A Built Environment for
Mental Wellness

2018 PIVOT Architecture Fellowship
Evon Calabrese

Contents

Acknowledgments

As an architecture student and emerging professional, it is daunting to approach established professionals for help with a research project. I found the topic of architecture for mental wellness fascinating and vital to the profession, but I was unsure how others would feel about it. To my surprise, the support I received from the architectural community and building owners and operators has been extraordinary.

Firstly, I would like to acknowledge and thank PIVOT Architecture. It was an honor to be their second summer fellow and without the firm's support, mentorship, and funding, none of this would have been possible. I would also like to thank the many architects and interior designers who took time to share their process and expertise with me including Michele Hutchinson and Alan Bright from HOK, Marsha Maytum from Leddy Maytum Stacy Architects, Scott Shell from ehdd, Dave Otte from Holst, Richard Shiga and Kimberly Bandy from ZGF, Raphael Sperry from ADPSR (Architects/Designers/Planners for Social Responsibility), and Christie Johnson Coffin.

I also received an abundance of support from people outside of the architecture community including executive directors and facilities managers. Their enthusiasm in sharing their organizations' mission and showing me their facilities was incredibly inspiring. I would like to thank Kory Stradinger from Sweetwater Spectrum, John Langrill, Helen Ruisi, and Danielle Patterson from the Chartwell School, Kit Kryger from Providence Willamette Falls Medical Center, and the staff and officers at Maple Street Correctional Facility for taking the time to meet with me and give me tours of their buildings.

Thank you to my copy-editor Lizzie Short and finally, I would like to thank Will Stevenson for not only his incredible photographs but also for his support throughout this entire project.

Preface

I believe my passion for creating built environments stems from a personal sensitivity to my own environment. As a child, I attended a typical public elementary school in rural Vermont. Because the classes were small, the school opted for an innovative class structure called "multi-age classes" which essentially meant they combined the kindergarten through second grade and the fourth and fifth grade into single classes. The school, which was constructed in 1959, was designed in line with the typical methodology of the time: multipurpose room on one side, library on the other, with a double-loaded corridor for classrooms. When I think back to elementary school, I think of chaos. I remember the noise and the frantic energy, the chaotic hallways flowing into the equally chaotic classrooms, with multiple lessons and activities happening all at once.

I remember spending a lot of time in the multipurpose room, where the ceilings were nearly ten times my height and I was surrounded by painted block walls and laminate floors. The windows along the ceiling provided limited natural light and absolutely no view. I remember wondering what was happening outside, what the weather was doing, what my parents were doing, whether my parents would remember to pick me up after basketball practice - if they forgot, would I have to live here my entire life? In this echoey, manufactured chamber lit only by fluorescent tubes?

These spiraling thoughts would consume me when I was supposed to be playing Red Rover or eating lunch. Needless to say, I was an anxious kid and very sensitive to my environment. The design of my elementary school did not cause my anxiety, but it certainly exacerbated it. As a teenager, I would be diagnosed with anxiety,

Cavendish Town Elementary School

depression, seasonal affective disorder, obsessive-compulsive disorder, and dyslexia. These things do not define or consume me, but they do affect how I perceive the world and, more specifically, built environments. While primary school was tough, these "disorders" actually make me a keener designer and empathetic to other people's experience in buildings.

While I was a student at MassArt and even as a recent graduate, I, like most aspiring architects, felt the acute desire to fight for sustainability (though I still did not completely understand what that meant). I was heavily involved in the Solar Decathlon, a competition hosted by the Department of Energy, where student teams are tasked with designing and constructing a 1000 square foot solar-powered home, then shipping and assembling it in a matter of days for a public exhibition. I studied LEED and Passive House standards, I read the Green Studio Handbook, but I didn't feel the drive and excitement I expected to feel.

Scope of Study

I had originally planned to go straight to graduate school, but decided to take a year off, which ultimately turned into four. During that time, I was able to reevaluate what it was about architecture that I originally fell in love with and finally began to understand that while environmental sustainability is a vital part of the architectural practice, it is not the only part. I had heard of the triple bottom line but did not fully grasp the importance of fusing environmental, social, and fiscal responsibility until more recently. I've come to realize the future of architecture is about creating buildings that are not only healthy for the environment, but also for the people they contain.

My passion for creating space is rooted in my personal experiences in mental health and spatial sensitivity, and this newfound understanding of sustainability is what ignited my interest in architecture for mental wellness.

This study was primarily conducted over the course of ten-weeks with a fairly narrow scope: can design methodologies specifically for mental health facilities and special needs schools benefit the general population? The research consisted of a literature review and case study analysis. The intention of this study is to provide a prudent overview of the topic and create a foundation for future research. In this study, I began to explore the fundamentals of neuroscience, specifically human cognition and perception, which illuminated a need to study these topics in much greater depth. In order to narrow the scope of the study, this analysis does not include physical disabilities such as mobility or visual and hearing impairments. My intention is to use this investigation as a foundation for continued research including additional literature review, case study analysis, and experimentation to collect quantitative data.

The 4D Home by Team Massachusetts for Solar Decathlon 2011

Section 1:

an exploration of existing methodologies & cognitive science

Introduction

For many, the notion of designing for disabilities is limited to the practices outlined in the Americans with Disabilities Act (ADA) which entails providing handicap toilet rooms, wheelchair lifts, braille signage, and textured flooring (Dept. of Justice, 2010). The ADA is limited to physical disabilities and often applied to a building late in the design process. However, if universal design strategies are implemented at the conceptual design phase there is potential for the spaces to be richer and more inclusive for all. The Ed Roberts Campus in Berkeley, California is a community center designed to serve and celebrate the independent living and disability rights movement. The architects at Leddy Maytum Stacy created a "grand ramp" in the foyer which has become the symbol for the building. While the intention of the facility is to serve people with physical disabilities, rooms are often rented by able-bodied persons for meetings, events, and even weddings. The many design elements implemented for the intended users: accessibility, ample daylight, and intuitive wayfinding have created a building that is inviting and delightful for those with and without disabilities (Ed Roberts Campus, n.d).

This is certainly not the first time that a space or product intended for a minority became adopted by the masses. The cushioned OXO vegetable peeler that many are accustomed to using was actually intended for a very specific population - people with arthritis. In 1990, the designer Sam

Ed Roberts Campus
LMS Architects

Farber was cooking with his wife Betsey, who happened to be both an architect and a person with arthritis. She was complaining about how the handle on the traditional metal peeler hurt her hands and asked him to make one with a more comfortable handle. This led Sam to develop the Good Grips line for OXO, and it quickly became the preferred tool for the general public because the cushioned handle was so comfortable (Wilson, 2018).


OXO Good Grips Peeler vs. the standard vegetable peeler

In my first term in the Master of Architecture program at the University of Oregon, I wrote a research paper titled "Architecture for all Neurotypes" which focused on design methodologies in learning environments for children with autism. Magda Mostafa is an architect and researcher based out of Cairo and developed a design guideline called the Autism ASPECTSS Index. In this, she outlines seven key design principles:

- Highly controlled acoustics to limit noise level, echo, and reverberation

- Sequence spaces to create predictability and routine for users

- Provide an escape space which is a designated low stimulation zone that users can retreat to when feeling over-stimulated

- Compartmentalize spaces based on sensory qualities such as materials, sound, lighting

- Create a clear transition zone between high and low stimulus area such as the gymnasium and reading rooms

- Organize rooms based on the level of stimuli and sensory qualities

- Safety (Mostafa, n.d.)

The most surprising part of this study was how universal these principles are. I believe all children would benefit from an environment with these attributes, especially children with anxiety, ADHD, or learning disabilities. Wouldn't all children profit from spaces where their level of sensory stimulation correlates with the type of tasks they are completing? Where there is a clear transition between high energy, rambunctious areas and quiet areas requiring concentration?

Many of these concepts are just good design for any building type. Kevin Lynch studied intuitive wayfinding at length in his book, "The Image of the City" to better understand how people perceive and remember their environments (Lynch, 1977). An "escape space" by Mostafa's standards is very similar to the refuge rooms which have become common in workplace design (Mostafa, 2014). Peter Zumthor designed the Thermal Baths around the idea of sensory experience; the color, texture, sound, proportions, water temperature were all carefully considered. Similarly, the corridors in the Uffizi Gallery act as transition spaces between the galleries to help the visitors re-calibrate before taking in more visual stimulation.
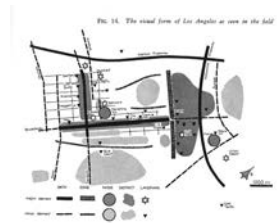
from "The Image of the City"
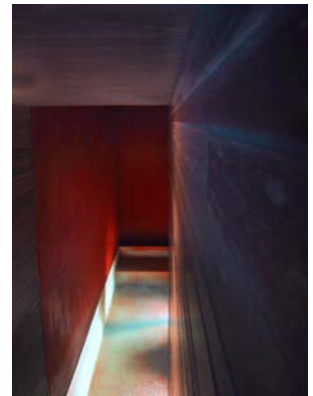
Thermal Baths by Peter Zumthor
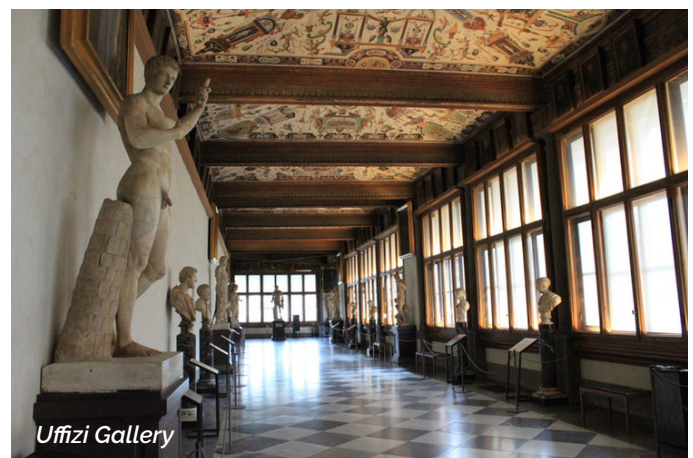
Uffizi Gallery

All of these spaces were designed by architects. However, architects only design 25% of the new construction in the United States (Dunham-Jones, n.d.). This seems shocking until you consider all of the big box stores, franchises, and McMansions, which may have a professional's stamp but lack thoughtful, responsive design.

In his book, "Survival Through Design," Richard Neutra says:

"The fact that a man does not realize the harmfulness of a product or a design element in his surroundings does not mean that it is not harmful."

I believe that spaces like these are harmful.

This fellowship report explores the topic of architecture and its effect on mental health. Studies show that design can positively impact those with mental, cognitive, and behavioral disorders and conditions, but currently, these design methods are implemented only in facilities for these users. Could these design principles also benefit the neurotypical? Is there the potential for design to be richer and more inclusive for everyone? I believe that current design methodologies for mental and behavioral health facilities have the potential to be applied to generic architecture to benefit not only those who are most sensitive but also the general public as well.

But why is this important? In architecture there are already so many factors that we need to consider: structure, budget, client needs. Is it really necessary to add another layer of complexity? I am not proposing we add another section to the ADA guidelines - I'm proposing a vital paradigm shift in the way we approach design.

Designing for mental wellness is the socially responsible thing to do, however there are additional motivation: money. Mental disorders cost about $2.5 trillion worldwide in 2010 and are projected to cost $6.0 trillion by 2030. The cost of mental disorders is greater than the cost of cancer, diabetes, and respiratory disorders combined (NIMH, 2011). Also, mental health

problems are more prevalent than one may think. Approximately 1 in 5 adults experience mental illness and approximately 1 in 25 adults experience serious mental illness (NIMH, 2015). That is 4% of our population, which may not seem substantial, but if you consider the effect one person's mental health can have on others around them - all of the friends and family members affected by something like suicide - that percentage grows.

We know that interior environments have a profound impact on our well-being. Poor ventilation and toxic building materials can lead to and/or exacerbate respiratory infections and inflammation; elevators and cubicles can reinforce a sedentary lifestyle; and poor interior lighting can disrupt hormone regulation, affecting alertness and sleeplessness. Poorly designed interior spaces can also attribute to irritability, depression, and reduced productivity. Office furniture moguls such as Herman Miller and Knoll have done extensive research on human wellness in the workplace because they understand that furniture design and comfort affects how employees feel and perform, which in turn affects productivity and profit.

Human wellness in the built environment is also being addressed at the federal level. Professor Kevin Van Den Wymelenberg recently testified before the U.S. House Transportation & Infrastructure Subcommittee on Economic Development, Public Buildings, and Emergency Management. In his testimony, he explains that it is not enough to simply construct and retrofit federal buildings to be energy efficient. For the United States to significantly reverse our energy consumption trend, we must also address human health and wellness. Van Den Wymelenberg urges that for our buildings and cities to be resilient and sustainable they must be designed holistically:

"Survivability is critical during an extreme event, but for a more comprehensive understanding of resilience on a day to day basis, we really need a vision of "passive thrive-ability", or environments that improve human productivity and health outcomes while using less energy and approaching net-zero energy performance."

(Kevin Van Den Wymelenberg, "Efficiency and Resilience in Federal Building Design and Construction", 2019, p. 2)

There are many factors that lead to emotional distress and mental illness. Often time our buildings are not even a direct cause for this. Architecture alone is not going to solve the mental health crisis, but the built environment in which we live and spend the vast majority of our existence is a major factor. As a soiceity shouldn't we use all the tools at our disposal to improve the way we live and exist?
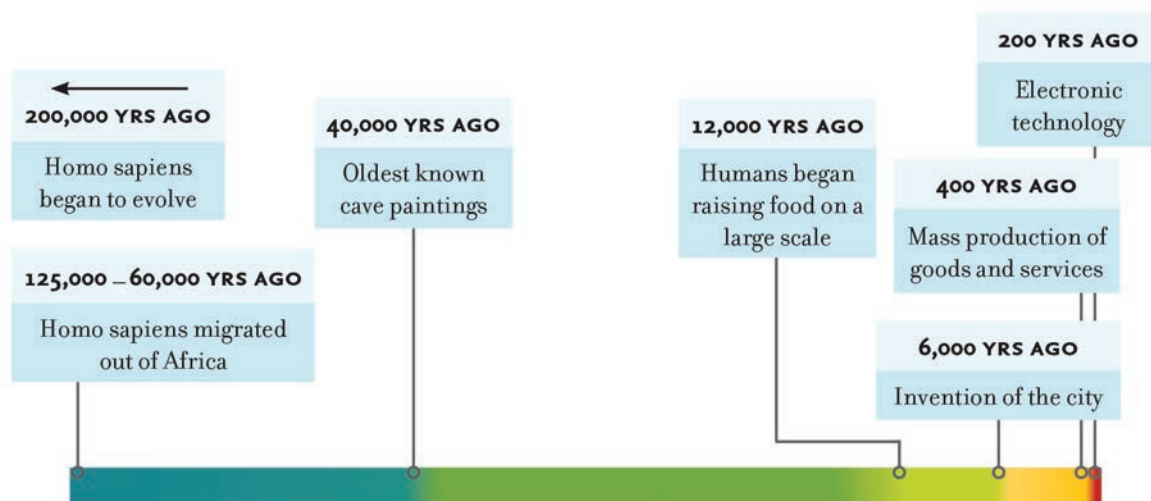
Human Perception + Cognition

But how do you design for mental wellness in a way that works for everyone? How can we make generalizations about what kind of spaces make a person feel good when everyone is so different? The reality is we are not that different when it comes to our ideal habitat. Yes, we come from many different backgrounds and cultures, giving us different experiences, which contribute to varying and changing personal tastes. However, as human beings, we are more alike than we are different. For one, we all experience and move through the world similarly, or at least more similarly than compared to a starfish or house fly. Most able-bodied humans stand on two legs between 5 and 7 feet tall and walk upright. We see the world with two eyes located in our head, which also houses our ears, nose, and mouth. These generalizations are what drove the dimensions of steps, doors, counter heights, and the like because they conform to the anatomy of the average human body. Like our bodies, our minds also are similar in how they function.

