Biophilic Design with Wood

in British Columbia

A publication by Terrapin Bright Green
in collaboration with Forestry Innovation Investment

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Biophilic Design with Wood in British Columbia

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Back cover: KF Aerospace Centre for Excellence at the Kelowna International Airport in the Okanagan Valley of British Columbia. Photo by Shawn Talbot, courtesy naturallywood.com

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Ponderosa Pine, courtesy naturallywood.com

Introduction

Biophilic Patterns: Examples in B.C. Wood Buildings

Closing Perspectives

What Makes a Biophilic Building?

Experiences of nature can reduce our stress, improve cognitive function, and enhance our overall happiness and well-being.

What makes a building biophilic?

Intentionally bringing experiences of nature into our buildings is the heart of biophilic design. There's an art and a science to it, and endless potential solutions. Using wood—in material and spatial ways—can be a very effective and complementary strategy for improving the experience and impact of a place.

Exposed wood can set the foundation for a more holistic or multisensory biophilic experience. The use of multiple pieces of wood to create larger structures inherently creates complex ordered structures. These can be structures that have biomorphic forms mimicking living things, or spaces whose form creates embracing refuge. Some species of wood have a persistent scent, while certain cuts reveal familiar or notable textures, fractal patterns, colour, or light reflectance characteristics. Particular treatments allow expressions of wood to change over time—a weathering or patina that provides a deeper/persistent context. Wood can introduce perceptions of warmth and wood grain patterns can have a calming effect.

This publication is an exploration of buildings in British Columbia that make effective use of wood to connect their occupants to experiences of nature.

Tseshaht Tribal Multiplex and Health Centre in Port Alberni, Vancouver Island, B.C., is a wood structure that features a hierarchy of window and mullion sizes, a design characteristic that is less common in modern buildings.

Photo by Rasti Zabka courtesy of Lubor Trubka Associates Architects.

Wood and Design in B.C.

A brief cultural history and tradition of wood as a building material

Wood has been used for building homes and other structures for thousands of years in and around British Columbia. Yellow cedar and western red cedar trees are woven into the cultures of many **First Nations** and were regularly used for construction, clothing, canoes, carvings, and even medicines.

First Nations in the interior often built conical pit houses with four large angled posts supporting a square of four large beams. Smaller beams and purlins placed around the central structure were then covered with sheets of bark and then soil. The structures were entered either via a ladder through the central smoke hole or through an east-facing door.[1]

Along the coast, First Nations often built longhouse structures that were covered with large planks. The core structure was large western red cedar posts and beams typically used to form a gabled square or rectangular building. The planks could be removed and relocated. Exterior totem poles and interior carvings told the family history.[2] These buildings continue to inspire the design of new structures today.[3]

Edward Curtis

First Nations are people who identify with their ancestral Indigenous origins, which have distinct cultures, languages and traditions and connections to a particular land base of traditional territory. The Kwakiutl, or Kwakwaka'wakw, are part of the Mamalilikulla-Qwe'Qwa'Sot'Em First Nation, one of several First Nations who inhabit the western coast of British Columbia. Pictured here is a **Kwakiutl house frame**, circa 1914, on the west side of Village Island in the Johnstone Strait region of Mount Waddington.

KK Law, courtesy naturallywood.com

What became the City of Vancouver started with harvesting the abundance of Douglas-fir trees and the construction of the Hastings Mill on Burrard Inlet in 1867. The wood was initially exported and later became a main resource for building the city. In the late 1800s, large warehouse and office buildings were constructed of post-and-beam heavy timbers, with nail-laminated timber (NLT) decking, frequently using what were called "Vancouver toothpicks", 60×2×2-foot Douglas-fir timbers.[4] Many were six storeys—The Landing, a well-known building in Gastown, is nine storeys.

As the early 20th century saw commercial construction move increasingly to concrete and steel, the timber industry began producing dimensional lumber for residential construction. Most building codes prohibited wood construction above four storeys. Large glue-laminated (glulam) beams were the only large structural timber component seen in commercial and public buildings.

In the late 20th and early 21st centuries, a confluence of issues, including the sustainable sourcing of wood, new laminated timber components like cross-laminated timber (CLT), and interest in reducing the carbon footprint of building materials has led to a rebirth of timber construction. Recent code changes once again allow the construction of taller wood buildings and will likely soar to greater heights.

Brock Commons Tallwood House, an 18-storey wood hybrid UBC student residence under construction in 2016, Vancouver.

The Pattern Language of Biophilia

An evidence-based approach to designing for health and well-being in the built environment

Humans have an innate affinity for nature—a phenomenon known as biophilia. This connection has become the subject of many research initiatives exploring how different experiences of nature affect humans both physiologically and psychologically, leading to the recognition that designing elements of nature into the built environment can have health benefits including stress reduction, improved cognitive performance, enhanced moods, and increased preference for spaces.

Experiences of Nature

Experiences of nature in the built environment can be thought of as design patterns, of which there are 15 with scientific evidence, that tend to fall into three broad categories.

Nature in the Space

Direct experiences of nature and natural processes in the built environment. These include views to landscape, the presence of living plants, animals, water, sunlight, breezes, and the changing seasons.

Natural Analogues

Indirect experiences of nature in the built environment. These include collinear and biomorphic forms, natural materials, and a level of complexity and order through materials or patterns, such as fractals.

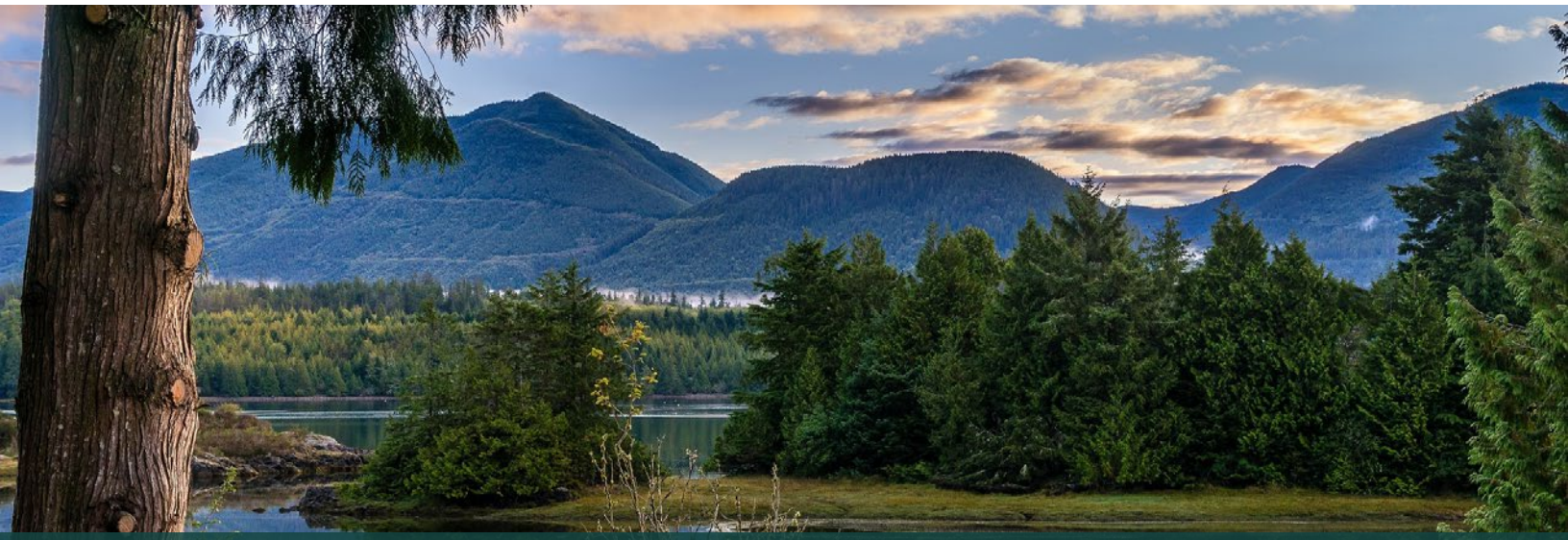
Nature of the Space

Spatial experiences induced by three-dimensional characteristics of the built environment. These include distant views and conditions that provide refuge and retreat, compel exploration, have an element of risk, or induce awe and wonder.

Research

Early biophilia research focused on the responses to viewing and experiencing natural environments. One of the best known studies found that having a view to nature led to better healing outcomes among hospital patients. Research also suggests that humans have a preference for views to savannah habitats with trees and, specifically, shade trees like those on the African savannah. Through guided walks in forests in Japan and Korea, researchers have been exploring Shinrin-yoku (Forest Bathing) in conjunction with impacts on stress reduction and immune system function.

While wooden objects are crafted by humans—a process that is often regarded as manufactured or unnatural—the wood itself is still considered to be “natural”, which may hint at an explanation for why research indicates that we like having wood around us in buildings. Wood has been used in the construction of shelter and artifacts for thousands of years in cultures around the world.



15 Patterns of Biophilic Design

Nature in the Space

1. Visual Connection with Nature
A view to elements of nature, living systems and natural processes.

2. 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.

3. Non-Rhythmic Sensory Stimuli
Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.

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

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

6. Dynamic & Diffuse Light
Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature.

7. Connection with Natural Systems
Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

15 Patterns of Biophilic Design

Natural Analogues

8. Biomorphic Forms & Patterns
Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.

9. Material Connection with Nature
Material and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place.

10. Complexity & Order
Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

15 Patterns of Biophilic Design

Nature of the Space

11. Prospect
An unimpeded view over a distance for surveillance and planning.

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

13. 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.

14. Risk/Peril
An identifiable threat coupled with a reliable safeguard.

15. Awe
Stimuli that defy an existing frame of reference and lead to a change in perception.

Wood as a Biophilic Material

One possible explanation for our biophilic response to wood is that the brain makes a series of associations—what is sometimes referred to as semantic processing. In other words, the brain subconsciously links wood to trees, trees to life and nature, and a biophilic response is subsequently triggered. This connection is implied by research on associative processing and in general public surveys and is, at least in part, a plausible explanation for our positive response to wood.

Wood grain is essentially a series of collinear striations or patterns that are broken into segments to form nested contours. Studies with rhesus monkeys indicated that (within a given image) lines running in the same direction are processed by one set of neurons in the brain; whereas, with lines running in multiple directions, more effort is needed—by multiple sets of neurons—to process the image. The human brain will follow curvatures and contours, and even connect short segments of lines to discern a longer curving pattern. These pattern conditions occur frequently in nature, that our brains, it could be argued, are predisposed to easily decipher them and thus lower stress.

Statistical fractals are layered, self-repeating mathematical patterns with variations. They are everywhere in nature—snowflakes, fern leaves, waves on a beach, flames in a fireplace, the dappled light under trees. These statistical fractals are so common that when we see these patterns, even in human designed objects, it is easy for the brain to process the image and measurably lower our stress level. This effect is called fractal fluency. The nested contour patterns that are repeated in a wood grain fit the definition of a statistical fractal.

Courtesy TimberTiles

TimberTiles Showroom celebrates colour and pattern variations in this detail of a tiled wall installation made with western hemlock grown and harvested on Vancouver Island.

For greater depth in research and citations for this section, see ***14 Patterns of Biophilic Design*** by Browning, Ryan and Clancy (2014) and ***Nature Inside, A Biophilic Design Guide*** by Browning and Ryan (2020).

Benefits of Biophilic Design and Wood

The Economics of Biophilia

Biophilic design has economic benefits that accrue across most economic sectors, and many strategies cost little or nothing to implement. In offices, biophilic design can help improve measures of workplace performance, including increased productivity and reduced absenteeism. In schools, improvements to academic achievement and, among younger students, cognitive development rate have been studied in relation to biophilic design. In hospitals, research indicates that biophilic elements can help patients heal faster and mitigate occupational stress among hospital staff. In retail, there is evidence that biophilic elements can increase shoppers' perceived willingness to pay, improve gaze attention, and increase dwell time—shopping behaviours that are known to contribute to additional sales. In hotels, a view to nature can accommodate higher room rates, and the biophilic elements can increase dwell time and revenue in common spaces. Finally, in communities, evidence suggests that street trees and proximate green spaces can support better health outcomes, including willingness to walk, more prosocial behaviour, and a reduction in crime.[1]

The use of wood in the spaces and places where we live, work and play definitively supports a biophilic experience. Research indicates that the presence of wood surfaces in a space can have a number of psychological and physiological benefits. While wood is

Table 1. Biophilia Impacts for Positive Returns

Sector	Health & Well-being Impacts	Financial Impacts	
		Direct	Indirect
Offices	Presenteeism • Performance • Productivity	Absenteeism • Staff retention • Lease rate • Churn	Talent acquisition • Health claims • Employee satisfaction
Education	Attention • Learning rate	Absenteeism • Test scores	Graduation rates
Retail	Customer attention • Brand perception	Hedonic value • Sales • Staff retention	Dwell time • Return patronage • Social media attention
Healthcare	Healing rate • Analgesic intake	Patient turnover • Staff retention	Visitor perception
Hospitality	Staff performance • Perception of place	Average daily room rate (ADR, RevPAR)	Employee satisfaction • Brand loyalty • Social media attention • Total revenue per available room (TRevPAR)
Communities	Perception of safety • Crime rate • Overall public health	Tourism • Crime rate	Investment attraction • Migration • Real estate value • Tax base • Climate change adaptability • Resilience • Equity • Incarceration rate

Source: Table adapted from The Economics of Biophilia, 2nd edition © 2023 by Terrapin Bright Green

often described as being "warm, comfortable, relaxing, natural and inviting" and people believe that "wood can help to create healthful environments",[2] studies have revealed that the presence of wood supports creativity in the workplace,[3] which can lead to more favourable impressions of coworkers.[4]

For more on the science, practice and case studies of biophilic design, these publications are strongly recommended: ***Biophilia*** by Edward Wilson (1984), ***Forest Bathing*** by Qing Li (2018), ***Nature by Design*** by Stephen Kellert (2018), and ***The Economics of Biophilia*** by Ryan, Browning & Walker (2023).

Where Biophilia and Sustainability Cross Paths

Project priorities differ for many reasons—from climate and site conditions to intended users to financing options or investor expectations—and so too do opportunities for aligning biophilic design intent with these project priorities. Many times, the use of wood can even help champion those alignments.

