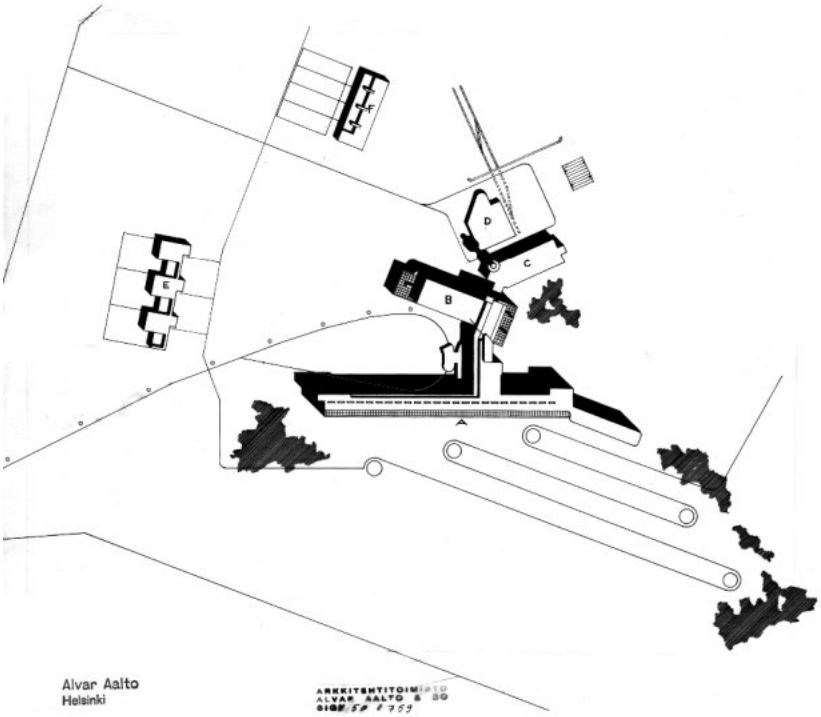


Figure 2. Site plan showing main building and it’s wings (A–D), the Junior Physicians’ and Administrative Director’s house facing the hospital entrance (E) and workers’ apartment building (F). Detail of drawing No. 50-759, the drawing has been edited. Alvar Aalto Museum. Material used for educational or research purposes permitted.

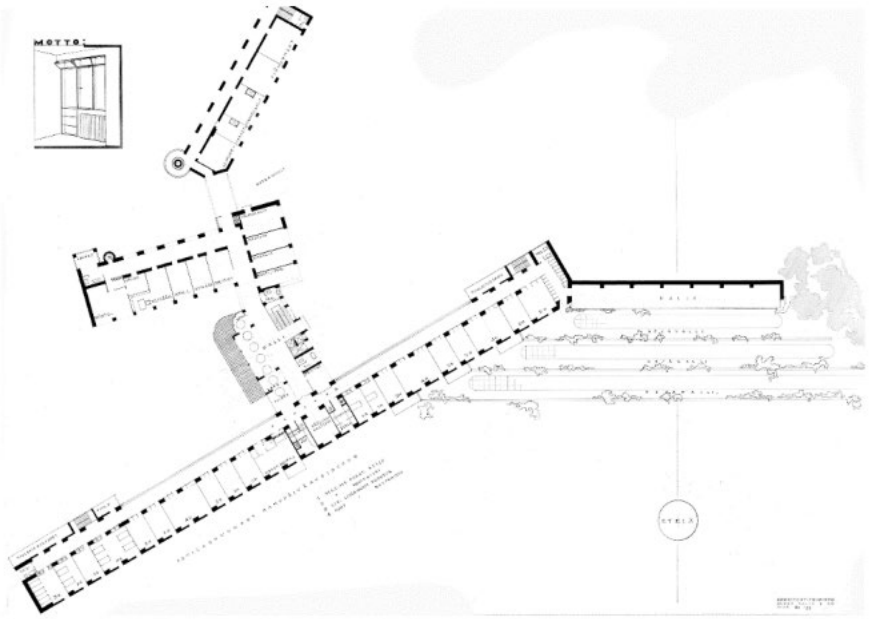


Figure 3. The main building ground floor plan of the competition stage design of the Paimio Sanatorium in 1929. Drawing No. 50-25. Alvar Aalto Museum. Material used for educational or research purposes permitted.

The A-wing, the largest of the four, contains 145 patient rooms and a private apartment for the ward sister separated at the west end. To achieve optimal sunlight for the patient's balcony, the wing is oriented south of southeast so the balconies at the end face due south. The seven-story housing ward is astonishingly tall, long and skinny. A central line of concrete columns allows the corridors to be cantilevered. Balconies bracket either side of the wing giving a particularly dynamic expression of a glazed lift. Spanning across the roof of the A-wing is a roof terrace facing south. The patients spent a large amount of time outside lying down. Aalto designed sun chairs for each of the balconies that patients were required to use year-

round, even in Paimio's average temperature of -6 degrees Celsus in February. Fur lined bags were on hand to help encourage the use. Originally, each floor continued an open, terrace-like dormitory. Along the long axis, the B-wing is orientated east-west and contains collective programs such as dining hall, common rooms, library, reading rooms, work rooms, etc., with doctors' rooms and treatments rooms downstairs. C-wing has a different orientation aspect. Rooms are on both elevations, so it was positioned so both sides receive sunlight. From the basement upwards, C-wing has laundry, pantry, bakery, refrigeration plant, kitchen preparation areas, the kitchen's separate sections, and a hostel for kitchen and service staff on the top floor. The single-story D-wing contains the boiler room and heating plant. Originally in the south yard, there were serpentine paths where patients, whose condition allowed it, were encouraged to take walks around.

Each wing employs a different structural grid in response to programmatic needs, while sporadic, discontinuous glazing treatment sacrifices structural purity to enable each space to be specifically oriented. Aalto argued that varying orientation was valuable to ensure patients were able to find a place to rest in or out of the sun at any given time of the day. When the occasion demanded, Aalto was content in abandoning structural logic; the library in the communal block is hung from steel posts that allows the dining room extending below to be column free.

Aalto's attention to detail and patient's wellbeing is imprinted on every component of the interiors. The principal innovation was the scale they designed at. In response to Finland's unforgiving winters, each window was designed to be double paned with a wide gap of air between the panes. The offsetting allowed ventilation to be enabled without generating a draft. The beams picked up at the edge of the slab were inverted setting the windows flush to the ceiling, therefore providing the deepest possible penetration of daylight. At the bottom of the window, the window was connected to the floor by a curving addition that provided better light reflection and facilitated cleaning erasing the accumulation and buildup of dust. The window extended sufficiently low to allow patients a view of the exterior landscape while lying in bed the orientation of the entire wing and the asymmetric location of the windows admit plenty of morning sunshine into the rooms, but less admission of the sun during Finland's long summers. Windows are equipped with external venetian blinds to combat the excess solar gain; they are in wood with metal frames and are double, so the ventilation opening is vertical. Heating is completed by Rayrad radiators installed in the ceiling at the greatest possible distance from the patient, so the person in the horizontal will be subject to the least possible amount of radiation. One wall was lined in a soft insulation material to enhance the acoustic quality of the room. Wall mounted sinks were designed to reduce splashing, conical spittoons paired on either side to minimize the sound. With the thought of one patient not disturbing the sleep of the other, the rear surface was set at a 30-degree angle that was

tested to have the quietest performance. Door handles were designed not to catch the sleeves of the Doctor's coats. The ceiling had a newfound, maximum, importance, it became a new façade. The walls and supporting equipment were white, but the floor, ceiling, and other furnishings reinstated the colors of the surrounding landscape. Aalto designed the interior color scheme in conjunction with the decorative artist Eino Kauria. The terraces were the main equipment of the building – patients were wheeled out for regular doses of fresh air and sunlight.

