The image shows a bright, modern interior space, likely a cafe or office lounge. The ceiling is made of dark wood with horizontal beams and a single cylindrical pendant light hangs from it. Large windows with dark frames offer a view of a lush forest with green and yellowing trees. In the foreground, there are several round tables with black chairs. A person is sitting at one of the tables, working on a laptop. The overall atmosphere is clean, bright, and connected to nature.

# Biophilic Design LookBook

**THINK  
WOOD®**



**WoodWorks™**  
WOOD PRODUCTS COUNCIL



#### About Think Wood

Think Wood is a communications campaign that provides commercial, multifamily and single-family home wood design and build resources to architects, developers, and contractors. Visit [ThinkWood.com](http://ThinkWood.com) for project profiles, expert Q+As, and the latest wood construction news.



**WoodWorks**<sup>™</sup>  
WOOD PRODUCTS COUNCIL

#### About WoodWorks

WoodWorks – Wood Products Council provides education and free technical support related to the design, engineering and construction of commercial and multi-family wood buildings in the U.S. A non-profit staffed with architects, structural engineers and construction experts, WoodWorks has the expertise to assist with all aspects of wood building design. For assistance with a project, visit [www.woodworks.org/project-assistance](http://www.woodworks.org/project-assistance) or email [help@woodworks.org](mailto:help@woodworks.org).

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# Trend Towards Healthy Buildings

Americans spend about 90 percent of their time inside. As a result, building professionals are rethinking how people design, use and occupy buildings.

Biophilic design is increasingly used to boost occupant well-being through connection to nature and the use of natural elements like daylight, plants, water and exposed wood. These elements have been attributed to positive outcomes in humans—from reducing stress to boosting productivity.

Today, this emerging trend is increasingly a market expectation, with tenants seeking sustainable, functional and aesthetically pleasing features throughout their offices, homes, retail and hospitality spaces.

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## Money Grows on Trees

McKinsey & Company predicts that wellness is the next trillion-dollar industry, as employers invest in healthy living programs, and as customers take more responsibility for optimizing their own health.<sup>1</sup> Biophilic design, and wood specifically, can contribute to a project's sales proposition and create warm, beautiful environments that appeal to a new generation of eco-minded employees, residents, and occupants.<sup>2</sup>

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**“Health and wellness-  
focused environments...  
can help reduce  
company operating  
costs and increase  
revenues and profits.”**

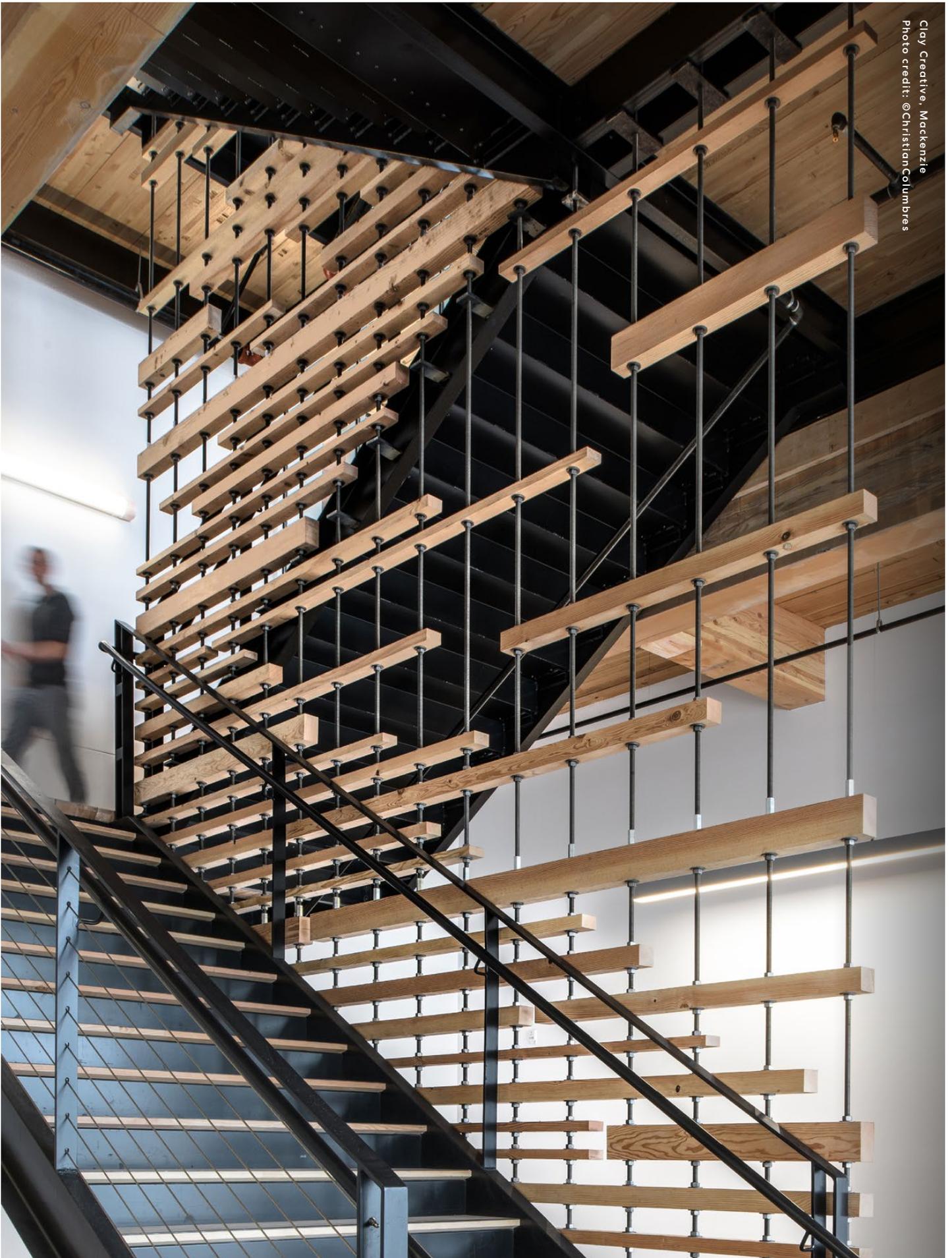
*The Business Case for Healthy Buildings*  
Urban Land Institute

