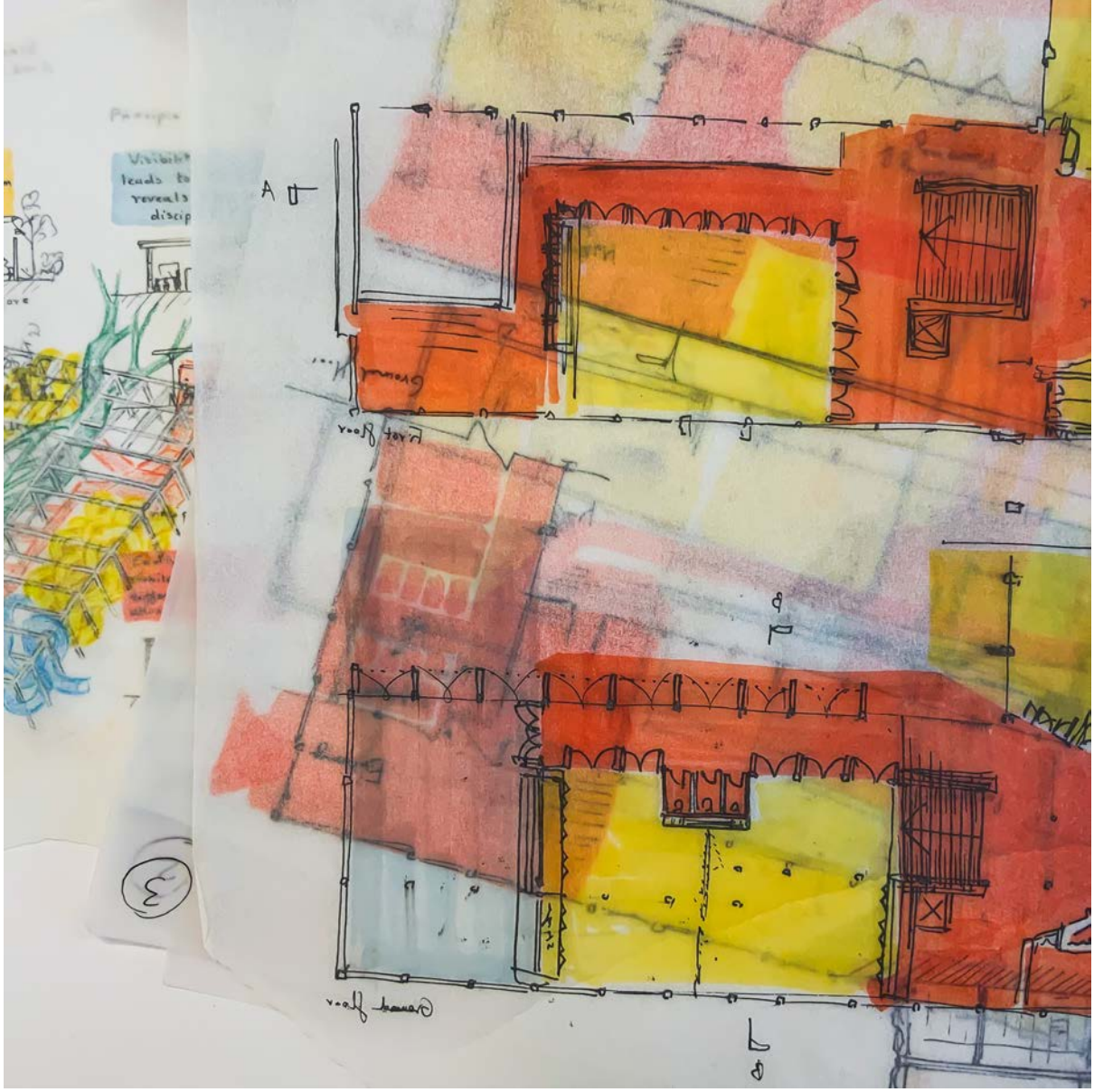

Teaching to Treasure

Design and Education for Nature Connectedness

Recognising biophilic design as an important educational tool for shaping future generations that care for the planet

18 January 2024

“The greatest lie that humans ever told is that Earth is ours, and at our disposal.”

The Golden Mole
K. Randell

Abstract

The design of the physical environment for education has a lasting impact on the values of newly forming members of society. Therefore, giving attention to biophilic design and taking 'nature as precedent' for the design of educational spaces is a key ingredient to the success and lasting impact of environmental awareness taught within the classroom. This dissertation will cement nature connectedness as a key goal for the design of interior spaces in education, identify principles of biophilic design most suited to education design and how they may best be applied, and call for 'nature as precedent' to become normalised within design education curriculums.

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Introduction

We have a problem. We, human beings, need to care for the planet we live on. The problem: in our everyday lives, we just don't seem to care (Gifford, Chen, 2017). A root of this bewildering lack of concern stems from humanities loss of connection to nature, evident by a growing cultural shift away from nature references and increasingly centring of the human-made (Kesebir, Kesebir, 2017).

Education is one channel through which this issue could effectively be addressed (Ajaps, McLellan, 2015). Our education shapes us as people. What we learn, how we learn it, and indeed where we learn it affects what we value, what we do, and who we are. It is often easier to see the 'what' and 'how's influence. For example, one has an enthusiastic physics teacher who taught Newton's third law of motion with such zeal that it opened their eyes to the workings of the world and now they're a rocket scientist. But the experience of place, especially at the formative time of early education has an equally impactful effect on a person's identity (Rieh, 2020). It is this undeniable effect on people's identity and values that the field of education and all others connected to it, namely the design of such environments, must uphold as a driving force to its priorities and agendas. Most importantly, as it moulds the cogs within society it must pay special attention to and keep up with what society really needs and how it must evolve.

As our understanding of the human brain and body increases, along with the parallel increase in technological advance and awareness of our own impact on our planet, our acknowledged societal needs look a lot different than that of a century ago. As reflected in the United Nation's goals for sustainable development, a society aware and prepared to take action in harmony with environmental sustainability should be the current priority for education. While the 'what' and 'how' of education can address the need for awareness and preparedness, it is the less tangible 'where' which influences a person's identity that can develop the 'attachedness' and empathy that are perhaps even more powerful tools in the future citizen's kit for change. It's our connectedness to nature that proves to be a necessary and profound step to creating an environmentally sustainable society (Mayer, Frantz, 2004).

The 'where' most significantly involves the design of education environments, especially the design of its interiors. To achieve this sought after harmony, to evolve our relationship with our home planet, the design of schools and other learning spaces must endeavour to harmonise with the new curriculums slowly being taught within their walls and emulate nature.

But how can this be done? How can the educational environment be designed to awaken and amplify this connectedness and empathy to a world so removed in our modern lives? This paper will explore how the use of biophilic design in schools and classrooms can accomplish this to a fruitful degree. The first chapter will examine what biophilic design is and isn't, as well as the general use of nature as precedent in design history and modern day, and why it's such a successful tool in building connectedness to nature. Chapter two will focus on the particular

principles of biophilic design that can be applied specifically to design for education. The third chapter will follow the research phase of an interior design school project. It will closely examine how certain design decisions can be originally informed by biophilic criteria whilst also looking to nature for design solutions. Finally, chapter four will be a call for nature as precedent to be taken more seriously as a necessary consideration within course curriculums of interior design, especially for use in community building projects.