Usually conceived for the vertical person, the design here was for the client permanently horizontal. The whole design changed accordingly. Sanatoriums modernized architects, the whole design of the room and building had to change to be as functional as possible

Each floor of the patient's wing represented one color; spending a broad range of time in the sanatorium, from months to years, the patients created government systems within themselves.

View of Terrace

View of Main stairwell and Paimio chair

The color palette was designed specifically for the sanatorium by Alvar Aalto in collaboration with artist Eino Kauria. Colors were particularly important in hopes of trying to soothe patients; Aalto wrote about the colors; "The walls are light and ceilings darker. This makes the general tone more peaceful from the perspective of a lying down patient. The general lighting point of the room is above the patient's head at the interface of the wall and ceiling, which means that it is outside the angle of vision of a lying-down patient." [x]Different colors were used for different floors.

Furniture was specially designed to emphasize the primary function of promoting healing. Each piece of furniture, from door handles to lighting to furniture, were custom developed by Aalto in close collaboration with his wife, Aino. The Paimio chair, the most celebrated product of the collection, was designed for use in the recreation area and is still produced by Artek. Aalto innovated Marcel Breur's Wassily Chair by demonstrating the possibilities of bent plywood technology. Although existing in a sculptural like form, the design was married to the considerations of comfort and functionality. Plywood was chosen for the natural feel and insulating qualities, white the angle of the seat and back aided patients' breathing. The backing was extended and curved for patients to pull their arms through with the intention of opening the diaphragm to fresh air. Aalto's intent for the furniture was to promote the well-being of the patient's with their functionalism and beauty.

Alvar and Aino Aalto also worked together to design the light fixtures of the sanatorium. Most of the furniture and light fixtures ended up in serial production and some are still manufactured by Artek to the day.

View of patient’s room

View of interior community area

Paimio Sanatorium has been praised for crystallizing functionalistic architecture, Aalto developed specific architectural solutions for the specific needs of a tuberculosis sanatorium while fulfilling the general modernist requirement of “light, air, and sun’ and achieving high hygiene standards that were in line with state-of-the-art tuberculosis treatment at that time.

Following the advent of antibiotics in the late 1950s, tuberculosis was not a pressing issue anymore. The disease could be cured and ceased to be a terrifying disease, so the modern tuberculosis hospital became outdated. Tuberculosis sanatoriums were later modified to into hospitals around Europe. Over the years, it has been considerably altered, but the key characteristics stand the test of time. It was then retasked as an ordinary, general hospital. The Paimio Sanatorium has since been declared as a UNESCO World Heritage Site. People from all over have flocked to see how the Finnish architect brough modern hospital design to the architectural agenda. Aalto and his contemporaries were convinced of the idea that good design is healthy. Health, cleanliness, and simplicity continue to live on today in our societies at large and in our own perceptions of architecture and design.

This building has been highly revered, celebrated, and used as an inspiration in many other projects. For 81 years of varied use, the building has proved to be much more than a precise answer to a set of reductive functional requirements. Approaching the project by privileging the individual’s experience for every design problem,

Aalto created a building that transcended that architectural doctrines of its time and continues to radiate a deep sense of human empathy today.

Views of Paimio Sanatorium

Analyzing Paimio Sanatorium

My reason for choosing the Paimio Sanatorium was because of my interest in the health obsessions at the time. People were starting to move towards the idea of holistic lifestyles, and designers adapted that idea. Aalto's sanatorium has also been the inspiration for many projects and is highly regarded to this day. Being able to see the

site and scale of the project was most exciting to me while visiting. It is in rural Finland tucked away into masses of trees that feel like a shelter. Of course, now it is more developed than it was in the 1920s as Aalto designed it. Inside, it had a clinical, sterile feeling that made me wonder how comfortable it would have been to live there for months with Tuberculosis. The design of the details gave it comforting sense, how if you were a patient there, the innovation itself would have been exciting. Seeing a glass elevator for the first time or noticing the door handles that never caught on a doctor's coat.

The Sanatorium, from the competition win until now, is seen as a groundbreaking, innovative design for healthcare. This building sparked my interest in the bond between architecture, illness, and technology. Aalto and his team designed the hospital down to each detail, as he believed that an increase in light and air would help prevent the spread of disease.

In the journal article *Restructuring Isolation: Hospital Architecture, Medicine and Disease Prevention*, Jeanna Kisacky examines the changing isolation strategies in hospitals between 1771 and 1930. At this time, hospitals were known more for the diseases they caused instead of the ailments they cured. Kisacky goes on to write about any preventative design in hospital's were focused on details of we now consider ventilation and maintaining a pure quality of indoor air. "Doctors, reformers, and scientists thought that by identifying the specific architectural features that induced the disease and then

designing buildings that eliminated those features, they would prevent the incidence."[xi] There was an expectation that the new architecture would make disease destitute.

Aalto, along with other professionals at this time, understood that our buildings can help shape our health. In *X-Ray Architecture* by Beatriz Colomina, she claims that "tuberculosis helped make modern architecture modern. Rather, sanatoriums modernized architects."[xii] Tuberculosis, having an outbreak in the beginning of the 20th century, caused architects to start designing new hospitals and sanatoriums for disease prevention. Aalto believed that an increase in light and air would help in the spread of diseases, so he and his team designed the innovated sanatorium that combined these ideas.

Maggie’s Leeds Centre United Kingdom

“Above all what matters is not to lose the joy of living in the fear of dying.” – Maggie Jencks

View of Maggie’s from the road view

Soft, soothing design is what emulates from Maggie's Centers across the United Kingdom; Maggie's Centers functions as a free cancer care facility where patients and their loved ones can get practical and emotional support. Maggie's Yorkshire, located in Leeds, was designed by Heatherwick studio, a London based architecture firm famed for their illusory, sculptural, and almost theatrical flamboyance. The project was started in 2012 and opened in 2020. Although their start was at the beginning of Covid, Maggie's now helps roughly 1000 people per month.

Maggie Keswick Jencks, a gardener, designer, and writer, was the founder of Maggie's Cancer care centers, a charitable initiative co-founded with her husband and architectural historian, Charles Jencks, in 1995. Using her experience of cancer, she wanted to offer people professional support in a calm, friendly, uplifting space. The first of the centers opened in Edinburgh in 1996 and now consists of a network across the UK and abroad. Maggie was diagnosed with cancer at 47. Five years later, in May 1993, she was told that it had returned. Maggie and her husband, Charles, were then moved to a windowless hallway to process this news. They understood the effect of space and discussed the need for somewhere better for people with cancer to go. They founded Maggie's, and their centers have served individuals affected by cancer and their loved ones in a warm, inviting environment ever since.

The center is located on a piece of St. James University hospital campus, a formidable medical establishment and Europe's largest

teaching hospital. The £6 million project is situated adjacent to the hospital's £220 million Bexley Wing. St. James, even prior to Maggie's Centre, is home to Europe's largest specialist cancer care center with its oldest wing dating back to 1848. The University Hospital became a medical hub in the 20th century and in the 21st century, a globally renowned oncology center. Known as Jimmy's by the locals, St. James serves a diverse community across Yorkshire. The staff of the hospital have been working themselves to improve patient experience, for example, by bringing a piano into the Bexley Wing and hanging paintings from the city gallery. Maggie's Leeds Centre is one of 26 other innovative, high-profile commissions that seek to domesticize and deinstitutionalize palliative care for patients and their families by turning away from the common clinical environment. Other high-profile designers commissioned by Maggie's include Norman Foster, Frank Gehry, Richard Rogers, Zaha Hadid, and Amanda Levete. The hospital complex sprawls across large blocks that have slowly expanded over time. Maggie's is a garden oasis tucked into institutional blocks of concrete jungles.