Why do we think the way we do?

Humans began to evolve 200,000 years ago; 12,000 years ago we began raising food on a large scale, and it was also around this time we abandoned our nomadic lifestyle and began constructing our environments. However, our brains evolved primarily while we were hunter-gatherers and living in a natural environment. Despite this, we now spend the vast majority of our lives, up to 90%, in artificially constructed environments (Kellert, Calabrese, 2015).

Even though we no longer face the same struggles and threats as our hunter-gatherer ancestors, we have many of the same instincts, such as our innate need to be connected to nature (Kellert, Calabrese, 2015). This hypothesis, developed by biologist E.O. Wilson, has been widely accepted by many other environmental theorists, architects, and even material suppliers such as Interface, Inc., an international commercial carpet manufacturer that is actively trying to incorporate biophilic design principles into their product line and educate their clientele on the theory.

Studies have shown that simply having a view of nature can have significant physical and emotional benefits including reducing blood pressure, heart rate, muscle tension and stress hormone production. Natural views have also been shown to reduce anger, stress, and anxiety. In the 1970s Roger S. Ulrich conducted a study in a Pennsyl-

human evolution timeline from "The Practice of Biophilic Design"

vania hospital that compared forty-six surgical patients all recovering from the same routine procedure. Half of the patients recovered in a room with a window looking at a brick wall and the other half had a view of nature. The results were unsurprising: the patients with a view of nature had a shorter recovery, fewer complications, and requested less pain medication (Ulrich, 1984).

In 1999, the Heschong Mahone Group conducted an experiment on daylight in elementary schools. The researchers compared test scores of over twenty-one thousand students in California, Oregon, and Washington. The different classrooms had varying amounts of daylight from windows and skylights. The investigators "found a statistically compelling connection between daylight and student performance" (Heschong Mahone Group, 1999, page 2). The Heschong Mahone Group discovered that students in classrooms with ample daylight performed better on standardized tests and had fewer behavioral issues than those with minimal or no natural light. In a similar study by Heschong Mahone Group, they looked at retail spaces and found that merchandise illuminated by skylights sold better than merchandise lit by artificial lights (Heschong Mahone Group, 1999).

There are many explanations for these findings (including the improved light quality from daylight), but the biggest difference between daylight and the electric lights used in these facilities is that daylight is never static. Throughout the day, daylight changes in intensity and color temperature. Even if we are not consciously aware of it, our internal clock can distinguish between cool bright light in the late morning and the warm soft light in the late afternoon, this is what gives us a sense of the time of day, even when we cannot verify the time.

A view of the sky also allows us to observe shifting weather patterns. It was crucial for our ancestors to prepare for impending storms to ensure survival. Now, storms do not carry the same threat, and many of us can instantly check the weather on our devices. However, this does not negate our deeply embedded natural instincts for survival, and we still seek things like *prospect and refuge* which is an attribute of biophilic design that explains our inherent desire to feel protected while still able to see potential threats (Kellert, Calabrese, 2015). This is why many people find it uncomfortable to sit with their back to a door or why it may feel uneasy to walk down a narrow alley where there are limited options to flee. We naturally look for patterns and associations so we can better understand and remember things. Initially, humans sculpted earthen and artificial materials to conform to their needs and improve their quality of life. However, at some point our society started simply adapting and conforming to the artificial world we created for ourselves, rather than questioning it.


an incoming storm at Canyonlands National Park

Human Perception + Cognition
Terms + Elements

Since the 1600s, the Cartesian model has been accepted as the primary model for understanding human cognition. It explains cognition as a discrete set of parts that move in a linear path starting with sensation, and continuing on to perception, imagination, feeling, memory, and finally reason. However, we now know this is not correct. Cognition is not linear but rather a web of elements, most of which are nonconscious (Goldhagen, 2017).
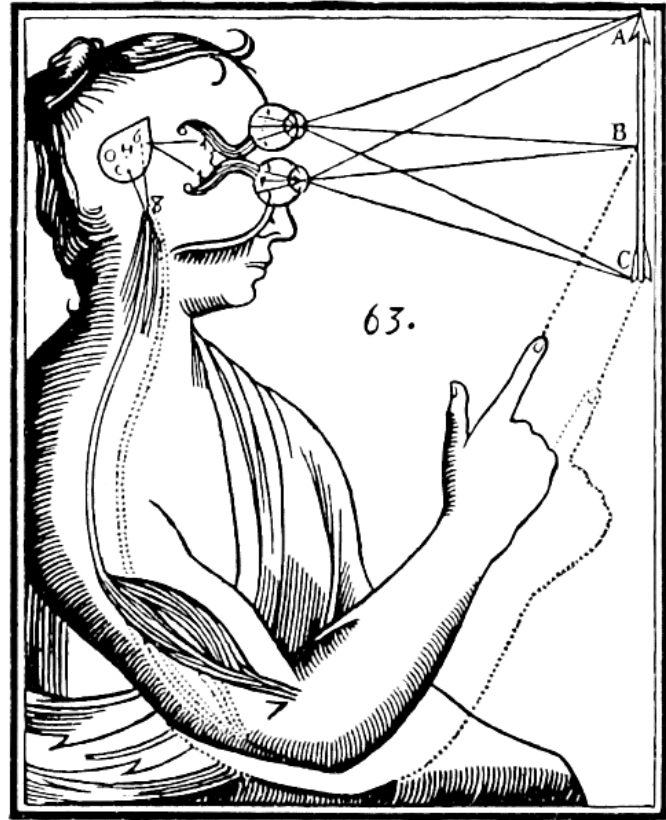
Rene Descartes's illustration of Cartesian dualism

Key Terms

Perception

Perception is the process of identifying and interpreting sensory information.

Schema

A schema is a cognitive framework that helps us organize and interpret information. This helps us determine what information is important and what we can discard. Without schemas, it would be impossible to process the infinite amount of stimuli we are exposed to at every moment.

Cognition

Cognitions often come after perception and involves higher-level brain function. Cognitions can be conscious or nonconscious and contribute to comprehension and learning.

Prime

Primes are nonconscious perceptions of environmental stimuli that can influence a person's proceeding thoughts by activating emotions, memories, and other types of cognitive associations. Primes help to streamline our perceptions by taking cues from our environment to form cognitions.

Aspects of Cognition

Nonconscious

Perceptions and cognitions that we are unaware of.

Example - gut feelings or intuition

Multisensory

Neurons from different sensory systems work together to provide a more complete perception.

Example - When we see an image of a texture, we can imagine feeling it. When we hear a sound, we can typically distinguish from what direction it came from.

Non-Logical / Associative

Developing schemas about experiences that are then transferred into other realms of knowledge and informatio*n.*

Example - associating a ceiling fan with active combat

Multimodal

As we perceive stimuli, we are simultaneously considering reactions using a combination of motor and sensory neurons.

Example - Feeling a sensation of jumping just from looking at an image of a bouncy house or the feeling of your stomach dropping just from looking over a railing and imagining falling from a high distance.
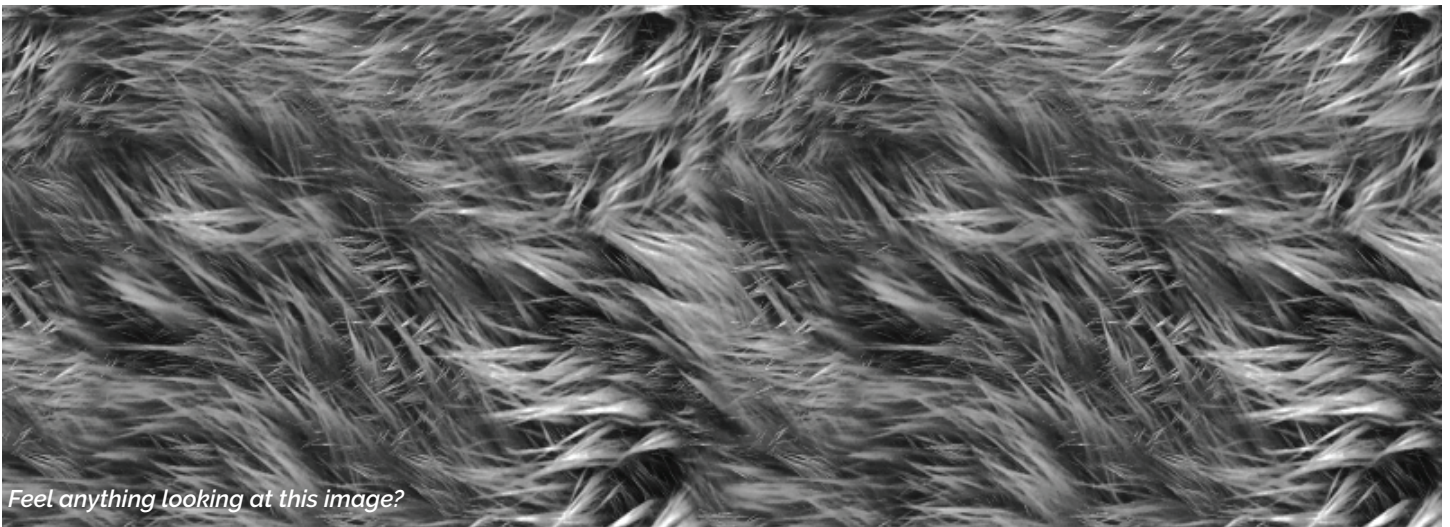
Feel anything looking at this image?
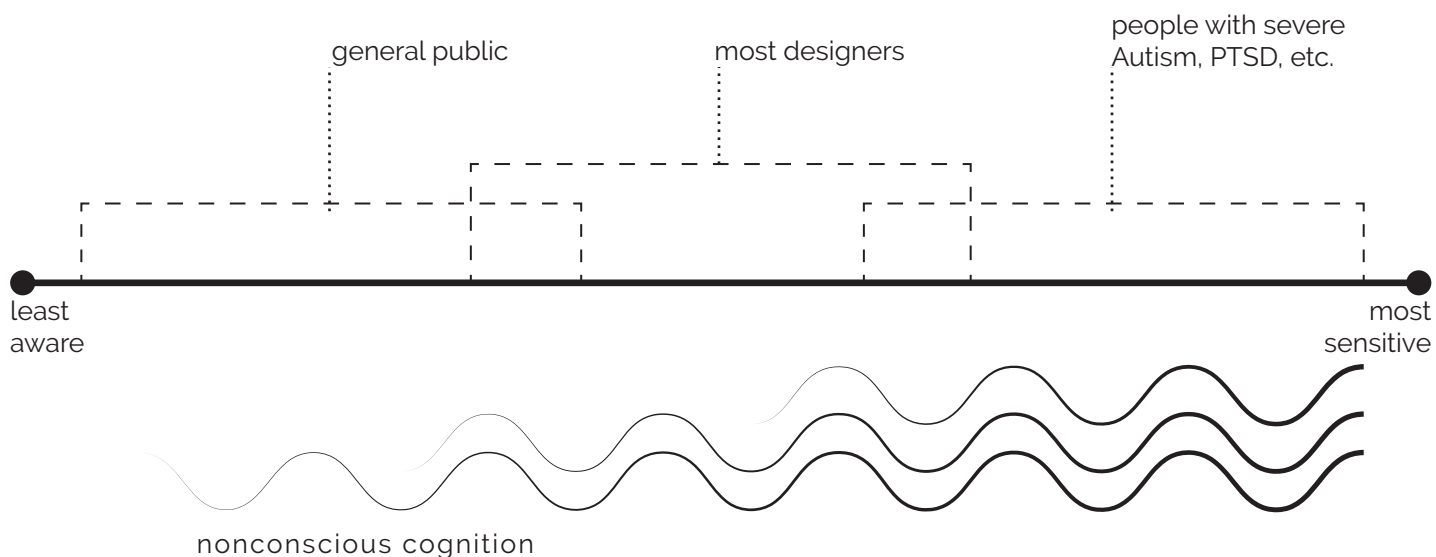
Human Perception + Cognition
In the real world:

Neuroscientists now understand that the way we think is directly influenced and impacted by the environment our body is inhabiting. We are constantly experiencing nonconscious cognition; some scientists estimate up to 90% (Goldhagen, 2017). Most of the time we are not even aware of how or to what degree our environment is affecting us. The Royal Ontario Museum, designed by Daniel Libeskind, provides an excellent example. This building is a renowned piece of contemporary architecture visited by 1.3 million people a year (ROM, 2017). Approaching the building is thrilling, not only because of its regard in the design community, but because your nonconscious cognition is likely telling you to stay away from that precariously sloping slab of metal and glass hanging off the side of that building! While our conscious mind knows this building was carefully engineered and constructed, our nonconscious cognitions are telling us to be wary.

Royal Ontario Museum, Daniel Libeskind

How we perceive our environment

general public

most designers

people with severe Autism, PTSD, etc.

least aware

most sensitive

nonconscious cognition

This type of reaction and sensation may add to the experience of visiting a museum, but what if we have this type of nonconscious cognition every time we entered our home, school or work-place? How would that affect our overall well-being? Bjarke Ingels Group (BIG) and JDS designed the VM House in Copenhagen to maximize views and daylight in the apartments and corridors. The triangular-shaped balconies were conceived to minimize shading and create a "vertical backyard community" (Ingels, 2010) but I question how much use these balconies get. From the images, they look incredibly exposed, harsh, and as if they are dangling off the side of a building. Our hunter-gatherer ancestors would likely be very hesitant to step onto a surface resembling these balconies. While our rational mind knows they are safe, our instincts tell us otherwise.