Chapter 1
Biophilia vs Biomimicry vs Nature as Precedent

1.1 What is Biophilic Design?

Biophilia is humankind's innate biological connection to nature. The term was first coined by social psychologist Eric Fromm (The Heart of man, 1964) and later popularised by Harvard naturalist Dr. Edward O. Wilson to describe humanity's "innate tendency to focus on life and lifelike processes"(Wilson, 2009, p. 1). It can simply be translated as 'love of life' but should not be limited to a passive enjoyment of the natural living world; an appreciation of potted plants or amusement at the sight of playing puppies. To better understand, let us split the bio from philia; life from love.

Bio, a combining form of the Greek bíos (life), is most familiar as the prefix of certain compound words: biology, biodiversity or biography; all of which indicate the involvement of living organisms or human life. This includes everything from giant taro leaves, the 290 papillae on your cat's tongue, to the documentation of humanity's heroes. It is the 'word' that groups humans with insects, trees and flower petals, etymologically unifying a diverse and often estranged family.

Philia denotes fondness, an affection for and inclination to a specified thing. Rather translating it as love, which is variable, obscure and sometimes controversial in definition, a close friendship would be a better description.

Considering its polar opposite, phobia, can also help expand its meaning. Rather than a fear or strong desire to avoid, philia denotes a compulsion, a magnetic attraction to the specified entity - living things in this case. Additionally, it involves a satisfaction in being in its presence. Philia also carries the idea of affinity. The feeling of familiarity and empathy is an important central core to the overall definition.

Therefore, Biophilia is the powerful pull and affinity to other living things that humankind crave and find satisfaction within. It is clear why this notion and its effects on design is so paramount to connectedness.

Biophilic design is the attempt to create environments that respect and amplify this natural connection. Its agenda is to strategically frame the natural world by being informed by it. It draws from influential perspectives to create spaces that are inspirational, restorative, and integrative to its function and surrounding ecosystem. Importantly, biophilic design must nurture a love of place (Terrapin, 2014, p. 13).

While being a relatively new, thrown-around term, biophilia isn't a contemporary concept. Nature themes are found in early human structures and appear with a consistency that highlights biophilic design as an extensively practiced field of applied science and a codification of human intuition throughout history (Terrapin, 2014, p. 6). For example the Wabi Sabi world view, and the Japanese love of nature. 'Wabi Sabi is borne of a people whose traditional view of nature is that they are a part' of it, [it] is 'an intuitive response to beauty', a beauty that reminds us that everything is impermanent, and that we are part of something miraculous (Kempton, 2018, p. 63). It envelopes every part of life, such as art (see fig 1.1), and

Fig 1.1 - Snow Scene at the Shrine of Benzaiten, 1844 Woodblock Print. Buildings, people and nature habitually depicted as one in Japanese art. Particular attention is given to seasons and weather, surrounding water and trees. Here, the heavy snow engulfs the human-made shrine, natural pond and visitor, gathering them as a harmonious whole.

haiku poems about first winter rains. This deep cultural love and appreciation for nature remains evident today; Japanese architecture and design remains some of the most closely rooted to the natural world.

The human-designed has most definitely been influenced by nature throughout human history. This is no different today, although these inspirations are now predominantly for the betterment of human 'inventions', which we will examine in the field of Biomimicry.

1.2 Biomimicry, a More Scientific Approach

Biomimicry refers to the practice of learning from and mimicking the strategies found in nature to solve human design challenges. It is particularly used in the field of engineering and has been very widely applied, although not always with a

deserving amount of credit. It's behind a plethora of inventions, e.g., the aerodynamic form of the Bionic Car inspired by the Boxfish, a hairbrush that effortlessly unsnarls tangles (going back to the cat's tongue), etc.

Its use can also be successfully applied to the design and construction of buildings. A thesis project conducted by Michael J. Maglic (2012) applied processes found within the human body and the Namaqua chameleon, to the design of a medical research, manufacturing and therapy facility. The result was a proposed building that responded well to its inhabitants' activities as well as the surrounding environment; its undulating shape blending into the site's dunes. The design also proposed several prodigious technologies such as fritted glass integrated with film solar panels inspired by the adaptive skin of the Namaqua Chameleon to regulate the building's temperature while collecting solar energy (Maglic, 2012, pp. 46-48).

These designs result in beautiful and mostly environmentally-friendly structures, but do not usually bring to mind the source of its technologies; living organisms. The field of Biomimicry prioritises borrowing the practicalities and efficiencies of biological patterns and forms for the betterment of human creations rather than the evocation of its origins. Thus, for the purpose of cultivating connectedness it's less relevant than biophilic design. However, there is a seriousness and more scientifically rooted basis to biomimicry that can lend itself well to biophilic design. In an effort to counteract the increasingly casual understanding of biophilia as simply the inclusion of greenery and an abundance of timber, design solutions from nature within the field of interior design can open the way for the discovery of new and more encompassing ways to bring nature to mind and heart.

1.3 'Nature as Precedent'

This dissertation will at times elect to use the term 'nature as precedent' rather than biophilic design. It is not because the latter term itself is flawed but rather to bring attention to certain points of importance.

Firstly, there's the crude issue occasionally overlooked in the field of Biomimicry (e.g., natural water purification inspired by ocean diatoms), that 'bio' refers only to what is living, excluding such things as rocks and rain clouds. These entities, packed with plentiful patterns that evoke nature and offer potential design solutions, should not be left out. In various writings about biophilic design (Ghazinai, 2021) this distinction is often overlooked and the umbrella term 'nature' is used to refer to the natural world; everything non-artificially manufactured by humans (Terrapin, 2014, p. 8). As 'nature' is a more encompassing term, this dissertation will use 'nature as precedent' to place emphasis on its broad inclusion.

Secondly, there is the issue of purpose. The aforementioned definitions of biophilic design reveal a sliver of the self-centredness humans are prone to. Current applications of biophilic design is at its core for humans to better enjoy and perform within a built environment, upheld and utilised for its continually proved benefits on our health and wellbeing; namely its ability to reduce stress, improve cognitive function and creativity and expedite healing (Browning, Ryan, 2020). However, less-discussed is its natural excellence as a tool to counteract our undeniable apathy toward environmental concerns (Gifford, Chen, 2017, p. 166). The term 'as precedent' elevates nature to the reason behind design decisions rather than just the tool. Nature is the existing standard as well as the 'client' we must design for in its role as paradigm.

There is another factor behind the choice of the use of ‘precedent’ that will be explained further in chapter four as it’s paramount to the involvement of the design process. The following chapter will examine particular principles of biophilic design that can be applied specifically to design for education.