Mental Health

One of the many reasons for the renewed attention to timber construction is that wood is perceived to be natural and beautiful.[5] In a room with white walls, the addition of wood surfaces has shown to lower stress more effectively than the addition of a few plants.[6] In other research, rooms with (about 45% of the) surfaces being wood have shown to boost perceptions of comfort and lower blood pressure.[7]

Carbon

If sourced from sustainably managed forests, these building components can store more carbon than is emitted in their production.[8] In effect, the mass timber portions of these building components have the potential to store the carbon footprint of other materials[9,10]—a significant achievement for green building.

Recycle, Reuse & Repurpose

At the end of the building's life cycle, wood components can be reused or repurposed for other products. There is a substantial market for reclaimed wood for use in flooring, furniture and panelling. With attention to structural requirements, CLT panels can be reused in new structures.[11] New structures using reclaimed wood inherently present a story and a sense of time through patina, texture, and other qualities that can't be achieved with highly processed materials or polished finishes.

Energy Performance

Wood creates less thermal bridging than steel or aluminium. Wood can be combined with insulation to form insulated panels or offset truss systems, such as those used in Passive House construction.

Aaron Miller, courtesy naturallywood.com

The timber rotunda roof of exposed glulam and wood decking at **Abbotsford Senior Secondary School**, in Abbotsford, B.C., exhibits a varity of Natural Analogues, while the multi-level mezzanine with transparent railings embodies Nature of the Space patterns such as Risk and Awe. Station One Architects and Bush, Bohlman & Partners (2012).

"You definitely feel better once you've been in a space that incorporates wood. It clears your head. We often have students that just come to the rotunda to be there, enjoy the space, and hang out. It's open and the wood beams are beautiful and inviting. I think it helps with anxiety."

Rob Comeau
Principal | Abbotsford Senior Secondary School

Seismic Resilience

Wood weighs less than steel and concrete construction. The older timber buildings in Vancouver are a testament to the seismic resilience of wood construction. There is increasing evidence of the resilience of mass timber buildings using CLT.[12]

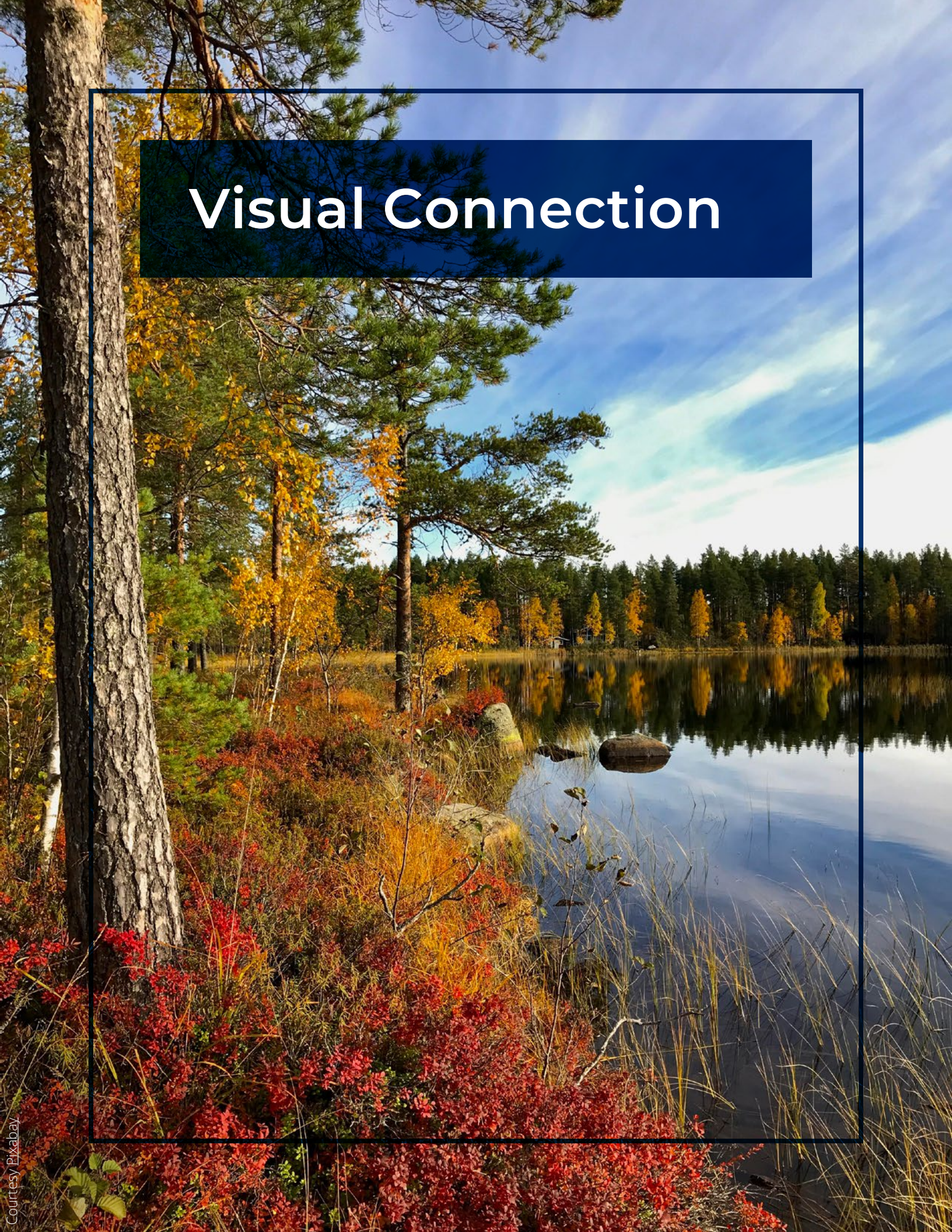
Local Economy

The economy of British Columbia was built on the wood industry. Today, there are still 140 communities in the province that rely on the wood industry as their primary economic activity.[13] Sustainably managed forests can support local economies for generations, while also helping to address issues of erosion, water infiltration, biodiversity, carbon and climate change.[14]

Connection to Place

Forests and wood buildings are part of local identity and tradition extending back for many centuries.

Visual Connection



Courtesy Pixabay

Visual Connection with Nature

Biophilic Design Pattern #1

The Visual Connection with Nature pattern has evolved from research on visual preferences and on responses to views to nature. Positive outcomes from having a quality visual connection with nature include reduced stress, more positive emotional functioning, and improved concentration and recovery rates. More specifically, these benefits are evident through lowered diastolic blood pressure and heart rate; reduced sadness, anger, and aggression; improved mental engagement and attentiveness; and improved attitude and overall happiness.

The most common design strategies using this pattern include prioritizing window placement to emphasize views out to nature. Indoor strategies include bringing living nature into spaces with green walls, indoor gardens, multi-species planters, terrariums and aquariums.

While real living nature is preferred and has a strong physiological impact, photographs, paintings and videos can also be used to make a visual connection with nature. For many locations in British Columbia, building sites are blessed with near and distant views of forested mountains or water bodies.

Definition

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

Positive Impacts

- Blood pressure and heart rate
- Mood
- Mental engagement
- Attentiveness
- Attitude
- Overall happiness

Project Examples in B.C.

In this chapter

- Slack Headquarters
- Tall Tree Integrated Health Centre
- Bayview Elementary School

Elsewhere in this book

- Tsleil-Waututh Administrative Centre
- The Hive
- Squamish Lil'wat Cultural Centre

Slack Headquarters

Vancouver

Leckie Studio Architecture + Design.Inc

Location	**Vancouver**
Owner	**Slack Technologies**
Architect	**Leckie Studio Architecture + Design**
Completion	**2016**
Size	**1,208 square metres**
Impactful wood components	**Heavy timber post-and-beam, NLT**

Biophilic Patterns in the Project
#1 Visual Connection with Nature
#9 Material Connection with Nature
#10 Complexity & Order
#12 Refuge

Slack is an innovative software company that makes a productivity app and wanted a building that connected to the culture and environment of Vancouver and the Pacific Northwest. Undertaking an adaptive reuse of a century-old warehouse building in the Yaletown neighbourhood of Vancouver was an appropriate fit for the company. Like many buildings of that era the structure is heavy timber post-and-beam construction with NLT (nail-laminated timber) decking, and brick interior and exterior walls.

Visual Connection. In many buildings, the visual connection to nature is a view out the window and sometimes it is internal to the space. In the case of the Slack building, a multi-storey green wall is the centrepiece of the space. The green wall is made with preserved moss that requires little maintenance

and looks and feels like it is still alive. This green wall is lit by a skylight and is visible from multiple spaces in the building.

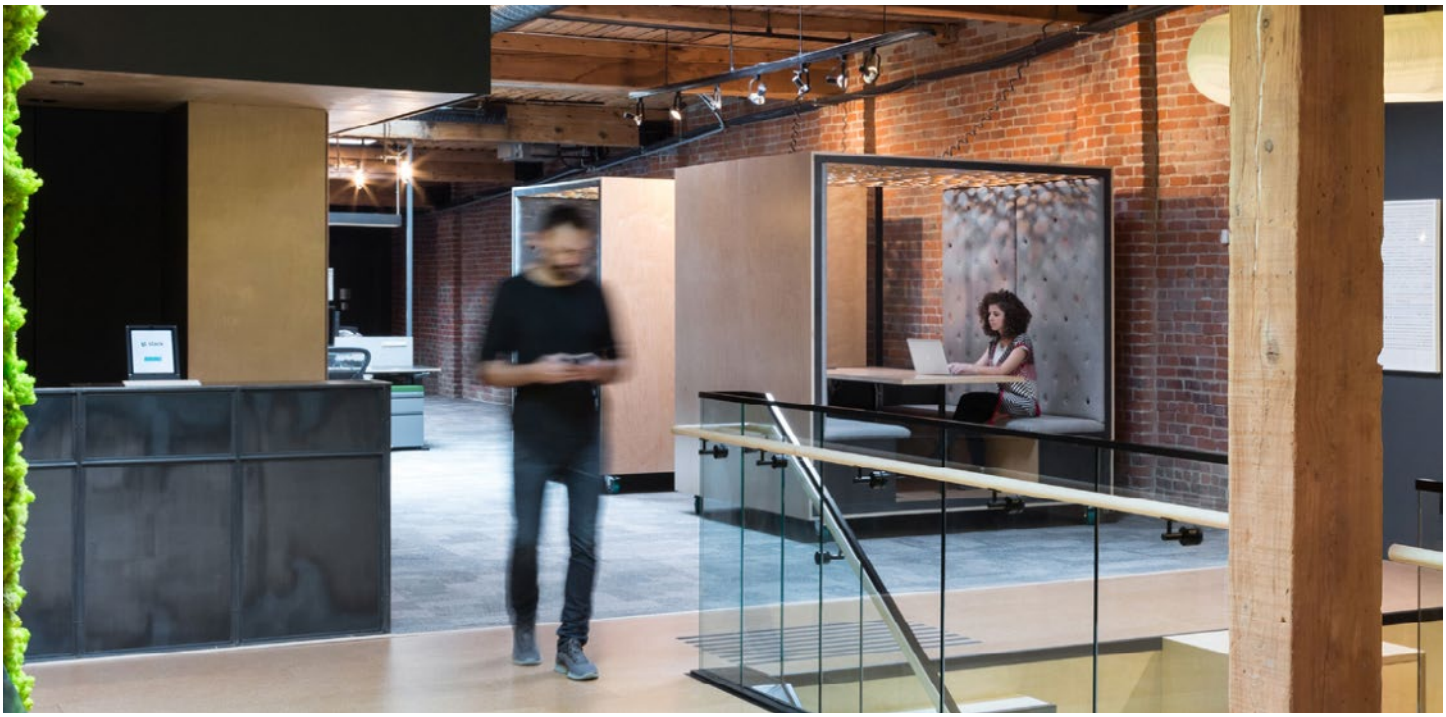
Material Connection. In adaptive reuse projects of old warehouses, the surfaces are frequently covered with drywall. The Slack space intentionally keeps the original structure and wood ceilings exposed. While there is some electrical and mechanical infrastructure overhead, the majority of these systems are hidden, making the wood surfaces the predominant visual feature.

Complexity & Order. The ceiling of the moveable booth units is made of wood panels with varying sizes of circular perforations that bring in light and cast shadows. The light coming through this ceiling creates a dappled light pattern not unlike being under trees in a forest. This is a type of fractal pattern that has been shown to reduce stress.

Leckie Studio Architecture + Design.Inc

Refuge. In many post-occupancy surveys of office spaces, refuge—spaces to retreat and refocus—are sadly missing. The Slack space features moveable booth areas with two high-backed upholstered bench seats facing across a table top and a wood ceiling with circular perforations. They are, in effect, small booth rooms and are stunningly effective refuge spaces.

The interior design of the Slack space celebrates the original structure of the warehouse building and uses a number of natural materials including cork, burlap and reclaimed wood to further support biophilic design.



Leckie Studio Architecture + Design.Inc

Leckie Studio Architecture + Design.Inc

Tall Tree Integrated Health Centre

Victoria

Silent Sama Architectural Photography

Location	**Cordova Bay**
Owner	**Jawl Properties**
Architect	**Cascadia Architects Inc.**
Completion	**2015**
Size	**463 square metres**
Impactful wood components	**Douglas-fir CLT, Western red cedar panelling**

Biophilic Patterns in the Project
#1 Visual Connection with Nature
#9 Material Connection with Nature

Tall Tree Integrated Health Centre is a 463-square-meter stone and wood building nestled in among existing rock outcroppings and mature trees in Cordova Bay on Vancouver Island. Biophilia and the experience of connecting to nature is part of many integrated health practices. The siting of the building within a native forest landscape and the use of natural materials are obvious biophilic design strategies.

Visual Connection. Views to nature are known to lower blood pressure, lower heart rate and improve healing. The Tall Tree facility has vertical windows in individual rooms, along with bands of clerestories, that focus on views to the surrounding trees and landscape. Floor-to-ceiling windows surround the fitness centre with views into the landscape. Typically skylights are treated just as a beneficial source of daylight;

Silent Sama Architectural Photography

however, this building has three large skylights that are placed to allow views into the tree canopy overhead. The pattern of branches and foliage against the sky forms a type of fractal pattern that is known to lower stress.

Material Connection.

The roof and shear walls of the Tall Tree building are constructed of Douglas-fir CLT panels, and western red cedar panelling lines many of the interior surfaces. The ceilings and exterior soffits are wood that, due to the configuration of the clerestory windows, appear as one continuous plane. Native stone masonry wraps much of the exterior walls, furthering the connection to natural materials.