Using neuroscience to influence the design of our buildings and landscapes does not only benefit the neuro-atypical, but everyone. While some people are very sensitive to, and cognizant of their surroundings, not everyone is consciously aware of how their environment is affecting them.

VM House, BIG & JDS

VM House, BIG & JDS

VM House, BIG & JDS

Methodologies for Mental Health Facilities

Design Guidelines

The Practice of Biophilic Design
Stephen Kellert, Elizabeth Calabrese

Biophilic Design is a growing theory that addresses humans' innate need to be connected to nature and the importance of creating built environments that coincide with human needs and desires from an evolutionary standpoint.

Designing the Built Environment for Recovery from Homelessness
Michael J. Berens

This guideline relies heavily on trauma-informed design because homelessness is a traumatic event, both physically and emotionally. When designing spaces for the previously homeless, it is crucial to create a calming space that gives inhabitants a sense of empowerment and dignity as well as reinforces their own sense of safety,

Design for Mental + Behavioral Health
Mardelle McCuskey Shepley, Samira Pasha

This guideline is specifically for mental health facilities such as psychiatric hospitals, and inpatient and outpatient treatment centers. Their methodology emphasizes users' experience, specifically the importance of patient personal space, privacy, and control as well as safety and supervision.

Biophilic Design	Direct Connection to Nature	Natural Materials + Colors	Natural Light + Air	Natural Shapes + Forms	Information Richness	Age, Change, + Patina of Time	Biomimicry
Home-lessness	Aesthetics	Color	Crowding	Empowerment	User Control	Home/Sense of Place	Order/ Arrangement
Mental Health	Personal Space + Density	Choice + Control	Sensory Conditions	Spatial Clarity + Organization	Comfortable + Homelike Conditions	High-Quality, Well Maintained	Positive Distraction
Autism	Acoustics	Spatial Sequencing	Escape Space	Compartmentalization	Transition Zones	Sensory Zones	Safety
Dementia	Clearly Defined Spaces	Increase Light Levels + Reduce Glare	Material Color + Tonal Contrast	Stronger Colors	Intuitive Wayfinding	Acoustics	Connection to Nature
WELL	Acoustics	Thermal Comfort	Furnishings	Light Quality	Air Quality	Cleanliness + Maintenance	Layout
LBC	Access to Fresh Air + Daylight	Indoor Air Quality	Direct Connection to Nature	Indirect Connection to Nature			
LEED	Air Quality	Safety	Acoustics	Cleanliness	Low-emitting Materials	Thermal Comfort	User Control

Autism ASPECTSS Index
Magda Mostafa

Mostafa's design guideline is specifically for schools for children with autism. In this, she outlines seven key design principles which aim to create predictability and routine for the students and provide an appropriate level of sensory stimulation.

Designing for Dementia:
creating a therapeutic environment
Annie Pollock, Liz Fuggle

Methodologies for designing spaces for people with memory loss focus on intuitive wayfinding, spatial perception, and safety.

Building Standards

WELL Building Standard
International WELL Building Institute

This standard integrates scientific and medical research and literature to create spaces that foster mental wellness.

Living Building Challenge
International Living Futures Institute

The Health and Happiness Petal of the Living Building Challenge (LBC) focuses on access to fresh air and daylight.

LEED v4
U.S. Green Building Council

Aspects of LEED V4 that pertain to human wellness are primarily air quality and daylight as well as user control and connection to nature.

Prospect + Refuge	Organized Complexity	Integration of Parts into Wholes	Transitional Spaces	Mobility + Wayfinding	Cultural + Ecological Attachment		
Privacy	Safety/ Security	Layout + Perception of Space	Wayfinding	Connection to Nature	Lighting	Limit Visual Clutter	
Social Interaction	Access to Nature + Daylight	Safety	Supervision				
Cleanliness + Maintenance	Clear Lines of Sight	Limit Visual Clutter	Sensory Cues	Homelike			
				The matching colors represent similarities between the different methodologies			
Light Quality	Daylight	Connection to Nature					

Section 2:

case studies

Case Studies

Sweetwater Spectrum

Location - Sonoma, CA
Architect - LMS Architects
Building Type - Housing
Year Completed - 2011
Size - 16,500 sqft

Bud Clark Commons

Location - Portland, OR
Architect - Holst
Building Type - Homeless
Shelter/Housing
Year Completed - 2011
Size - 107,000 sqft

Chartwell School

Location - Seaside, CA
Architect - ehdd.
Building Type - School
Year Completed - 2006
Size - 21,000 sqft

Design Process Analysis

The spider graph at the start of each case study illustrates which design strategies were used most, with points further from the center representing more use. These graphs were generated based on conversations with the design teams.

Intuition - designing based on gut instinct

Previous Experience - using knowledge from past projects to inform the current one

Design Methodology - Using evidence-based design to inform the building

Case Study - analyzing existing buildings with a similar program, structure, conditions, etc. to learn what works and what doesn't

User Experience - working closely with clients/users to fully understand their needs, often through focus groups, observation, and design workshops
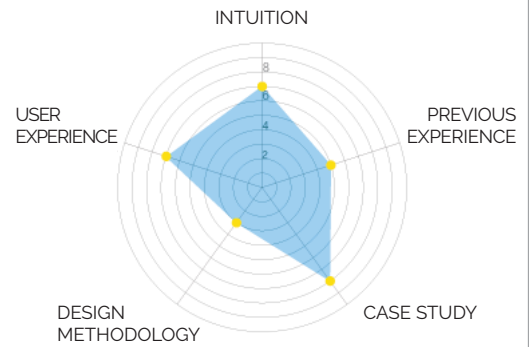
This graph shows that Case Study Analysis played the most significant roles in this design

Junction City Psychiatric Hospital

Location - Junction City, OR
Architect - HOK & SRG
Building Type - Hospital
Year Completed - 2014
Size - 222,757 sqft

image courtesy of architect

Willamette Falls Medical Center
Child + Adolescent Behavioral Health Unit

Location - Oregon City, OR
Architect - ZGF
Building Type - Hospital
Year Completed - 2016
Size - 16,000 sqft
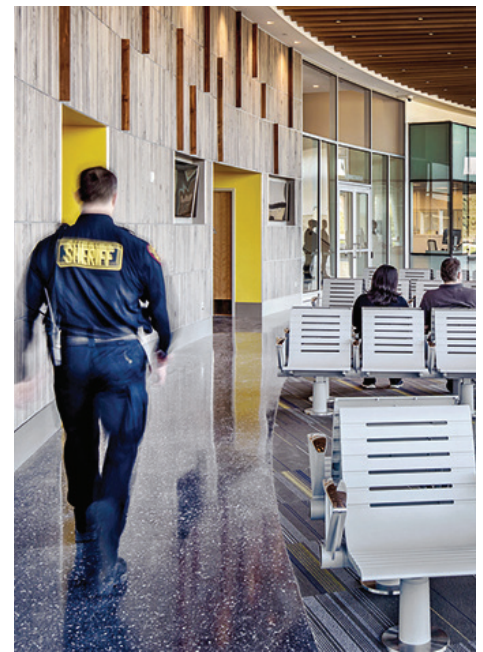
San Mateo County Maple Street Correctional Center

Location - Redwood City, CA
Architect - HOK
Building Type - Correctional Facility
Year Completed - 2011
Size - 257,000 sqft

image courtesy of architect

Sweetwater Spectrum

Sweetwater Spectrum is a co-housing community for adults with autism. The campus consists of four cottages each housing four residents as well as staff. Sweetwater Spectrum also features a therapy pool and spas, a farm and greenhouse, a community center with staff offices, an exercise room, a media center, and a large kitchen. Residents vary in their ability and level of independence. Some residents are able to leave the campus on their own to attend the local community college and work, while others need round-the-clock assistance. The mission of Sweetwater Spectrum is for residents to be able to age in place and live a "life with purpose." The intention of this project is to serve as a model for similar communities around the country.

Location - Sonoma, CA

Architect - LMS Architects

Building Type - Housing

Year Completed - 2011

Size - 16,500 sqft

Sweetwater Spectrum

Design Process

For this project, LMS Architects conducted extensive research to meet the needs of the residents, including a literature review and case study analysis. They worked closely with families, caretakers, and educators of people with autism to better understand the specific needs and challenges they face. LMS Architects also referenced a design methodology developed by ASU's Stardust Center: "Advancing Full Spectrum Housing, Designing for Adults with Autism Spectrum Disorders". This framework illustrates best practices ranging from spatial organization to material specification.
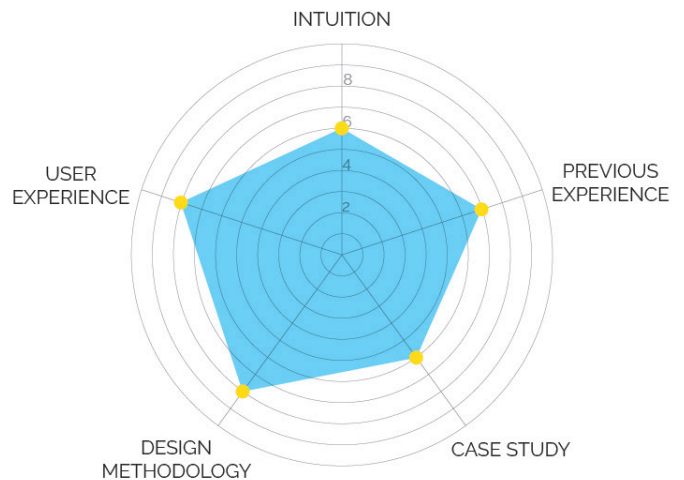
Key Findings

Connection to Nature (Direct + Indirect)

The campus is deeply connected to nature both directly and indirectly. The mild weather in Sonoma allowed the design team to create a variety of outdoor spaces that can be enjoyed year-round. The landscaping was carefully considered to create a vibrant natural habitat full of interesting textures and varying shades of green and tan. The cottages are clad in wood siding and cement board to mimic the surrounding landscape of Sonoma, and the interior spaces feature extensive wood paneling, earth tones, ample daylight, and fresh air.

Transitions + Spatial Organization

From the moment a resident enters the campus, they pass through various "transition zones" as they move from a very public space, such as the street, to increasingly more private zones. The trellises at either end of the campus act as a transition portal; they are not intended as a place to stay but rather signify to the resident that they are moving from a public realm into a semi-private one. The shade and sense of enclosure provide visual and sensory cues. The cottages use a similar technique by separating the living space and bedroom with a corridor. Often, architects seek to minimize hallways because they can be considered a waste of space. However, they can also provide an excellent buffer and transition zone from more public living areas. Bedrooms directly off the living room or kitchen may feel too overwhelming to residents, who may be hesitant to leave one's room knowing there are people and activities occurring directly on the other side of the door. The hallway provides a transition space for the resident to re-acclimate to a change in privacy levels and adapt to what may be happening beyond their bedroom.

Typical Residence Floor Plan
image courtesy of LMS Architects

1. Entry Court
2. Porch
3. Entry
4. Staff Office
5. Hall
6. Bedroom
7. Bathroom
8. Closet
9. Skylight Above
10. Laundry Room
11. Staff Bathroom
12. Dining Terrace
13. Kitchen / Dining Room
14. Living Room
15. Terrace
16. Utility Room
17. Bio-swale.

Wayfinding

The four cottages are nearly identical in their design. This is to create predictability for the residents when they visit each other's homes and to lessen the disturbance if someone has to move to another cottage. Because the homes are so similar, it was important to clearly differentiate them with an accent color and distinguishing letter. Using a combination of symbols and colors makes wayfinding more effortless for everyone, but is especially helpful for people with language-based difficulties. The visual and sensory cues throughout the campus, such as the transition zones, help with developing intuitive wayfinding.

Sensory Experience

When designing for people with autism or other sensory processing disorders it is crucial to carefully consider the sensory environment. Sweetwater Spectrum strategically used only muted colors, textures, and patterns so as not to over-stimulate the residents. However, it is also important not to create a space devoid of any visual stimulation. Naturally occurring textures and patterns are often favored over artificial ones for the biophilic properties.

The design team employed a combination of low windows and high clerestory windows to ensure plenty of cross ventilation and an even distribution of daylight. Acoustic panels are hidden behind the slat ceiling to minimize reverberation while maintaining a homelike appearance.

User Experience + Control

Sweetwater Spectrum features *sociopetal* and *sociofugal* seating arrangements inside the cottages and outside. Sociopetal spaces support socialization while sociofugal spaces are more reclusive. Providing a variety of spaces increases the resident's sense of empowerment because they have the choice as to what type of space they would like to occupy.

To further increase the resident's sense of control and empowerment, the layout of the cottages and community center were carefully considered to ensure residents were able to "preview" a space before they entered it. Sidelights, half-walls, and careful consideration of sightlines ensured that residents could view a space, and the activities occurring there, before entering the room and thus committing to participating. The campus also features many peripheral spaces so that residents can choose their own level of socialization.

Bud Clark Commons

Bud Clark Commons is a single building with three programmatic elements to help serve people in Portland, Oregon experiencing homelessness. The structure consists of an overnight men's shelter with ninety beds, a coed day-use center that provides free access to services such as counseling, a hygiene center, and PO boxes, and on the upper floors, low-income permanent housing. For this case study, I analyzed the shelter and day center.

All interior images courtesy of Holst

Location - Portland, OR

Architect - Holst

Building Type - Homeless Shelter/Housing

Year Completed - 2011

Size - 107,000 sqft

Bud Clark Commons

Design Process

When Holst acquired this job, they had little experience designing for vulnerable populations. Up until that point, their housing portfolio consisted of market-rate apartments and condos. Because of this, the design team relied heavily on case studies and community involvement to conduct a thorough analysis and develop the project's driving principles. The team spent over 6 months analyzing case studies, attended over 30 community meetings and volunteered at the existing shelter regularly. This research, coupled with their extensive knowledge and experience designing market-rate housing, gave them a fresh perspective on how to tackle this type of project. The Holst team also incorporated biophilic design principles for added physical and emotional wellness among guests and staff.