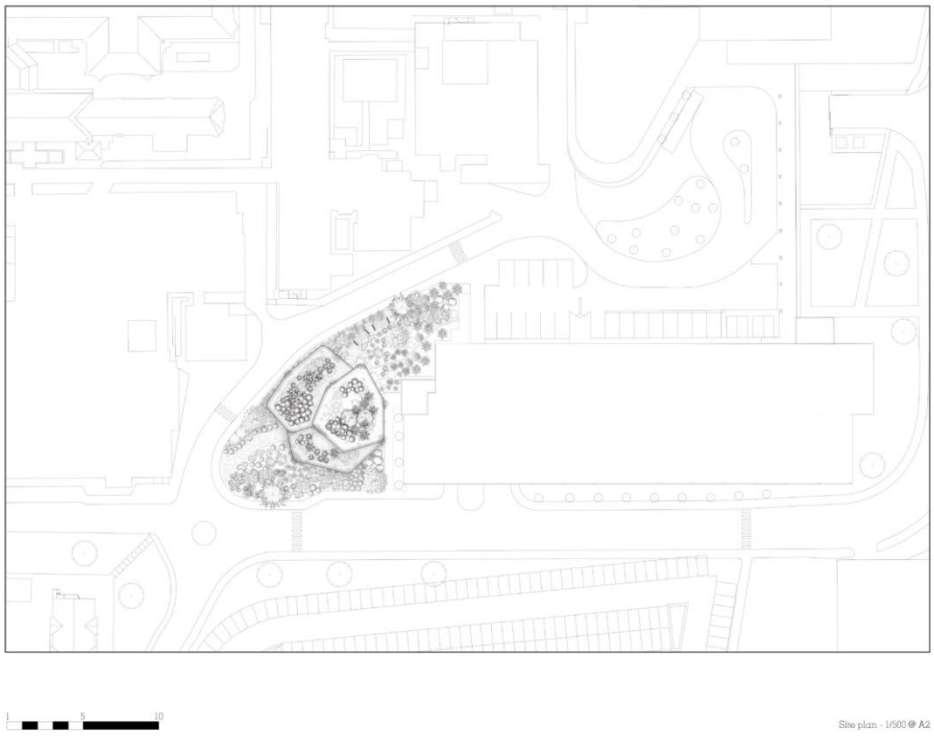


Figure 4 – Site plan of Maggie's Yorkshire center in Leeds. Accessed 14 December 2023. https://www.architectsjournal.co.uk/buildings/work-completes-on-heatherwick-studios-long-awaited-maggies-leeds#:~:text=Rob%20Partridge%2C%20design%20director%20at,above%20that%20of%20traditional%20softwood

View of main entrance encapsulated with greenery

Heatherwick Studio is a British practice founded by Thomas Heatherwick and their dynamic portfolio includes London's Coal Drops Yard, New York's Vessel, and the UK Pavilion at the 2010 Shanghai Expo. The firm prioritizes projects with a large social impact; this was the first healthcare project completed by the firm. Thomas stated, "Our aim was to build a home for people affected by cancer that would be soulful and welcoming, unlike other typical clinical environments." [xiii]The group leader was Mat Cash and project leaders were Neil Hubbard, Rebeca Ramos, and Angel Tenorio. Their approach to design is to lead from human based experience and motivated by creating soulful places that embrace the complexities of the real world.

The spot for the center was the last patch of greenery on an awkward, wedge-shaped corner sitting beside the hospital parking garage. Across the landscape, there is a 6-meter gradient. While there were obvious confining factors, that meant there was room for interesting design possibilities. Typically, this grade change would dictate a building dug into the slope, but the studio wanted to follow the natural contours. At the highest point, there were available views of the Yorkshire Dales that was a driver in the design. The team at Heatherwick studio wanted to enhance the greenery of the site to become a building that is combination of gardens full of local native species and an extension of the Yorkshire woodlands surrounding the city. The idea was to take the carpet of existing greenery, break it into modules, and develop it into a building.

The form of the building is composed of three arrangements of whimsical timber Babylonian-like tree houses that form the central "heart" of the space, with roof gardens situated above. The pillars of support at Maggie's are the counselling rooms, so these occupy the three pavilion spaces. Communal spaces weave around and between the pavilions containing a library, meeting, and kitchen areas. This spatial arrangement allows the building to have different external character from every angle. Two separate entrances were created: a front door and back and rear entrance for staff and regular visitors. The design was formed in 3D space, where rooms fit together as building blocks. The modestly scaled building reads as a trio of oversized planters.

Alluding to the angular geometry of the site, the plan view resembles a webbed three leaf clover. The building itself is a prefabricated spruce wood timber-frame structure built on a concrete slab up against a retaining wall. The challenge was to span the site, enclose the gradient, and reinstate the greenery. The geometry of the overlapping roof gardens allows step downs and overhangs shelter the communal areas. In this approach, the last of the green space is preserved – it lifts and is filled with native plants to be made more accessible and inviting. Heatherwick studio worked with structural engineers to innovate the space in their own language. Rob Partridge, design director at AKT II, said, 'The technical innovation behind the structural design of this project is evident in the impressive cantilevering ribs which rely on a "modern weave" of different wood

species working together to produce an enhanced stiffness – way above that of traditional softwood products.'[xiv]

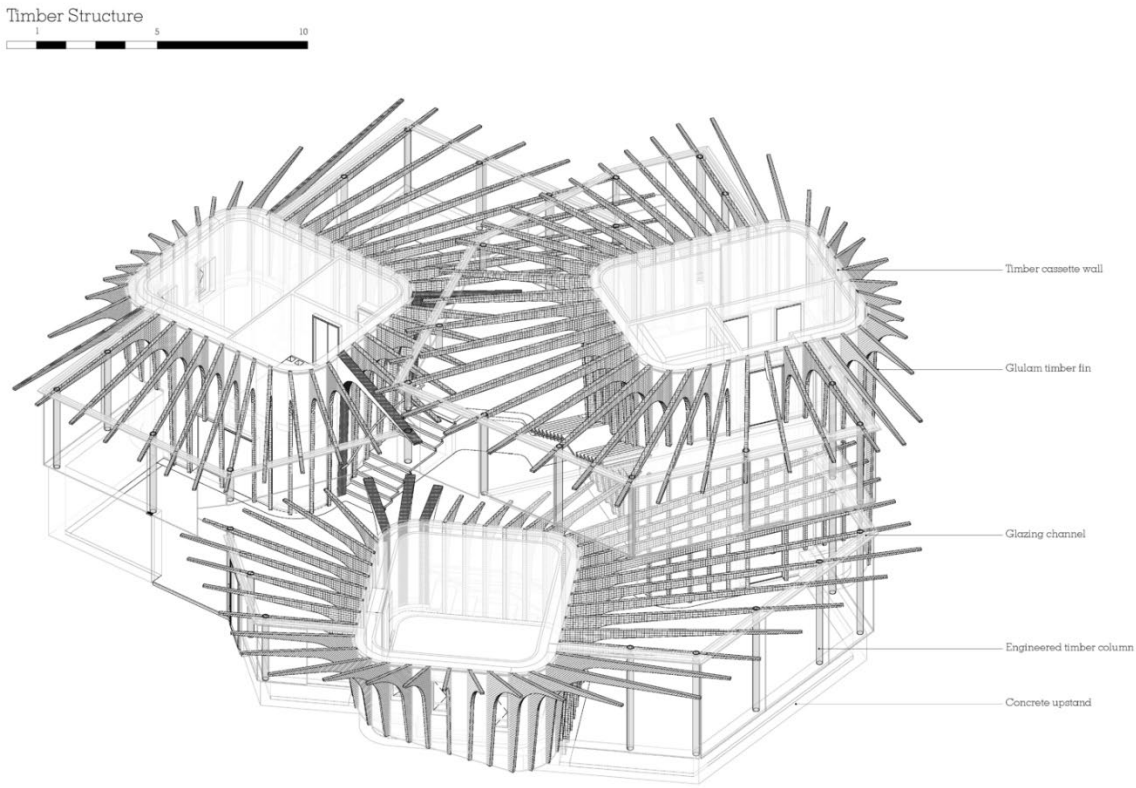


Figure 5 – This drawing shows the structure of the timber beams through a technical diagram. Accessed 14 December 2023. https://www.architectsjournal.co.uk/buildings/work-completes-on-heatherwick-studios-long-awaited-maggies-leeds#:~:text=Rob%20Partridge%2C%20design%20director%20at,above%20that%20of%20traditional%20softwood

The award-winning Landscape designers, Balston Agius, created the planting scheme; the site is now anchored by this vibrant landscape. Heatherwick worked alongside the studio to base the planting on the

British woodland. The gardens were developed around the shade cast from adjacent buildings, the local climate and high wind speed, and native species of plants that support the area's existing biodiversity. Featuring a mix of deciduous and evergreen trees, the garden remains animated year-round. The untamed gardens lushly carpet the print of the building, and there are approximately 23,000 bulbs and 17,00o plants on the site. Maggie herself was a gardener, so she understood the restorative nature of picking up the tools left for visitors and getting to work. Visitors are encouraged to spend time outdoors and tend to the care of the garden.