Chapter 2
Biophilic Patterns for Education Design

2.1 The Aim of Emulating Nature in School Design

Learning spaces must emulate nature, but not to an extreme. The aim isn't simply to recreate the outside. A foot of mud on our way to class or the piercing needles of cold wind on our cheeks aren't preferable. There is a reason for the invention of inside, for designed interior environments. Firstly, and most obviously, there are activities and times we need and wish for shelter (and floor consistency). Secondly, and importantly, it would not be advantageous to attempt to replace time spent outdoors in the wilds of true nature. (Atchley, et al, 2012) There are some experiences, like the wind and mud, that can't and shouldn't be recreated indoors.

Nonetheless, the truth is that we don't spend enough of our lives outdoors. A survey conducted by Opinium (2018) found that 90% of Brits spent their time indoors, about 22 out of 24 hours in a day. The reason? Weather and work commitments. Children aren't spared, with over a third (36%) not spending enough time outdoors and more than half (55%) spending less time outdoors than their parents did. For children, the blame falls on time spent playing video games and watching TV, and a good 7 daily hours spent in school - almost half of their daylight hours in the winter.

Fig 2.1 - John Hope Gateway, view from the Biodiversity Garden. A building built to be a gateway between city and nature, inviting visitors to transition from a man-made space to a natural one seamlessly.

Simply put, the time we spend outdoors is drastically decreasing with each generation. And the fact that most of our days are spent within the comfort of four walls isn't likely to change any time soon without drastic alteration in society.
That puts all eyes on interiors. Specifically, its design. If it cannot be the same as outside, what can it be? The answer is a gateway: a means of achieving a true connection to the living world outside.

The stunning sustainable venue within Edinburgh Royal Botanic Gardens, fittingly called the John Hope Gateway, draws in flocks of urban dwellers with its contemporary, organic design, drawing them to the beautifully curated biodiversity garden outside, and perhaps for some cultivate a desire to step further into wilder spaces. When designed with nature as its inspiration and intention, interiors can become a place that opens minds, hearts, and access to a world we have been far removed from for years.

So, how is this achieved?

2.2 The 7 Terrapin Patterns for Biophilic Design Most Suited for Education Spaces

Creating opportunities for children to learn outside is of primary importance as it has the strongest, purest effect on children's connectedness. There exists a push to improve and enrich the natural experience of school grounds, but, to be a gateway to the outdoors, the indoor spaces must adopt biophilic design patterns to perform effectively.

Defined within Terrapin Bright Greens 14' Patterns of Biophilic Design (2014) are aspects of biophilic design most suited to interior use in schools. The 14 patterns are organised into three themes:

- **Nature in the Space** - Meaningful and direct connections to natural elements in order to perceive the outdoors inside.
- **Natural Analogues** - Organic, non-living and indirect evocations of nature manifested as artwork, ornamentation, furniture, décor and textiles.
- **Nature of the Space** - The creation of deliberate and engaging spatial configurations that draw on our desires to see beyond our immediate surroundings, and be fascinated by spaces.

All 14 patterns within these themes, along with a further 15th, 'Awe', introduced later as part of the Nature of the Space theme (Browning, et al, 2020), can be used efficiently in almost any interior project. While fore-mostly written for the consideration of office design, the relevant principles prove most valuable in the configuration and design of progressive school environments. In previous case studies of primary schools applying biophilic design, the patterns most often applied fall within the first two themes; 'Nature in the Space' and 'Natural Analogues'. These are usually manifested in the incorporation of green roof

gardens, vast openings to nature, curves and natural shapes within the structure and furnishings, and sustainable features such as rainwater filtration visible to the users (Ghaziani, et al, 2021).

The choice to employ and the analysis of the effects of these patterns are however most commonly studied through the lens of health and wellbeing benefits, instead of connectivity effectiveness. The following are seven of the patterns most suited to education design along with an analysis of their potential impact on children's connectedness to nature.

Pattern 1 - Visual Connection with Nature

This pattern is a straightforward view to elements of nature, living systems and natural processes. It is the allowed possibility of viewing scenes of nature. Such scenes stimulate a larger portion of the visual cortex than non-nature scenes, leading to prolonged interest.

For a school this can be achieved by introducing biodiversity-rich outdoor spaces, then configuring the layout and design of openings to frame the optimal scenes. Furthermore, circulation may be specifically designed to purposely move students in and out of these outside areas, allowing the outside to seep in whilst the inside seeps out.

It's potential applications in education design is the most outright attempt at a nature connectedness gateway. It's effectively used to comfortably draw interior inhabitants outside through necessity as well as desire. It's inclusion is a strong step in a building's design not acting as a barrier that visually locks nature away, but that frames it as a constant presence, a lasting visual part of the inhabiting student's daily routine.

Pattern 5 - Presence of Water

This pattern involves the seeing, hearing or touching of clean water. This multi-sensory experience of water must be carefully introduced into school environments in light of health and safety requirements. A shallow body of water with a gentle-flowing path may be most adequate.

The patterns application is strongly linked to that of pattern 1 - a way to bring a natural element directly inside. Natural scenes without water and urban scenes with water elements follow up with primary equal benefits (White, et al, 2010). The partial placement of a water feature between inside and outside could also provide a blurring of boundaries, incorporating the gateway purpose. However it is applied, the presence of water is one of the strongest perceivable connections to life, and one of the necessities for life from nature best recognised by humans.

Pattern 7 - Connection with Natural Systems

A connection with natural systems is the awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

This pattern could arguably be the most useful in cultivating nature connectedness. The intent is to draw the inhabitants of a building into an affinity with the natural world around them through seeing and understanding its processes and cycles and how they can fit and contribute to it. It is thus a valuable partner to the design of a school; the design of exposed and clear systems incorporated with nature being a possible teaching tool. It is however perhaps one of the harder patterns to incorporate within an interior environment.

First, the natural systems existing within the particular site of the project must be carefully studied. This would likely include the path of sunlight, seasonal

distinctions, the natural fall and gathering of rainwater, and the local plant and wildlife of the surrounding area. Afterwards, educational and activity-orientated connections can be made, e.g., the placement and size of ceiling and elevation openings may be determined by the calculation of shadows cast by natural sunlight. This could then be used by the students as a natural clock, its consistency allowing them to determine the start and end of break-time by simply observing a shadow hitting a mark on the floor.

Such incorporations in the interior environment allows for natural systems to have a meaningful role in the children's daily routine, rendering nature, not as an other, but as an understood kin.

Pattern 9 - Material Connection with Nature

This pattern includes the use of materials and elements from nature which, through minimal processing, reflect the local ecology or geology to create a distinct sense of place.

This pattern is one that lends itself well to and is increasingly most extensively used in interior design, most commonly manifested in the introduction of natural materials; timbers and stone. Although relatively simple, it's an effective way to quickly evoke the feeling of being in nature, especially when the correct balance between raw and highly manufactured is utilised.