Bayview Elementary School

Tree-canopied Schoolyard

Michael Elkan Photography

Michael Elkan Photography

Location **Vancouver**

Owner **Vancouver School Board**

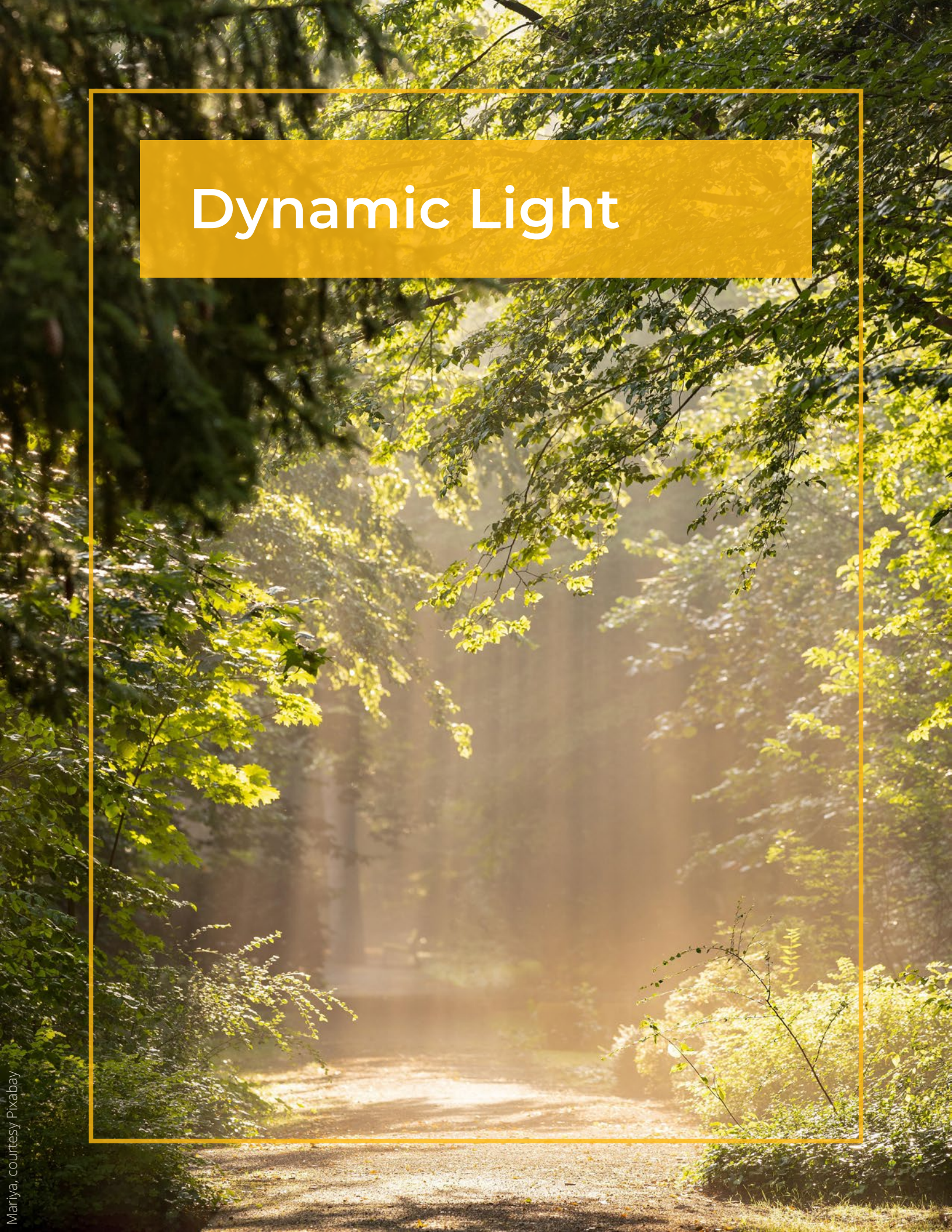
Architect **Francl Architecture**

Completed **2022**

Impactful wood components
Glulam, CLT

The new Bayview Elementary School replaces a 1913 building (that could not meet contemporary seismic standards) with a structure that uses glulam post-and-beam with CLT walls, floors and roof construction. Large trees in the schoolyard along with a significant number of street trees surround the new building. Many of the educational spaces are located on the second floor where large open central spaces and classrooms look out into the tree canopy. Schoolyards with significant tree canopy have been linked to better cognitive development rates among elementary school students. The fact that the building was constructed of wood has become a source of pride for the teachers.

Dynamic Light



Mariya, courtesy Pixabay

Dynamic & Diffuse Light

Biophilic Design Pattern #4

Lighting design has long been used to set the mood for a space, and different lighting conditions elicit a range of psychological responses. The impact of daylight on performance, mood and well-being has been studied for many years, in a variety of environments, and in the overlapping fields of science and design. Early research showed that in daylit spaces we can expect higher productivity, higher performance, and higher sales, as well as better moods.

Later research has put more focus on illuminance fluctuation and visual comfort, human factors and perception of light, and impacts of lighting on the circadian system functioning. Sunlight changes colour from yellow in the morning, to blue at midday, and red in the afternoon/evening. The human body responds to this daylight colour transition in body temperature, heart rate, and circadian functioning.

There is also a direct relationship between wood, light and perception. Daylight across wood in a building can change our perception of colour and warmth over time. Wood can also look different depending on the viewing angle. Light both reflects off the surface of wood and penetrates into the outer cells of the wood where it is scattered in ways that create variable reflectance. This can make both the grain pattern and surface colour appear to change. Artificial wood (as of yet) does not have a cellular structure and cannot replicate this visual experience.

Definition

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

Positive Impacts

- Circadian rhythms
- Visual comfort
- Cognitive performance
- Behavioural performance
- Attitude
- Mood

Project Examples in B.C.

In this chapter

- Tseshaht Tribal Multiplex & Health Centre
- Kelowna Downtown Marina
- Pacific Autism Family Centre

Elsewhere in this book

- Audain Art Museum
- South Flatz Building

Tseshaht Tribal Multiplex and Health Centre

Vancouver Island

Rasti Zabka, courtesy Lubor Trubka Associates Architects

Location	**Port Alberni**
Owner	**Tseshaht First Nation**
Architect	**Lubor Trubka Assoc. Arch.**
Completion	**2007**
Size	**1,521 square metres**
Impactful wood components	**Douglas-fir glulam columns and beams, Rafters, Outriggers**

Biophilic Patterns in the Project

#1 Visual Connection with Nature
#4 Dynamic & Diffuse Light
#5 Presence of Water
#7 Connection with Natural Systems
#14 Risk/Peril

The Tseshaht First Nation Multiplex and Health Centre serves as offices for the Chief and other officials, a health centre, and meeting facilities. The centre of the building is an important communal gathering space where Tseshaht elders interact with each other and children. George Watts, who was hereditary chief of the Tseshaht and the lead for the project, asked architect Lubor Trubka to design a culturally contextualized building of the Tsehaht people, not of western convention.

The wood for the building was all harvested locally from Tseshaht lands, and the majority of the construction crew were Tseshaht people. The structural system of post-and-beam glulams, similar to that used in traditional longhouses, is a repeated module to ease construction. This community involvement is a source of pride and was important economically.

Rasti Zabka, courtesy Lubor Trubka Associates Architects

Dynamic Light. The exterior of the building has outriggers that are a visual reference to traditional potlatch structures and were based on information in archival photographs taken by Edward S. Curtis (early 1900s). Blankets and other items to be given away in the potlatch would have been hung on the outriggers. The beams of the outriggers and horizontal wood slats create a moving shadow pattern on the façade in the adjoining interior spaces.

The building has extensive clerestories that bring light into the core of the building. According to Lubor Trubka, "...sun moving through the building is incredibly important to the Tseshaht as it would be a key figure of their traditional longhouses." This combination of features means that the light and shadow patterns are constantly changing within the building, helping animate the communal gathering place at the centre of the building. The glulam post-and-beam structure, wood rafters and ceiling are all exposed and lit by the clerestories and extensive windows, giving a warmth to spaces.

Visual Connection. The Tseshaht Multiplex is surrounded by trees and native landscape and the long back façade is cantilevered over the Somass River. Windows and glass doors on the balconies provide a strong visual connection with nature. Post-occupancy, some changes were made to further improve views from the offices, particularly to the river.

The Multiplex has become a highly favoured place for people to work.

Photo credit

Kelowna Downtown Marina
Window Treatments

Colin Jewall Photo Studio Inc.

Location **Kelowna, Okanagan Valley**

Owner **Westcorp Inc.**

Architect **Kasian Architecture**

Completed **2013**

Impactful wood components
Douglas-fir glulam columns, Siding and slats

At the Kelowna Downtown Marina, two small service buildings on the ends of piers have angled glulam beams that create large overhanging sloped roofs. The outside of the buildings have a horizontal lathe of wood slats that cover the upper portion of the windows.

The combination of the sloped roof and wood slats creates a dynamic pattern of light and shadow both on the outside and inside of the marina buildings.

Pacific Autism Family Centre
Skylight

Derek Lepper Photography

Location **Richmond, Vancouver**

Owner **Pacific Autism Family Centre Foundation**

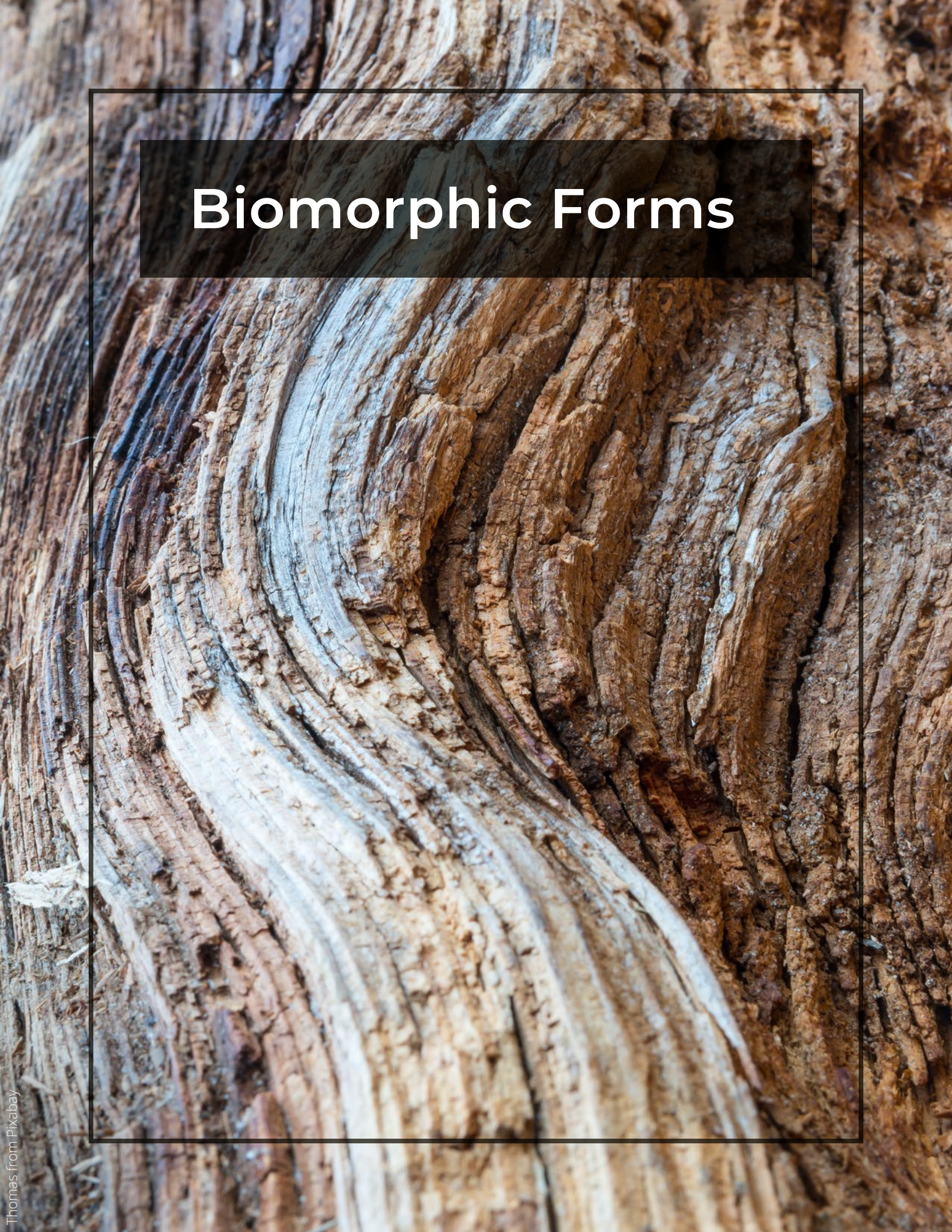
Architect **NSDA Architects**

Completed **2016**

Impactful wood components
Glulam, Laminated Veneer Lumber, Panelling, NLT

Wayfinding is an important consideration for many people on the autism spectrum. The Pacific Autism Family Centre uses dramatic daylighting to create a strong sense of place and floor-to-ceiling windows to help with wayfinding. In the main lobby, a large circular skylight is a space defining element. This oculus is surrounded by a ring of wood and has wood panelling on the inside surface. Light striking a playful mobile of paper airplanes suspended in the centre of the skylight further animates the space.

Biomorphic Forms



Thomas from Pixabay

Biomorphic Forms & Patterns

Biophilic Design Pattern #8

Biomorphic Forms and Patterns as a design pattern has evolved from research on view preferences and shifts in focus that result in stress reduction and enhanced concentration. The science behind why humans have a visual preference for organic and biomorphic forms is not yet fully formulated. While the brain knows that biomorphic forms and patterns are not living things, they are perceived as symbolic representations of life.

Right angles and straight lines are not naturally occurring phenomena. The Golden Angle, measuring approximately 137.5°, is the angle between successive florets in some flowers, while curves and angles of 120° are frequently exhibited in other elements of nature. The Golden Mean (or Golden Section), a ratio of 1:1.618, surfaces time and again among living forms that grow and unfold in steps or rotations, such as with seed arrangements in sunflowers or spirals in seashells.

