Biophilia as an Inclusive Design Strategy

How biophilic design strategies can enhance sensory inclusivity in architecture, particularly for users with fluctuating or partial vision

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Abstract

Accessibility frameworks within the construction industry remain largely ocular-centric and focused on regulation, reducing visual impairment to the binary categories of ‘sighted’ or ‘blind’. This approach to accessibility alienates people within the wider spectrum of visual impairment - such as those who are partially sighted or with fluctuating vision. This group of people struggle with issues such as glare, sensory overload, light sensitivity and depth perception – experiences which are overlooked in architectural guidance and discourse.

This dissertation investigates how biophilic design strategies can enhance sensory inclusivity within architecture, particularly for people with fluctuating or partial vision. Adopting an ethnographic methodology informed by lived experience, the study combines a pilot spatial analysis of two everyday buildings with case studies of Maggie’s Centre, West London and the LightHouse for the Blind and Visually Impaired in San Francisco. These buildings are analysed using a critical reinterpretation of the *‘14 Patterns of Biophilic Design’*, examined through the lens of visual impairment.

The findings of this research suggest that biophilic design strategies such as dynamic and diffuse lighting, material connection with nature, and refuge can help to reduce sensory overload, visual fatigue and disorientation - making spaces that offer autonomy to people with a range of visual impairments. However, when applied in isolation they can unintentionally reinforce the isolation felt by people with partial or fluctuating vision. Maggie’s is an example of biophilic design that unintentionally has features of inclusive design without direct engagement. On the other hand, LightHouse is an example of inclusive design tailored to a very specific user group, which unintentionally excludes others and engages with some biophilic principles.

This dissertation argues that inclusive and sustainable architecture must move beyond prescriptive compliance towards a holistic, multisensory design approach, where biophilic principles and inclusivity are integrated from the early stages of design projects to address the needs of a wider range of users. It also advocates for further engagement of practising architects with different users – noting the value in alternative perspectives.

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Glossary

Biophilic design

An architectural and design approach that seeks to strengthen the connection between people and nature within the built environment. Biophilic design typically incorporates natural light, materials, vegetation, views, and spatial qualities inspired by natural systems, and is associated with improved health, wellbeing, and environmental performance. Contemporary frameworks for biophilic design include the ‘14 Patterns of Biophilic Design’, which provide a structured set of strategies for integrating nature into architectural practice.

Fluctuating vision

A form of visual impairment in which visual acuity, comfort, or perceptual clarity varies over time due to factors such as lighting conditions, fatigue, inflammation, or disease flare. Unlike static models of blindness or sightedness, fluctuating vision exists on a spectrum and may include symptoms such as light sensitivity, visual fatigue, floaters, reduced depth perception, and sensory overload. This variability can significantly affect how architectural environments are perceived and navigated.

Inclusive design

A design approach that places people at the centre of the design process, acknowledging human diversity and difference. Inclusive design seeks to offer choice, flexibility, and adaptability where a single solution cannot accommodate all users, aiming to create environments that are convenient, usable, and enjoyable for the widest possible range of people (Fletcher, 2006).

Ocularcentrism

A philosophical and cultural bias that privileges vision over other sensory modalities in the production of knowledge, meaning, and spatial experience. In architectural discourse, ocularcentrism manifests as a prioritisation of visual aesthetics, visual legibility, and sight-based navigation, often at the expense of multisensory engagement. The term is most commonly associated with the work of Martin Jay (1993), though critiques of vision’s dominance can be traced to earlier philosophical traditions and later phenomenological thought.

Universal design

A design philosophy introduced by architect Ronald Mace in the 1980s, defined as the design of products and environments to be usable, to the greatest extent possible, by all people throughout their lifespan without the need for adaptation or specialised design. Universal design is often positioned as contributing to sustainability by promoting long term usability and social equity (Heylighen, 2008)

Chapter 1

Introduction

Despite huge strides in the areas of equality, diversity and inclusion, disability remains one of the biggest taboos of architecture – seen as something to mitigate with regulation and code. However, disability is an extensive spectrum, covering loss of senses, poor mobility, mental conditions, and much more, which cannot be catered for in this way. Due to the vastness of this topic, I have narrowed my focus down to the areas of visual impairment. As somebody with an eye condition that causes fluctuating vision, I will take an ethnographic approach to address the gaps in literary discourse. I suffer from a condition called Uveitis – which has taken the sight completely from my right eye and left my other eye with fluctuating vision. As an architecture student with a visual impairment I have always been fascinated by how our ocular-centric industry can cater for people like myself.