INTUITION

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USER
EXPERIENCE

PREVIOUS
EXPERIENCE

DESIGN
METHODOLOGY

CASE STUDY
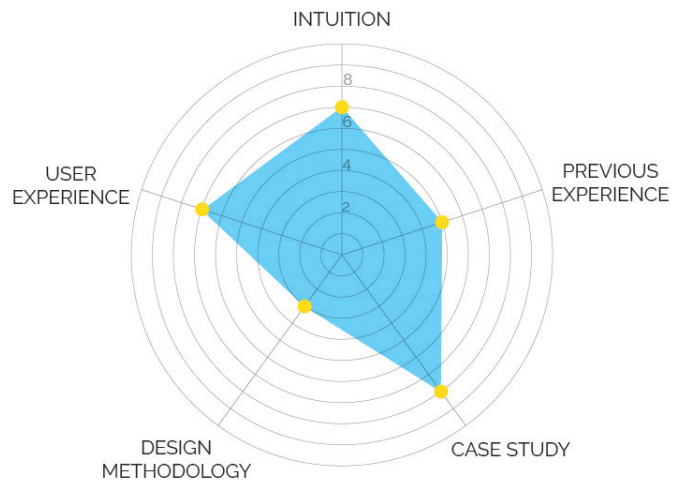
Key Findings

Connection to Nature (Direct + Indirect)

Natural features include ample daylight from at least two directions in all major spaces. The sunken courtyard, entry courtyard and garden balcony all provide views of nature. Natural materials and patterns are used throughout, including wood wall paneling, wooden slat ceilings and half walls, green accent colors, and hexagonal ceiling tiles. Board formed concrete and a variation of green tones on the facade provide further connections through texture and color.

Wayfinding + Spatial Organization

The building serves three separate functions, an overnight shelter, a day-use center, and housing, which complicates wayfinding. Holst's design solution was to provide each function its own entry each on a different street face. This streamlines access and alleviates the burden on staff to monitor a single entry point. Daylight throughout the major spaces and corridors, as well as an atrium and interior windows, help orient users. The floor plan in the shelter is very intuitive which is crucial so as to reduce potential agitation in users, especially those who may be unfamiliar with the facility or have impaired wayfinding abilities.

Attention to Detail / Non-Institutional

Before this project, Holst did not have any experience with low-income housing or low-income spaces with this type of program. Instead, they brought their expertise in designing high-end multifamily housing to this project. This led them to use alternative finishes; rather than the typical FRP (fiberglass reinforced plastic) wainscoting and acoustic ceiling tiles, wood panels on the walls and slats on the ceiling reduce the institutional feel. Instead of the linoleum or carpet tiles which are typical in these facilities, a raw concrete floor offers durability and a contemporary and industrial aesthetic.

Cleanliness + High Quality

Despite being seven years old, the interior and exterior spaces still feel new. The wooden wall panels age well and are easy to refinish, and the concrete floor shows very little wear. Since opening, the building has required minimal maintenance due to user abuse or error. Most maintenance has been related to plumbing issues in the apartments and at the time of my visit Bud Clark Commons had experienced only one instance of vandalism since opening.

Safety: Actual + Perceived

The safety of staff and guests was one of the top priorities for this project. It is vital that the public spaces in this building are not only safe but also feel safe for the users. Clear lines of sight throughout the building make it easy for staff to monitor the common areas and makes the space more comfortable for guests. The wood slat screen in the men's shelter provides privacy from the street without obstructing views. However, the staff has found the slats do not provide the residents enough privacy from the street to feel comfortable, so they often leave the shades down. An additional screen on the window could alleviate this issue. When developing the floor plan, the design team was careful not to create any potential hiding places so to ward off unwanted behavior or activities.

Chartwell School

The Chartwell School is a K-12 private day school for students with language-based learning differences, such as dyslexia. The school has about 90 students and sits on 60 acres near Monterey Bay. Along with traditional classrooms, the school features a multipurpose room, outdoor recreation space, and maker-spaces for ceramics, robotics, and STEAM (science, technology, engineering, art, math)-related curriculum.

Location - Seaside, CA

Architect - ehdd.

Building Type - School

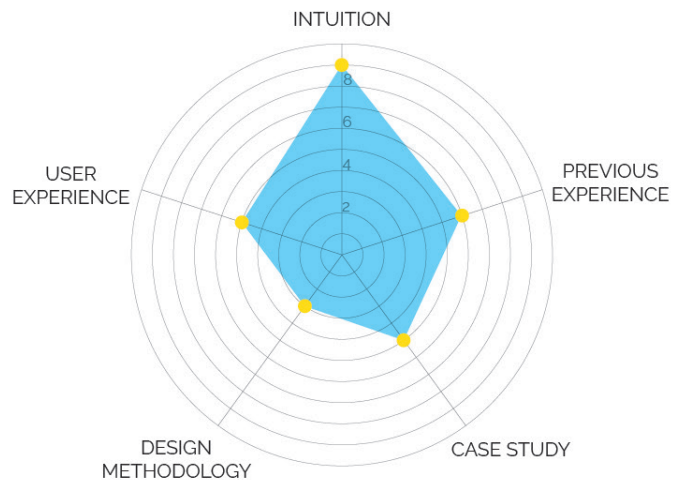Year Completed - 2006

Size - 21,000 sqft

Chartwell School

Design Process

The design team relied heavily on their past experience, intuition and client direction. The school had done extensive research already and had a very clear sense of what they wanted for their new campus.

Key Findings

Transitions + Spatial Organization

The goal of the school in both the design of their campus and academics is to balance students' weaknesses and strengths. The program director, John Langrill, explained that many special needs programs focus entirely on students' weaknesses (which are often math, reading, and writing) while excluding their strengths. At Chartwell, they focus on these areas but also foster students' interests in athletics, the arts, robotics, and vocational skills. The design of the school supports Chartwell's mission by making the sports fields, the stage in the multipurpose room, and studio classrooms very prominent.

The hallway is fairly narrow and dimly lit compared to typical schools, making it feel very tranquil compared to the bright, day lit classrooms. This physical difference help students transition between classes and activities. This is especially helpful when students are switching from a high stimulus activity such as PE to a high concentration task such as reading or math.

Connection to Nature (Direct + Indirect)

The Chartwell school has a deep connection to its surrounding nature both in terms of its physical environment and the school's curriculum and culture. The campus takes full advantage of Seaside's mild weather by providing ample outdoor space, including the basketball court, gathering areas, and about half of the school's circulation, meaning that students spend a considerable amount of time outdoors every day.

Given the location of Chartwell's campus, creating a direct connection to nature was very easy. The surrounding oak groves provide spectacular views and assure daily wildlife viewing.

Daylight was a crucial element of the design because of its visual and non-visual human benefits. Most major spaces throughout the school have daylight from at least two directions making electric lighting nearly unnecessary.

The design team employed natural finishes and earthy colors throughout the interior and exterior spaces further connecting the students to nature.

Wayfinding

While people with dyslexia often have strong spatial awareness, they can struggle with direction and orientation. The cardinal directions are embedded in the plaza at the school's entry to help orient students to their surroundings. The expansive views from the classrooms further develop this understanding of spatial organization and connection to the surrounding world.

The main building has a central node connecting the hallways of the two wings. The area serves as a landmark and a place for students to reorient themselves. The timber post, wood paneling, and skylight differentiates this zone from any other in the school.

Sensory Experience + Comfort

Students' sensory experience and comfort was a top priority in this project. Thermal, visual, and auditory comfort is important in any building but is vital for special needs students who may be easily distracted or hypersensitive to sensory stimuli. North-facing windows combined with south-facing clerestory windows and skylights ensure the classrooms are lit evenly and that overheating and glare are kept to a minimum. The combination of operable windows with operable skylights or clerestory windows enhances natural ventilation. In cases where the windows are closed, each room has a small fan with its own CO_2 sensor to ensure the students and teachers always have fresh air. Acoustic needs are met by discretely covering the walls and ceiling with sound-absorbing panels to reduce reverberation without diminishing sound quality. In a post-occupancy study conducted by UC-Berkeley's Center for the Built Environment (CBE) users rated their level of satisfaction for air quality, thermal comfort, and lighting at 99%, 98%, and 92%, respectively (Center for the Built Environment, 2009).

Connection to Place

Walking trails snake through the campus' oak groves and provide an outlet for not only the students but for their parents as well. Most of the students commute an hour or more, and the trails give the parents something to do rather than heading home immediately. The trails also help foster relationships among the parents.

Many of the materials throughout the school were salvaged from the site, including the timber posts and the wood sliding doors in the multipurpose room. This helps instill a sense of heritage amongst the students and staff.

The Chartwell School is highly efficient and employs passive strategies and active technology to keep its energy and water consumption extremely low. These systems are expressed and displayed throughout the building to serve as a teaching opportunity for the students.

The design team was very intentional in expressing the sustainable systems. What was less intentional, but equally beneficial, is how visually expressive the structural components of the building are. Rather than concealing the structure, the design team celebrated it and drew attention to it. Studies have shown the people feel more at ease in built environments where they can easily discern how the building is constructed (Goldhagen, 2017). The visible truss in the classrooms and multipurpose room and bolted connections in the timber column cue the building occupants into how the structure is held up; the clear parts and connections subconsciously put users at ease.

Junction City Psychiatric Hospital

Oregon State Hospital (OSH) provides two locations for psychiatric inpatient care, one in Salem and the other in Junction City. The new Junction City campus can serve up to ninety-six patients and features patient housing, indoor and outdoor recreation areas, as well as staff offices, and counseling and treatment rooms.

All images courtesy of HOK & SRG Partnership

Location - Junction City, OR

Architect - HOK, SRG Partnership

Building Type - Hospital

Year Completed - 2014

Size - 222,757 sqft

Junction City Psychiatric Hospital

Design Process

This design team was also responsible for the Salem campus renovation, and they applied the knowledge gained from that experience to phase two of OSH's master plan. Throughout the entire design process, the client and a patient advocate were heavily involved, as well as a medical planner. In addition to a case study analysis, HOK and SRG investigated the mindset of the patient to better understand their perspective and triggers. This understanding allowed them to develop a story for the design: "journey to recovery." They carried this concept throughout the design from building form to material selection.

INTUITION

PREVIOUS EXPERIENCE

CASE STUDY

DESIGN METHODOLOGY

USER EXPERIENCE

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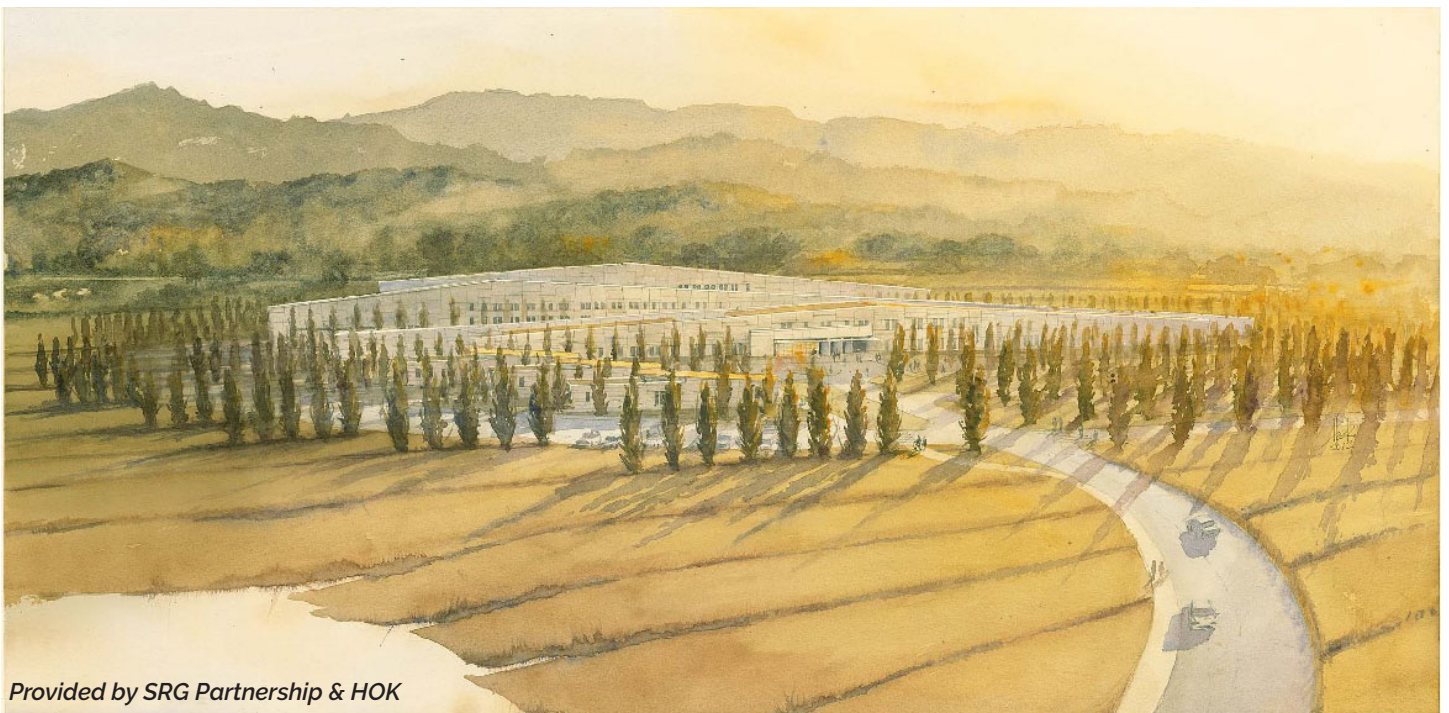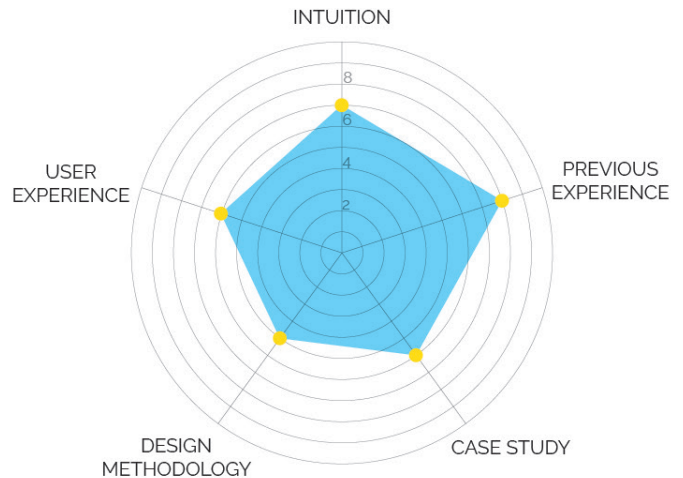
Provided by SRG Partnership & HOK

Key Findings

<u>Wayfinding</u>

A gradation of warm and cool colors aids in way-finding and helps define zones within the facility. All of the corridors have a window at the end to help orient users.