Variety is a key component that enhances this pattern. So, too, is the choice of native and locally sourced materials. Their inclusion limits the sensation of change between the outside surrounding environment and the interior space just entered.

Fig 2.2 - The Arc, the gym hall at the world renowned Green School in Bali, Indonesia. The difficult design task of creating an unprecedented inner volume with an impossibly thin structure, without any disturbing trusses found its answer in nature; the human ribcage.

Pattern 10 - Complexity and Order

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

This pattern continually baffles and eludes designers. It can be very difficult to find the correct harmony between complexity and order that is so ubiquitously seen in nature, with its effortless intricacies.

Within an education environment this balance becomes a decision of even more crucial consequence. The environment should not project a superficial outward complexity that is distracting or overstimulating to students, but should remain subtly evident under further inspection. Like an onion, there should be layers to its complexity that can be discovered progressively. In nature we see this achieved

through size and scale. What looks simple from a distance reveals its most complex inner workings under closer investigation. Patterns and rhythms are another way natural complexity is ordered. We see the same patterns repeated, such as Fibonacci's sequence, which allows us to connect solutions in our minds rather than remain perplexed.

This need for further inspection and instinctively dependable patterns builds a natural sense of awe. This sense of awe (itself now distinguished as a biophilic pattern), is crucial to developing a care for the natural world. It skews the picture that humans are a solitary source of wisdom and intelligence (see fig 2.2). When it's understood from a young age that valuable lessons lie within the rhythms of nature, we'll be less inclined to ignore its presence and effect.

Pattern 12 - Refuge

Refuge is 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 created with this pattern feels safe, separate and distinct from its surrounding environment. It can feel contemplative, embracing or protective. An array of such spaces within a school can be widely applied. It is an ideal pattern to create spaces for visual or speech privacy, reflection or meditation, rest or relaxation, reading or complex cognitive tasks.

The result of applying this pattern is a feeling of security and safety. In turn, this contributes to a desire to remain within the space and to love the space. This is a crucial ingredient to nature connectedness as, when the space created for us to learn feels like nature and also feels loved, an affinity and care for that space is developed (Bezeljak, et al, 2023, pp. 191-192).

Pattern 13 - Mystery

This pattern involves the promise of more information achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment. It's based on the idea that people have two basic needs in an environment; to understand and to explore (Kaplan & Kaplan, 1989).

This pattern, when applied well, works in perfect harmony with patterns 1 and 7, creating a space rich with possibilities to stimulate learning, and an effective tool in creating a gateway to nature. It can be used to draw inhabiting students to points of biophilic significance within the interior of the building - whilst drawing them to explore outside.

To conclude, these seven particular patterns can be extensively and effectively used in the design of education environments. While their application will doubtlessly be constructive to the health and wellbeing of the pupils inside, these patterns, especially patterns 1 (combating interior's alienation to outside spaces), 7 (introducing an affinity, belonging and responsibility to local living cycles), and 13 (drawing inhabitants to be inquisitive about the designed spaces), are invaluable tools in creating affinity and connectedness to nature, allowing for pupils to acquire a love and a care for the spaces they learn and live in.

The next chapter will consider how these patterns can be specifically applied in the design process of a school project.

Chapter 3
The Earth School Project

3.1 The project

Prospectively situated in the Edinburgh areas of Leith Walk and Canonmills on McDonald Road, this learning centre (affectionately called Earth School) is the 4th year final project of Interior design student -Author- (2023).

The project involves the repurposing of the McDonald Road fire station into a centre for interdisciplinary learning. The centre aims to bring the newest generations closer to a deep understanding of the living world and interconnected organisms that support their life. With everything from labs for the dissection and study of locally found organisms, a workshop to chisel and carve found wood, to a theatre for a moving performance on the effects of throwing plastic bottles and straws, this learning centre has connectedness at its core. The research phase and design process reflects this by assigning a large portion of study to biophilic design patterns and the local natural context.

3.2 Design Decisions Informed by Biophilic Design

The first part of the research process included the study and application of the Biophilic Design patterns stipulated by Terrapin. Their potential applications were explored through concept sketches.

Fig 3.1 - Configuration of Openings, ground and first floor plans. This illustration explores the building's possibilities to offer visual and physical access to the garden and views to surrounding nature.

Configuration of Openings

As stated in chapter two, a visual connection to natural outdoor spaces is central in biophilic design. This strongly influenced the choice of site. On the corner of two streets and bordered by a wildlife corridor, the L-shaped building frames a generously-sized courtyard. The design proposal includes the conversion of this space into a wild-flower garden for children to explore through play and lessons. The garden will be designed with biodiversity and closely resemble local wild areas.

The openings and entire layout of the interior spaces were then developed to prioritise the framing of views and connection to this outdoor space (see fig 3.1). All lesson and activity areas have visual, auditory and olfactory access to the outside garden. Views from the other street-facing elevations were also studied, with the openings created in these sides positioned to frame them.

A Connection with Natural Systems

Addressing pattern seven; 'Connection with Natural Systems', required a vast amount of research to achieve a successful concept. This research primarily involved the study of weather patterns, tracking the direction of natural sunlight through the seasons, and briefly studying the habits of local animal life.

This research facilitated the introduction of certain design features that highlight and welcome the existing life and cycles of the host environment. For example, research conducted on the natural habitats and diet of local birds (the robin, blackbird, and wren), and local solitary bees, informed the choice of plants for the central garden (see fig 3.3). An original design concept for the roof to include space for birds to nest was changed after research showed local birds preferred to nest close to the ground or in hollows in vertical spaces (Woodland Trust, 2020).