Although not coined as a term until Martin Jay's 1993 book *'Downcast Eyes'*, the idea of ocularcentrism has been around since Ancient Greek times, discussed by philosophers such as Plato and Aristotle. Plato in particular made a case for the importance of vision in his 'allegory of the cave', insisting that people only knew reality when they could see. Regardless of whether Plato was referring to the "pure sight of perfect and immobile forms with 'the eye of the mind' or... the impure but immediately experienced sight of the actual two eyes" (Jay, 1993), it was still vision that was, to him, the noblest of the senses. The superiority of sight was significantly heightened by French philosopher Descartes – considered the "founding father of the modern visualist paradigm" (Jay, 1993) – and carried into the Enlightenment period, before any serious anti-ocularcentric critics appeared.

Significant contributors to anti-ocularcentric thinking included French philosophers Denis Diderot (1713-84) and Maurice Merleau-Ponty (1908-61), with Juhani Pallasmaa leading this opposition in an architectural context. In Pallasmaa's *'Eyes of the Skin'* he argues that "life-enhancing architecture has to address all the senses simultaneously." This shifting attitude sought to create a more inclusive built environment.

Introduced in 1985 by American Architect Ronald Mace, universal design "denotes the design of products and environments to be usable, to the greatest extent possible, by all people throughout their lifespan, without adaptation or specialised design. As such, universal or inclusive design can be considered as contributing to sustainability." (Heylighen, 2008). A design ideal that encapsulates both this regard for sustainability and inclusivity, is biophilia.

> "Biophilic design is the designing for people as a biological organism, respecting the mind-body systems as indicators of health and well-being in the context of what is locally appropriate and responsive. Good biophilic design draws from influential perspectives – health conditions, socio-cultural norms and expectations, past experiences, frequency and duration of the user experience, the many speeds at which it may be encountered, and user perception and processing of the experience – to create spaces that are inspirational, restorative, and healthy, as well as integrative with the functionality of the place and the (urban) ecosystem to which it is applied. Above all, biophilic design must nurture a love of place" (Browning, Ryan & Clancy, 2014)

'Biophilia' was a term introduced in 1973 by German psychologist Erich Fromm, defined as "the passionate love of life and of all that is alive; it is the wish to further growth". American Biologist Edward Wilson expanded upon this, writing the book *'Biophilia'* in 1984, a revolutionary piece of literature that highlighted the innate tendency of humans to seek connections with nature. Stephen Kellert - an American psychology researcher – dedicated his career to continuing the work of Fromm and Wilson, editing a series of essays alongside Wilson in the 1993 *'Biophilia Hypothesis'*. He believed that "nature substantially enhances human physical and mental health, performance, and well-being." (Kellert, 2018) and contributed to modern discourse around biophilia. In 2018 he proposed a framework for integrating its principles into the built environment in his book *'Nature by design: the practice of biophilic design'*. Similar research was undertaken in 2014 by environmental design experts William Browning, Catherine Ryan and Joseph Clancy – who co-authored the report *'14 Patterns of Biophilic Design: Improving Health & Well-being in the Built Environment'*. It is these 14 patterns, alongside the now widely accepted biophilic framework that will form the basis for architectural analysis in the following chapters.

This well-established research, alongside my own interest, that has led me to the following question: how can biophilic design strategies enhance sensory inclusivity in architecture, particularly for users with fluctuating or partial vision? Whilst biophilic design has been studied at length, and much peer-reviewed evidence is available to support its impact upon mental health (as referenced in *'14 Patterns of Biophilic Design'*), there is limited research into its potential to eradicate the alienation of people with a range of physical disabilities.