<u>Connection to Nature (Direct + Indirect)</u>

Another driving concept of the design was "the healing power of nature". The form of the building is an ode to the surrounding landscape and region's agriculture. Natural views and daylight are strategically placed throughout all of the patient and staff areas to capture the surrounding landscape. Earthy colors and natural textures and materials provide an indirect connection to the outside world. The wood slats on the walls and ceiling create an interesting and dynamic texture as the light and shadows move throughout the day. In addition, a secure screened-in porch allows patients to relax outside without leaving the facility.

<u>User Control</u>

The library has a variety of seating arrangements, some promote socializing (sociopetal) and others that are more reclusive (sociofugal). Breakout spaces along the hallways allow for less formal and spontaneous gatherings. By creating a variety of gathering spaces, the design encourages community without forcing it, which in turn empowers patients and gives them a sense of control.
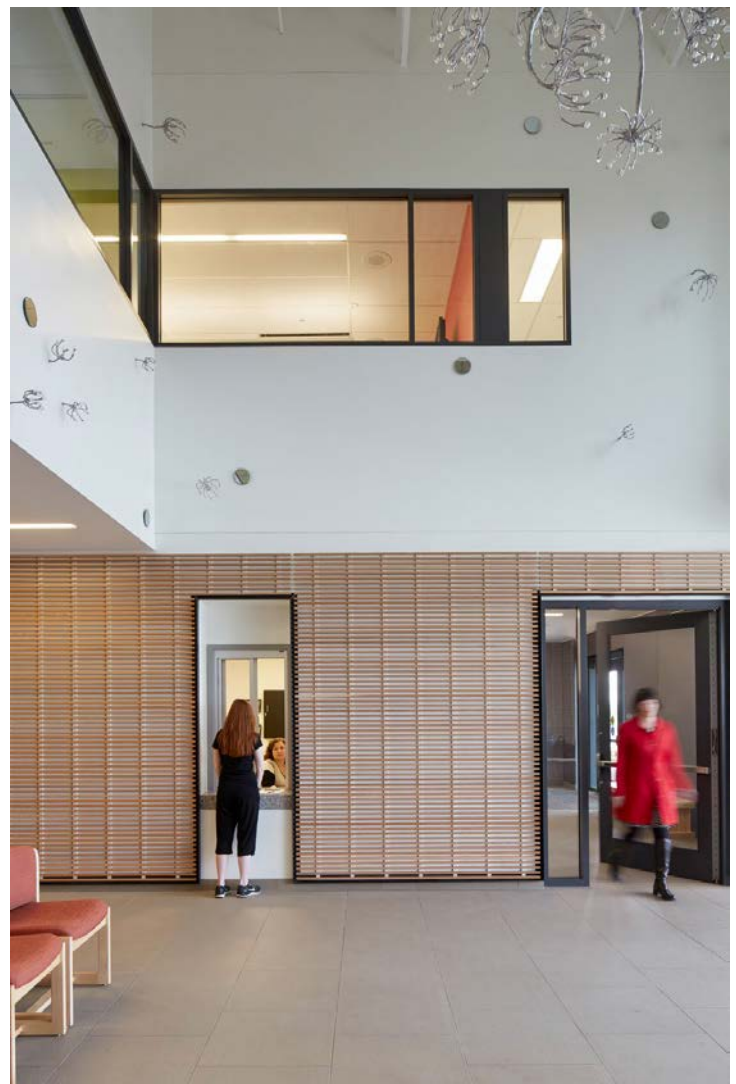
Color

The design team uses color to enhance the sensory experience. Cool colors in the bedrooms are soothing while warm colors in the treatment and public spaces help invigorate the patients. The gradation of warm to cool color through space aided in wayfinding and spatial understanding. Wood tones throughout the building introduce a warm color as well as natural texture.

Sense of Community

This design creates a sense of community not only through connecting to the surrounding landscape but also through art. A local artist worked with the architects to create a 30-foot by 10-foot glass etched window featuring poems and songs by former residents. The art piece is at the entrance of the facility, greeting people as they arrive and unifying everyone on the journey to recovery.

Homelike

The design team found their approach to this project similar to that of hospitality projects, which is likely why the end result feels more homelike than institutional. Whenever possible, they used doors made of wood rather than metal and residential looking plumbing fixtures. The bedrooms feature wood veneer casework, cork boards, and an accent wall for a more dorm-like feel. The wood slats on the lobby walls and ceiling add a unique accent and landmark to the entry of the facility.
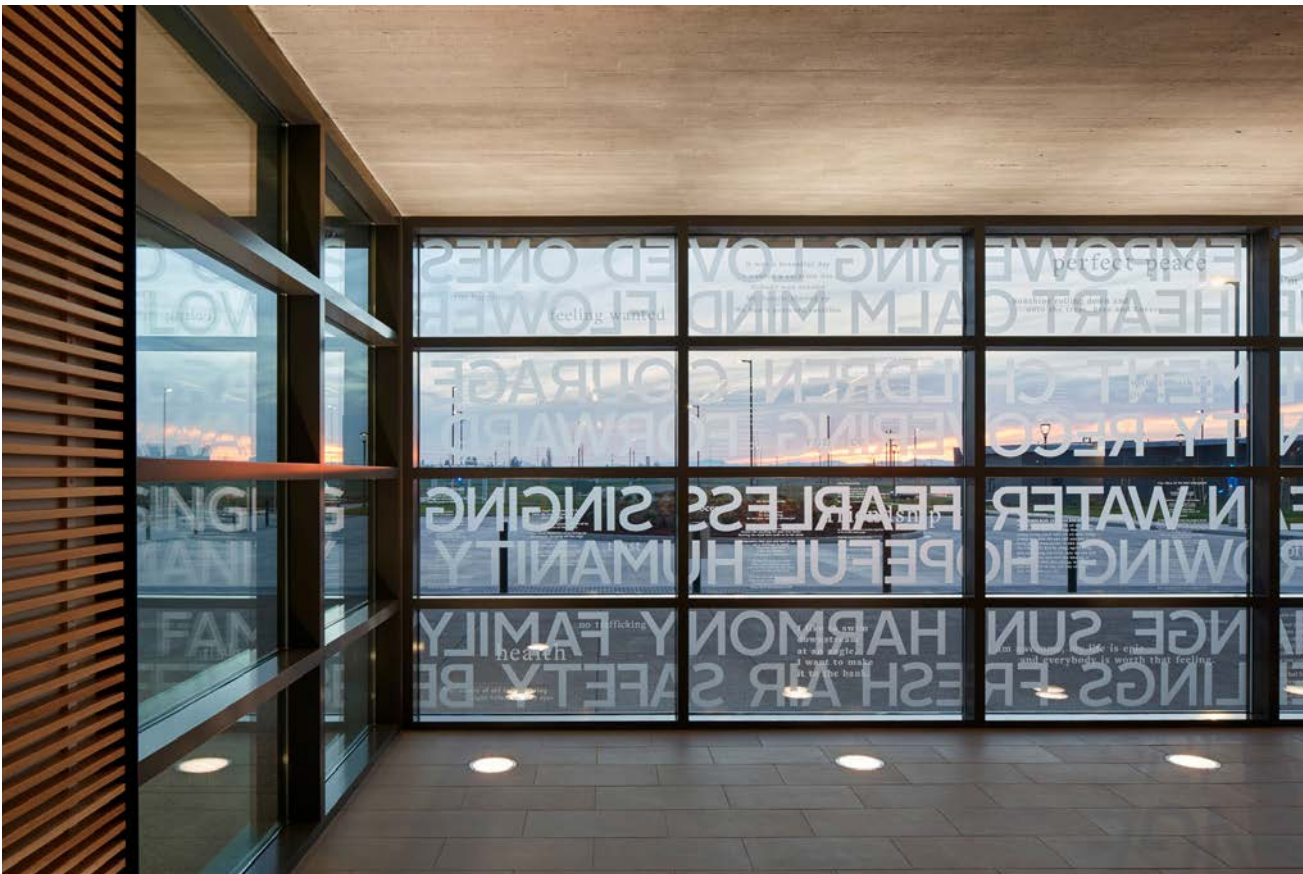
Providence Willamette Falls Medical Center
Child & Adolescent Behavioral Health Unit

The Willamette Falls Medical Center Child and Adolescent Behavioral Health Unit is one of only two facilities providing child-specific behavioral health inpatient care in the state of Oregon. The hospital has 22 beds, half of which are for children, and the remaining are for adolescent patients. A typical stay is about fourteen days; however, the hospital has had patients for as long as six months. The new unit occupies the second floor of the Willamette Falls Medical Center and features private rooms for patients, designated rooms for group activities, a classroom, a low stimulation room, a padded seclusion room, as well as an enclosed outdoor play yard on the roof.

Location - Oregon City, OR

Architect - ZGF

Building Type - Hospital

Year Completed - 2016

Size - 16,000 sqft

Providence Willamette Falls Medical Center
Child & Adolescent Behavioral Health Unit

Design Process

The design team at ZGF worked extensively with the hospital directors and staff to better understand the specific needs of the new unit. Facilities for children and psychiatric hospitals each come with particular requirements to ensure safety and security, however there are many additional factors that are only discovered from experience in those types of spaces. ZGF also utilized their extensive knowledge in healthcare design from previous experience and conducted a case study analysis.
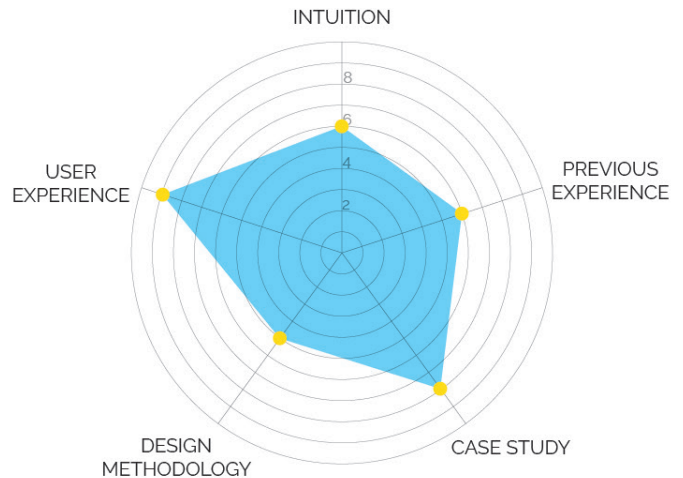
Key Findings

Connection to Nature (Direct + Indirect)

The unit provides ample connections to nature both directly and indirectly through color, texture, imagery, and materials. Illustrative and photo-realistic murals of landscapes and animals are throughout the halls and group activity rooms. While some doors were required to be metal for security purposes, most have a wood finish. The exterior shell was not altered during construction, but interior glazing and round skylights help bring daylight deep into the floor-plate. From nearly any point on the floor one can see the trees surrounding the perimeter of the building, providing a view of nature and a sense of orientation.

Homelike / Non-Institutional

Hospital aesthetics are often focused on strict sanitation and safety needs, and mental health facilities are even more restrictive. However, it is still possible to have a space that feels non-institutional and homelike. ZGF accomplished this with playful artwork, color schemes, wood doors and casework, and furniture selection. While the space has many safety features for emergency situations, it feels more like a school than a secure institutional facility.

Wayfinding + Spatial Organization

ZGF used color to assist with wayfinding. The unit is divided into three wings, two for adolescents and one for child patients. Each wing is distinguished by an accent wall color: yellow, blue and green. By painting only one side of the corridors or a single wall in a room the designers kept the halls from feeling too long and the rooms from feeling too small.

Transitions + Spatial Sequencing

A change in floor material signifies a transition from the corridor into particular rooms. This helps the patients orient themselves and anticipate a change in space, privacy level, or activity. The band of color also helps caregivers set boundaries, and patients understand boundaries. The floor plan was carefully considered and laid out to create a gradient of privacy; this is crucial not only for actual safety, but also for perceived safety by patients and staff.

Aesthetic + Sensory Experience

The designers used color, material, and texture to provide gentle sensory stimulation and a positive distraction. The finishes are a combination of warm and cool colors but are all muted so as not to be too arousing. One of the escape rooms has corduroy-textured wall panels in lieu of wainscoting to provide a more tactile experience. The circle patterns in the activity room (on the interior windows and backsplash) create a "sticky surface," as writer and theorist Sarah Williams Goldhagen would call it, meaning they draw you in and capture your attention.
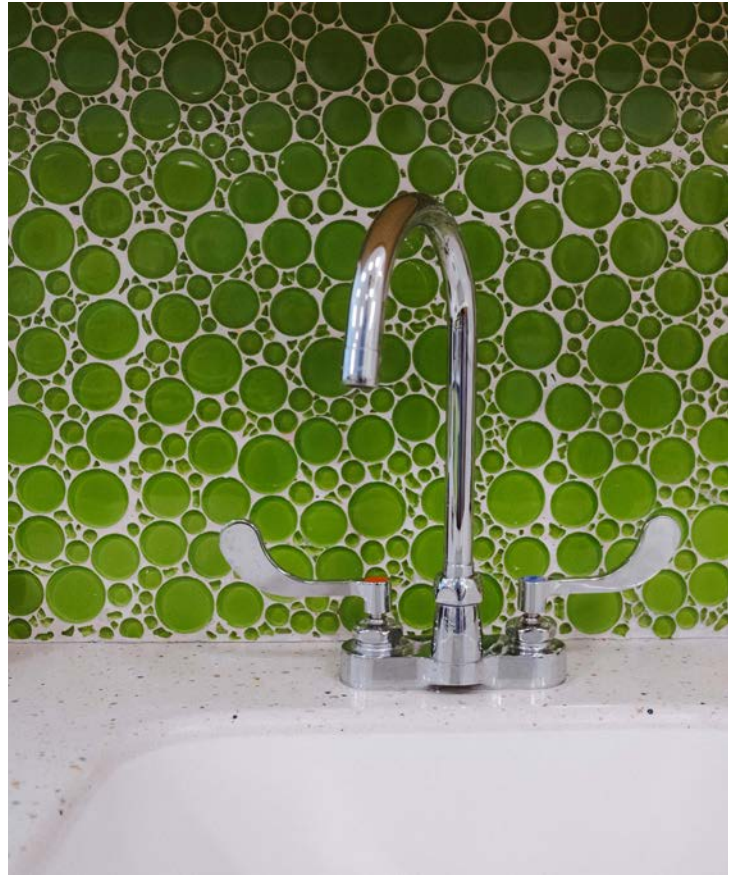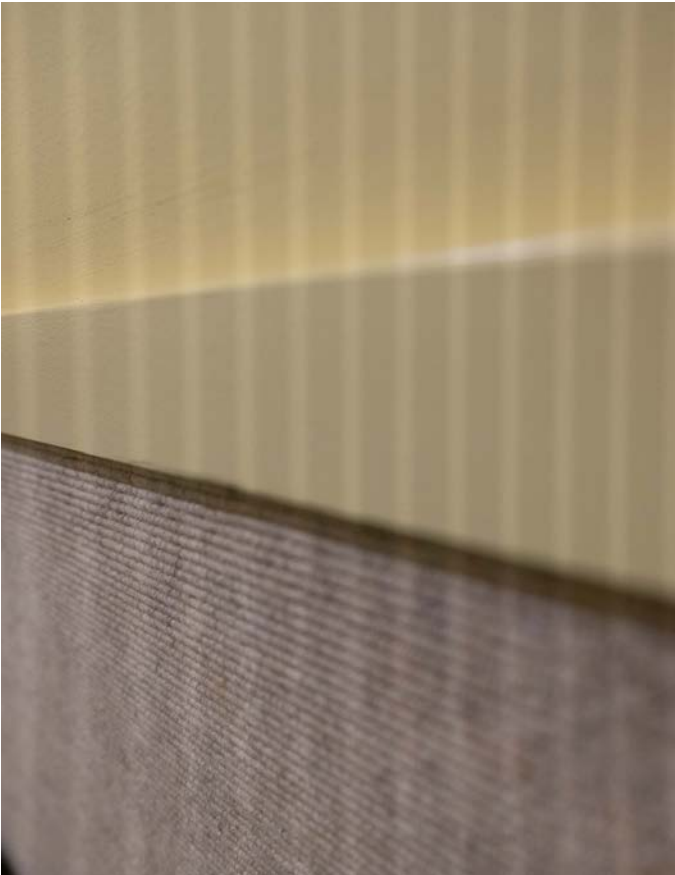
San Mateo County Maple Street Correctional Center

The Maple Street Correctional Center was the first facility to open as part of California's new initiative to move non-sexual, non-violent inmates out of over-crowded state prisons to smaller county jails. The 832-bed facility was designed with the goal of reducing recidivism by providing enrichment programs and classroom spaces. The facility also features an 88-bed transitional housing unit for inmates that are serving alternative sentencing as well as a women's psychiatric wing.