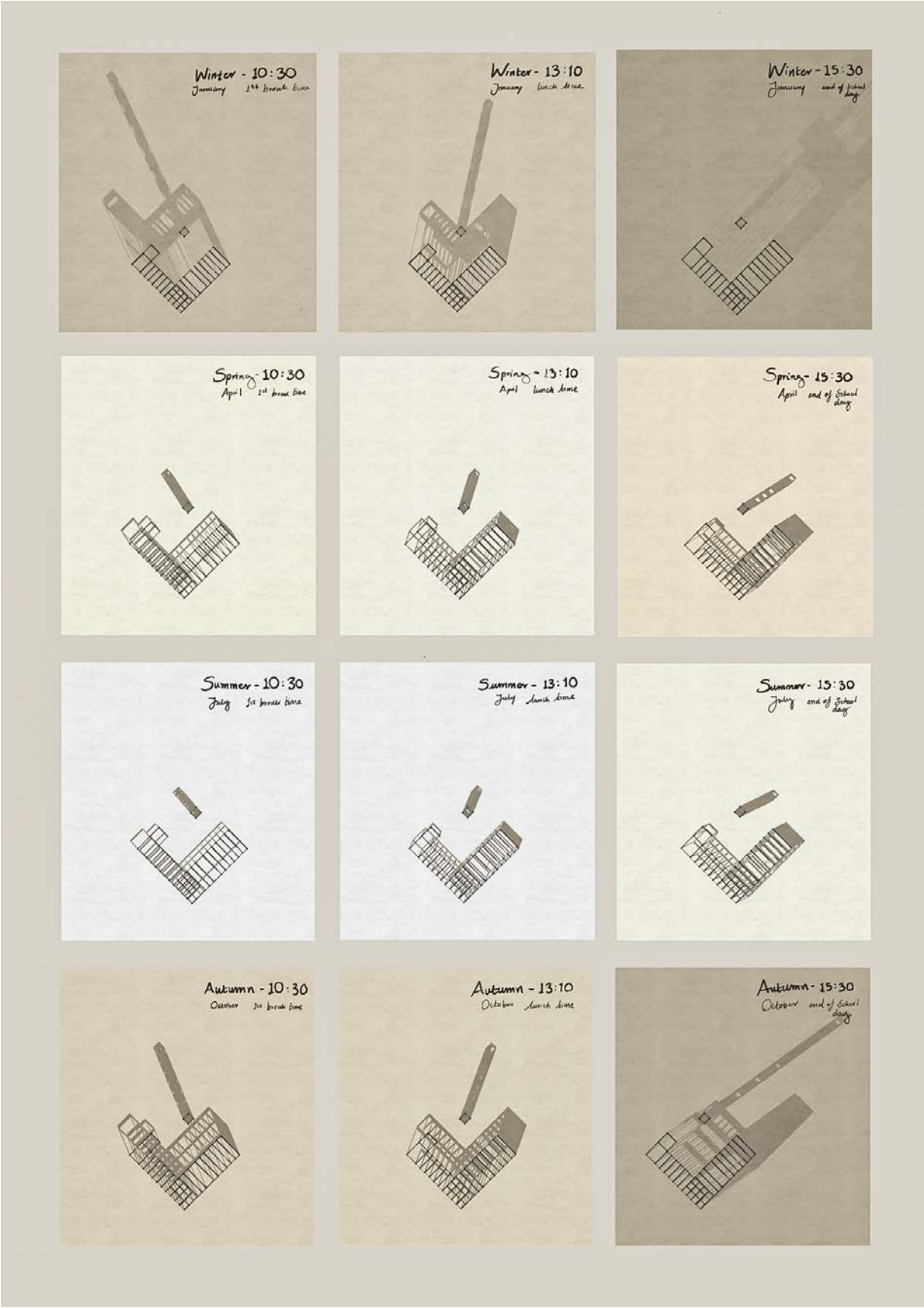


Fig 3.2 - A connection with Natural Systems, Analysis of sun light paths throughout the day and seasons. Using sketch up to establish location and shadows cast during breaktime, lunchtime and end of the school day.

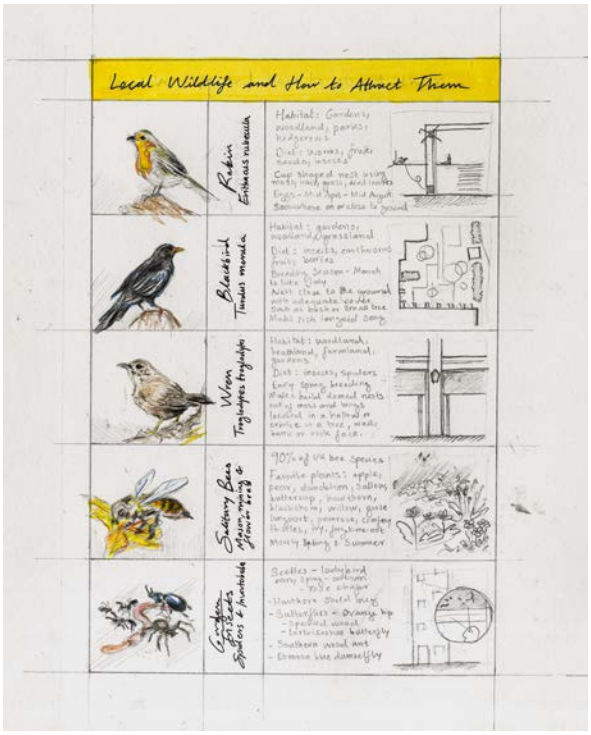


Fig 3.3 - A Connection with Natural Systems, exploration of local wildlife habits and potential design applications.