Biomorphic forms and patterns have been artistically expressed for millennia and are commonly adopted in architecture and interior projects for the feasibility, replicability, diversity and scalability of design options. British Columbia has a number of buildings that are inspired by biomorphic and natural forms found in local nature, like wings, feathers, seashells, and waves. Building these complex forms in wood can be more cost effective than with concrete or steel.

Definition

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

Positive Impacts

- Stress recovery
- Learning outcomes
- Visual preference
- Concentration

Project Examples in B.C.

In this chapter

- VanDusen Botanical Garden and Visitor Centre
- Tsleil-Waututh Administrative Centre
- The Hive

Elsewhere in this book

- UBC Forest Sciences Centre
- Richmond Olympic Oval

VanDusen Botanical Garden | Visitor Centre

Vancouver

Nic Lehoux, courtesy naturallywood.com

Location	**City of Vancouver**
Owner	**City of Vancouver Board of Parks and Recreation**
Architect	**Peter Busby, Perkins+Will**
Completion	**2011**
Size	**1,810 square metres**
Impactful wood components	**Panelized wood roof, Wood columns, Glulam beams, Douglas-fir plywood slats**

Biophilic Patterns in the Project
#1 Visual Connection with Nature
#8 Biomorphic Forms & Patterns
#9 Material Connection with Nature
#12 Refuge
#13 Mystery

The aging VanDusen Botanical Garden needed a new facility to help reinvigorate interest in the gardens. The Visitor Centre, designed by Peter Busby of Perkins+Will Architects, did just that with a dramatic wood and rammed earth building.

Biomorphic forms can be literal or abstract representations of nature. Sometimes they can be cartoonish cute surface forms that don't reflect the spaces within, and sometimes they can be absolutely appropriate to the function and meaning of a building. The VanDusen Botanical Garden Visitor Centre is a great example of the latter—it feels organic and absolutely appropriate. The design is based on the petals of a British Columbia native orchid. The curving forms define the spaces within; for example, one uplifted petal provides shelter from the rain, defines the entrance and draws visitors into the building. The other petals define other parts of the visitor centre, like the cafe, conference and meeting rooms.

Dynamic Light. The oculus in the centre of the building brings in daylight that is then both diffused through and bounced

off the cylindrical metal screen suspended under the oculus. Clerestories formed between the overlap of the petal forms bring in additional light that highlights the wood slats on the ceilings.

Material Connection. The panelized wood structure is not directly visible; however, the wood columns and the paired glulam beams clearly delineate the structure. The underside of the roof and many of the walls have Douglas-fir slats that emphasize the biomorphic forms. The collinear pattern of the slats makes the space much more interesting than if the ceilings and walls were covered with plaster or wall board. Some of the walls of the facility are made with locally sourced rammed earth, which creates surfaces with beautiful textures and colours.

Mystery. The curving hallways create a strong sense of mystery that invites exploration.

Nic Lehoux, courtesy naturallywood.com

Refuge. The curvature of the walls in the main conference room creates an area where seating can be placed such that a person's back is to the wall which then curves up to form a canopy overhead. This sets up a refuge space on the edge of the larger room.

Visual Connection. In a botanical garden, the main focus is of course the gardens themselves. The form of the walls of the visitor centre help to frame the views to the botanical garden on the backside of the building.

KK Law, courtesy naturallywood.com

Sustainability. In addition to being a biophilic building, the VanDusen Botanical Garden Visitor Centre has a number of other green building features, including daylighting, rainwater capture systems, geothermal systems, photovoltaics, solar hot water systems, and on-site wastewater treatment.

The project has achieved LEED Platinum and Living Building Petal Certification and garnered international consideration as an important example of biophilic design when it won the Stephen R. Kellert Biophilic Design Award in 2018.

Tsleil-Waututh Administration & Health Centre

North Vancouver

Andrew Latreille, courtesy Lubor Trubka Associates Architects

Location	**North Vancouver**
Owner	**Tsleil-Waututh First Nation**
Architect	**Lubor Trubka Associates Architects**
Completion	**2018**
Size	**2,900 square metres**
Impactful wood components	**Douglas-fir glulam columns and beams, NLT, Rafters, Outriggers, Carved wood entry doors**

Biophilic Patterns in the Project

#1 Visual Connection with Nature
#4 Dynamic & Diffuse Light
#8 Biomorphic Forms & Patterns

The Tsleil-Waututh Administration and Health Centre houses administrative offices, meeting space, and a health services centre for the First Nation. It is located among homes in the Tsleil-Waututh lands, with parking and landscape in the front and native forest to its back. The building is a linear composition divided by three tall wave-form roof pavilions. The central pavilion is the largest and tallest, and it contains a large space that can be used for events, the main conference room and a reception desk.

The roof structure is composed of nail-laminated spruce-pine-fir panels supported by Douglas-fir glulam beams. Locally harvested wood was used for interior panelling, the reception desks and the exterior of the building.

Ema Peter, courtesy Lubor Trubka Associates Architects

Biomorphic Forms. The roof form of the pavilions is a series of parallel waves, and nail-laminated panels allow the ceiling to follow the curvature of the waves. The Tsleil-Waututh Nation are People of the Inlet, with a strong connection to the water. In the pavilion spaces, the ceiling creates a feeling of being under the waves. The tall wave form pavilions give a presence to the building that is greater than the actual square footage of the building.

Visual Connection. On the back side of the building, balconies and extensive glazing of the pavilions and other spaces allow a great visual connection to the adjoining forest.

Dynamic Light. Glazing on the walls and between the intersections of the waves creates interesting light patterns on the ceiling surfaces and enhances the feeling of being underwater and looking up at the underside of waves.

The Hive

Vancouver

Rendering courtesy DIALOG

Location	**Vancouver**
Owner	**Bentall Green Oak**
Architect	**DIALOG**
Completion	**2025**
Size	**15,096 square metres**
Impactful wood components	**Glulam columns and beams, CLT**

Biophilic Patterns in the Project

#1 Visual Connection with Nature
#8 Biomorphic Forms & Patterns
#9 Material Connection with Nature

2150 Keith Drive, also known as The Hive, is an office building in the False Creek Flats area of Vancouver. The Hive is nine storeys of mass timber construction above a concrete ground floor. As a demonstration project, the building is reflective of changes in code that allow for the construction of taller timber structures.

Biomorphic Forms. Instead of the normal space-consuming internal seismic shear walls, the building has a honeycomb patterned external, brace-frame structure. It is the signature piece of the exterior design, and the angled components of the frame will add visual interest to the interior spaces—giving The Hive its name.

Rendering courtesy DIALOG

Rendering courtesy DIALOG

Visual Connection. The Hive is located near the crest of a hill. On the north side of the building, there are views over the top of a transit station to the North Shore Mountains, a mountain range located to the north of the city of Vancouver, a well-known landmark in British Columbia.

On the south, east and west sides of the building, the façade is set back from the brace frame, creating space for balconies. These balconies have integral planters, so views to nature from inside the offices will be proximate and not just distant views.

Material Connection. Like many new mass timber office buildings, The Hive will have raised floors so that the glulam post-and-beam structure and the underside of the CLT decking are visible in the office spaces.

Material Connection

Image courtesy Pixabay

Material Connection with Nature

Biophilic Design Pattern #9

Our brain has a strong preference for natural materials; it also subconsciously sorts objects as either living or human made. As a design pattern, Material Connection has evolved from research on the physiological and cognitive performance impacts of exposure to natural materials and natural colour palettes.

The ratio of wood to other materials in an interior space can lead to different physiological responses. Large ratios of wood can decrease brain activity, enabling highly restorative experiences for a spa, home, or doctor's office waiting room. Whereas, a room with a moderate ratio of wood may offer a subjective "comfortable" feeling and a significant decrease in diastolic blood pressure without interfering with expectations for high levels of cognitive performance, such as in a commercial office.

Wood and other natural materials are experiencing a surge in interest from designers looking to incorporate biophilic design into their projects. Thermal qualities, textures, a new-found appreciation for naturally occurring imperfections and aging processes, and the growing science supporting the stress-reducing characteristics of natural materials—and of wood in particular—are among the many sustainability factors contributing to this demand. In many wood buildings in British Columbia, exposed structure and finishes are also experiential features with health benefits.

Definition

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

Positive Impacts

- Heart rate variability
- Comfort and Calmness
- Blood pressure
- Stress hormones
- Task performance
- Creativity
- Material preference

Project Examples in B.C.

In this chapter

- Nita Lake Lodge
- MEC Flagship Store
- B.C. Passive House Factory

Elsewhere in this book

Most project examples in this book exhibit strong material connections with nature.

B.C. Passive House Factory

Squamish-Lillooet

Ema Peter, courtesy Hemsworth Architecture

Location	**Mount Currie**
Owner	**B.C. Passive House**
Architect	**Hemsworth Architecture**
Completion	**2014**
Size	**1,500 square metres**
Impactful wood components	**Douglas-fir glulam columns and beams, Larch slats, Yellow cedar vertical louvres, CLT**

Biophilic Patterns in the Project

#1 Visual Connection with Nature
#4 Dynamic & Diffuse Light
#9 Material Connection with Nature
#10 Complexity & Order
#11 Prospect

The B.C. Passive House Factory (BCPH) is a facility that manufactures wood, metal and insulation panels used in constructing energy-efficient Passive House standard buildings. The building was constructed in two phases, and the original portion has a display and meeting space on the ground floor with office space above it. This entry space has floor-to-ceiling windows on two sides with views to the mountains and trees, wood panelling, and a large wood table.

The entryway is a very deliberate, quiet space, separate from the factory floor. The original manufacturing area has CLT walls, large garage doors and high glass clerestories.

Material Connection. Wood surfaces are highly visible in the original part of the building, with a massive Douglas-fir post-and-beam structure combined with CLT panels on the walls. The addition has a different structural system, with

Ema Peter, courtesy Hemsworth Architecture

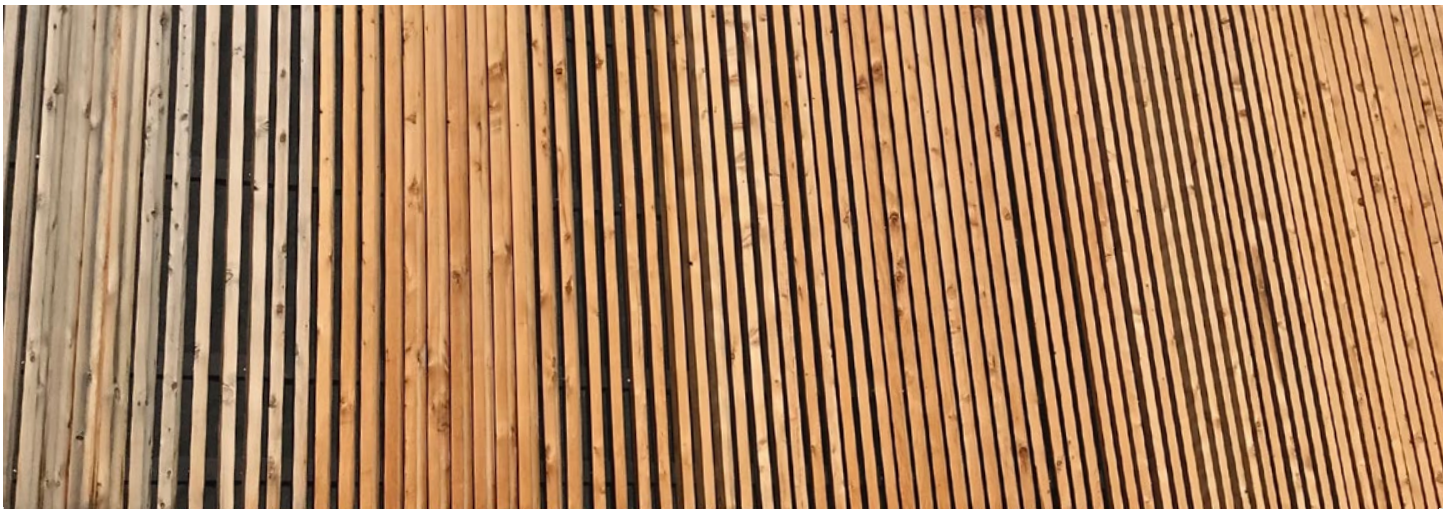
wood columns and metal trusses topped by wood joists and wood panels. The hybrid approach of using metal trusses allowed for a column-free manufacturing space while preserving the movement of daylighting in the space.

The walls of the addition are made with oriented strand board panels, so in combination with the columns, joists and ceiling, wood is still highly visible.

The exterior of the original structure is covered with horizontally placed larch boards that stand proud on the wall, along with a combination of diamond pattern metal panels, the clerestories and vertical yellow cedar louvres.

Visual Connection. High glass clerestories in the original portion of the factory give beautiful views to surrounding mountainsides, while the solid walls below screen out the surrounding industrial buildings and equipment. This is similar to the Japanese garden design concept of a borrowed view—capturing a distant views while blocking unpleasant foreground views.

The original office space did not have any views to



Ema Peter, courtesy Hemsworth Architecture

the outside, but only to the factory floor. Over the objections of the architect, they later added a window to one end of the office space. The later office space has windows, both to the factory floor and behind the exterior wood slats along one wall of the office, which both bring in light and allow some view to the outside. One of the staff said that he didn't like working in the old office space, but liked the newer office space.

On the manufacturing floor, in the addition, there are large, non-transparent clerestories and at eye level, rows of windows with views to the yard, trees and mountains. The lunch room is on the second floor of the addition and has windows with views to the mountains and the factory floor.

Dynamic Light. High clerestories with clear glazing were used on the first section of the factory, which bring in light and views. Large acrylic, non-transparent panels were used for the clerestory in the adjacent area. These do not allow views, but ameliorate the glare that could be caused by clear glazing. B.C. Passive House CEO Matheo Dürfeld said the clerestory and bringing in natural light was a very important part of the design, and that the building was somewhat inspired by Austrian factories.

Complexity & Order. Portions of the exterior are covered with horizontal larch slats, and some portions have vertical yellow cedar louvres. The spacing of the yellow cedar louvres uses a Fibonacci sequence, a numerical sequence found frequently in nature.

Prospect. There are clear views from one end of the building to the other. This makes it easy to see all the activity on the factory floor and is particularly important in spaces with large overhead cranes.

The project team looked at tents, pre-engineered metal buildings, and stick frame construction. Ultimately, it was most cost-effective to build a post-and-beam structure with CLT panels on the exterior.