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Live Oak Bank Headquarters. LS3P Associates  
Photo credit: Mark Helbooth Photography

## Tree-economics

Real estate prices show that people will pay more for properties with good views of nature. Developers also are seeing higher leasing velocity and/or lease rates for offices with natural wood environments. The developer for Clay Creative, a timber office building in Portland, Oregon, reports that tenants were willing to pay \$7 more per square foot annually than a similar non-wood structure located across the river downtown.<sup>3</sup>



Clay Creative, Mackenzie  
Photo credit: @ChristianColumbres



The Hudson, Mackenzie  
Photo credit: @ChristianColumbres

## Backed by Emerging Research

Wood has been used as a building material for millennia, but its benefits to people who live, work and gather in the built environment are only beginning to be understood. Researchers are discovering that wood can contribute to the health and well-being of building occupants. While many people would agree that wood is visually pleasing, its aesthetic properties affect humans on a deeper level.

Those in workplaces with a higher proportion of visible wood feel more connected to nature, and rate their working environment far more positively. These people report higher concentration, lower stress levels, and improved overall mood.

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**"Wood in the workplace  
is associated with  
higher productivity and  
reduced sick leave."**

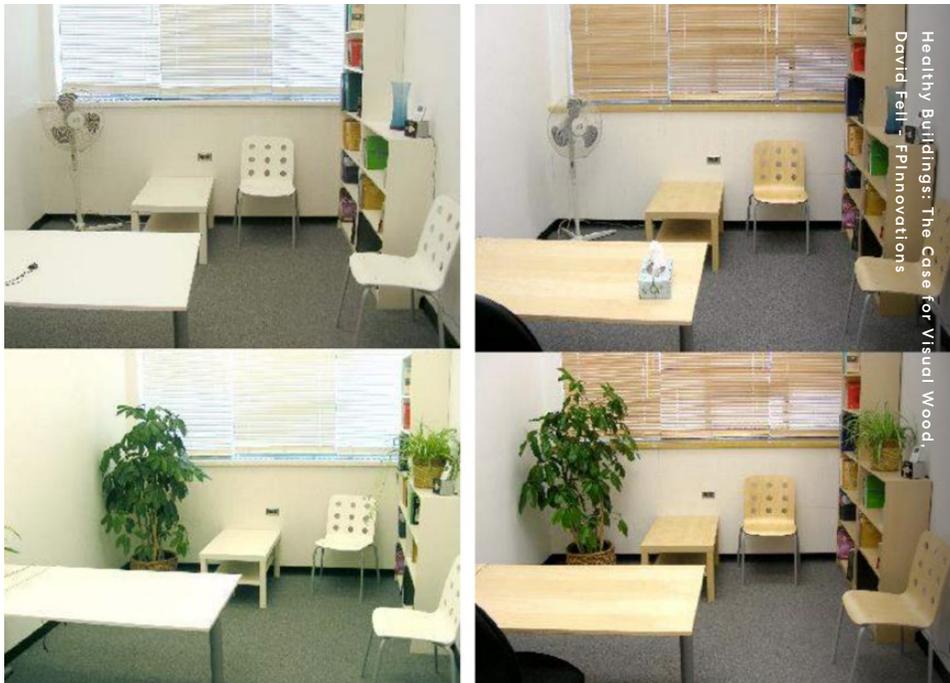
*Workplaces: Wellness + Wood = Productivity,*  
Pollinate