Visual impairment in itself covers a vast range of conditions and experiences, but the greatest gap in research lies with this 'in-between' category of people who experience fluctuating vision. These individuals (depending on disease flare and management) often face issues such as light sensitivity, eye fatigue, sensory overload and floaters – challenges that fall outside the binary of the fully-sighted and the blind. To begin with, I will explore how attitudes

towards disability have changed over the course of architectural discourse, before analysing the current standard of building regulations and design guides available to practising architects.

In the 1970s, Edward Steinfeld and his colleagues at the University of Buffalo's Centre for Inclusive Design and Environmental Access (IDEA Centre) were the first people to attempt a simplified approach to disability through their creation of *'The Enabler'*.

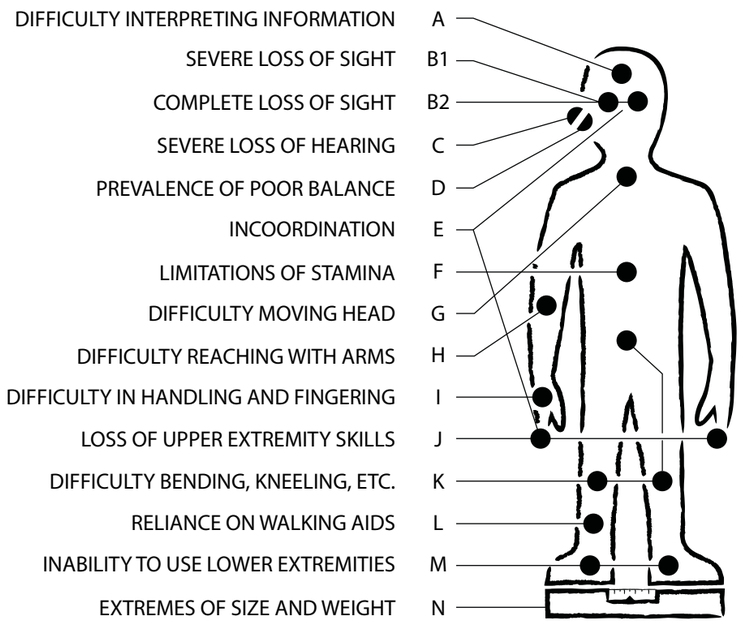


Fig. 1.1: The Enabler, by Edward Steinfeld

This model was intended to act as a design tool, replacing diagnostic terms such as 'blind' with their functional limitations - i.e., severe/complete loss of sight. Much work in the field since then has continued to categorise disabilities, to the point where the terms 'wheelchair user' and 'visually impaired' within building regulations, standards, and academic discourse are commonplace; perpetuating the notion that disabilities can be neatly categorised and dealt with independently, with little to no regard for nuance. This functional approach to disability and impairment was also prominent in the USA, where "space was viewed as functioning better for disabled people when such differences were addressed within it" (Gissen, 2022). Throughout history, it was believed that catering for the physical, dimensional needs of disabled people was enough, but this approach devalues the importance of the full spatial experience. In the context of wheelchair users, we can widen corridors for them, but do we consider how their perspective - sat in a chair at low height - impacts what they see?

In 2010, the Helen Hamlyn Centre at the Royal College of Art in London produced *'Sight Line: Designing Better Streets for People with Low Vision'*. This contemporary guide focuses on

the challenges of visually impaired people in navigating urban environments, whilst perpetuating the idea of categorisation by stating that there are 3 types of people with visual impairments; guide dog users, long cane users and those that rely on residual sight.