Nita Lake Lodge
Materiality

KK Law, courtesy naturallywood.com

Bill Browning, courtesy Terrapin Bright Green

Location **Whistler**

Owner **Nita Lake Lodge Group**

Architect **IBI Group**

Completion **2008**

Impactful wood components
Heavy timber, Millwork, Plywood

Nita Lake Lodge is a 77-room lodge and train station built as an entry point to Whistler for visitors during the 2010 Winter Olympics. The structure is a hybrid of concrete, wood, steel and heavy timber, but has the look and feel of the great lodges built by railroad companies in the late 1800s and early 1900s. The heavy timber construction, particularly the Douglas-fir columns with stone bases, gives the building a feeling of substantiality, while the Douglas-fir wood structure and alder wood doors and panelling on the interior reinforce perceptions of warmth and rootedness.

MEC Flagship Store

Exposed Structure

Michael Elkan Photography

Location **Vancouver**

Owner **Low Tide Properties and PCI Developments**

Architect **Proscenium Architecture + Interiors Inc.**

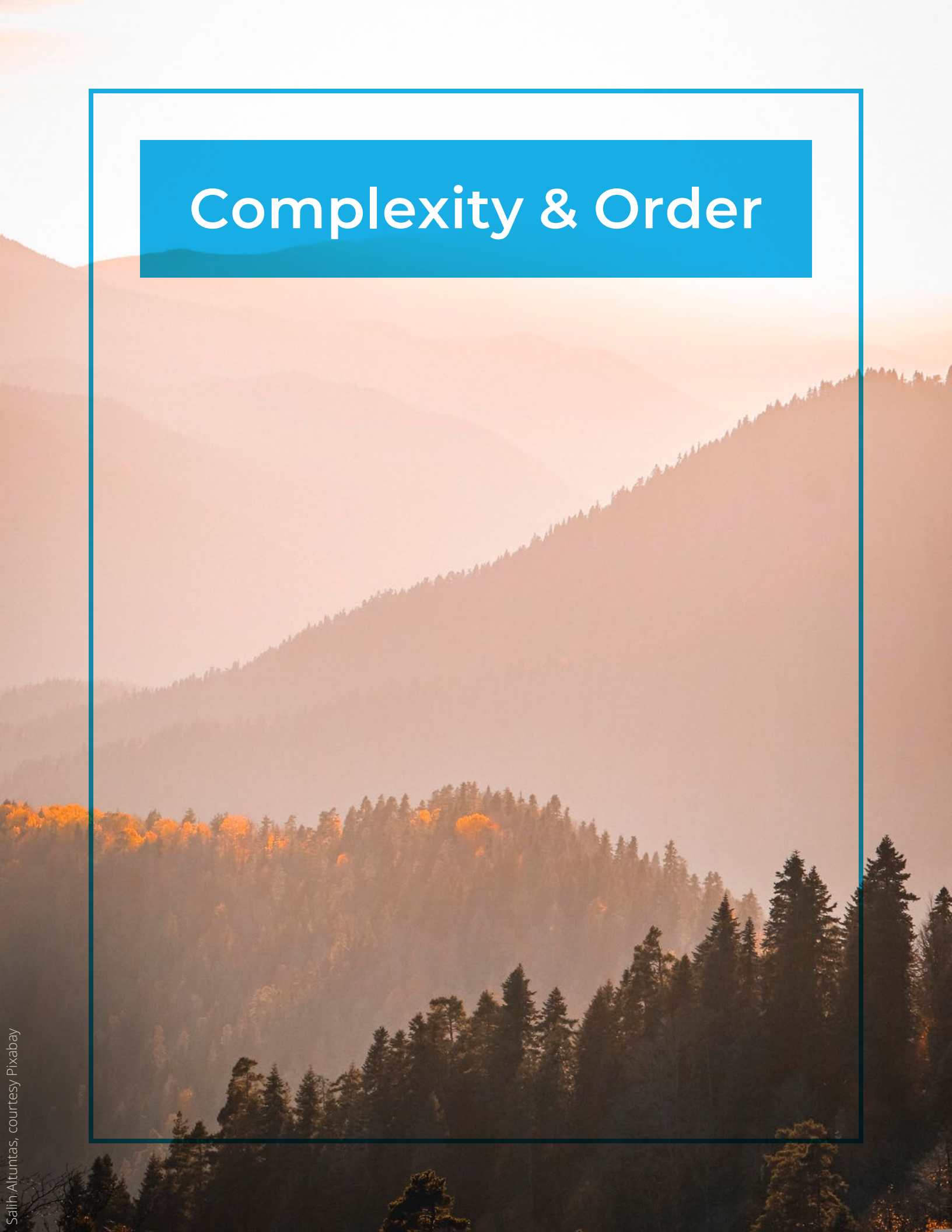
Completion **2021**

Impactful wood components
Glulam columns, Glulam beams, CLT

The MEC flagship store is a big, open building with a brightly daylit central atrium. The mass timber structure is intentionally highly visible through the store. Glulams are used for columns and beams, while CLT is used for decking and for select display racking.

As the subconscious brain associates wood with trees and nature, having an exposed wood structure, with its naturally occuring colour variations, is an effective way for an outdoor sports equipment retailer to connect with its patrons.

Complexity & Order



Salih Altuntas, courtesy Pixabay

Complexity & Order

Biophilic Design Pattern #10

As a design pattern, Complexity and Order has evolved from research on fractal geometries and preferred views; perceived and physiological stress responses to the complexity of fractals in nature, art and architecture; and the predictability of pattern occurrences in nature.

Nested fractal designs are repetitions of the same pattern at different scales. Designs that are characterized by at least three iterative scales of a pattern are more likely to achieve a level of complexity that conveys a sense of order and intrigue, which subsequently reduces stress. This quality is lost in much of modern architecture, which tends to limit complexity to the first or second iteration, such as with the size of windows or mullions, and consequently results in an orderly but uncomplex form that fails to stimulate the mind or engender stress reduction.

Statistical fractals are repeating, nested patterns with variations. These occur frequently in nature; for example, in snowflakes, bracks in a fern leaf, flames in a fireplace, or the grain in a plank of wood. These patterns are so common in nature that when viewed in a human-designed object, the brain processes the image very easily, which leads to a stress reduction effect. This phenomenon is called “fractal fluency”.

In wood construction, the repeating of small elements to assemble larger pieces can create fractal patterns. Actions like hand adzing the surface of wood in traditional First Nations structures creates a repeating pattern with variations in scale and detail.

Definition

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

Positive Impacts

- Physiological stress responses
- Brainwave relaxation
- Spatial navigation
- Subjective mood response

Project Examples in B.C.

In this chapter

- Audain Art Museum
- Kwakiutl Wagalus School

Elsewhere in this book

- Slack Headquarters
- Richmond Olympic Oval

Audain Art Museum

Whistler

Derek Lepper Photography

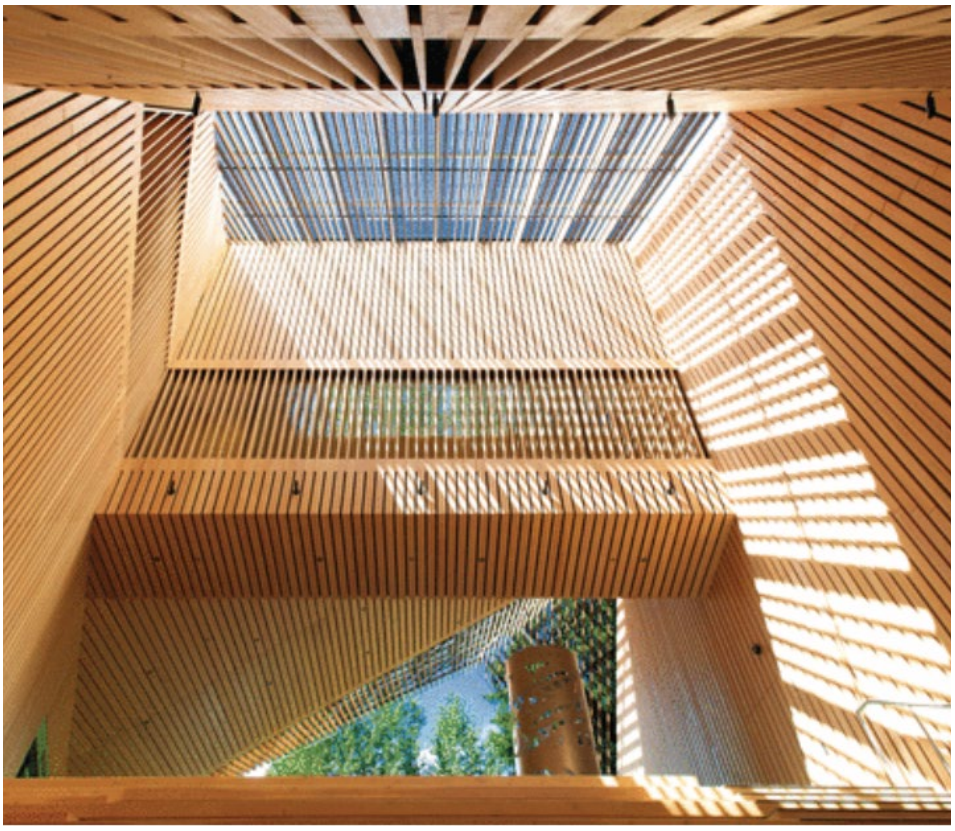
Location	**Whistler**
Owner	**Michael Audain** **Audain Art Museum**
Architect	**Patkau Architects**
Completion	**2016**
Size	**5,203 square metres**
Impactful wood components	**Parallel strand lumber (PSL) columns, Laminated strand lumber (LSL), Western hemlock tongue and groove**

Biophilic Patterns in the Project

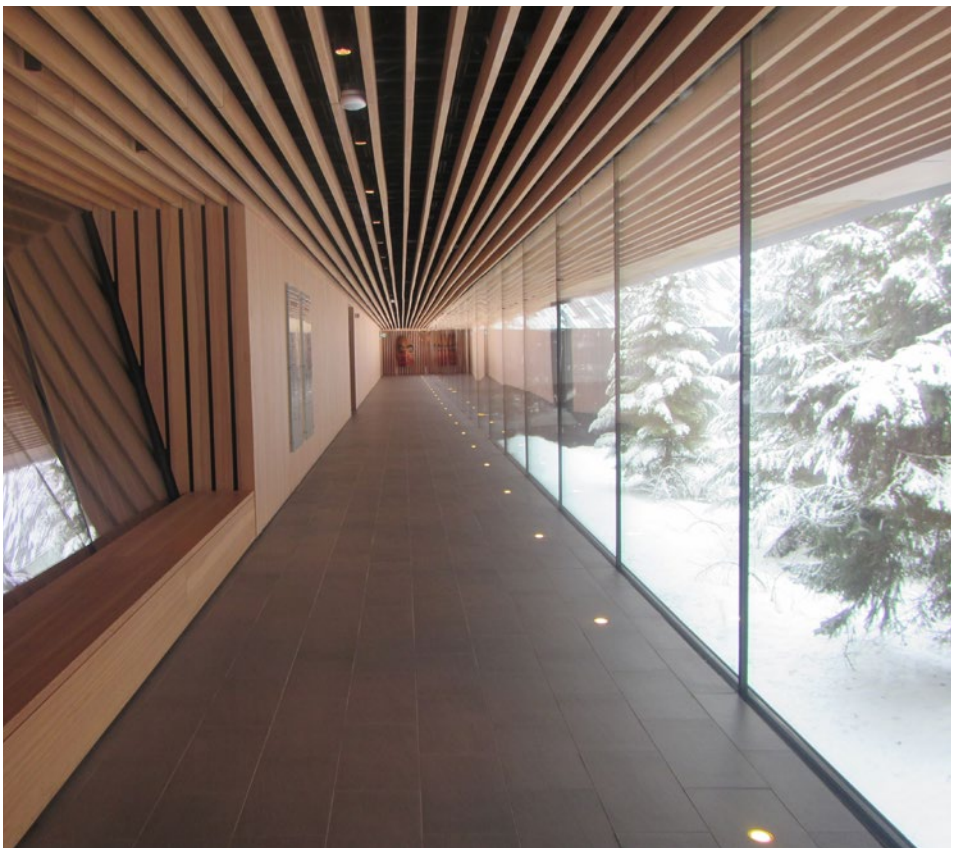
#1 Visual Connection with Nature
#10 Complexity & Order
#11 Prospect
#13 Mystery

The Audain Art Museum in Whistler is the home of the art collection of investor Michael Audain. The structure is elevated above the ground to preserve wetlands and is nestled into the trees. While the building is a hybrid steel structure and prefabricated wood panel construction with a metal skin, the wood slats in the entrance area and lobby are the predominant visual feature. The building is entered from an elevated walkway that leads to a covered portico that is defined by a flaring glass and wood archway.

Complexity & Order. The precisely ordered western hemlock slats in the ceiling of the lobby are laid in one strongly collinear direction which extends down the corridor to the exhibit space entrance. Vertical wood panelling in the lobby and entry area play off the pattern in the ceiling. The composition of slats is most complex in the entryway arch.



James Dow, courtesy Patkau Architects



Bill Browning, courtesy Terrapin Bright Green

Dynamic Light. The structure of the glass roof over the entrance area and a skylight interacts with the patterns of the wood slats to produce amazing and dynamic dappled light patterns on the floor and walls.

Mystery. The collinear pattern of the western hemlock slats draws visitors into the funnel of the entrance portico, but rather than entirely focusing on the entrance doors to the side, the effect is to actually channel people to hidden amphitheater stairs that drop down on the other side of the space. This three-dimensional surprise adds to the power of this space.

Prospect. The long hallway leading to the exhibit space with windows to the surrounding forest, collinear slats overhead, and a large First Nations mask at the terminus is a great example of a prospect condition supporting directional wayfinding.