All images courtesy of HOK

Location - Redwood City, CA

Architect - HOK

Building Type - Correctional Facility

Year Completed - 2011

Size - 257,000 sqft

San Mateo County Maple Street Correctional Center

Design Process

The design team has a slew of previous experience that they used to their advantage, but they also worked closely with the warden and officers to fully understand the needs of the facility. The San Mateo County directors were very interested in incorporating neuroscience and psychology into the building design to create a space that would promote rehabilitation, reduce recidivism, and create a healthy work environment for their staff. Rather than sticking to the traditional cell layout, the design team took an innovative approach to the floor plan in order to incorporate biophilic design elements.
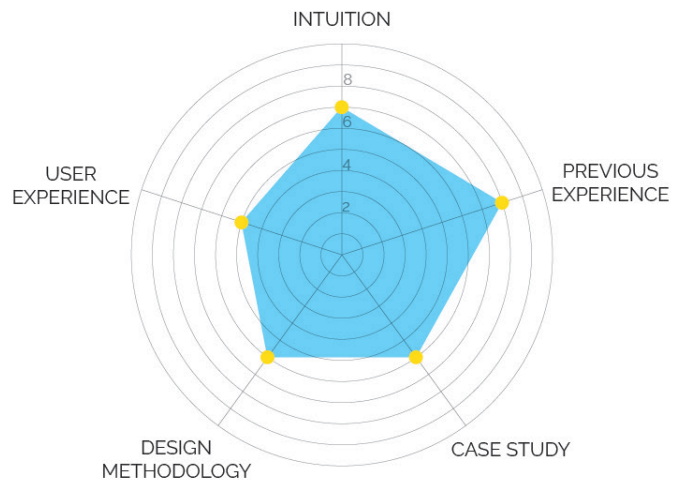
Key Findings

Building Form

When one imagines a prison or jail, we typically think of an isolated, barricaded building surrounded by razor wire. However, the Maple Street Correctional Center is located in downtown Redwood City and has no fence or intimidating demeanor. The building form is a testament to the design effort to reduce recidivism. The curving front to the building is incredibly welcoming, much like Ed Roberts Campus by LMS Architects. Curving planes are more welcoming than flat ones and tend to draw people in (Goldhagen, 2017). A welcoming building also encourages family and friends to visit and remain connected with inmates, which in turn can help inmates reintegrate with the community. For an institution with the goal of rehabilitating inmates, giving them the tools to be productive, contributing members of society, it seems logical the building would mimic that sentiment.

Ed Roberts Campus, LMS Architects

Connection to Nature (Direct + Indirect)

Most correctional facilities place individual cells around the perimeter of the building, cutting off daylight to the common areas. The design team took an alternative approach, and arranged day rooms that open into private cells along the curved-glass facade. This maximizes daylight in both the cells and common spaces, while also improving security. The secure, rooftop-level recreation yard lets inmates spend time out-doors, and throughout the facility natural colors and scenes of nature provide additional indirect connections to nature. The transitional housing wing is much less institutional and has even more natural colors, wood tones, and artwork, making it feel more like a dorm than a jail.

Color

Throughout the facility, there are mostly cool soothing colors with some warm invigorating colors in commons spaces. The pale yellow in the common space of the women's psychiatric wing is cheerful and encourages community.

Durable + Well Maintained

Durability is critical in institutional projects. If a space appears maintained, users are more likely to keep it maintained. Having an orderly and well-maintained facility helps ensure a calmer environment.

Positive Distractions

Even with an inviting building, visiting an incarcerated loved one can be very stressful. The material choices in the lobby and the mural in the playroom offer positive distractions for adults and children. The lobby and waiting area feature textured vertical planks on the wall which mimic the linear nature of the carpet tiles and wood slats on the ceiling. The yellow accent walls provide additional interest. Distinguishing the path (terrazzo floor) from the carpeted waiting area creates a sense of variety and logic. However, the most effective natural distraction is likely the view of nature and community out of the large glass facade.
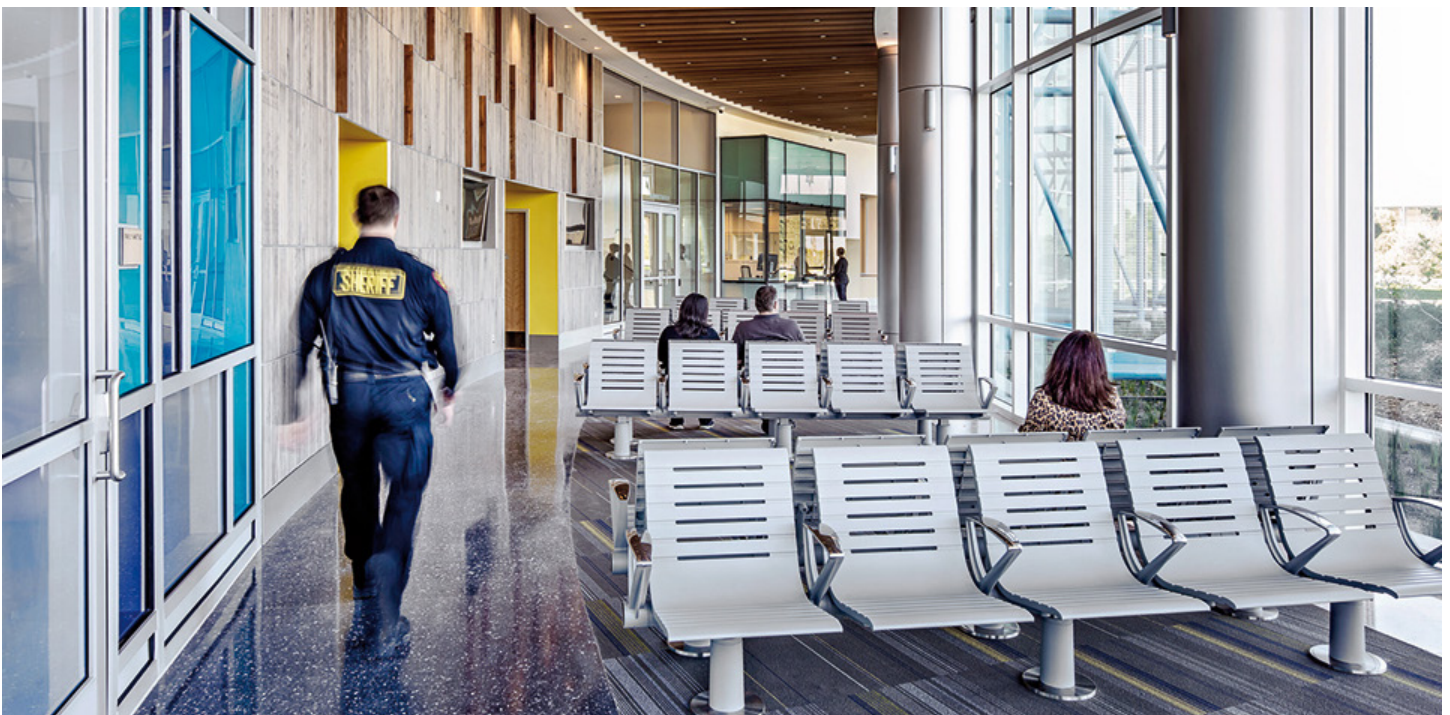
Case Studies

Synthesis of Findings

Sweetwater Spectrum

key findings:

Connection to Nature

Wayfinding

Transitions

User Experience + Control

Sensory Experience

Bud Clark Commons

key findings:

Connection to Nature

Wayfinding + Organization

Cleanliness + High Quality

Safety: actual + perceptual

Attention to Detail

Chartwell School

key findings:

Connection to Nature

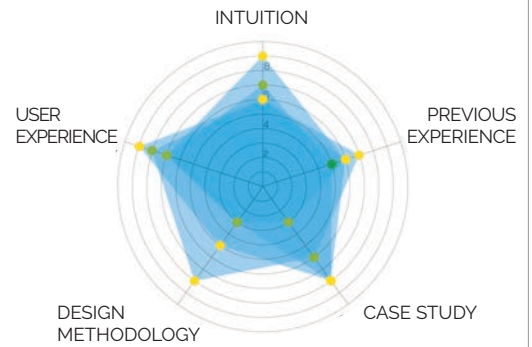Wayfinding + Organization

Transitions

Connection to Place

Sensory Experience

Design Process Analysis
Findings

Among all the case studies and design teams, the most prominent driving force for the design was user experience. Many of the firms went to great lengths to fully understand the needs of the client, residents, staff, and visitors in order to translate those needs into a building design. Conducting a thorough case study analysis was also a common tactic. Many design teams designated months just for pre-design research. Using intuition and previous experience is inherent in every project, for highly specialized projects such as hospitals, previous experience is a huge asset. Design methodologies were the least common design tool, most likely because 10-years ago, design methodologies were not very prevalent.

INTUITION
PREVIOUS EXPERIENCE
CASE STUDY
DESIGN METHODOLOGY
USER EXPERIENCE

Junction City Psychiatric Hospital

key findings:

Connection to Nature

Wayfinding

User Experience + Control

Sense of Community

Homelike

Color

Willamette Falls
Child + Adolescent Behavioral Health Unit

key findings:

Connection to Nature

Wayfinding + Organization

Transitions

Sensory Experience

Homelike
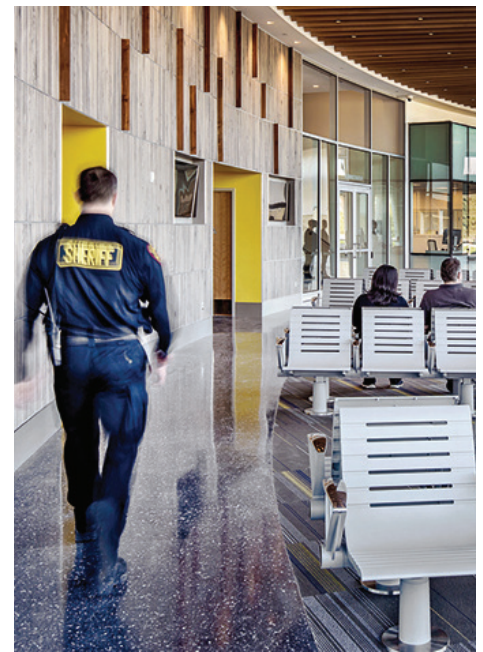
San Mateo County Maple Street Correctional Center

key findings:

Connection to Nature

Wayfinding + Organization

Cleanliness + High Quality

Safety: actual + perceptual

Homelike

Section 3:

synthesis of findings & mindful design strategies

Mindful Design Strategies

This set of *Mindful Design Strategies* compiles lessons learned from existing methodologies, neuroscience, and case studies. The intention is for this to serve not as a guideline or check-list, but rather as a series of design suggestions and considerations that can be used as part of the design process, and as a "check-in" throughout the design process to ensure design elements critical to human wellness are not lost. My hope is this report can be useful for architects, as well as students, teachers, business owners, and anyone interested in learning more about how our built environment affects how we feel.

a quick overview:

Building Form + Surface

Direct Connection to Nature

Indirect Connection to Nature

Wayfinding + Spatial Organization

Transitions + Spatial Sequencing

Human Scale

Sensory Qualities

Information Richness + Organized Complexity

Physical Comfort

Aesthetics

Homelike / Non-institutional

Color

Cleanliness + High Quality

User Experience
Connection to Place, People + Context

Clear Sight Lines + Preview Space

Social Control

Connection to Place

Celebrate the Systems

Building Form + Surface
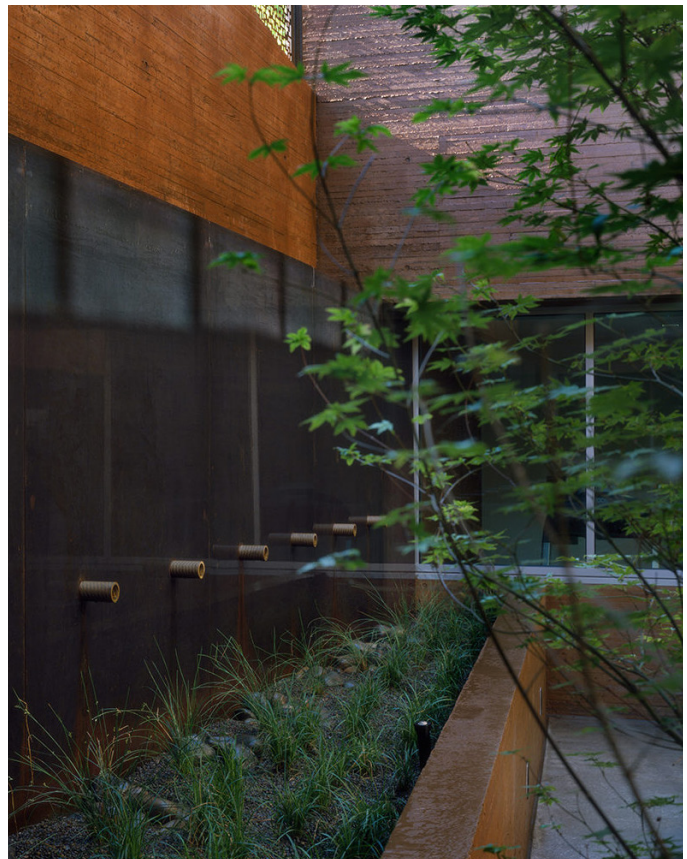
Direct Connection to Nature

A direct connection to nature means experiencing the natural world first-hand (Kellert, Calabrese, 2015). Studies show that contact with nature can have a profound emotional and physiological effect on people. It not only reduces stress and anxiety, but also decreases cortisol levels and regulates heart rate (Twohig-Bennett & Jones, 2018).