The relationship between the architecture of the center and the visitor's experience extends beyond the inspiring effect of the building's integration with nature. For example, the front door acts as a psychological threshold - the moment where someone might start accepting a cancer diagnosis. There are seating areas for visitors who are not ready to open the door straight away, or private paths to wander through the gardens. To create a soft transition, the entrance wall is transparent, and the door is moved to the side below a shorter roof. The reception area is unconventional, there is no reception desk but a welcoming window seat, a noticeboard, and a view to the heart of the space with its communal table in the arc of the staircase that leads to the kitchen. The kitchen table, a key feature of all Maggie's Centers, represents another threshold, where visitors are ready to share their experiences. In the kitchen, everything is on display. There are no moments of awkward rummaging through cabinets to find a

mug. Above this space, there is a small private space for staff to rest. A sheltered, accessible roof garden encloses this space.

For construction, the road running along the site presented a challenge. It could not be disrupted by months of heavy vehicles, as it is the main ambulance route. The studio designed a structure that could be prefabricated off site and quickly assembled during construction with minimal disturbance. Manufactured in Switzerland, the entire building superstructure was put together on site in eight weeks. The structure is mainly composed of sustainably forested spruce, a material that flows with the seasons as if it is alive.

Heatherwick studied the qualities that make a building a home, driving away from the clinical feeling of materials. The use of warm, natural materials was relied upon, the way that objects are used to express individuality, the combination of private and communal spaces, and ambient lighting.

The most distinctive features are the ribbed glulam beams creating a distinctive, elegant skeleton that fuses the walls and ceiling into a canopy that intimately embraces the interiors. The three volumes rest on the blonde spruce timber base. Each fin progressively inclines and produces a vertical curve that embellishes the building as a tree trunk that rises and explodes into a crown of branches. This effect is recognized most successfully in the interior of the building in the central and communal spaces. The ribbed striations sprawl upwards on each surface creating an intimately warm embrace of the building; this creates an immediately disarming affect

that fully complies with Maggie's mantra of intimacy and warmth. Structural glazing seamlessly combines the envelopes of the pavilions together without creating any view blocking barriers.

Heatherwick studio took cues from the surrounding curvilinear language and designed tables fashioned from cork and beech. The intent was to help "remove any of the traditional hallmarks of a clinical healthcare environment. Instead of cold and harsh stainless steel, we chose to use natural materials, which have an inherent warmth to them,"[xv] says Angel Tenorio, Heatherwick's project leader. To implement ideas such as the glowing ambience, the studio had to work backwards. From early in the process, the designers had to understand and specify how the lighting and services would be integrated while the building was still taking shape.

Figure 6 – Ground floor plan of Maggie's Yorkshire center in Yorkshire. Accessed 14 December 2023. https://www.architectsjournal.co.uk/buildings/work-completes-on-heatherwick-studios-long-awaited-maggies-leeds#:~:text=Rob%20Partridge%2C%20design%20director%20at,above%20that%20of%20traditional%20softwood

The use of ambient lighting combined with light wood, exposed concrete, and natural lighting creates a calming environment but also a dramatic and fluid movement of spaces by the interlinked internal levels. The expansive staircases seem to effortlessly combine these spaces through a waterfall effect of graceful circulation underneath and between the levels. Shelving is built into the walls and stairs

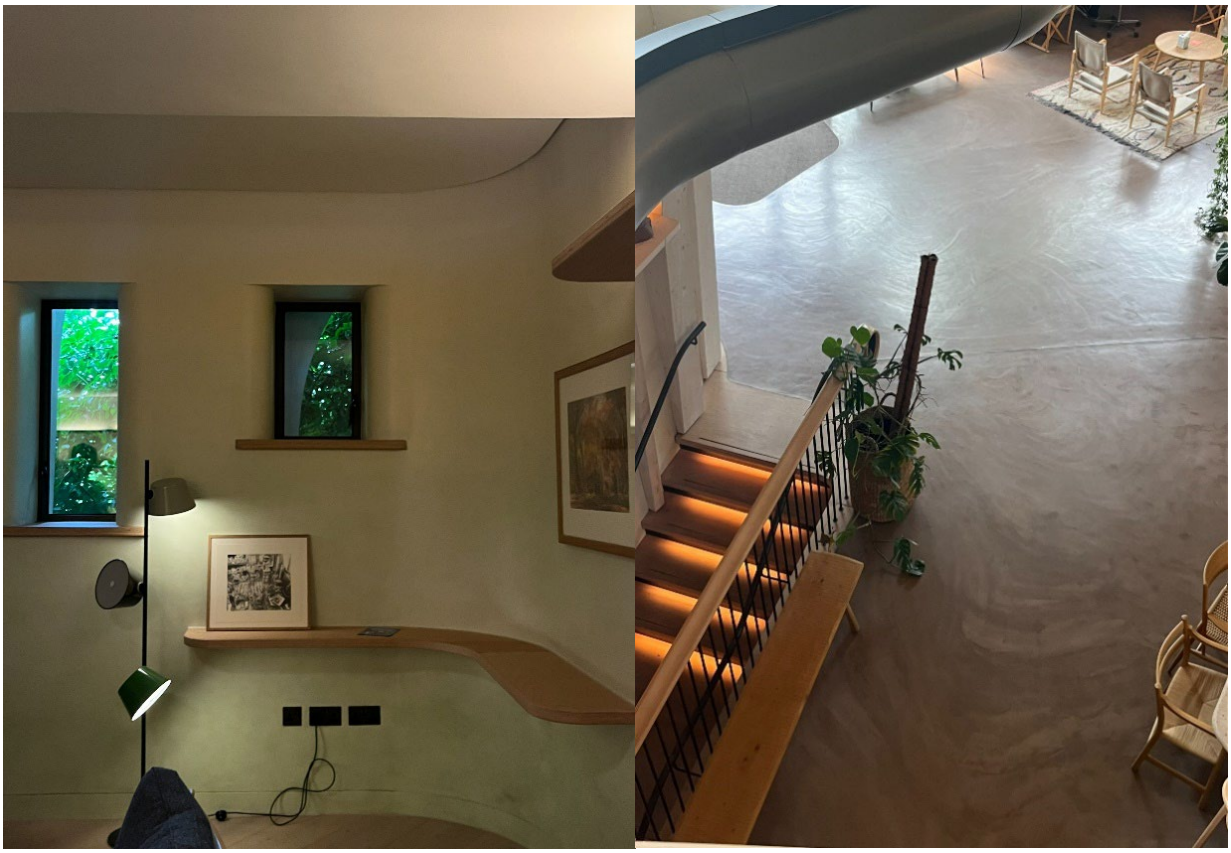
where the users will be invited to add their own objects to feel at home. The lighting is key to this experience; a soft undertone of natural light recessed between the ribs bathes the interiors with a warm glow. Natural light is still fractured through the exterior garden into the spaces and through open expanses of clear glazing. On the highest platform, the instances of glazing provide sumptuous views over the Dales while providing recuperative and psychological support to the center's users. The glazing also provides an immediate connection to the gardens and surrounding plants. The building is encapsulated at almost every square inch with richly planted shrubs, flowers, and trees. From any exterior view, the imagery of a partially submerged tree house arises from this naturalistic narrative.