Kwakiutl Wagalus School

Vancouver Island

Lubor Trubka Associates Architects

Location	**Port Hardy**
Owner	**Kwakiutl First Nation**
Architect	**Lubor Trubka Associates Architects**
Completion	**2016**
Size	**1,637 square metres**
Impactful wood components	**Glulam panelling, millwork, heavy timbers**

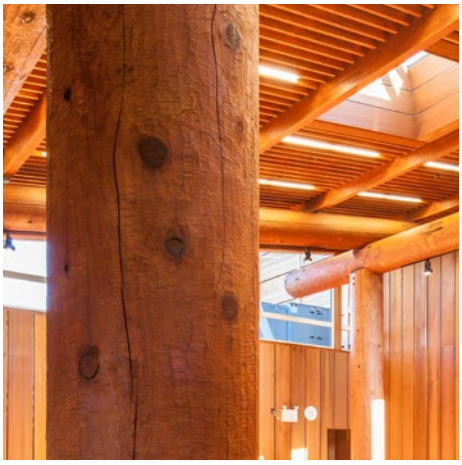
Biophilic Patterns in the Project
#9 Material Connection with Nature
#10 Complexity & Order

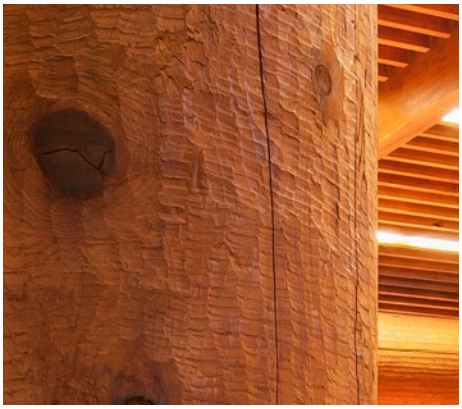
Designing and building the Kwakiutl Wagalus School on Vancouver Island was a community process. There were at least six community design sessions involving 150–200 participants—Kwakiutl elders, students and other community members. They made it clear that they wanted a building that reflects the Kwakiutl community, the fish, the sea and the forest.

The elementary school has classrooms, an auditorium, gymnasium and other spaces around a central multipurpose room. The multipurpose room has a form and structural system that is based on a Kwakiutl longhouse, including a skylight that represents what would be the central smoke hole.

Complexity & Order. The visual composition of massive log columns and beams, with glulam beams, linear ceiling slats and large vertical boards on the walls, is culturally relevant and creates an ordered pattern with enough complexity to make it visually appealing.

In the central multipurpose room are four massive western red cedar timber columns. Six Kwakiutl elders were asked to





Peter Powles

hand adze the surface of these columns. The scooped texture of adzing on a large rounded surface is a great example of complexity and order on a small scale.

When the process of hand-adzing was completed, architect Lubor Trubka was slightly disappointed because the pattern of adze marks was not uniform. Each elder had used their own tool and had slightly different stroke marks leading to variation in the patterns on the columns. However, the architect's attitude completely shifted when, at the opening ceremonies for the building, a young boy brought him over to one of the columns and pointed to a section of the adze marks and said, "that is the pattern of my grandfather's adze".

Material Connection. Much of the wood is western red cedar, which the Kwakiutl call the tree of life and was harvested from Kwakiutl lands. Other local woods used in the school include Douglas-fir and white birch. The woods are all unpainted and make up much of the surface treatments of the interior.

Prospect–Refuge

Cultus Lake in Fraser Valley, B.C. Brigette Werner, courtesy Pixabay

Prospect

Biophilic Design Pattern #11

Prospect as pattern is derived from visual preference research and spatial habitat responses, as well as cultural anthropology, evolutionary psychology and architectural analysis.

The objective of the prospect pattern is to provide users with a condition suitable for visually surveying and contemplating the surrounding environment for both opportunity and hazard. In landscapes, prospect is characterized as the view from an elevated position or across an expanse. While an elevated position can enhance (indoor and outdoor) prospect views, it is not essential to creating a quality prospect experience.

There are potentially endless combinations for applying characteristics of prospect. There is interior prospect, exterior prospect, as well as short-depth and high-depth prospect that can occur simultaneously. The complexity and variety of ways to achieve prospect is what makes it such a powerful design element. For interior spaces or dense urban spaces, prospect is the ability to see from one space to another and is strengthened when there are clear distinctions and the opportunity to see through multiple spaces.

Definition

An unimpeded view over a distance for surveillance and planning.

Positive Impacts

- Attitude
- Blood pressure and heart rate
- Decision making
- Fatigue recovery
- Stress levels
- Perceptions of comfort, safety and vulnerability

Project Examples in B.C.

In this chapter

- UBC Forest Sciences Centre
- South Flatz Building
- Ts'kw'aylaxw Cultural and Community Health Centre

Elsewhere in this book

- Tseshaht Tribal Multiplex and Health Centre
- Pacific Autism Family Centre
- First Nations Health Authority Metro Vancouver
- Audain Art Museum

Refuge

Biophilic Design Pattern #12

Much like Prospect, Refuge as a pattern is derived from visual preference research and spatial habitat responses, as well as cultural anthropology, evolutionary psychology and architectural analysis.

The primary objective of the Refuge pattern is to provide users with an easily accessible and protective environment—a smaller portion of a larger space that supports restoration and stress reduction. The principal spatial condition is protection overhead and to one's back, preferably on three sides.

The secondary objective is to provide visual and/or auditory privacy. Strategic placement, orientation and aperture of a refuge space can each influence the efficacy of a refuge experience. The traditional lean-to is a great example of basic refuge, as are an egg chair, a high-backed booth, a cozy bay window seat, or an inglenook.

Definition

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

Positive Impacts

- Attitude
- Blood pressure
- Concentration
- Fatigue recovery
- Heart rate
- Stress levels
- Perceptions of comfort and safety

Project Examples in B.C.

In this chapter

- UBC Forest Sciences Centre
- South Flatz Building
- Ts'kw'aylaxw Cultural and Community Health Centre

Elsewhere in this book

- Slack Headquarters

UBC Forest Sciences Centre

Vancouver

Don Erhardt, courtesy naturallywood.com

Location	**UBC School of Forestry**
Owner	**University of British Columbia**
Architect	**DGBK Architects**
Completion	**1998**
Size	**21,500 square metres**
Impactful wood components	**Parallel strand lumber (PSL), Wood beams, Columns, Panelling, Pergola**

Biophilic Patterns in the Project

#1 Visual Connection with Nature
#4 Dynamic & Diffuse Light
#9 Material Connection with Nature
#10 Complexity & Order
#11 Prospect

The University of British Columbia School of Forestry's Forest Science Centre is a five-storey, L-shaped building with a thin atrium through the centre. One leg of the atrium is the entrance to the building with offices on one side and auditorium/classroom space on the other. The other leg has circulation on one side and study areas stepping up on the other. The structural system for the glass roof is composed of a row of 13-metre-tall bundled PSL columns to one side of the atrium. The columns are topped by a forest of PSL angled beams. The walls are covered in wood panelling.

Refuge. Refuge experiences are often created at the scale of small rooms or individual pieces of furniture. Occasionally, spatial factors combine to create perceptions of a comforting embrace in larger spaces. In the study space of the Centre, the narrow configuration of the atrium confines the space.

Overhead balconies along one side and large seating niches carved into the wall along the other side provide overhead enclosure. In the center of this space are very large potted trees and a wooden pergola providing extra cover.

This atrium space is considered to be one of the favourite places on campus to study. There are meeting spaces on the main level and on balconies and other levels around the perimeter of the atrium. Other than the central space at the student union during lunch time, this atrium may have one of the higher concentrations of people than any other public space on campus.

In the entrance of the atrium, seating niches built into the sloping wood-panelled walls provide a refuge to sit and observe the action in the busy atrium space.

Visual Connection. The atria are tall and relatively narrow with walkways and glazing at the ends, although there is not much view to outside. Trees and other plantings on one side of the atrium provide a strong internal visual connection with nature. The planters have diverse vegetation with trees and an understory, giving the effect of a miniature habitat.

Biomorphic Forms. The structural system is an abstract reference to a forest canopy. The PSL column bundles have 'branches' supporting the glass roof. The asymmetry of the columns on one side of the atrium and the branches reaching out across the space makes the visual reference to a canopy more effective. The mottled surface pattern of the parallel strand lumber also gives the illusion of bark columns and beams.

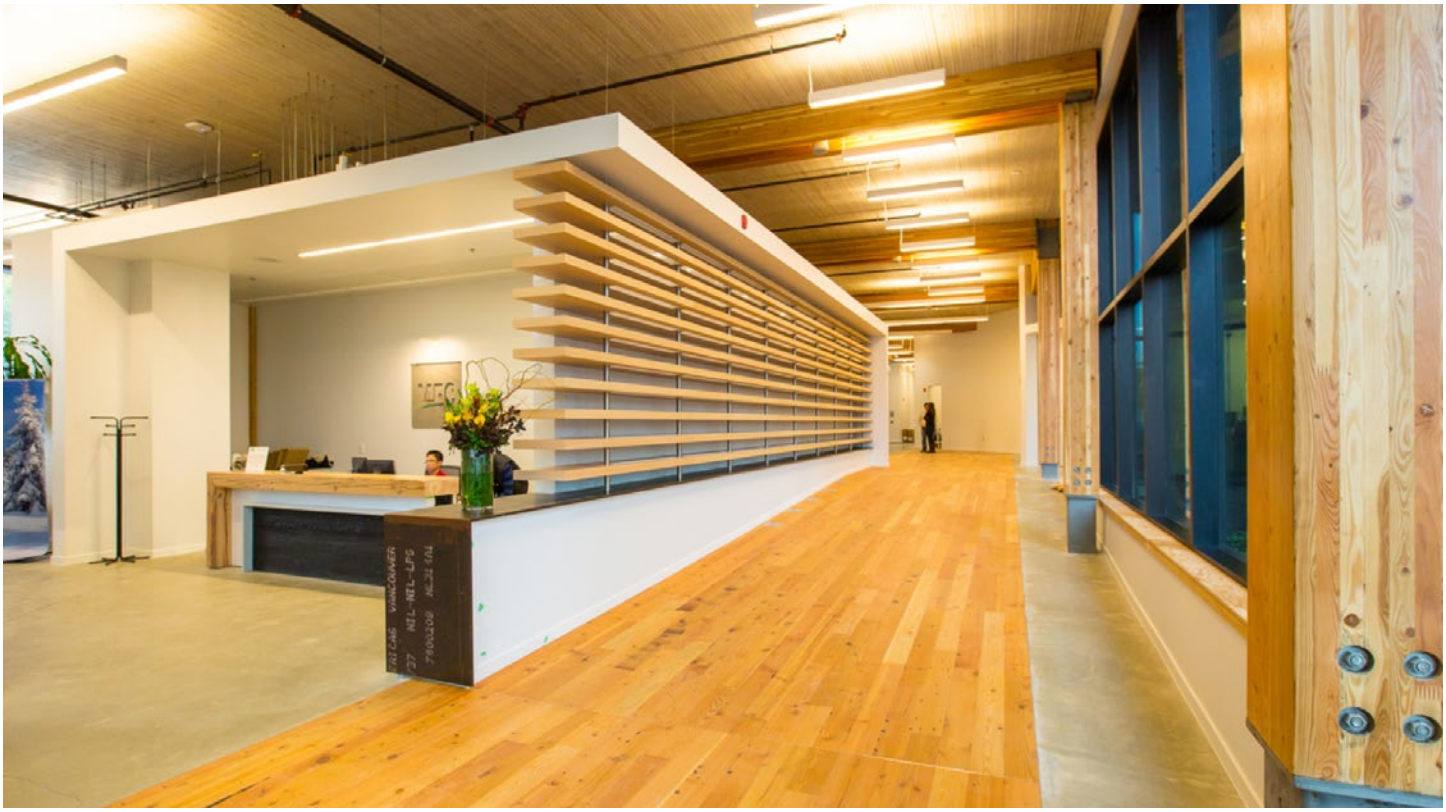
Prospect. Strong distant views are accessible through the centre's atrium and from every floor.

Risk. At the intersection of the legs of the atrium, diagonal catwalks connect across the space. These catwalks with glass railings in the upper part of the atrium introduce an element of risk, which is partly mitigated by lattice outriggers at the base of each walkway.

Don Erhardt, courtesy naturallywood.com

South Flatz Building

Vancouver



KK Law, courtesy naturallywood.com

Location	**Vancouver**
Owner	**Low Tide Properties and PCI Developments**
Architect	**Proscenium Architecture + Interiors Inc.**
Completion	**2014**
Size	**10,219 square metres**
Impactful wood components	**Glulam columns and beams, Millwork, NLT**

Biophilic Patterns in the Project
#9 Material Connection with Nature
#11 Prospect

The South Flatz Building is a four-storey commercial office building that splits what would typically be a wide rectangular floor plate into a V shape. This allows for better daylighting performance and increases the number of spaces that have a direct view to the outside. It also allows for a private internal courtyard. At the base of the V is a large open stair that invites people to walk rather than take the elevator and creates a visual connection between floors.

Prospect. One of the floors on the primary circulation path is along the wall of windows lining the inside. There is a clear view from one end of the building to the other, which helps the sense of wayfinding. This is a classic, effective example of the pattern of Prospect. Additionally, having clear sightlines between multiple floors in the open stairwell creates a vertical prospect view.

KK Law, courtesy naturallywood.com

Material Connection. The main structure is exposed glulam post-and-beam, and the floors are nail-laminated timber (NLT) panels. As NLT is a mass timber strategy that has been around for more than a hundred years, it can be found in many late 19th century heavy timber buildings. Today, the NLT panels might be made on-site, or pre-manufactured and brought to the site. The use of raised floors with underfloor air distribution keeps the ceilings uncluttered and the wood surfaces much more visible.

Sustainability. The South Flatz building has a number of other green building features, including geothermal wells for heating, light shelves on the exterior to lower heat gain and help with glare, daylight sensors to control window blinds and lighting, and rainwater capture systems that then are used to supply landscape irrigation. The building achieved a LEED Platinum Certification.

Ts'kw'aylaxw Cultural and Community Health Centre

Gathering Spaces

Ema Peter, courtesy Unison Architecture Ltd.