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# Impact of Wood Finishes

A study by the University of British Columbia and FPInnovations established a link between wood and human health.<sup>4</sup> Four office environments were created to study the effects of natural materials in the built environment on autonomic nervous system responses. The effects of both plants and wood were studied on a sample of 119 university students.

In the study, students were assigned to one of four treatment conditions. They were told only that they were going to participate in an office performance task, and were not informed that the effects of materials were being studied.



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**“Stress, as measured by sympathetic nervous system activation, was lower in the wood room in all periods of the study.”**

*Wood and Human Health*  
FPInnovations

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Carbon12  
Photo credit: Andrew Pogue, courtesy Kaiser + Poth

## What is Biophilic Design?

One of the most well-known of the approaches to nature-based and wellness-focused architecture is biophilic design. While the overall goal of designing buildings that promote the well-being of occupants is not new, the concept of biophilic design has only been around since the 1980s, when an evolutionary biologist named Edward O. Wilson introduced the philosophy via his book, *Biophilia*.

*Biophilia*, which literally translates to “love of life” or “love of living things,” is a concept that addresses human connections with nature. The premise behind biophilic design is the idea that incorporating natural elements — water, natural light, green plants, and exposed wood where you can see and feel the grain — into buildings can contribute to the health and well-being of occupants.

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**“Building with and exposing the wood in buildings is a simple way to achieve multiple objectives, including aesthetics, sustainability and occupant well-being.”**

Dr. Mike Burnard  
Deputy Director, InnoRenew CoE

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## Biophilic Patterns

Research firm Terrapin Bright Green, created the “14 Patterns of Biophilic Design” to articulate the relationships between nature, human biology and the design of the built environment. While informed by science, biophilic design patterns are not formulas; they are meant to inform, guide and assist in the design process and should be thought of as another tool in the designer’s toolkit. The purpose of defining these patterns is to articulate connections between aspects of the built and natural environments and how people react to and benefit from them.<sup>5</sup>

These fourteen patterns of biophilic design focus on psychological, physiological and cognitive benefits and align to three categories: Nature in the Space, Natural Analogue and Nature of the Space. Specifically, we’ll explore how biophilic patterns can be incorporated through wood design and construction.

In the pages that follow, the text describing each biophilic design pattern is excerpted from the Terrapin Bright Green report, [\*14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment.\*](#)

# 14 Patterns of Biophilic Design

	Pattern	Stress Reduction	Cognitive Performance	Emotion, Mood & Preference
Nature in the Space	Visual Connection w/ Nature			
	Non-Visual Connection w/ Nature			
	Non-Rhythmic Sensory Stimuli			
	Thermal & Airflow Variability			
	Presence of Water			
	Dynamic & Diffuse Light			
	Connection w/ Natural Systems			
Natural Analogues	Biomorphic Forms & Patterns			
	Material Connection w/ Nature			
	Complexity & Order			
Nature of the Space	Prospect			
	Refuge			
	Mystery			
	Risk / Peril			

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# Visual Connection with Nature

A view to elements of nature, living systems and natural processes.

A space with a good Visual Connection with Nature feels whole it grabs one's attention and can be stimulating or calming. It can convey a sense of time, weather and other living things.

The Federal Center South Building 1202 brings nature inside within the "commons" or social heart of the building. Timber reclaimed from an existing warehouse is a focal point.

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Federal Center South Bldg 1202  
Photo credit: Benjamin Benschneider, courtesy ZGF Architects LLP

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# Non-Visual Connection with Nature

Auditory, haptic, olfactory or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes.

A space with a good Non-Visual Connection with Nature feels fresh and well balanced; the ambient conditions are perceived as complex and variable but at the same time familiar and comfortable, whereby sounds, aromas and textures are reminiscent of being outdoors in nature.

Might the texture or smell of wood contribute to this biophilic pattern? The natural smell of wood has surprised some designers who did not consider this element in their designs.