View of stairs and ambient lighting design

The form and orientation of the building were carefully instructed to maximize natural ventilation throughout the building.

Natural porous materials, like lime plaster, were chosen for the walls to help maintain the internal humidity of the naturally ventilated building to a comfortable level. Passive design strategies were used in energy efficiency efforts.

Heatherwick studio manipulated these materials with such thoughtful effort, even from conception of the design. Through the combination of breathable healthy materials, light, form, planting, engagement with the landscape, the reliance on nature seeks a kinship of human intimacy with its users empathizing with the stark emotional traumas. The focus on human scale and material choice drives the design away from clinical healthcare architecture and towards Maggie's philosophy that design can help people feel better. The building's low energy design takes a fabric first approach. The demand for heat is exceptionally low with excellent air tightness, building form, and fabric thermal performance. The gardens have increased biodiversity on the site by 436%. "From the outset, we wanted to ensure that the center would be giving back more than it was taking away,"[xvi] says Tenorio.



Views of Maggie’s interior spaces

This building is non programmatic, it is free flowing and has different pod like spaces. Patients are allowed to occupy any of the ‘community’ spaces and ‘private’ rooms – although there is no distinct classification. There are spaces where silence seems to be vital and spaces where talking is celebrated. There are no distinct programs other than the kitchen, toilets, and shelves lined with books showing the library. Because of this, there is only a small space above the kitchen that the staff uses for storage. The effect of this is having people working everywhere but being able to find private areas to work. Maggie’s also hosts events each week, so the interchangeability of spaces is vital.

Maggie’s stayed open during COVID-19 to continue offering the face-to-face support to continue to grow the community, Maggie’s is a pioneer of human-led design and truly understands the positive impact that human contact and community can make to the way that healthcare architecture is approached.

View of Maggie’s lobby area

View of Maggie’s showing submersion in nature.

Analyzing Maggie's

What initially drew me to Maggie's Center was the seamless integration of nature and the healing effect on patients. When I stumbled across this project, the heavy use of plants drew me in. Once I started looking at the details of the project, I loved it even more. Visiting the hospital was unexpecting. Walking to the back of the hospital, past a parking garage to a mass of plants with an unsuspecting building tucked away. Looking closer, I could see parts of the windows or roof peeking through like they were saying hello in passing. Walking into the place, it was warm and dry, a completely different experience from the damp and gloomy outside environment. People were having tea at the large kitchen table while others individually found their own workspaces. Everyone was calm and quiet, leaving you to privacy in the open building.

In "Architectural Lessons from Environmental Psychology: The Case of Biophilic Architecture," Yannick Joye reviews findings of environmental psychology showing the natural attraction of humans to natural elements and particular landscape configurations and how these have had positive effects on human functioning and reducing stress. This article is not specifically on healthcare architecture but notes the contribution of nature to the restoration of humans individually. Two major interpretations of the restorative responses have been proposed. The first interpretation is the attention restoration theory (ART) developed by the Kaplan and Kaplan 1989 and interprets restoration as 'the recovery of directed attention or the ability to

focus.'[xvii] Natural settings have been the most helpful settings to restore, or rest directed attention from tasks requiring profound concentration such as proofreading or studying. The second interpretation is part of Roger S. Ulrich's psychevolutionary framework. This theory applies restoration to a broader context and understands restoration as stress reduction. He explains human behavior throughout history with stress of threatening and demanding situations (a predator) while noting that the immediate effects of such responses are beneficial for individuals. These reactions can lead to physiological and psychological stress and restoration is needed when the threat has vanished. The restoration in early humans typically occurred in natural, unthreatening settings and facilitated by the availability of resources.

There is another study in an often-cited article in *Science,* where Ulrich (1984) discusses a group of patients who had undergone gall bladder surgery. The recovery rooms had views of either a small tree group or a brown brick wall. "Patients with the tree view had shorter hospital stays, received fewer negative comments from the nurses, required less moderate and strong analgesics, and had slightly fewer postoperative complications." [xviii]

Maggie's Center relies heavily on nature to mitigate stress reduction and provide an environment that helps and promotes healing.

Butaro District Hospital – Butaro Sector, Rwanda

"I believe that architecture can mend the broken hearts, recover the mind and stimulate the soul. There is still hope."

Jean Paul Uzabakiriho

Design Director at MASS Design Group in Kigali, Rwanda

View of volcanic stone facade

One hospital complex that has had an intensely profound impact on the local area is the Butaro District Hospital. After the 1994 Genocide against the Tutsi, the Rwandan government committed to decades of rebuilding the nation's health system. In 2007, out of 30 districts in Rwanda, 2 of them did not have a tertiary care hospital. A population of 340,000 people had no access to a single doctor; the Burera District was one of the most under-served areas of Rwanda. Partners in Health collaborated with the Rwandan Ministry of Health and specialists from Harvard Medical School to provide high-quality healthcare design to the country's poorest regions that was supported financially by the Clinton foundation. A district-wide plan was developed, and Butaro district hospital was created. Even before the hospital was built, MASS Design Group offered the construction workers an unusual amount of respect, equality, and opportunities for self-development. The NGO responded to this by updating modern architecture's central order of Louis Sullivan's decree that "form follows function" with a new important concept: process follows ideals.

Partner's in Health, a nonprofit organization, was founded in Haiti in the 1980s long before Covid-19, and long before the fight against Ebola in West Africa. Barely out of their teens at the time, Dr. Paul Farmer, Dr. Jim Yong Kim, and Ophelia Dahl, changed global health by co-founding Partners in health. They have rerouted ideas of public health from injustice to treating all people with dignity and world class medicine. They emphasize "a preferential option for the poor" – that means offering support and empowerment to impoverished

patients. Dr. Paul Farmer reached out to a second-year architecture student in 2007 to move to a Rwandan hilltop and accompany the design and construction of a new hospital. This student, Michael Murphy, is now the co-founder of MASS design group after immediately realizing the 'Architecture' he has known is not sufficient for what the district required.

Proving the government's commitment to building this hospital, they offered a special site perched high above the valleys of Butaro. The views show the mountains of Rwanda and Uganda fading into each other. The site once was a military camp, the transfer to medical shows the demilitarization of a war-ravaged country. It showcases how committed the government is to serve its people better with emergence, healing, and rebuilding.

This facility was a symbol of what infrastructure is demanded in this district; infrastructure including roads, water, and electricity, but also economic opportunities, laborers, educational programs, and material markets required to make this holistically a product of the Burera district. It was much more than handing a set of drawings to a local contractor, construction of dignity was required. This was why, on that hilltop, MASS Design Group was formed.

MASS (Model of Architecture Serving Society) design group believes architecture plays a critical role in supporting communities by confronting history, shaping new narratives, collectively healing, and projecting new possibilities for the future. The group is a 501©3 not-for-profit organization with a diverse group of leaders. The team

at MASS includes over 200 architects, landscape architects, engineers, builders, furniture designers, makers, writers, filmmakers, and researchers coming from 20 countries around the world. In 2020, MASS was named Wall Street Journal architectural innovator for their work in healthcare and the ability to use architecture as a medium to heal. They believe every project has a mission and begin the process by collaboration with different partners throughout the process. MASS believes it is imperative to build a climate positive future. Beyond energy use and efficiency, to holistically design the project ecosystem with a supply chain that is sustainable, resilient, and regenerative.