Location **Lillooet**

Owner **Ts'kw'aylaxw First Nation**

Architect **Unison Architecture Ltd.**

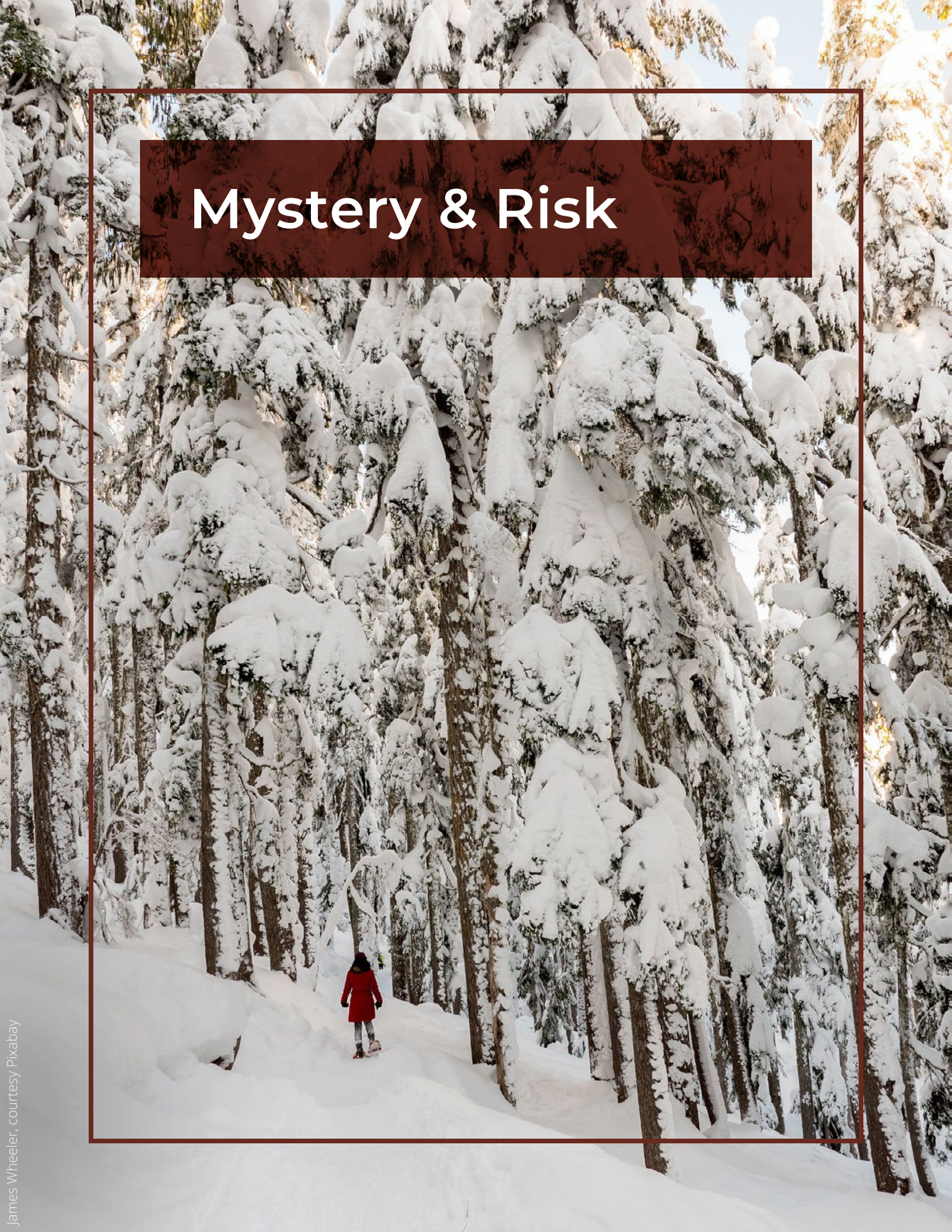
Completion **2018**

Impactful wood components

Douglas-fir glulam columns, NLT decking, Wood composite Passive House panels, Birch veneer, Plywood panelling, Aspen logs

The Ts'kw'aylaxw Cultural and Community Health Centre is a three-storey building with offices, meeting rooms, a gymnasium and an Elders' gathering space on the third floor. The cylindrical space has a feature wall of aspen logs, a banquette along the wall, and a large rock in the centre. Adjoining is a larger, taller multipurpose space with a lowered wood ceiling and circular skylight in the centre. The Elders' gathering space feels like a firepit in the forest, and spatially it is somewhat like the traditional pithouse structures. The round, embracing space embodies the concept of Refuge.

Mystery & Risk



James Wheeler, courtesy Pixabay

Mystery

Biophilic Design Pattern #13

A strong Mystery condition has a palpable sense of anticipation—a teasing of the senses in a duel of denial and reward that compels one to further investigate the space. As a design pattern, Mystery has evolved from research on visual preference and perceived danger and is supported by research on pleasure responses to anticipatory situations. These pleasure responses within the brain may be similar to the sense of anticipation. Listening to music is pleasurable in part due to assumptions we make as to what beats, rhythms or words come next. Mystery conditions theoretically create that same experience, where we find pleasure in making assumptions about what may be around the next corner.

Key to perceptions of Mystery is that spatial conditions do not engender a fear response. The conditions that differentiate between fear (surprise) and pleasure (reward) centre around the visual depth of field. Obscured views with a shallow depth of field (<20 ft) have can lead to unpleasant surprises; whereas, greater visual access with higher depths of field (≥100 ft) are preferred and can support curiosity and exploration.

A good Mystery condition can also be expressed through the obscuring of the boundaries and a portion of the focal subject (e.g., artwork, room, building, outdoor landscape feature), thereby enticing the user to anticipate the full extent of the subject and explore the space further. Using vertical wood slats can be a very effective way to create a curving wall or a partially obscured view.

Definition

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

Positive Impacts

- Spatial preference
- Curiosity
- Interest

Project Examples in B.C.

In this chapter

- First Nations Health Authority Metro Vancouver Office
- Squamish Lil'wat Cultural Centre

Elsewhere in this book

- Audain Art Museum

Risk/Peril

Biophilic Design Pattern #14

A biophilic Risk/Peril condition feels exhilarating and with an implied threat, maybe even a little mischievous. Perceptions of danger and intrigue combine to encourage exploration, possibly to an irresistible degree.

The defining difference between Risk/Peril and fear is in the degree of perceived threat and control. Having an awareness of a controllable risk can support positive experiences that result in strong dopamine or pleasure responses. In adults, short doses of dopamine support motivation, memory, problem solving and fight-or-flight responses; whereas long-term exposure to intense Risk/Peril can be counterproductive. For this reason, introduced risk conditions need to be optional to the prospective user.

The objective of the Risk/Peril pattern is to arouse attention and curiosity and refresh memory and problem solving skills. There are different degrees of risk that can be incorporated into a design depending on the intended experience or the space available. Crossing cantilevered walkways and wood-slatted bridges, walking on glass-railing stairs or balconies and rock-hopping through a shallow water feature are examples of Risk/Peril experiences.

Definition

An identifiable threat coupled with a reliable safeguard.

Positive Impacts

- Motivation
- Memory
- Problem solving
- Fight-or-flight response

Project Examples in B.C.

In this chapter

- UBC Earth Sciences Building

Elsewhere in this book

- UBC Forest Sciences Centre

First Nations Health Authority Metro Vancouver Office

Vancouver

Rendering courtesy DIALOG

Location	**North Vancouver**
Owner	**First Nations Health Authority**
Architect	**DIALOG**
Completion	**2024**
Size	**9,000 square metres**
Impactful wood components	**Douglas-fir glulam columns, Douglas-fir CLT**

Biophilic Patterns in the Project
#1 Visual Connection with Nature
#9 Material Connection with Nature
#11 Prospect
#13 Mystery

The First Nations Health Authority Metro Vancouver is a new five-storey office building built on a sloping site on the Tsleil-Waututh Nation lands and serves First Nations from throughout the province. The glulam columns and beams along with the CLT decking is visually similar to the traditional plank house construction of the Coast Salish peoples. Different floors will have art and details that are cultural references to different regions of British Columbia. The spandrels on the exterior of the building and elements on the corners of the building are orange-red aluminum composite pieces that reference Indigenous basketry and plank house construction.

Mystery. The centre of the building is a skylight atrium with a red metal stair connecting all the floors. When entering the building, this stair is partially visible and draws attention to itself, attracting people to walk up through the building rather than taking the elevator. The red colour is a strong contrast to the wood and surfaces of the columns, beams and ceiling, and it has cultural significance to a number of the First Nations.

Rendering courtesy DIALOG

Visual Connection. The office spaces are open plan and have views to the surrounding forest, and some portions of the building, including a rooftop terrace, also have views to a nearby inlet. The landscaping around the building uses native species.

Material Connection. The First Nations Health Authority chose to build a wood structure as it both ties to cultural history and has environmental benefits. The structure has two concrete cores for earthquake shear resistance and is built with glulam beams and columns with CLT decking. The use of raised floors and underfloor air distribution keeps the wood structure and wood ceilings visible. Some wood panelling and some lowered wood ceilings reference traditional plank house construction.

Prospect. The open plan offices allow clear views through the spaces, resulting in a strong prospect experience.

Sustainability. It was important for the building to reflect First Nations environmental ethics. The raised floor with underfloor air distribution improves air quality and allows individualized control of temperature and airflow. The exterior basketry-inspired metal bands help shade windows to control glare and lower summer heat gain. The internal stormwater capture system and native species landscape swale system— with attention to eliminating toxic materials at risk of leaching toxins — allowed the project to receive Salmon Safe certification.

Squamish Lil'wat Cultural Centre

Whistler

Michael Bednar, courtesy naturallywood.com

Location	**Whistler**
Owner	**Squamish Nation and Lil'wat Nation**
Architect	**Formline Architecture and Toby Russell Buckwell & Partners**
Completion	**2008**
Size	**3,350 square metres**
Impactful wood components	**Glulam post-and-beam**

Biophilic Patterns in the Project
#1 Visual Connection with Nature
#9 Material Connection with Nature
#11 Prospect
#13 Mystery

The Squamish Lil'wat Cultural Centre is a museum and cultural centre for the two Nations indigenous to the Whistler area. In their discussion of objects and cultural meaning, the Squamish and Lil'wat guides emphasized the importance of western red cedar and yellow cedar to their lives. These trees provided material for clothing, buildings, canoes, ceremonial masks, boxes, totem poles, basketry, and medicines.

The structure is glulam post-and-beam, with western red cedar cladding, interior panelling and massive carved western red cedar entry doors. The post-and-beam structural system is a reference to the traditional Squamish longhouses, while the radial composition is a reference to the form of Istken, traditional Lil'wat pit houses.

Mystery. The building has a radial floor plan with a curving back wall and beams reaching out through a curving glass front façade; the curvature makes the space feel bigger and draws

you through the building. Totem poles, hanging banners and display panels somewhat obscure the view, while the front façade has portions that inset—all of which enhances the mystery experience.

Visual Connection. The full-height glazing along the front façade frames views over the road and across to the stream and forest.

Material Connection. The post-and-beam structure, panelling, and other wood components are left exposed, making wood one of the major surfaces in the spaces.

Prospect. The two-storey space has some sight lines that terminate in carvings, canoes or other important cultural objects. This is a good way to further support exploration of the spaces.

Sustainability. In addition to local sourcing of wood, the Squamish Lil'wat Cultural Centre has a number of sustainability measures. The building was placed on a steep, rocky slope in a way that minimized the need for dynamiting and has native species landscaping, green roofs, and permeable walkways to infiltrate precipitation. The building uses high-performance glazing and radiant floors to lower energy use and can be naturally ventilated during spring and fall. The centre achieved a LEED Gold Certification.

Michael Bednar, courtesy naturallywood.com

Michael Bednar, courtesy naturallywood.com

UBC Earth Sciences Building
Interior Stair

KK Law, courtesy naturallywood.com

Bill Browning, courtesy Terrapin Bright Green

Location **Vancouver**

Owner **University of British Columbia**

Architect **Perkins+Will**

Completion **2012**

Impactful wood components
CLT, Glulam beams

The cantilevered stair extends five floors up into the space. The adjoining walkways, having transparent railings with minimal metal top caps and horizontal wood bars, can be quite exhilarating or terrifying to traverse depending on one's fear of heights. The thin wood bar offers the slightest sense of enclosure on the upper landings in particular. On the lower landings, having the wood underside of the structure gives a little sense of warmth and safety that other materials might not be able to engender.

Awe

Kattsussi, courtesy Pixabay

Awe

Biophilic Design Pattern #15

Awe is a sensory overload, experienced in the medial-prefrontal cortex of the brain, that triggers a pause in the body, reflected in the muscles in the face going slack, but not the physiological signs of fear. An Awe experience can change our perception of the world around us and lead to outward focus and prosocial behavior.

The original definition of Awe was related to a fear experience, like the fear of god. This framing shifted to include the sublime—beauty with a tinge of fear. In nature, a sense of Awe can occur when watching lightning under a thunderstorm on the horizon, walking among ancient Douglas-fir and cedar trees, looking at the stars at night, or watching a butterfly emerge from a cocoon. Paintings, music and great performances can induce Awe as well.

Conditions that lead to a characteristically awe-inducing experience embody perceptions of both vastness and accommodation. Awe experiences can be induced by a transition to a grand space, like walking up the rim of the Grand Canyon, entering the nave of Notre Dame or encountering the Kamakura Buddha. Smaller scale experiences of awe can also have effective outcomes. Frank Lloyd Wright used the phrase “compression and release” to explain the spatial sequence found in many of his buildings in which one enters a small low space and then transitions into a higher and more expansive space.

Definition

An overwhelming experience that subsequently requires mental reaccommodation.

Positive Impacts

- Stress reduction
- Attitude
- Overall happiness
- Charitability
- Humbleness
- Prosocial behavior
- Ethical decision-making

Project Example in B.C.