Jamison Square Park, PWP Landscape Architecture

Strategies

• Daylight and views of nature through a window
• Indoor plants
• Decorative water fountain
• Outdoor room and courtyards

Bud Clark Commons, Holst

Indirect Connection to Nature

An indirect connection to nature is a representation of the natural environment through color, form, texture, and light quality (Kellert, Calabrese, 2015). Indirect connections to nature affect people in much the same way direction connections do, and help reduce stress and anxiety. The diversity and information richness found in natural environments can also be expressed in built environments. Humans are drawn to stimulating environments that provide a wealth of information, but only if the space is coherent and does not overwhelm the users.

Bud Clark Commons, Holst

Strategies

• Art and graphics that depicts nature
• Natural materials or natural-looking materials
• Surface colors, patterns, and textures inspired by nature, such as hexagonal grids
• Specialized artificial lighting that combines dimming with color-shifting fixtures that mimic natural daylight to support circadian rhythm

*Providence Willamette Falls Medical Center Child & Adolescent Behavioral Health Unit, ZGF*

Bud Clark Commons, Holst

Wayfinding + Spatial Organization

Confusing wayfinding can cause disorientation, which can heighten anxiety and stress. Wayfinding that is clear and intuitive will aid in users feeling at ease and in control of their surroundings.

Strategies

- Wayfinding signage that utilizes color, graphics, and texts
- Views outside from corridors, especially at elevator lobbies and stairwells, where the user is most likely to be disorientated
- Landmarks to create distinguishing features
- Break large spaces up into "districts" or "neighborhoods" and use color or other distinguishing features to differentiate
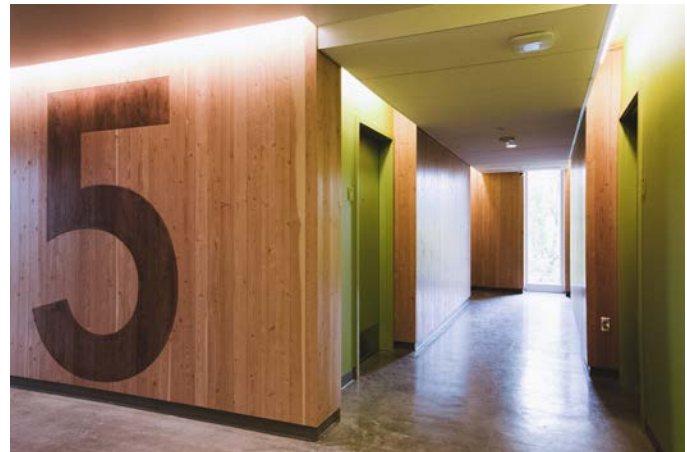
The Children's Hospital of Philadelphia, ZGF

Chartwell School, ehdd.

Transitions + Spatial Sequencing

A transition zone is a passageway allowing the user to recalibrate between spaces, often accomplished by a drastic change in the visual and non-visual sensory environment, including surface materials and the level of enclosure. Consider the sensory environment, social environment, and level of privacy in each room and how it will feel to move between rooms. A privacy gradient helps transition a person from very public spaces, such as a city sidewalk, into gradually more private zones of a building.

Strategies

- A deep door threshold or passageway with contrasting material and a low ceiling
- A drastic change in lighting such as bright classrooms and a dim corridor
- Creating a distinct sensory experience with sounds, textures, or other stimuli

Providence Willamette Falls Medical Center Child & Adolescent Behavioral Health Unit, ZGF

Bündner Kunstmuseum, Alberto Veiga & Fabrizio Barozzi

Sweetwater Spectrum, LMS Architects

Human Scale

Computer modeling has revolutionized the design process, but it has also made the process more detached. Within the digital realm, it is easy to forget how a building may actually feel to approach or walk along. Form and surface treatment have a tremendous ability to make even the largest buildings still feel relatable to human size. In Europe, many of the alleyways have proportions that few would expect to find comforting - narrow, with tall imposing walls - yet many people romanticize the confined ,winding alleyways in European cities. This is in part due to the richness of information on the building surfaces, especially at eye level. The character and layers tell a story about the people who constructed and once occupied these buildings.

Strategies

- A material change or building "step back" partway up the facade
- Natural and/or visually stimulating texture, especially at the ground plane
- Active storefronts, windows, or visually interesting features at the ground plane

Bud Clark Commons, Holst

Kneeling Windows, Michelangelo

*Rome, Italy*

Aesthetics

Homelike / Non-institutional

A homelike interior, as opposed to institutional, is one designed with care and attention to detail and materials. Whenever possible, avoid institutional looking features, such as standard acoustic ceiling tiles and FRP (fiberglass reinforced plastic) wainscoting. Often, designers resort to standard details and specifications for seemingly trivial things, such as a rubber wall base, and standard lighting and hardware. However, the essence of a "home" is human touch; the materials and details tell a story about who created it, its history and the inhabitants. A homelike / non-institutional interior does not signify any particular style, but rather careful attention to detail, through material transitions, lighting, furniture, and casework.

Junction City Psychiatric Hospital, HOK & SRG Partnership

Strategies

- Finishes such as wood paneling
- Built-in furniture or "soft" furniture
- Integrated high-quality lighting
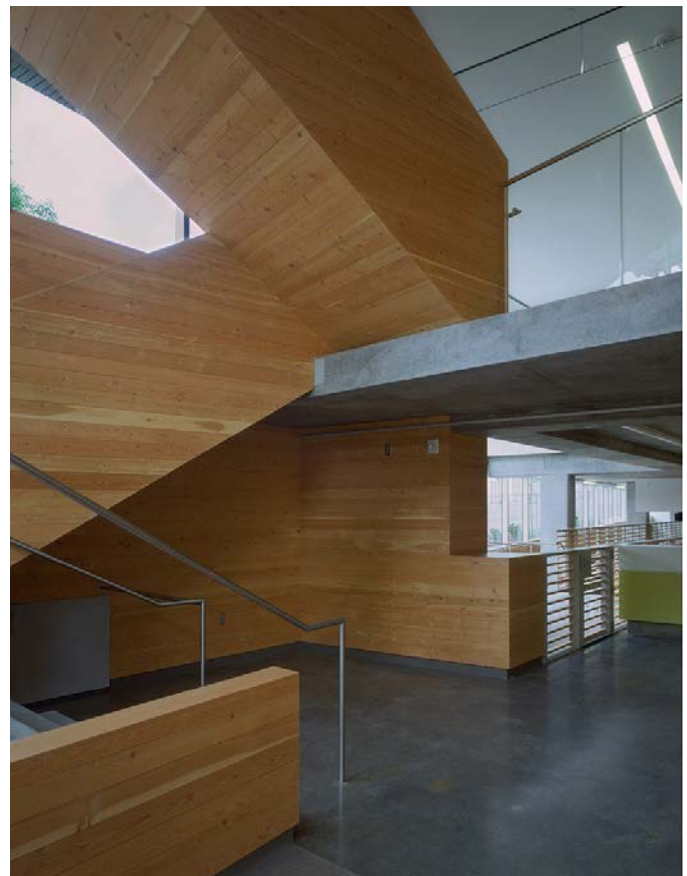
Bud Clark Commons, Holst

Color

Color is the brain's interpretation of sensations caused by certain qualities of light that the eye recognizes. Poorly chosen color in the built environment can cause stress, anxiety, headaches, and visual disturbance. Color also has the ability to create spaces that are soothing or invigorating. By understanding color theory, designers can use color to enhance a user's experience in a space (Mahnke. 2012).

Strategies

- In spaces intended to be calming, avoid stark white and saturated or dark, warm-colored walls. Stark white can be perceived as institutional and warm colors can be arousing
- Light, cool colors, as well as light pink and peach, tend to have a calming effect
- Bright colors can be used as accents to create a fun lively space
- Red and warm tones should be used in moderation and with the understanding that they are invigorating and arousing

Sanatorium, Alvar Aalto

Iowa Hawkeyes Away Locker Room
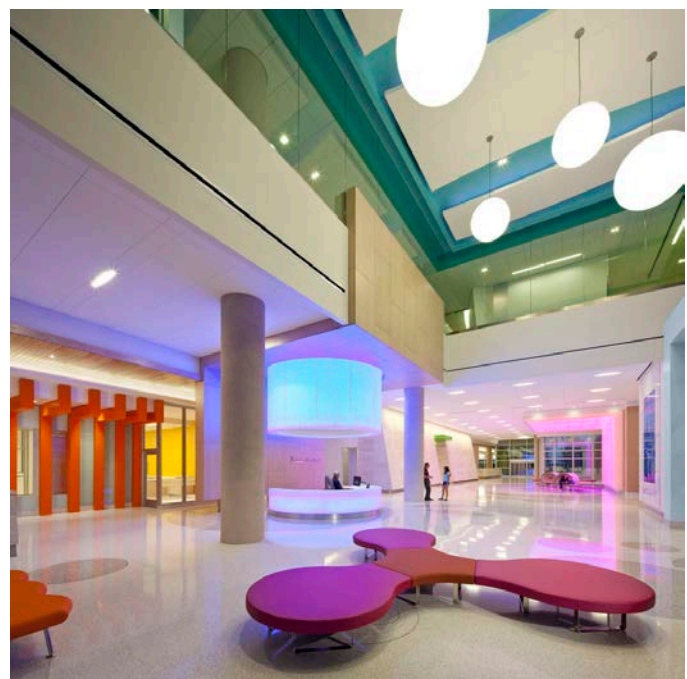
Nemours Children's Hospital, Stanley Beaman & Sears

Cleanliness + High Quality

Studies have shown that aesthetics can have a profound effect on a person's mood and well-being. When people are in a space that appears cared for, they are more likely to treat it with respect. It also instills a sense of dignity in the user (Berens, 2016).

Strategies

- Using materials that age gracefully such as wood, stone, and concrete, rather than plastic, glass, and aluminum
- While movable furniture is ideal, it should not appear flimsy or temporary
- Materials, casework, and furnishings should be durable and easy to clean so they do not show wear and tear
- Since ceilings see minimal wear and tear, they are a good place to use less durable materials, such as wood slats.

Bud Clark Commons, Holst

Junction City Psychiatric Hospital, HOK & SRG Partnership

User Experience

Connection to Place, People + Context

Clear Sight Lines + Preview Space

Building codes and current methodologies for mental health facilities focus on occupant safety, but what about perceived safety? Perceived safety is whether or not the person feels safe, regardless of a building's code compliance or robust security systems. Does the space instill a sense of calm and contentment, or does it tell our instincts to stay alert? Clear lines of sight are crucial for feeling safe because they enable us to see potential threats in the distance (Kellert, Calabrese, 2015). They also aide in spatial clarity, giving users a more comprehensive understanding of their surroundings.

Clear sightlines also foster user empowerment and control because the occupant can preview spaces before entering. This gives them the power and choice, or at the very least a chance to prepare mentally and physically for the environment they are about to enter.

Strategies

- Partitions that are transparent/translucent or visually permeable
- Half walls
- Strategically placed windows or sidelights

Providence Willamette Falls Medical Center Child & Adolescent Behavioral Health Unit, ZGF
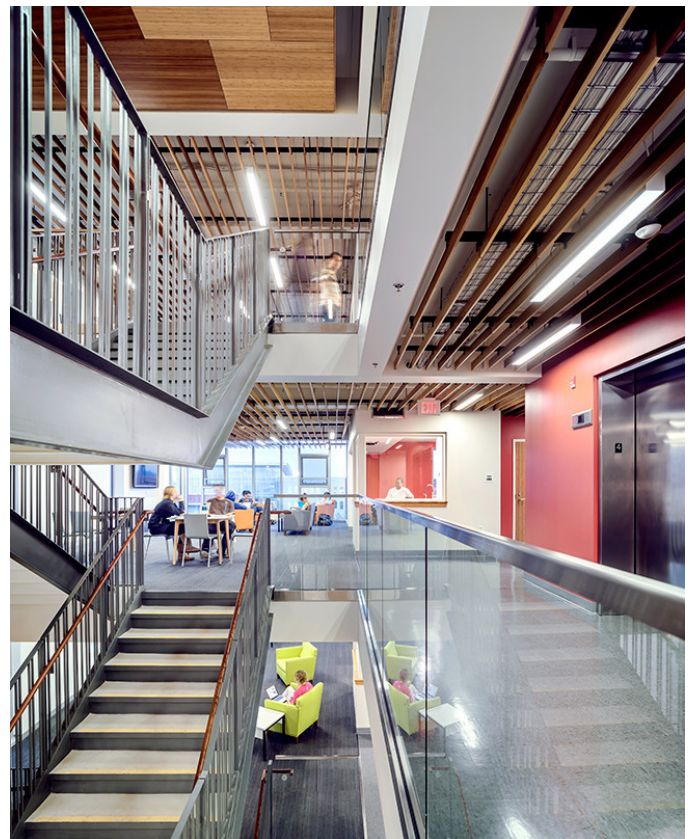
Living and Learning Residence Hall 6, LTL Architects & Quinn Evans Architects

Sweetwater Spectrum, LMS Architects

Social Control

Another method for providing choice and control for people in built environments is providing options. By creating a variety of spaces that support varying levels of social interaction, the user has the agency to decide what is most comfortable for them. Provide common areas that encourage social interaction (sociopetal) as well as ones that support seclusion (sociofugal). Consider creating peripheral social areas that can complement the main gathering area to provide varying degrees of social engagement and participation.