Figure 7 – Lower level of Site Plan of Butaro District Hospital. Accessed 19 December 2023. https://www.archdaily.com/165892/butaro-hospital-mass-design-group

Figure 8 – Upper level of Butaro District Hospital. Accessed 19 December 2023. https://www.archdaily.com/165892/butaro-hospital-mass-design-group

Rwanda, the land of a thousand hills, is characterized by their vernacular architecture of earth bricks, terra cotta roofs, and mud being an integral building material. Most of the buildings along the roads are built with this traditional language. Kigali is the capital of Rwanda, expanding over a huge area of land. There is dense development with modern and vernacular architecture braiding and starting to expand into the hills past Kigali. Rwanda has developed exponentially over the past decades since the infamous Rwandan Genocide of 1994. Since the hospital's opening in 2011, there has been a domino effect of infrastructure development to Butaro. The journey from Kigali to Butaro is roughly 2.5 hours on mainly dirt roads

clinging to the sides of each mountain. Half of the way is paved, and local workers are expanding the roads to lay concrete the rest of the way. Now, there is a bus that runs from Butaro to Kigali multiple times a day.

In the center of the complex stands the umuvumu tree, a traditional Rwandan gathering space, which is the most sacred space. The 150-bed facility was programmed to provide in-patient and out-patient care that now serves over 400,000 people. Construction was complete and the hospital opened in 2011, with focuses on maternal health. Core programs have integrated a laboratory, a neonatal intensive care unit, and operating rooms. 2 million dollars has been saved in construction fees by implementing a construction plan that involved a combination of local materials, builders, and sustainable practices while employing around 3500 community members. Working with local craftspeople gave a site-appropriate and sustainable design, reduced the embodied carbon of the project, and invested 85 percent of the building costs into the local economy.

View of umuvumu tree centering the hospital campus

MASS took into consideration how the building's health affects patient health. The various systems, overall layout, patient and staff flows, and natural cross ventilation are designed to mitigate and reduce disease transmission. All the hallways and check-in areas are placed on the building's perimeter, the intention behind this was so that while patients are waiting for treatment or while staff and patients circulate through the hospital, this will provide fresh, open air and a lower chance of transmission. Inside of the hospital, patient's beds are situated in front of large windows to frame the view of the Rwandan landscape and for natural light and ventilation. Ultraviolet Germicidal Irradiation (UGVI) light fixtures help to neutralize microbes as the air is drawn upwards. To further lower the risk of infection and disease transmission, a non-permeable floor finish provides an easy-to-clean and durable surface.

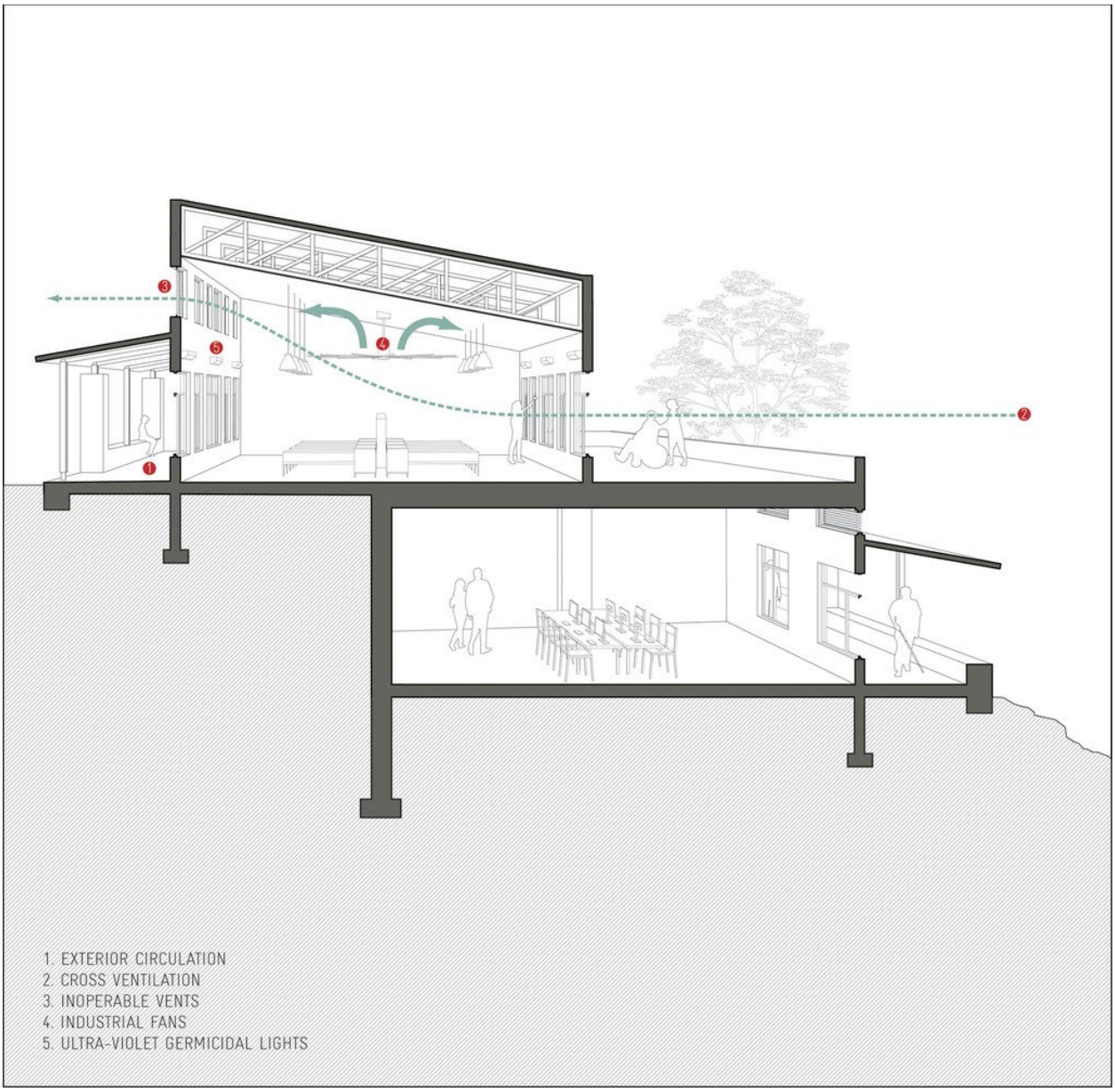


Figure 9 – Diagram showing ventilation strategy in Butaro District Hospital. Accessed 19 December 2023. https://www.archdaily.com/165892/butaro-hospital-mass-design-group

View of exterior waiting space

View of exterior hallway

When designing for the occupants, several questions arose on how to design for these people. How do you orient someone who cannot read signage? The designers chose to answer with colors and symbols for patients to orient themselves. A spatial triage system assists the most vulnerable and immunocompromised patients. The architects prioritized air quality as a central design problem; tuberculosis and HIV are present in the area and are primary killers in the medical environment. The overlapping epidemics have had a devastating impact. Many clinics have been destined to be sites of infection rather than places to find care at. This building has created new standards where the leading design strategy is infection control.

View of signage noting the use of color and symbols

Other passive design techniques integrated to enhance cross ventilation are the use of high-volume, low-speed fans, high ceilings, louvers, and large operable windows. The architecture takes advantage

of Rwanda's climate to create networks of exterior spaces and a ventilation strategy that circulates the air in the ward at least a dozen times an hour using a simple stack principle; hot air rises and is pushed beyond the building. The campus is a series of terraced gardens, courtyards, and covered verandas that create gathering areas and prevent infection.

Local materials were sourced for the whole of this project. Volcanic rock from the Virunga Mountain chain located near the site creates one layer of a double tiered building envelope. Low stone walls allow views of the northern Rwandan landscape while acting as resting and seating areas. Stone-clad labs, wards, and treatment centers used a 'jigsaw' joint technique that is new to Rwanda' it was created on site by local masons. The masons were learning the technique as they were building; you can see human print in the evolution of the building. As more walls were clad, the stones fitted closer together.