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Albina Yard, LEVER Architecture  
Credit: Marcus Kauffman, Oregon Dept. of Forestry

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# Non-Rhythmic Sensory Stimuli

When immersed in nature, we continually experience environmental stimuli: birds chirping, leaves rustling, the faint scent of eucalyptus in the air. The objective of the Non-Rhythmic Sensory Stimuli pattern is to encourage the use of natural sensory stimuli that unobtrusively attract attention, allowing individuals' capacity for focused tasks to be replenished from mental fatigue and physiological stressors.

A space with good Non-Rhythmic Sensory Stimuli feels as if one is momentarily privy to something special, something fresh, interesting, stimulating and energizing—a brief but welcome distraction. A non-rhythmic stimuli strategy can be interwoven with almost any landscape or horticulture plan. For instance, selecting plant species for window boxes that will attract bees, butterflies and other pollinators.

The LEED Platinum Oregon Zoo Education Center blurs the natural and built environment to create unexpected teachable moments. Throughout the spiraling campus, natural stimuli piques visitors' interest and invites them to observe and engage. Landscape architects blurred indoor and outdoor experiences—coalescing around an immersive central plaza brimming with native plant species, local insects and rotating exhibits that include a living turtle lab, rain gardens and an insect zoo.

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# Thermal and Airflow Variability

Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.

A space with good Thermal & Airflow Variability feels refreshing, active, alive, invigorating and comfortable. The space provides a feeling of both flexibility and a sense of control.

The Commons' operable windows invite sunlight and fresh air into the building interior while sliding doors allow students to spill outside under the patio's slatted roofs. The lower level Guild incorporates large garage doors opening out onto a patio, garden, and surrounding outdoor teaching areas.<sup>6</sup>

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Sonoma Academy Janet Durgin Guild & Commons, WRNS Studio  
Photo credit: Michael David Rose



Cultural Crossing at Portland Japanese Garden  
Photo credit: Jeremy Bittermann, courtesy Hacker with Kengo Kuma and Associates



Cottonwood Valley Charter School  
Photo credit: Patrick Coulle Photography, courtesy Environmental Dynamics, Inc.

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# Presence of Water

A condition that enhances the experience of a place through the seeing, hearing or touching of water.

A space with a good Presence of Water condition feels compelling and captivating. Fluidity, sound, lighting, proximity and accessibility each contribute to whether a space is stimulating, calming, or both.

The Enso Apartments' central courtyard features a cascading fountain focal point surrounded by stone finishes and natural wood pergolas that, together, mimic a rustic mountain escape in the middle of Atlanta.

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Enso Apartments  
Photo credit: Davis & Church LLC

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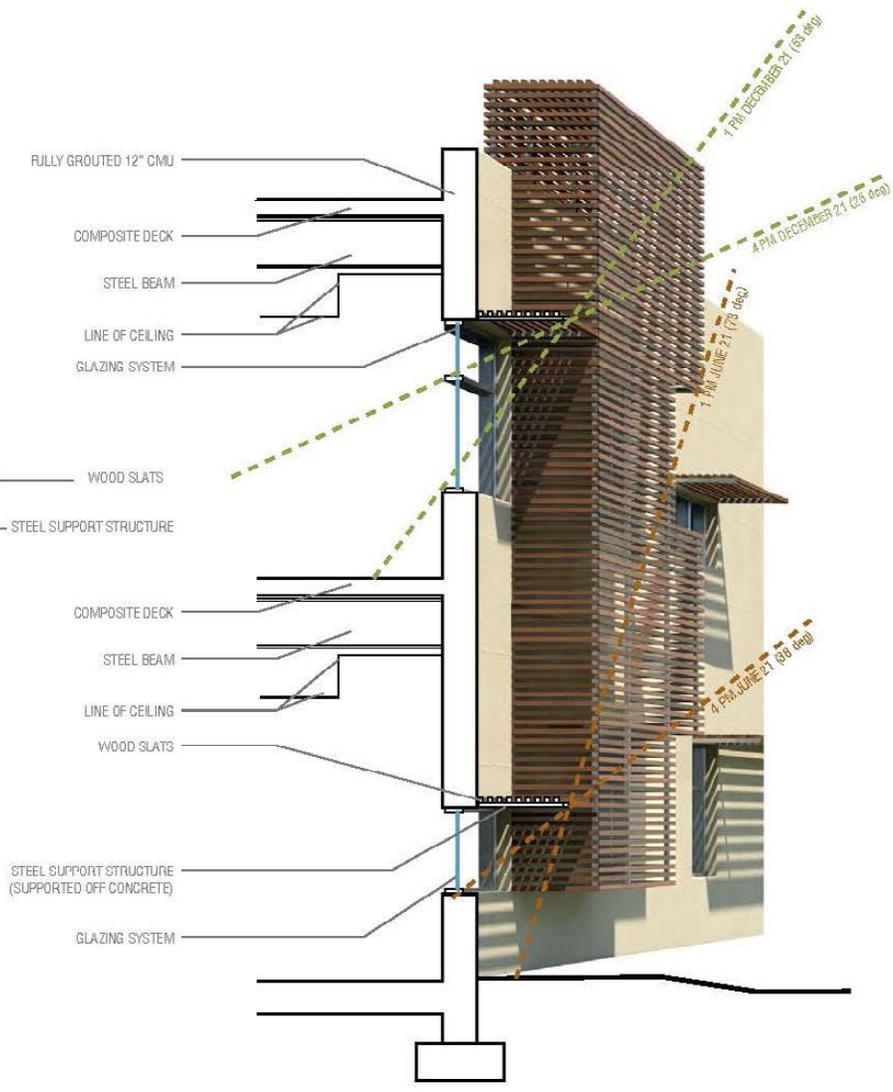
# Dynamic and Diffuse Light