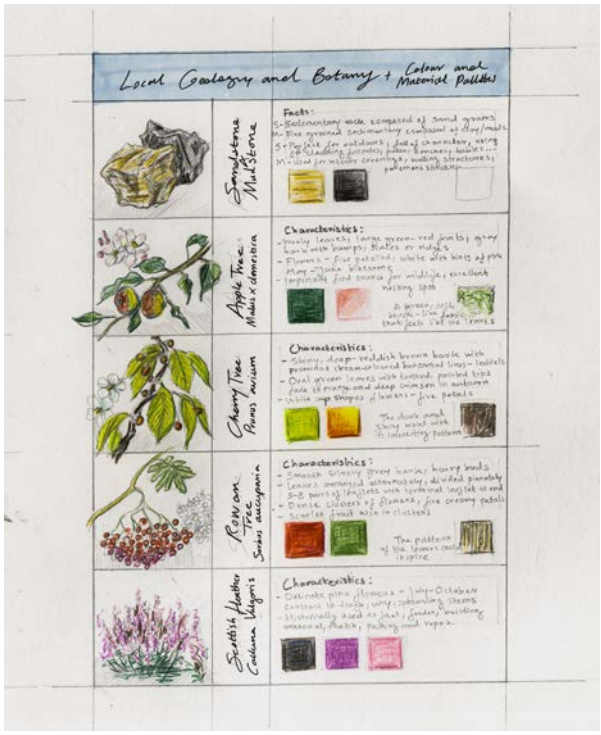


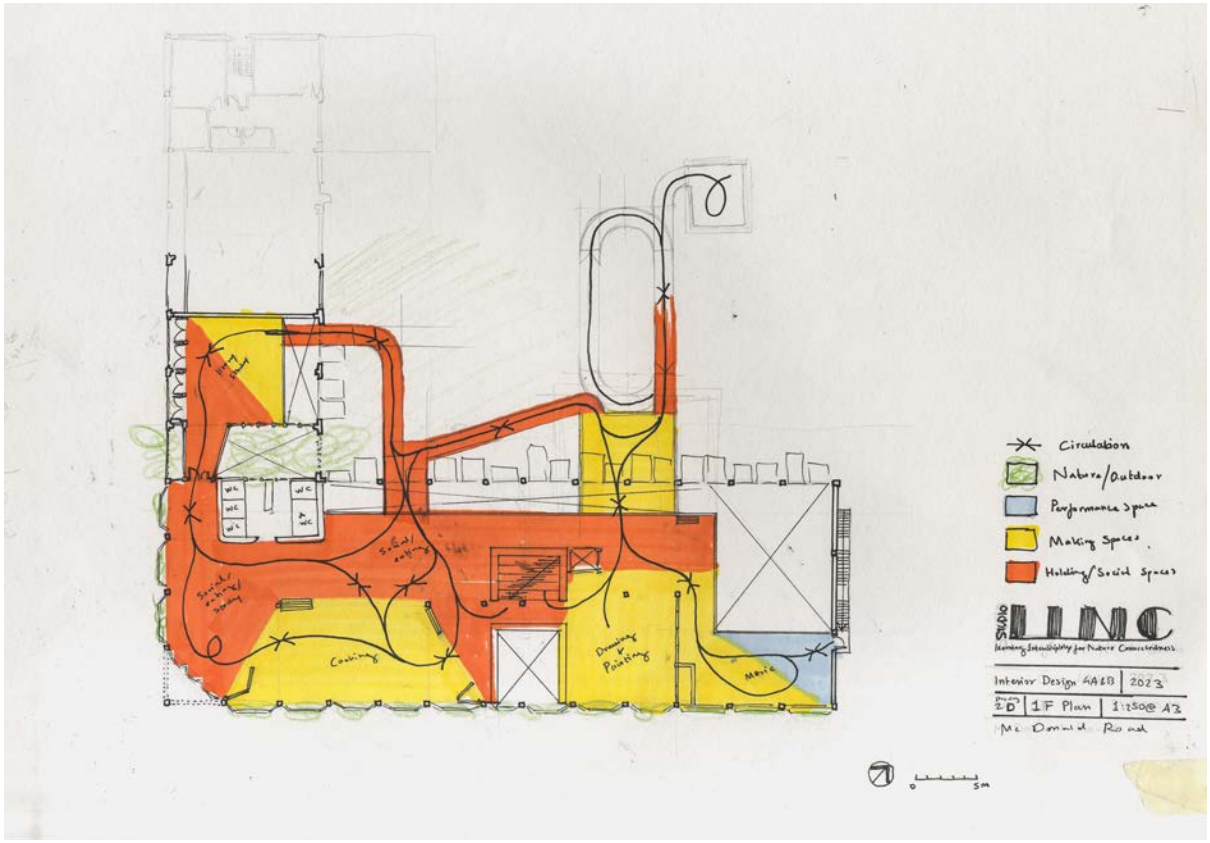
Fig 3.4 - A Material Connection, exploration of local geology and plant life and creation of a preliminary colour palette

The design now includes nesting spaces within the inserts between the building structure.

The design of the roof, namely the size and shape of the openings, was configured by natural light paths of the site (see fig 3.2). From inside, by observing where the light reaches, inhabitants may discern the time of day, and recognise the distinction of seasons.

A Material Connection

In line with pattern nine, a material connection with nature is the primary informant for the choice and application of materials in this project. The aim, however, isn't in choosing natural-looking materials but in finding answers through observing the existing surroundings: the area of Edinburgh, precisely Leith Walk and Canonmills.



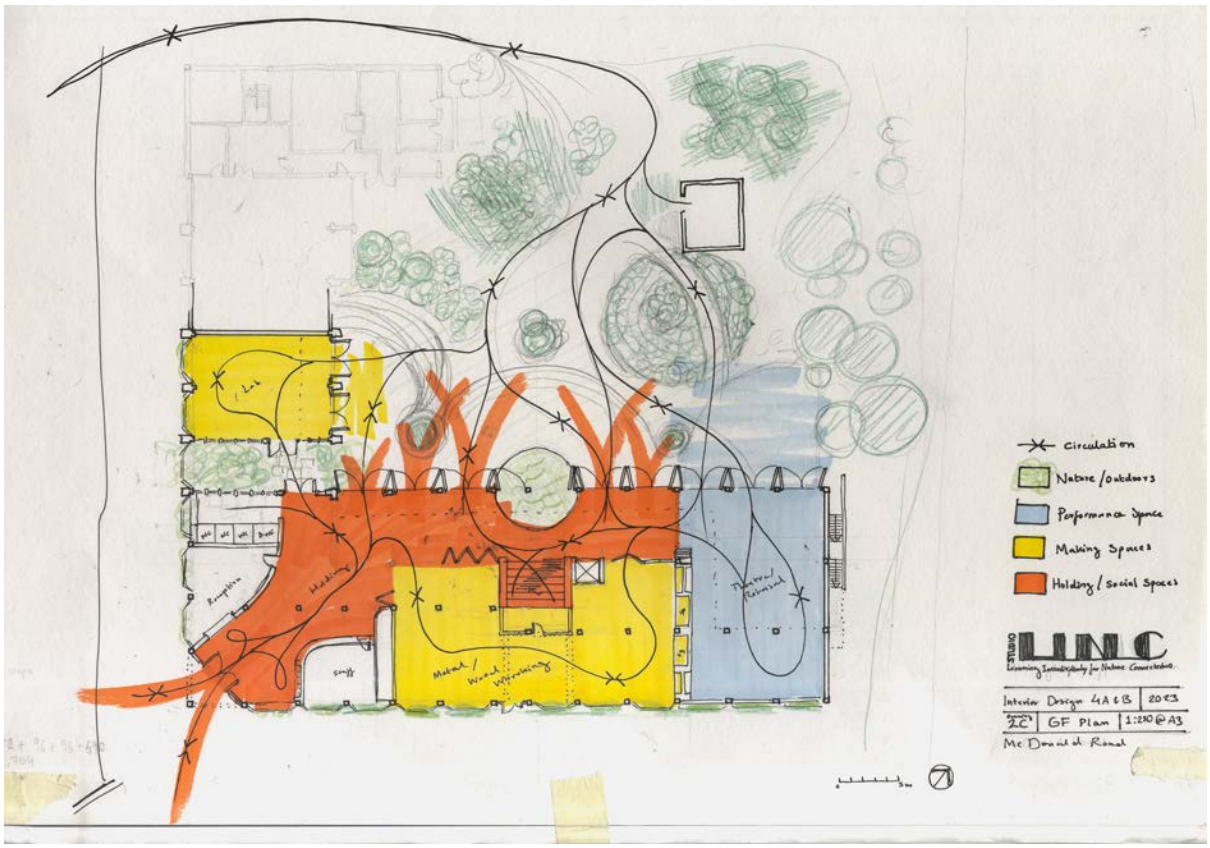


Fig 3.5 - Circulation Informed by Mystery, ground (below) and first (above) floor plans. The illustrations mark out the dominant circulation paths showing its inter connectivity and variety of possibilities.

The research included gathering information on the local groundwork and stone, the variety and species of existing trees in the immediate area, and on plant life which evokes the wilder areas of Edinburgh such as the wild Heather of the Pentland Hills (see fig 3.4).

With this intel, a colour palette and materials board can be curated that cements the project in the site's natural surroundings and evokes the curation and application of nature.

Circulation Informed by Mystery

The ground floor circulation is designed to gather students within the inner NW side of the building: the area with the strongest connection to the garden. Obstacles such as the circular pond, lengthy shutters and supporting columns act as points of visual interest and obscure pathways in order to engage the interest of the children - encouraging them to explore.