View of volcanic stone facade

Other than just reduced disease transmission from air circulation, well planned exterior environments provide a greater sense of patient privacy and rainfall drainage away from the building. Lush vegetation and viewsheds have been shown to reduce stress and pain perception in patients, as well as increase retention of nursing staff. The interior to exterior conditions and views increases the one critical factor for patients – hope.

Landscape integration is a critical factor in the Butaro District Hospital design to reduce the spread of infection. Trees and shrubs help to stabilize the steep hillside while providing shade for outdoor seating areas. Using semi-permeable surfaces over hardscapes prevents standing pools of water, which can act as breeding sites for vector-borne diseases.

Rwanda serves neither a departure or arrival point for guest construction workers. The hilly central nation also deviates away from sub-Saharan Africa typologies, where slums offer economic survival, but at the cost of health and safety. The government of Rwanda has advanced education, health, and development. The capital, although tidy, does not imply wealth and underdevelopment lingers. Typically, a Rwandan lives on less than $1.50 a day. Poverty constrains construction, and often, the construction jobs are completed by precariously employed day laborers. The concept of architecture is nearly nonexistent in Rwanda, but Rwandans are not resistant to change. Prior to completion of the hospital, 3000 people were employed during construction. Most of it was just simple labor, but they also

offered skilled technique training that would not have been available otherwise, particularly stone masonry with volcanic rock. With completion of the building, the temporary jobs are over, but the impact of the experience carries through to the people. Kelly Doran, architect in the Kigali office of MASS, says “There’s now a group of volcano stone masons who specialize in a kind of volcanic stone production, and they have 23 members, and they’re working on housing. In a region that didn’t have construction at all, we’re seeing the emergence of groups of subcontractors who are self-organizing.”

From start to finish of MASS’ projects on the Butaro District Hospital Campus, local builders have been employed. For many of the people locally employed, this project was a learning experience. Mock-ups were made to show workers how to build and with each portion of the project, their knowledge expanded.

The impact of this project spreads vast and deep, from the sheer number of people that this hospital provides for to the relationships and connections it has made. A widespread number of local people came to help with this project. Not for monetary intention, but to help the community. People would move through different stages of the process; to start out carrying stones to eventually moving up to become a team leader, every hand that helped was recognized. The knowledge and skills taken from this by so many people were transferred into the rest of their lives; People learned to become masons, painters, landscapers, etc. Economically, it boomed the whole community.

In Rwanda, Architecture is a young profession in Rwanda. The birth of the Butaro District hospital aligned with the beginning of architecture school. MASS Design Group started expanding students' minds on what architecture is. With the intention that rural areas need designed spaces too, Butaro District Hospital was beginning to come to life. Questions arose of how do you design something to be dignified?

The inclusion of women on construction jobs has also been promoted, and they strive for half of the workers to be female. Traditionally, the Rwandan society existed under a patriarchal social structure where women and men have unequal social power. Kwankwanzi, a female mason, has worked on four projects as a result. She has become a mentor for other female stoneworkers, and she now attracts female apprentices from as far as Uganda. Therefore, the hospital not only initiated a serious boost in the Rwanda's economic activity, but also raised the subject of gender equality.

In the area, diseases related to water and sanitation issues have been high due to lack of relevant facilities. The hospital upgraded the daily life of people. It is now easier and cheaper to see a doctor and the mortality rates of children under 5 years old have dramatically reduced.

The area's earthquake activity called for a strong foundation that was necessary for the hospital. Plenty of time and attention was given to the excavation and foundation construction. The volcanic stone proved to be an ideal cladding solution.

The Butaro District Hospital was the first project on the Butaro District Hospital Campus and has grown to incorporate other MASS projects including Butaro Doctors' Housing, Doctors' Share housing, the Butaro Cancer Center of Excellence, and an Oncology Support Center.

Starting out as a district hospital, the complex has grown rapidly since. Doctors started coming into Butaro District Hospital from all over, even as far as Boston. The influx of doctors called for a need of accommodations. The first phase of doctor's housing was completed next. Butaro District Hospital kept growing and eventually, cancer patients came seeking treatment. A cancer wing, the Butaro Ambulatory Cancer Center, was then constructed using the same techniques and completed in 2013.

MASS's second housing complex and fourth project on the campus are The Doctor's Sharehouses. All of MASS's buildings on site have strived to inject as much money in the local economy as possible by entailed community involvement in the construction process and employing local labor. Sierra Bainbridge, MASS senior director says, "The landscape is one of the easiest ways to get people involved… You don't have to be a skilled mason. You don't have to have particular abilities. Everybody knows how to do planting there, and probably better than we do. In all of our projects, we're looking for the opportunities where we can have that maximum community involvement to get that relationship with the place started very early." Three communal Sharehouses accommodate up to five doctors per house and

encourage interaction between the residents in the communal spaces. People are beginning to use the construction techniques taught while constructing the houses and they are influencing local construction.

View from Doctor’s sharehouses

Butaro has started to shape into a scientific hub. The community of trainers and medical staff here will start to be able to research and spread knowledge.

Analyzing Butaro District Hospital

What initially sparked my interest in this hospital was simply the views that it framed. As I studied it more, I fell in love with every idea and detail of the project. I visited MASS's firm in Kigali and they took me to see the hospital's campus, trying African street food along the way. Infrastructure is still being built, we transitioned from paved to dirt roads on the 3-hour drive to Butaro. I sat down and talked to Jean Paul Uzabakiriho, a design director with MASS Design Group in Kigali, about the project and was inspired by the impact this hospital has made.

The Butaro District Hospital holistically integrates the environment, community, and culture to design for healing. MASS Design Group have begun to apply lessons from the past as a strategy to combat disease. Passive design strategies were heavily integrated into the campus design. The windows not only provide views but also bring in light and air, and this creates a space that feels comfortable, safe, and has visual interest. Since the building uses local materials, there is an implicit connection to the environment, which links a person and the community. In Jeffrey A. Garofalo's thesis, *How Can Architecture Make Communities and Urban Environments More Resilient To Disease?*, he researches how architecture and healing design can make communities more resilient to disease outbreaks.

Garofalo states how architects and designers of the past have deduced what the recent years' growing body of research has confirmed: "the built environment can promote health and wellbeing and reduce the public's exposure to such respiratory infections as tuberculosis and COVID-19."[xix] Garofalo intertwines this idea with urban planning and design solutions for public health. MASS created a resilient foundation that integrates many passive design strategies to prioritize health giving attributes and gives way for future development. "Reconnecting the urban planning and architecture fields with public health will be essential for meeting today's complex global health challenges."[xx] For our hospitals today, it is important that planners, policymakers, and architects draw lessons from the past in steering the design of regulating disease.

Bendigo Hospital – Bendigo, Victoria, AUS

View from Main entrance courtyard

As the largest regional development in Victoria, Silver Thomas Hanley worked in collaboration with Bates Smart to design the Bendigo Public hospital. The rebuilding of the hospital has been one of the largest pieces of new infrastructure seen in Bendigo for decades. The $AUD 630 million project was finished in 2017 and incorporates a cancer center, a psychiatric services precinct, retail facilities, a childcare center, and hotel. The project was undertaken by Exemplar Health Consortium (NBH) Partnership as a Private Public Partnership; sustainability, functionality, and longevity were major themes while considering investments to create a conscious connection to place and community. The massive hospital contains 724 beds, with each room having an ensuite and 128 serviced apartments. Bendigo hospital is the largest hospital in the area, serving 23 other hospitals. Bendigo is around 2 hours away from Melbourne by train or car, but the hospital reduces the need for patients to travel. This new hospital makes an architectural statement of quiet confidence through a contemporary reimagining of what a hospital can and should be.

View from main entrance showing fragmented massing

In the construction of the hospital, several smaller buildings were cleared away in the rebuild and was reimagined with a strong north-south axis. The demolition of older buildings resulted in lateral views across the site being opened up and was enhanced by elegant landscaping. The new site for the hospital involved closing a through road, Mercy Street. As the concept of design, the echo of the road is internalized as the internal "street" of the hospital. The internal street, the main foyer, connects to the rear of the site bordered by Drought Street. This allows easy access from either side of the building.