Leverages varying intensities of light and shadow that change over time to create conditions that occur in nature.

A space with a good Dynamic & Diffuse Light condition conveys expressions of time and movement to evoke feelings of drama and intrigue, buffered with a sense of calm.

Varying intensities of light and shadow throughout the day can be reminiscent of variations in natural daylight that help the human circadian system which manages sleep, eating and bodily functions.

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GSA Office Building rendering  
Photo credit: Patrick Coullie Photography, courtesy Page Southerland Page, LLP



GSA Office Building  
Photo credit: Patrick Goulie Photography, courtesy Page Southerland Page, LLP



Venture Capital HQ, Paul Murdoch Architects  
Photo credit: ©2012 Eric Staudenmaier

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# Connection with Natural Systems

Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

A space with a good Connection with Natural Systems evokes a relationship to a greater whole, making one aware of seasonality and the cycles of life. The experience is often relaxing, nostalgic, profound or enlightening, and frequently anticipated.

Harnessing the beauty of its densely forested site, Canyon Commons Dining Hall cultivates connections between interior and exterior spaces through proximity to the natural forest system.<sup>7</sup>

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George Fox University - Canyon Commons  
Photo credit: Jeremy Bittermann, courtesy Hocker

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# Biomorphic Forms and Patterns

Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.

A space with good Biomorphic Forms & Patterns feels interesting and comfortable, possibly captivating, contemplative or even absorptive.

The Cathedral of Christ the Light employs a non-linear pattern to honor the church's diverse 2,000-year history. The inner wooden vessel contained within a veil of glass conveys an inclusive statement of welcome and openness as the community's symbolic soul.<sup>8</sup>

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Cathedral of Christ the Light, SOM  
Photo credit: Timothy Hursley, courtesy Skidmore, Owings & Merrill LLP