Circulation on the first floor also focusses around this side of the building. Connected balconies at different levels with sloping, connecting pathways floating over the garden are positioned to encourage travel from one side of the building to another, as well as descending into the garden via a winding ramp (see fig 3.5). A variety of pathways and varying levels create a non-linear environment that stimulates thought and exploration.

3.3 Looking to Nature for Design Solutions

Just as solutions for engineering problems are found in nature, design problems in the field of interiors can similarly start to look for innovative responses from

processes found in the natural world. The Earth School project aims to make a founding step in this direction.

Adaptation of Existing Building - Inspired by Nature Reclaiming Urban Spaces

The existing site was chosen, not because it already harmonised with biophilic design or lent itself well to the genre in any way, but precisely because it was the opposite of what would be expected. Built in the 60's the old fire station is very human-made in appearance. Its primary structure of a coloured concrete frame in a linear grid formation is a far cry from the rough undulating landscapes of the local area. It was introduced within the brief that when left untouched in some respects but altered in others, the building would become an excellent feature and a teaching tool in itself (Browning, Ryan, 2020). An instructor could point to the juxtaposing structure and ask "Do you see the difference?"

The manner in which this juxtaposition would be created was naturally inspired by the way nature reclaims urban spaces after abandonment (see fig 3.6). The design

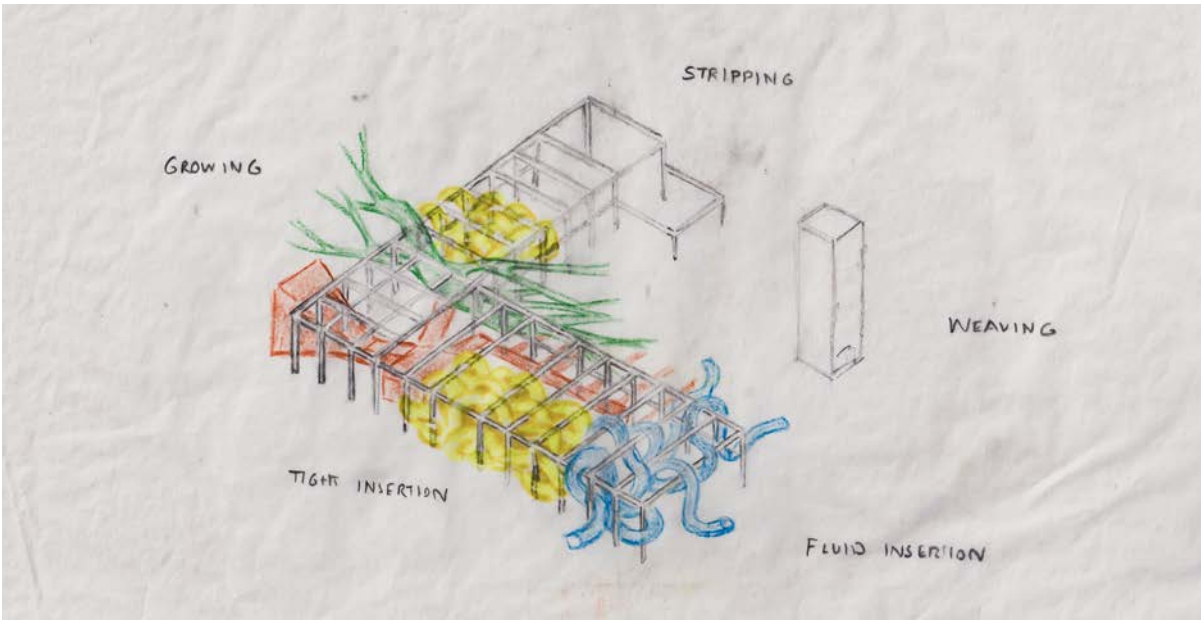


Fig 3.6 - Adaptation of Existing Building, concept orthographic drawing of adaption inspired by nature reclaiming urban spaces by weaving between and growing around the stripped back structure.

is a testament to nature's ability to survive and thrive when humans take a step back, encouraging those who observe to wonder at nature's resilience and better understand the human role as best accomplished when not dominating but rather nurturing. Coupled with instruction, the buildings physical adaptation highlights this lesson.

The Problem of Changeability

A key part of the brief was the incorporation of design features that allowed for flexibility within the interior spaces. The ability for a building's design to adapt and change through time, especially for a school in a time of education reform, will allow the design to live a healthy lifespan, without the need for pricy and environment-impacting renovations.

Flexibility, however is very difficult to design. Once out of the hands of the designer, outside the paper and models, and within a real tangible space occupied with various activities, features designed for flexibility such as movable walls and furniture can be 'misused', their original purpose lost, and the design could fail

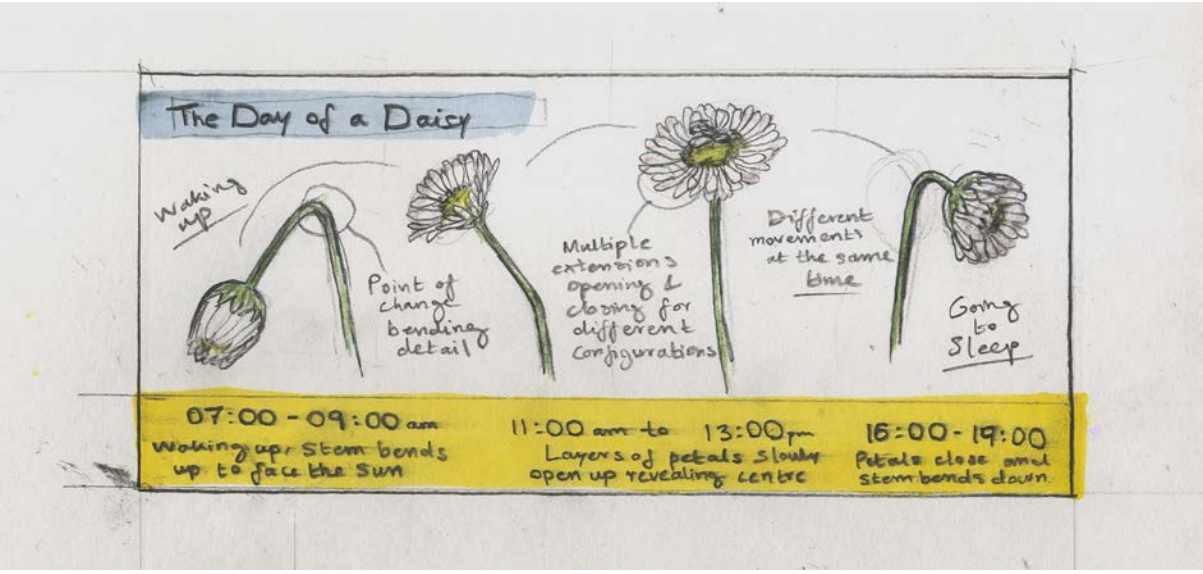


Fig 3.7 - Changeability Inspired by the Flower's Day, drawing depicting a flowers transitioning throughout the day and points of interest that could inform changeable design.

with too much control given to its occupants (Murphy, 2023). Changeability, rather than flexibility thus becomes essential.