Strategies

• Seating arrangements with a concaved (inward facing) curve support social engagement
• Counter seats and seating arrangements with a convex (outward facing) curve support seclusion
• Semi-enclosed "nooks" provide a degree of separation without being completely cut off from social activities
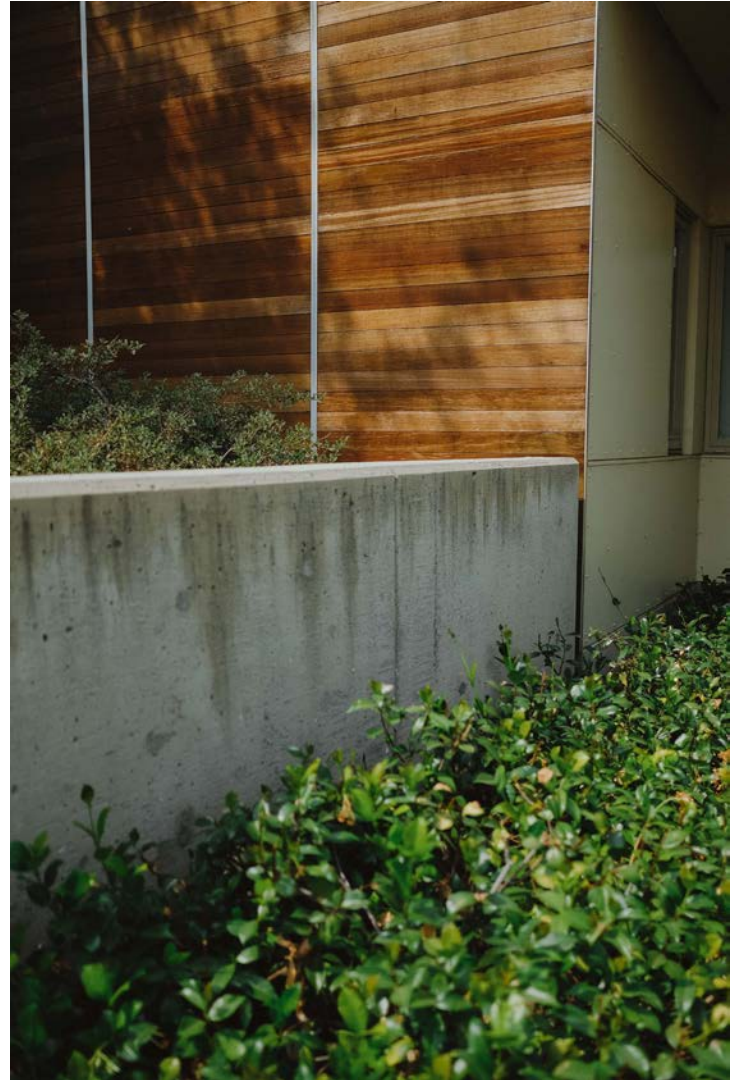

Sweetwater Spectrum, LMS Architects

Connection to Place

When people connect to a building, they are more likely to feel ownership toward it and advocate to protect it. In a lecture by Massachusetts based architect, Charles Rose, he asked for "more specificity please" in the way we approach architecture. One of the fears of mega-firms and developers is that the buildings they construct lack a connection to the context of the site. All over Eugene, Oregon, there are campus student housing complexes that look identical to ones located in university cities around the country. Rather than designing in a vacuum and placing an object on a site, the design of the building should draw from its surroundings: the climate, culture, and history of the site.

Strategies:

- Use reclaimed or salvaged material from the site so they can contribute to the "story" of the building
- Employ building materials that are native to the area or relate to surroundings
- Using surrounding buildings to influence form, material change, or datum lines

Sweetwater Spectrum, LMS Architects

Celebrate the Systems

Whether we are conscious of it or not, our mind is constantly taking in information around us, gathering the parts to understand how they fit together (Goldhagen, 2017). Rather than concealing building systems, we should celebrate them. Let them serve as a positive distraction, a learning tool, and a means for occupants to become more deeply invested in their surroundings.

Strategies:

- Expose structure and connections, celebrate the assembly of the building
- Celebrate building performance and sustainable systems
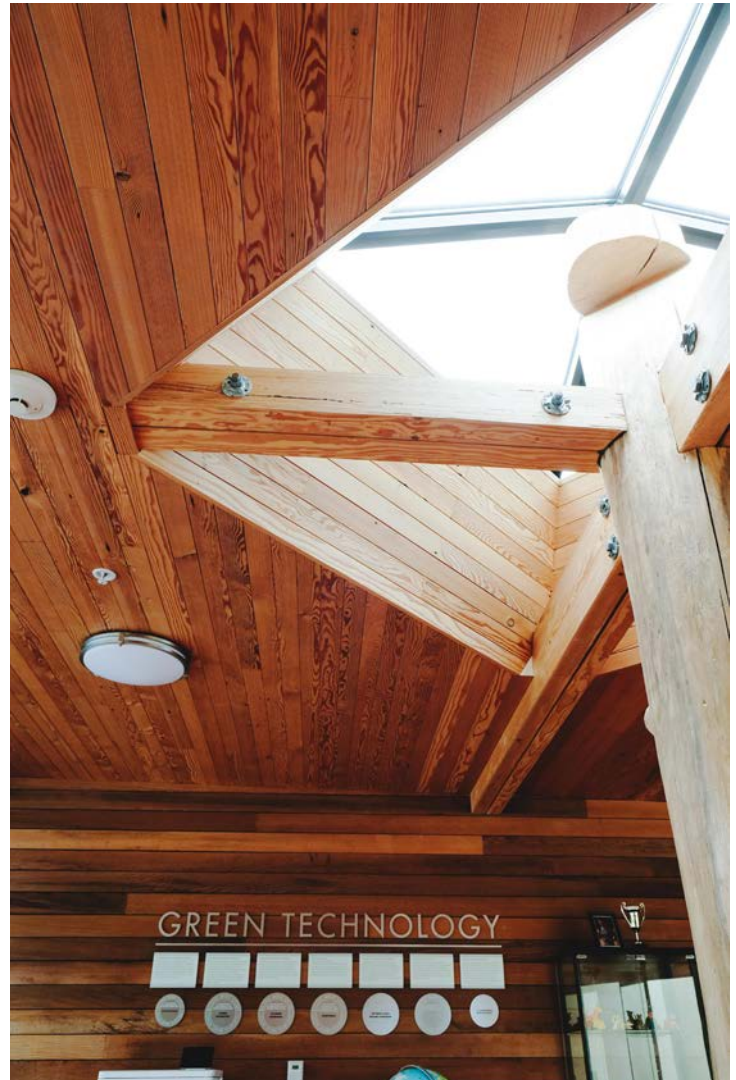
Chartwell School, ehdd.

# Sensory Qualities

Information Richness +
Organized Complexity

Sensory qualities are aspects of the environment that are perceived through the senses including sight, sound, touch, taste, and smell. The human perception of surfaces is multimodal, meaning when we see a surface's texture, our brain also imagines the sensation of touching the texture, which actively engages the users. The natural world is full of patterns, textures, and forms that are complex yet maintain an underlying rationale. This is likely why humans are often drawn to spaces that are rich in texture and pattern, thus providing our mind with a wealth of options and opportunities. It is vital that complex patterns and textures maintain an underlying structure or rationale so as not to overwhelm the viewer.

Strategies

- Patterns or textures that resemble those found in nature, also known as biomimicry
- Use color and finish materials to reinforce the desired experience in the space (calming, exciting, warm, cool)
- Use of accent colors and interesting patterns create visual complexity which aid in positive distraction
- Use of texture engages and activates the mind which also creates a positive distraction
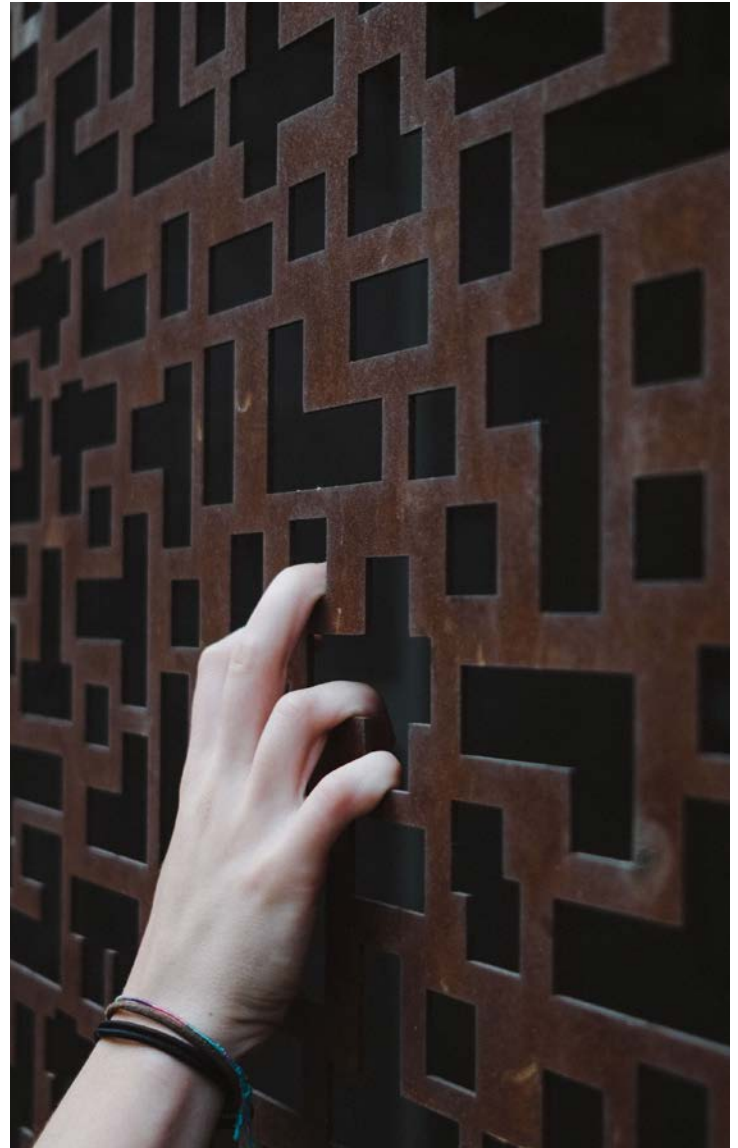
Bud Clark Commons, Holst

Physical Comfort

Use passive strategies and active technology to ensure physical comfort for the occupant. Thermal and visual comfort are often top priorities in new construction and renovation, but olfactory and auditory comfort are also crucial. When a person is not too hot or too cold, has fresh air to breath, and can see and hear comfortably, they perform better and are generally more content in their environment. Giving users the power to adjust and fine-tune their physical comfort reinforces empowerment and connection to place.

Strategies

- Avoid products and materials with strong odors
- Artificial lights should be high quality with no hum, buzz, or flicker. Lighting that supports circadian rhythm is preferred (see Indirect Connection to Nature)
- Daylight and glare should be controlled with operable blinds, louvers, or other shading devices
- A highly controlled acoustic environment that keeps noise level in an acceptable range (below 60 decibels) and reduces reverberation (Health Link BC, 2018).
- Operable windows coupled with supplemental ventilation

Chartwell School, ehdd.

Synthesis of Findings

Nearly every design methodology and case study I encountered emphasized a connection to nature, both directly with daylight and views of the outside, as well as indirectly by selecting finishes and artwork that resemble the natural environment. This strategy is not all that surprising; before E.O. Wilson coined the term Biophilia or Roger Ulrich conducted his study in a Pennsylvanian hospital, many architects attempted to blur the lines between interior and exterior in their buildings. In the Gordon House by Frank Lloyd Wright, it's difficult to tell what is inside versus outside; he extends the interior finishes to the exterior, making it appear as though the interior walls and structure are part of their surroundings rather than contained.

Gordon House, Frank Lloyd Wright

Salk Institute, Louis Kahn

Architects have also understood the importance of clear wayfinding. Louis Kahn's use of "served" and "servant" space allowed him to develop floor plans around a logical framework. Using design to promote community and engagement among inhabitants has been done as well. The design of the Salk Institute by Kahn fostered spontaneous collaboration while also providing space for reclusive studying (Fiederer. 2017).

While many of the findings in this report are already known attributes of "good design," I was surprised to learn about the importance of transition spaces, which are critical in areas for people with autism to prevent overstimulation but are beneficial for everyone. While gifted architects may incorporate these aspects into their buildings purely through intuitive design, I think it is still vital to define them.

The profession has changed drastically since Wright and Kahn; before every stroke of lead carried meaning and was intentional; now we have computers capable of generating 3D models very quickly. We can cycle through design iterations rapidly without the painstaking labor that went into hand drafting and physical models. With these improvements, though, we can become more detached from the end product. There are so many different forces affecting the design; while construction capabilities have improved, codes, regulations, and zoning have become more stringent, and buildings are becoming more complex. Evidence-based design and design methodologies can and should accompany and reinforce an architect's intuitive design sense.

Architecture is historically an elite profession and even now carries some pretension and elusiveness. The term "archispeak" refers to the separate vocabulary architects and designers have that typically consist of large words and odd sentence structures not understood by those outside the profession. As buildings become even more complex and building science expands, the divide could likely grow. However, while an architect's role is very technical and complex, the result is a product being consumed directly by the public. While not everyone understands a floor plan or a wall section, we all experience the positive and negative effects of a building's design.

The intention of this study is multifold, it is intended to be a resource, but more importantly, it is to open the dialog about how architecture impacts all of us mentally and emotionally, regardless of whether we are consciously aware of it. By understanding the influence our built environment has on our emotional state, we can not only make better design decisions, but we can advocate for those decisions and retain them through final design documentation stages and value engineering. To have a sustainable and resilient built environment our building must foster both human and planetary wellness.

Next Steps

This project answered many questions, but has raised even more. For example:

how does perceived safety in a building affect a person physiologically?

Or

what room proportions are the most calming?

This study consisted primarily of a literature review and case study analysis, but to truly understand how the built environment affects our mental wellness, it is essential to look at our physiology and collect quantitative data. Emerging technology such as EEGs, galvanic skin response sensors, eye trackers, and facial expression analysis makes this possible. This technology was at one time considered too unreliable or unfeasible for research, but now companies such as iMotions can streamline the data collection process by integrating several different biofeedback sensors. Combined with virtual reality, this opens up even greater possibilities. Evidence-based design can never replace an architect's intuition or design sense, but it does provide additional tools to construct the best environment possible for our communities and future generations.

Advanced Brain Monitoring EEG

Shimmer Galvanic Skin Response Sensor

Tobii VR headset with eye tracking

About the Author

Evon recently graduated with a Masters of Architecture from the University of Oregon and is currently residing in Portland. Before moving to the west coast, she earned a BFA in Architecture from Massachusetts College of Art & Design and worked for TruexCullins, a mid-size architecture firm Burlington, Vermont. Evon's passion for architecture lies in the human experience and the intersection of design, psychology, and sociology. Evon hopes to continue researching how design can promote mental wellness while working towards her architectural license.

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Credits

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