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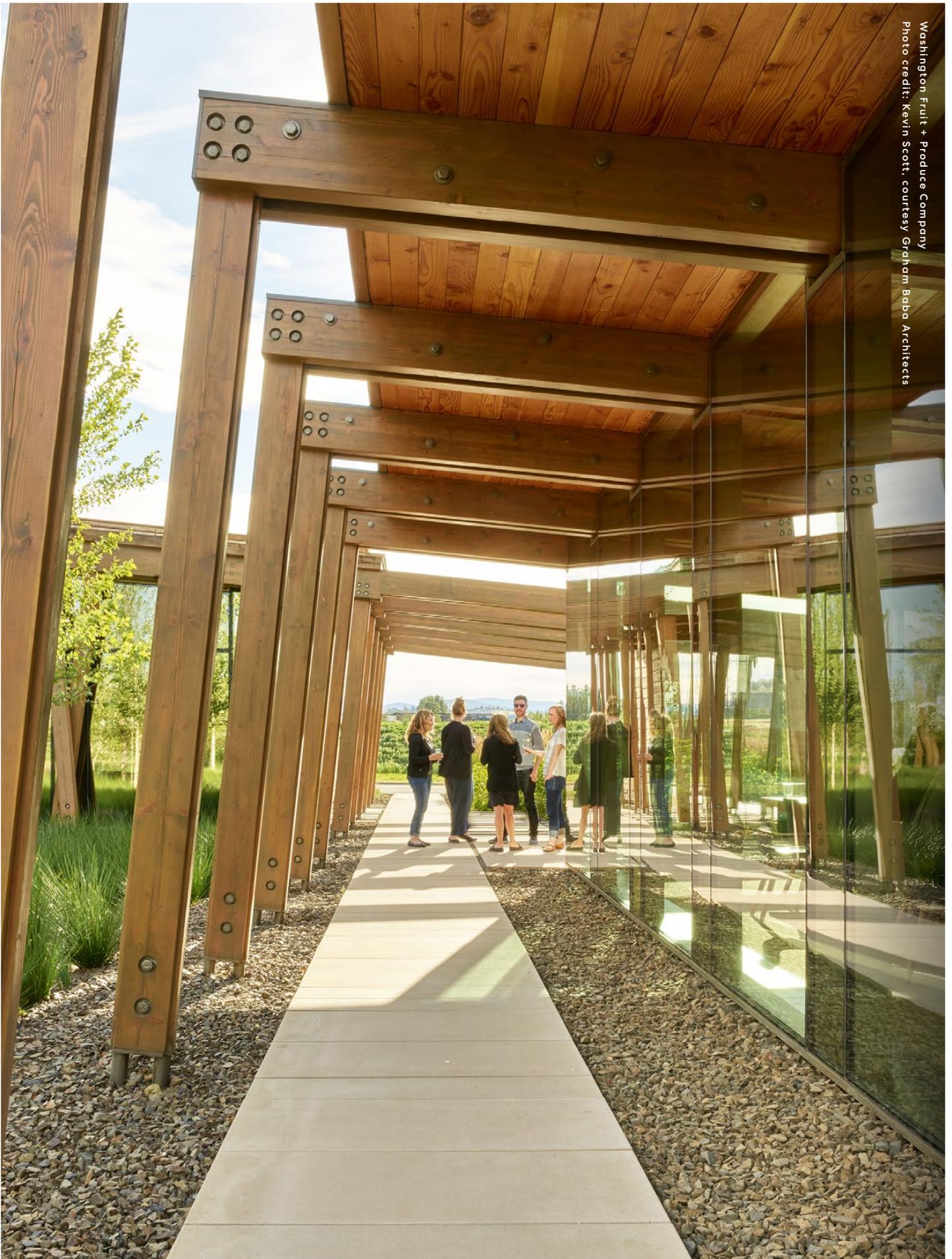
# Material Connection with Nature

Materials and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place.

A space with a good Material Connection with Nature feels rich, warm and authentic, and sometimes stimulating to the touch.

Wood can be used as an extension from the exterior natural environment to our interior spaces. Designers of Washington Fruit + Product Company's new office framed exterior walkways with the natural wood beams which extend to the interior.

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Washington Fruit + Produce Company  
Photo credit: Kevin Scott, courtesy Graham Baba Architects



Blue Ridge Orthodontics  
Photo credit: Mark Herboth, courtesy Clark Nexsen



First Tech Federal Credit Union  
Photo credit: Jeremy Bittermann courtesy Hacker with Krhmer Gehlen & Associates; Swinerton

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# Complexity and Order

Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

A space with good Complexity & Order feels engaging and information rich, offering an intriguing balance between boring and overwhelming.

The Portland Japanese Garden's Cultural Village is positioned along a journey from the city to the top of the hill, wherein the pilgrimage pays homage to the spirit of nature. The buildings are wrapped with wood battens that mimic the tall vertical lines of the surrounding Pacific Northwest conifers.<sup>9</sup>