Changeability is a feature we observe time and time again in the natural world. While only briefly touched upon at this stage in the design process, with more informed research required, the Earth School project aims to be inspired by processes, such as the simple day-cycle of a wildflower (see fig 3.7), in it's quest for a functioning changeable design.

This process, as well as those aforementioned, presented the designer with a hurdle: limited knowledge.

Chapter 4
Nature as Precedent's Place in Design Education

4.1 Cementing Biophilic Design in the Precedent Study Process

With limited experience in the fields of biology and natural processes, the application of biophilic patterns in interior design projects will remain relatively surface level. Unless projects are directly aimed at achieving nature connectedness, as in the case of Earth School, research carried out by the designers involved would only apply such patterns to a small degree, if at all.

It is considered an interior designer's job to become a temporary mini-expert in the field they are designing for. For example, when designing a tea house, the designer learns the history and culture surrounding the product; tea, in order to incorporate and accommodate its valuable context. If biophilia is an important concept in school design then biophilic patterns and their effects become central in the designer's research.

Currently a standard part of the research process for interior design is the study of precedents. Earlier the term 'nature as precedent' was stated to have a further etymological purpose. The purpose is to identify the inclusion of natural subjects as parallel and integral to a comprehensive search for precedent studies (see figs 4.1 and 4.2).

Fig 4.1 - The current standard precedent research phase in interior design illustrated through collage

The definition of a precedent is the study of existing projects as design inspiration and justification for the new project proposal. Any number of previous projects, from the overall building structure to the detailing of a handrail, can be used to inform design decisions.

If the mandated process of precedent research incorporated the study of nature subjects then knowledge of this field would cement itself in the designer's repertoire. As has been demonstrated in chapters two and three, patterns, rhythms and processes found in nature can be most valuable in the search for inspiration and design solutions. For example the Arc's structure informed by the rib cage (see fig.2.2), or Earth School's adaptation inspired by nature's reclaiming of urban spaces (see fig 3.6). Encouragement from faculty to look to such natural sources

for answers, and its incorporation into the research curriculum for interior designers would have a similar effect as biophilic pattern 10 has on its inhabitants. The act of peeling away layers and discovering complex-yet-orderly patterns and processes that can be constructively applied in their projects, strengthens a student's feeling of awe and respect for nature. In turn this increases the likelihood of their returning to it as a source for a precedent subject in ensuing careers.

As well as precedent subjects being human-made, site context research such as conservation reports also revolve around human factors (building history, listings, material features, urban context etc). The natural context of sites are rarely studied outwith targeted projects. This particular focus, when firmly integrated into planning regulations (LEIP2), encourages understanding and incorporation of the natural surrounding such as local wildlife and geology, into projects, becoming progressively integral in its final design.

4.2 Overcoming the Knowledge Gap between Biology and Interior Design

The average interior designer cannot be expected to become a complete encyclopaedia of every natural process, and the time-pressured disposition of construction projects will only ever allow for a certain portion of resources and energy to be spent by the designer in a field outside their comfort zone.

It would be advantageous for the push of interdisciplinary collaboration between designers and experts in natural processes to become more common in the field of interior design, especially in the strategic and conceptual (stages 0-3 in the RIBA Plan of Work) phases of a project. This is already becoming a highly encouraged proposition in the field of engineering. Collaboration between engineers and

Fig 4.2 - Proposed precedent research phase involving nature as precedent illustrated through collage

biologists has been shown to positively influence ideation in bio-inspired designs within engineering (Farzaneh, 2020). This can also become the case for interior design. Such collaboration has begun within the professional setting of certain design firms with a focus on designing with nature such as Cullinan Studio and Ibuku. In order to expend its adoption, this collaboration should be encouraged in higher education, with projects taking advantage of access to varying disciplines granted by large institutions. This will help bridge the knowledge gap and allow for more extensive and profound inspirations and applications to be uncovered within nature.

4.3 The Cycle that can be Created

When efforts are made by design teams, in collaboration with biologists and others experts in natural processes, spaces can be created that strongly evoke an affinity to the natural world. When new generations grow and develop within such spaces their collective connectedness to nature will read stronger than the previous generation's. This would hopefully result in the newest students of interior design having a stronger pull to and respect for natural processes; increasing desire for its incorporation in their projects while decreasing the knowledge gap, or at least the veil that covers its significance.

Eventually the design process will look very different to that of a few generations before. No longer will nature be the side precedent, occasionally consulted for a specific environmentally-orientated project. Instead it will encircle the entire project; it would be considered as part of the brief and feasibility studies, it will be the motivation for primary concept and configuration proposals, a primary inspiration for design solutions, and the characteristic most honoured and applauded in the final design.

Conclusion

We must change our attitude towards our vulnerable home, Earth, and its complex connected natural world. Although Wilson rightly insists we humans have a natural and compelling love for living things, we have nevertheless progressively secluded ourselves within the confides of interior spaces. In order to reconnect with the natural world, these interior spaces, especially those for formative development such as schools, must become a gateway; a means of achieving a truer connection to the live world outside. This is achieved through the application of biophilic design and the taking of 'nature as precedent' in interior projects. This biophilic design is not a superficial attempt at beautifying our environments for human enjoyment, rather an acknowledgment of existing patterns and processes found within nature that when thoughtfully applied can have a powerful effect on the inhabitants' relationship to the natural world.

There have been extensive studies on quantifying how such patterns and processes may be applied, such as Terrapin Bright Green's 14 Patterns for Biophilic Design. Many of these can be successfully applied to the design of school environments for the purpose of nature connectedness while also supporting sustainable education. The simple prioritising of views to nature scenes outside combat interior's alienation to outside spaces. A connection with local natural systems such as the inclusion of habitats for local species within built spaces introduces an

affinity, belonging and responsibility to local living cycles. And a creation of mystery through partially obscured views enticing inhabitants to travel deeper into the environment can engage the interest of children, encouraging them to explore what once was alien. All of these are invaluable tools in creating a gradual development of affinity and connectedness to nature, allowing pupils to acquire a love, care, and respect for the spaces they learn in.

To reach a state where education design prioritises the influence of nature in it's research, concepts, and brief, biophilic design and understanding nature's value as a primary precedent must be introduced and discussed more regularly and fervently in design education. The incorporation of nature subjects in the mandated process of precedent research, coupled with collaboration with fields of biology, geology and zoology, can render interior design curriculums in higher education as the important step in changing the priorities of built environments.

Then, when one embarks on a journey to learn how to create spaces for human habitation, they will be exposed to the merits of human's original natural habitat: nature. Through discovering complex yet orderly patterns and processes that can be constructively applied in their projects, prospective designers will come to understand the valuable inspiration and answers found in the natural world, leading to the creation of interior environments that opens minds and hearts to a world previously hidden away. We will build an intrinsic connectedness and refined desire to save our original environment; Earth.

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