In this chapter

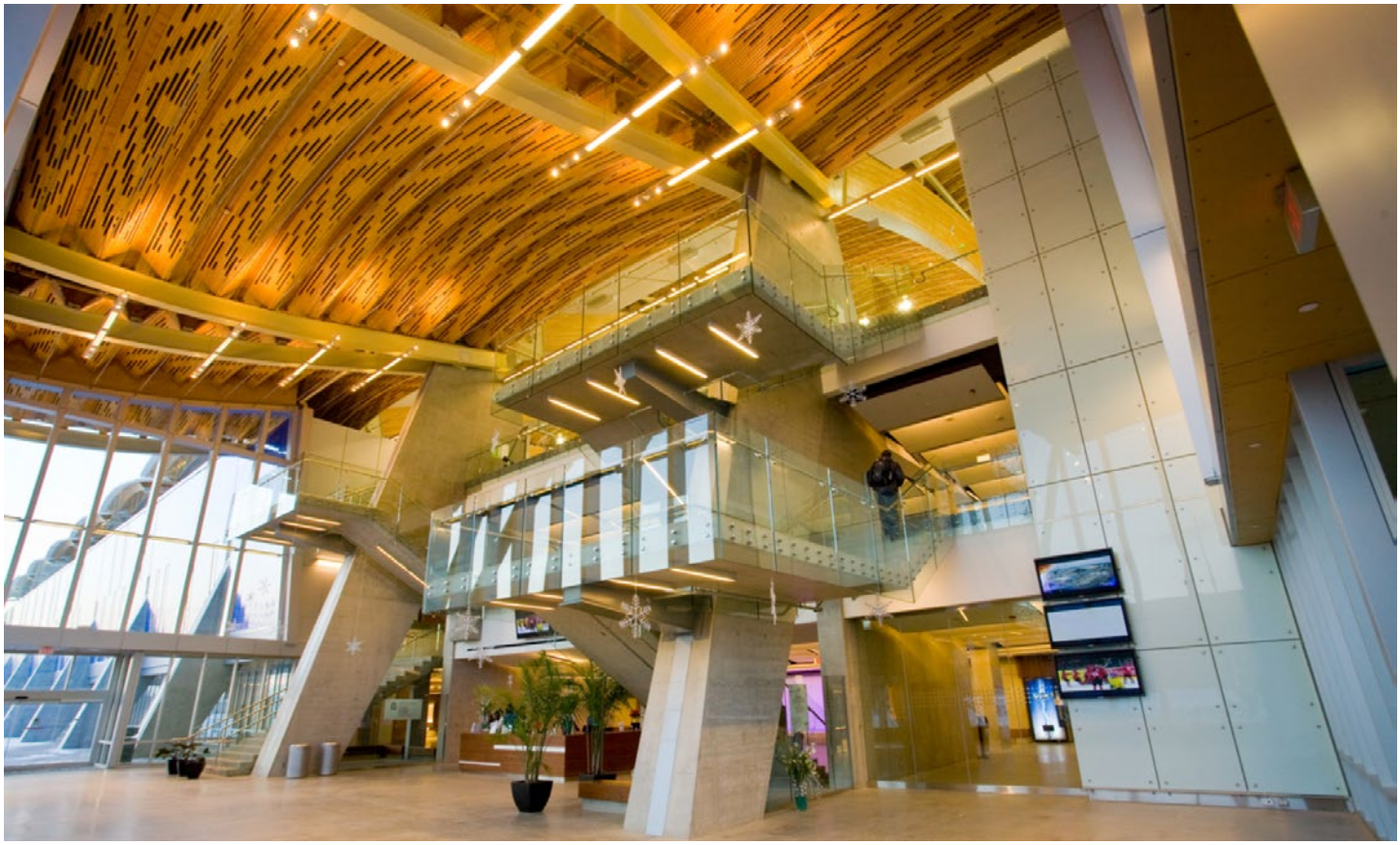
- Richmond Olympic Oval

Elsewhere in this book

- Pacific Autism Family Centre
- VanDusen Botanical Garden & Visitor Centre

Richmond Olympic Oval

Vancouver



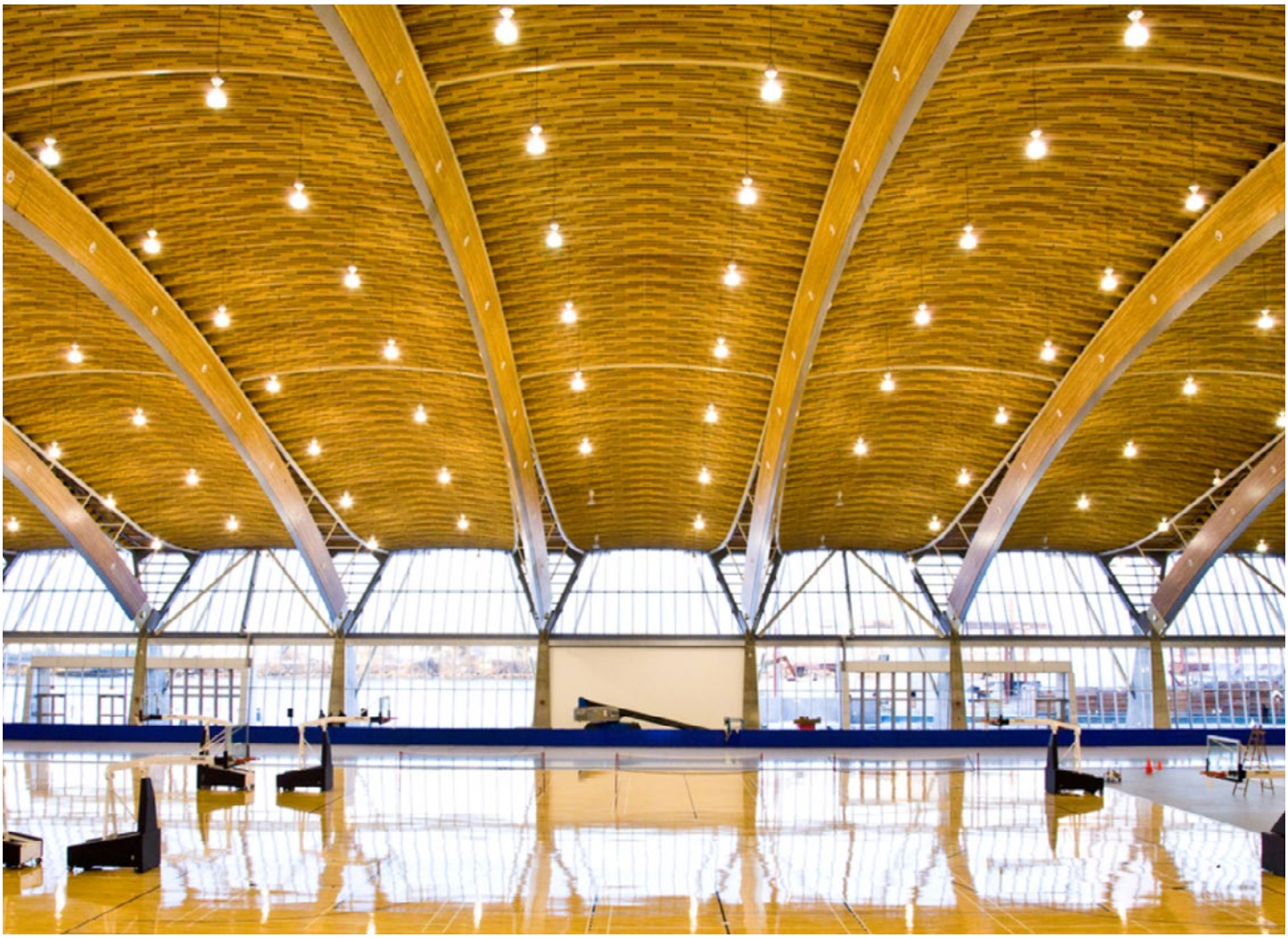
KK Law, courtesy naturallywood.com

Location	**Richmond**
Owner	**City of Richmond**
Architect	**Cannon Design**
Completion	**2008**
Size	**33,750 square metres**
Impactful wood components	**Composite steel wood Glulam beams, Spruce-pine-fir lumber, Plywood, Heavy timber**

Biophilic Patterns in the Project
#8 Biomorphic Forms & Patterns
#10 Complexity & Order
#15 Awe

The Richmond Olympic Oval was originally built to host the speed skating events for the 2010 Winter Olympics and now houses facilities for a variety of sports. The space is big enough to accommodate six football fields and has one of the largest free-span wood roofs ever built. The vast majority of the structure uses small-dimension, straight pieces of lumber glued together and bent in curved spaces. Much of the wood was sourced from standing dead trees that were beetle-killed. The main structure consists of massive steel-keeled, V-form glulam wood beams connected by WoodWave panels.

Awe. The Oval has tall perimeter windows and an impressive entryway, but the sheer scale of the space is only revealed upon viewing the interior of the structure. The sense of



KK Law, courtesy naturallywood.com

awe is further enhanced by the lack of interior columns and the multiple curvatures of the structure.

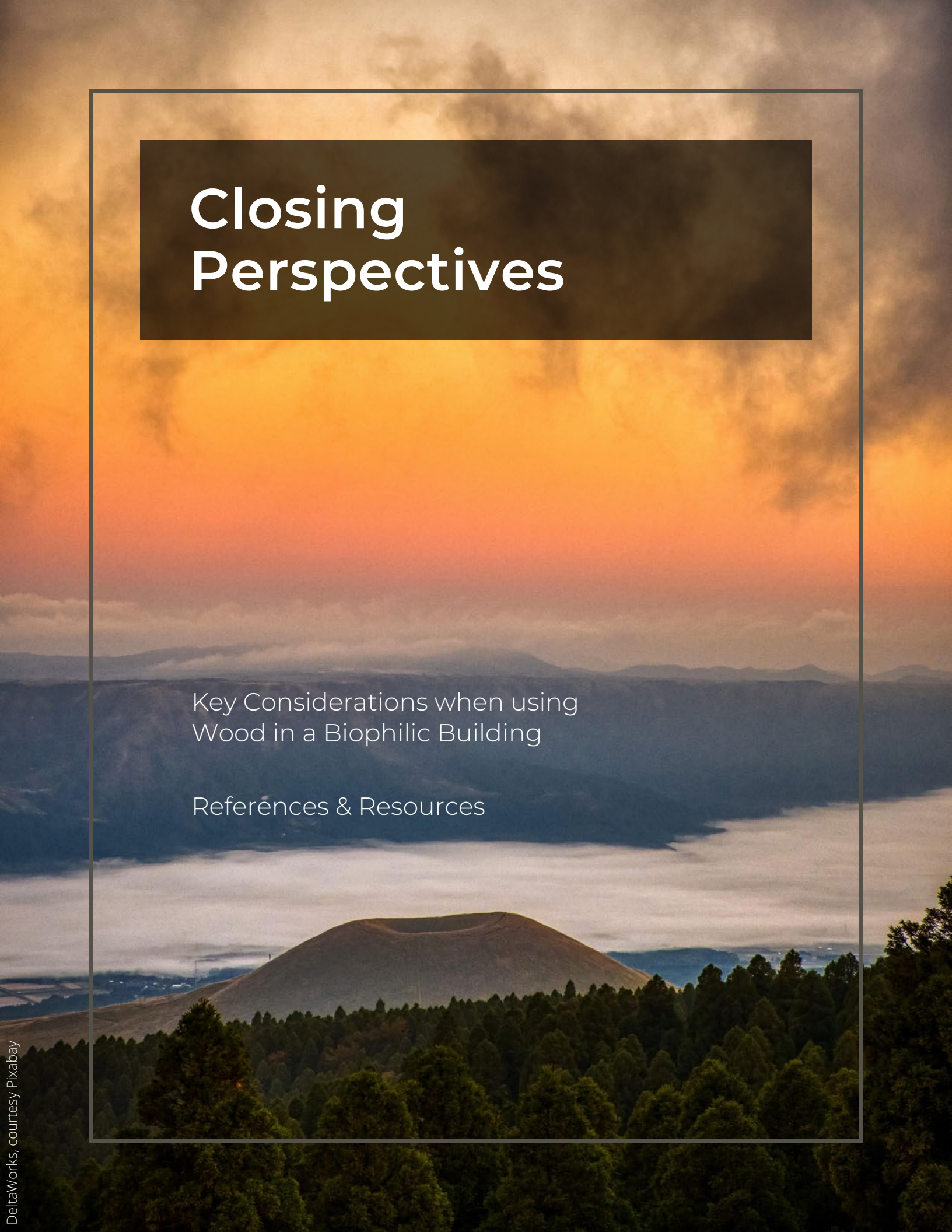
Biomorphic Forms. The combination of the curving glulams and WoodWave panels is much like feathers on the wing of a huge bird. The building entry is sheltered by three curving cantilevered feathers, the design of which was inspired by heron wings. The combination of curvatures is also very similar to a pattern of waves on water.

Complexity & Order. The large, curved glulams create a regular order and segmentation to the space, while the WoodWave panels have a compound curvature that is perpendicular to the glulams. The WoodWave panels are made of small individual pieces of lumber with gaps between some of them. The pattern of light and shadow created by these perforated surfaces has a fractal nature.

Closing Perspectives

Key Considerations when using Wood in a Biophilic Building

References & Resources



DeltaWorks, courtesy Pixabay

Key Considerations when using Wood in a Biophilic Building

Wood makes spaces feel warmer and more creative. Wood can be used to create amazing biomorphic forms, areas with engaging light and shadow patterns and embracing refuge spaces. To maximize those benefits and others when designing with wood, there are several considerations for potentially maximizing the biophilic benefits of wood in our built environments.

Celebrate wood, make it readily visible

In general, having wood at around half of the surface area in a space is optimal for engendering a biophilic response. The amount of wood used on a given project may be influenced by any number of factors, but to optimize the benefit of that wood (whether in small or large quantities), think about which spaces and surfaces will be most visible. For example, in a fully fitted-out, new office with furniture in place and possibly a carpet, the ceiling plane will be the most visible continuous surface; whereas, with an existing non-wood structure, the best opportunity may be as wall panels, exposed flooring or furniture—but don't underestimate the impact of small interventions, such as wood railings and door pulls.

Prioritize grain and contour lines

Grain and contour are visually more desirable than knots. Judicious use of knots is good practice; however, too many knots can redirect visual fixation, which can negate the stress reduction characteristics of the collinear and contoured patterns.

Preserve or enhance the grain

Choose a finish that enhances the grain pattern. Avoid heavy painting or lacquering that hides the main characteristics distinguishing the wood from synthetics or other highly processed materials.

Balance priorities

Sustainable wood sourcing is crucial for carbon accounting, habitat protection, and local economic resilience. The use of sustainably sourced wood in buildings can also be encouraged for its benefits to human health. In the design process, alongside life-cycle analyses and cost considerations, consider the long-term positive health implications of wood in material selection and application.

Integrate instead of add

Conventional cost engineering processes don't "value" the health benefits of building materials. Designing with wood should therefore be integral—relaying a wholehearted commitment to ensuring that wood material choices serve more than one purpose or goal (e.g., structure, carbon, sourcing *and* occupant health) so that health benefits can't be cost engineered out.

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Michael Elkan Photography

Brock Commons Tallwood House is an 18-storey student residence at the University of British Columbia (UBC) designed by Acton Ostry Architects Inc. and completed in 2017. While the hybrid mass timber structure is not exposed, interior features such as this lounge are clad in a variety of wood finishes and patterns accessible to all residents.


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