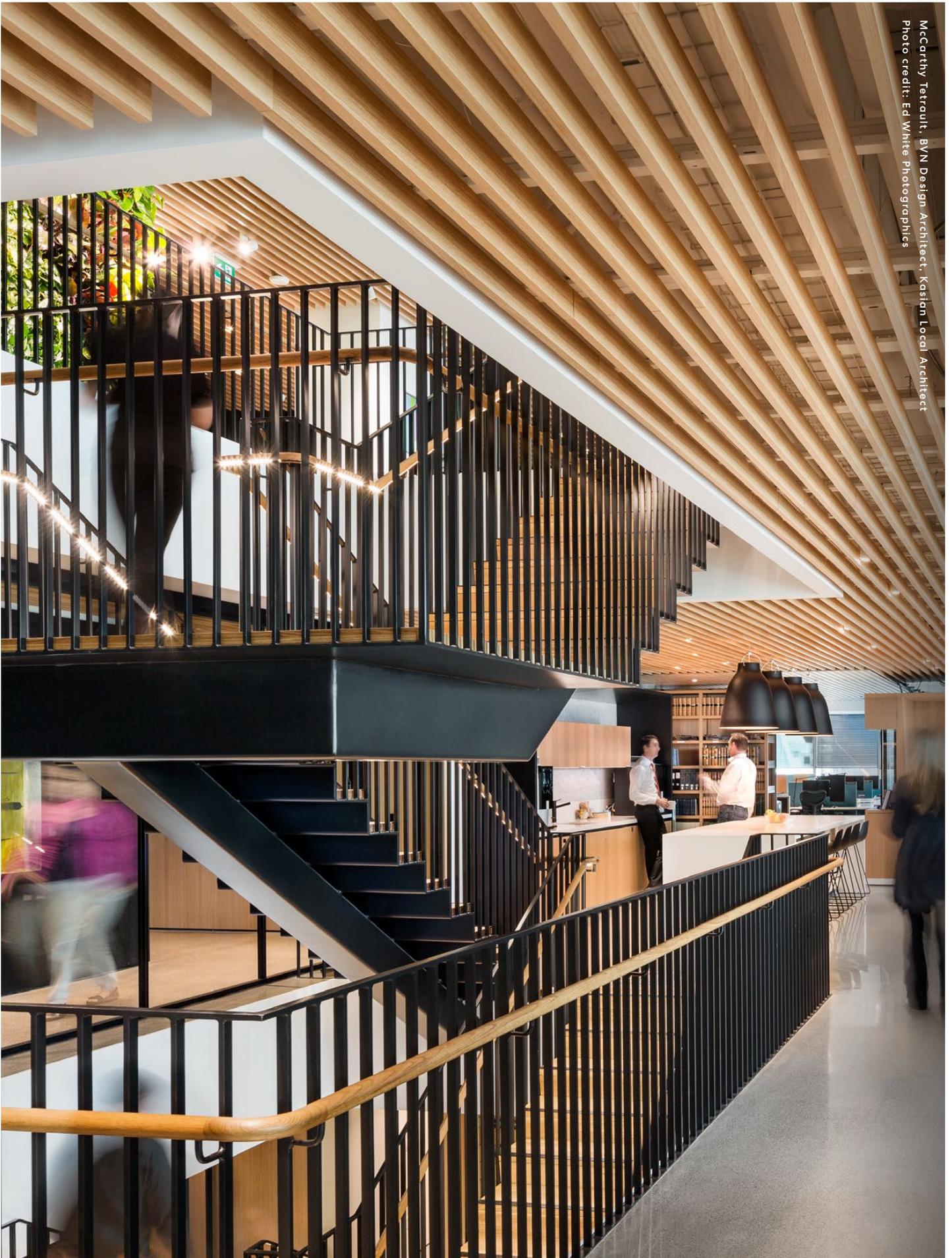
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Cultural Crossing at Portland Japanese Garden  
Photo credit: Jeremy Bittermann, courtesy Hacker with Kengo Kuma and Associates



Tashjian Bee and Pollinator Discovery Center  
Photo credit: Richard Brine, courtesy MSR Design



McCarthy, Tetrault, B/N Design Architect, Kasian Local Architect  
Photo credit: Ed White Photographics