A number of significant challenges were posed by the project brief and the site. The scale of the district and establishment of two-sub districts, the demolition of accredited heritage buildings and existing buildings, support of the growth of Bendigo, considerable grade changes along the site, accessibility and safety requirements, the complexity of designing a number of multi-level landscapes on structure with varying levels of exposure and enclosure, a wide variety of user group, access and maintenance and a 25 year design life were all taken into consideration.

During the design, there was emphasis on natural light and open spaces with 48 courtyards and terraces to draw the landscape into the building. This provides a peaceful and caring environment for staff, patients, and visitors. The new building, through the integration of architecture, landscaping, health planning and evidence-based design, holistically integrates Bendigo's architectural vernacular and the

natural environment. The project delivers world class healthcare while providing a welcoming, positive environment to promote wellbeing.

Figure 10 – North Elevation of Bendigo Hospital. Accessed 19 December 2023. https://www.archdaily.com/938939/bendigo-hospital-silver-thomas-hanley-plus-bates-smart/5eb19163b3576566600005b7-bendigo-hospital-silver-thomas-hanley-plus-bates-smart-north-elevation?next_project=no

Figure 11 – Site Plan of Bendigo Hospital. Accessed 19 December 2023. https://www.archdaily.com/938939/bendigo-hospital-silver-thomas-hanley-plus-bates-smart/5eb19163b3576566600005b7-bendigo-hospital-silver-thomas-hanley-plus-bates-smart-north-elevation?next_project=no

View of non accessible interior courtyard

View of Interior Courtyard

View from main courtyard

View from courtyard

The form of the hospital is modulated by tall, narrow forms that draw cues from terrace housing. As this hospital is a contemporary reimagining of what a hospital can and should be, there is a focus on user experience. The hospital makes a confident civic statement, but does not have the attention grabbing antics as a metropolitan hospital. A place such as Bendigo, which is far enough from Melbourne that it is not a commuter town, has its own identity and self-assurance. The regional building speaks primarily to its constituents instead of proffering metropolitan sophistication.

The massing of the building is divided into connected conglomerates to help ameliorate the scale with inspiration from the scale and proportion of Bendigo's heritage buildings. The needs of the hospital have been carefully managed in relation to the surrounding low-rise residential context, the topography, and campus context. By breaking down the scale of the hospital, especially at the ground plane, a more intimate and welcoming effect is shown.

The façade treatment is patterned with glass panels as a result of the broken up large scale brick bonds. The highly crafted windows increase reflectivity and glisten in the surrounding landscape to make the building an inviting facility. Most importantly, the window strategy creates an interesting and playful composition by disguising the individually stacked hospital rooms.

As the power of nature in a healing environment has been studied, it is an integral part of this project's design approach. The connection between building and nature was highlighted throughout the project

with inner courtyards and focus on landscaping. To connect viewscapes, the design was formed from the inside out. Floor-to-ceiling views of the landscape flow from the end of all internal courtyards. Courtyards provide amenity for staff and patients, and secluded gardens provide quiet reflection space for cancer patients. Three native trees were included within the hospital entrance with a rooftop garden that is visible from the mental health ward.

A warm, woven timber motif flows through the two entrances and fragments daylight from the skylights hanging above producing an ever-changing flecked light effect.

Large scale artwork in the public space provides vibrant energy including a piece by Noel Skrzypczak that references the local geological story and another by Esther Stewart that provides a colorful point of interest.

References to place are relatively subtle through the exterior, in the interior, they become the logic of wayfinding and decoration. As the hospital serves regions as far as Swan Hill, that is reflected in the floor names, color palettes, feature walls, and images in the elevators. The resonance with place helps bind the hospital to the community.

In such a complex project, some elements are compromised, or gaps emerge between design intent and use inevitably. The architects have repurposed and mixed-up materials where they can. Expanses of white flooring were specified for the corridors to make a visually sterile

environment. Elsewhere, these surfaces are treated more playfully. In the children's ward, Acrovyn climbs up the wall to form into clouds.

Landscaping

Exterior view

The design drivers for the landscape architecture were connection and kindness to develop a walkable district with a legible hierarchy of streets and paths to engage with the broader city, heritage buildings and topography. OCULUS design studio developed the landscaping through evidence based and Biophilic Design approaches. Incorporated across the project are fractal leaf structures, utilization of natural and local materials, moving water, and textured planting.

The design team recognized the region's significant cultural heritage and collaborated with the Dja Dja Wurrung Clans Aboriginal Corporation through the 'Closing the Gap' initiative. To enable cultural practices and education, an aboriginal garden incorporates the use of local indigenous planting while celebrating a valuable cultural artefact, a relocated scarred tree. The design and construction of the garden created local employment opportunities for the Dja Dja Wurrung. Local Chinese history is celebrated in this dedicated community garden and site-specific public artworks from the Bendigo Art Gallery and local artists are included across the district.

View showing vegetation in the main public area and timber ceiling allowing fragmented light to enter

In order to create a healing and therapeutic environment for all users, Bendigo Hospital has integrated sustainable aspects into the project. The green roofs reduce glare and heat island effect while simultaneously increasing thermal and acoustic performance; the roof also harvests and stores potable and non-potable rainwater in a drought-prone region. The recycled water systems are the primary supply to irrigation, flushing, and heat rejection systems. An extensive span of 770 solar photovoltaic panels generate clean energy with a yearly reduction of 300,000 kilograms of CO2.

The development is regarded as a key milestone for the central Victoria area and will continue to service the region into the future. The hospital has been the winner of numerous awards including the Premier's Regional Recognition award at the Victorian Government's 2017 Premier's Sustainability Awards and the Sir Zelman Cowan Award for Public Architecture in 2018 at the National Architecture Awards.

Analyzing Bendigo Hospital

I chose Bendigo Hospital because I thought it was incredible how many courtyards were added into the building. Visiting this building, it is typical of a contemporary hospital. The whole building seems to be surrounded by gardens where people coupled up together.

In large hospital design, clarity of wayfinding and direction is one of the most critical parts. Legibility, as defined by Kevin Lynch, is "the ease with which its parrs can be recognized and can be organized into a coherent pattern." [xxi] Lynch defines this in terms of urban context, but a hospital becomes a 'mini urban environment' with

different stagnant and moving parts, routes, nodes, etc. The moving elements are just as important as the stationary parts, they have defined the organization of the space. In the book *Healthcare Architecture as Infrastructure*, Stephen H. Kendall assumes how the built environment, healthcare facilities specifically, come into being and transform: "1.) the acquisition of buildings and building complexes – to be resilient, culturally grounded and prepared for change – must recognize the distribution… of decision-making control over time, and 2.) new design skills are needed… to assure excellence and readiness for change." Buildings will, part-by-part, transform over time to fit certain needs. To successfully design the most effective space needed, decisions should be made by all users of the buildings, patients, visitors, doctors, nurses, staff.

Conclusion

"Covid-19 reveals what many of us have long known: that buildings shape our health and our ability to access health every day. Architecture can play a unique role in contributing to a cure: if spaces can be purposefully designed, they can assist in the prevention, containment, and treatment of infectious disease, including COVID-!9" – Michael Murphy MASS Design Group

This paper studied the contribution of architecture to health. The Paimio Sanatorium, Maggie's Yorkshire, The Butaro District Hospital, and Bendigo Hospital provide specific examples of passive and biophilic create better places for healing. It has been known for centuries that humans are inherently connected to the environment, and our buildings should integrate that idea into our basic infrastructure.

In light of the current challenges of health care, architects can provide improved design. While light and air have been recognized to support healing, linking people to nature and community is also seen to be critical to providing healthy environments. If architecture is an invasive act that displaces nature, architecture that merges with instead of displacing nature helps to establish places that support health and healing.

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