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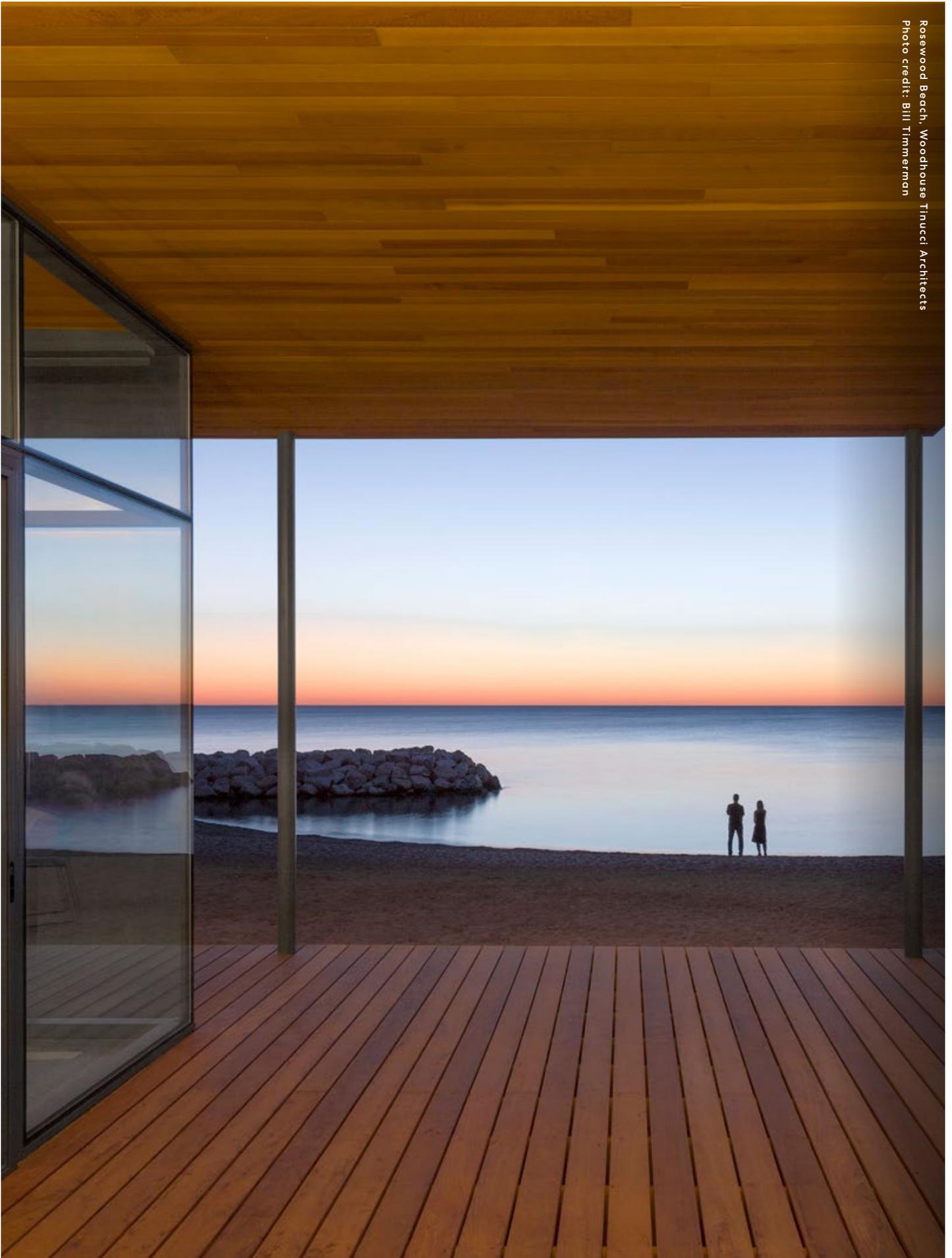
# Prospect

An unimpeded view over a distance for surveillance and planning.

A space with a good Prospect condition feels open and freeing, yet imparts a sense of safety and control, particularly when alone or in unfamiliar environments.

Rosewood Interactive Center's hybrid system of light wood-frame and steel construction creates an extra thin profile for roof and wall assemblies of the Rosewood Interpretive Center, while timber piles provide structure for the boardwalk. To minimize bulk, only functions needing privacy or separation are enclosed.<sup>10</sup>

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Rosewood Beach, Woodhouse Tinucci Architects  
Photo credit: Bill Trimmerman

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# Refuge

A place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.

A space with a good Refuge condition feels safe, providing a sense of retreat and withdrawal—for work, protection, rest or healing—whether alone or in small groups. A good refuge space feels separate or unique from its surrounding environment; its spatial characteristics can feel contemplative, embracing and protective, without disengaging the viewer.

Developed to respond to 21st century learning principles, the École Au-coeur-de-l'île community school is organized around four separate pods, each containing a variety of learning spaces like private reading nooks to enjoy a peaceful read.<sup>11</sup>

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Ecole au Coeur  
Photo credit: Derek Lepper, courtesy McFarland Marceau Architects

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# Mystery

The promise of more information achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.

A space with a good Mystery condition has a palpable sense of anticipation, or of being teased, offering the senses a kind of denial and reward that compels one to further investigate the space.

The Barn's curved edges, dramatic shadows and partially revealed views imply movement and compel visitors to see what's around the corner.

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The Barn, Imelk  
Photo credit: Chad Davles





Calgary Central Library, Sheheta  
Photo credit: ©2018 by Michael Grimm, courtesy StructureCraft



NestWeGrow, Designer: University of California Berkeley College of Environmental Design;  
Architect: Kengo Kuma Architects & Associates  
Photo credit: Shinkenchiu-sha Co., Ltd.

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## Risk / Peril

An identifiable threat coupled with a reliable safeguard.

A space with a good Risk/Peril condition feels exhilarating, and with an implied threat, maybe even a little mischievous. One feels that it might be dangerous, but intriguing, worth exploring and possibly even irresistible.

The focal point of the Washington State University Everett University Center is the cantilevered wood stair constructed of locally-sourced Douglas fir glued lamella stringers that span up to 44 feet.<sup>12</sup>

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WSU Everett University Center, SRG Partnership  
Photo credit: © Copyright 2017 Benjamin Benschneider

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