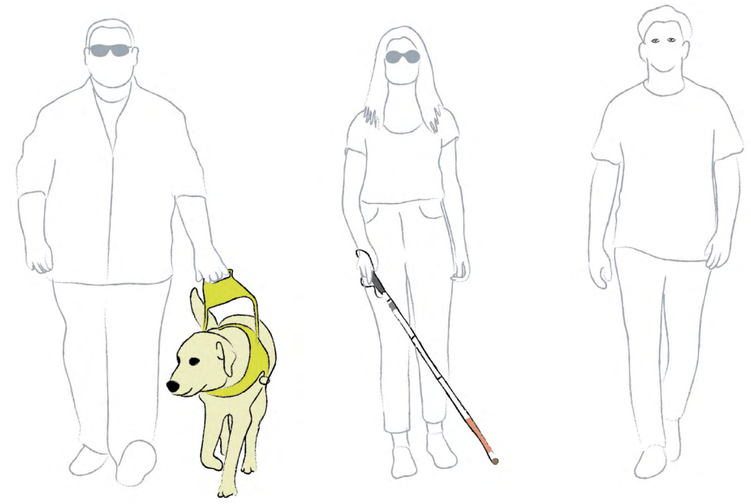


Fig. 1.2: The 3 types of visual impairments

Whilst the guidance within this was well considered and extensive, similarly to *'The Enabler'*, it failed to account for the people who don't fit neatly into a category. It acknowledges that of an estimated two million people in the UK with sight loss, the aforementioned categories only represent the 300,000 that are officially registered as blind or partially sighted (Atkin, 2010). The spectrum of sight however is much broader than this, including unregistered people with sight loss who may experience partial, monocular and/or fluctuating vision. Using my own experience of monocular and fluctuating vision I will highlight the gaps in regulatory and design discourse and explore through case studies how biophilic design principles could become a baseline for creating spaces that are universal rather than simply accessible.

Combining personal perspective with in-depth research, I will discuss some of the barriers faced by this nuanced group of people with sight loss, where the built environment reinforces their differences and elevates alienation. Due to the specificity of my condition, I do not claim to be speaking on behalf of all who consider themselves as visually impaired, but simply want to propose a new way of thinking in design; shifting from the paradigm of the ocular-centric towards a multi-sensory approach. Where the terms 'inclusive' and 'universal' eradicate the term 'accessible'.

Chapter 2

Literature Review

> "The resistance to access regulations and environmental modifications by public institutions and private development interests in Western countries attests to deep, and enduring, structures of disability discrimination which shape contemporary cities." (Butler & Parr, 1999)

This critique provides the lens through which I will examine the following regulations and practice-based literature, encapsulating the notion of accessibility being a tick-box exercise. If governments and people who have the money and power to deliver projects are not invested in accessible measures, how can we ever hope for a built environment that is inclusive? As mentioned briefly in the introduction, regulatory literature has a very narrow view on disability. UK building regulations "are heavily biased towards the needs of wheelchair users, hardly considering sensory disabilities... they are descriptions of minimum acceptable specifications which may allow use by disabled people (in wheelchairs)" (Holmes-Siedle, 1996). As stated in the 2nd edition of '*The Universal Design Handbook'*;

> "Accessibility is a function of compliance with regulations or criteria that establish a minimum level of design necessary to accommodate people with disabilities. Universal design, however, is the art and practice of design to accommodate the widest variety and number of people throughout their life spans." (Preiser & Smith, 2010)

'Access to and use of buildings: Approved Document M' is a significant contributor of categorical thinking, and a text that is heavily used by students and professionals within the construction industry. Within the limited discussion of visual impairment, it is framed in categorical terms, offering prescriptive provisions that focus largely on visual contrast, material choice, and signage. Specifically, it discusses the importance of entrance doors being distinguishable, especially when within glazed screens and how structural columns at entrances should "not present a hazard for visually impaired people" - but offers no real solution. Later in the document it states that "the appropriate choice of floor, wall and ceiling surface materials and finishes can help visually impaired people appreciate the boundaries of rooms or spaces, identify access routes and receive information"; acknowledging that "glare and reflections from shiny surfaces, and large repeating patterns, should be avoided in spaces where visual acuity is critical." The other relevant point it touches upon is the use of artificial lighting, saying it "should be designed to give good colour rendering of all surfaces, without creating glare or pools of bright light and strong shadows." In summary, it focuses more on awareness than solution,

highlighting problems that should be avoided without suggesting what would be better placed for those with visual impairments.

This regulatory framing has direct consequences within architectural education, where Approved Document M is often presented in universities as the baseline standard for accessibility. Its limitations henceforth risk becoming internalised by students who have no personal experience or interest in inclusive design. For many, this reduces accessibility to a regulatory checklist - reinforcing the culture of minimum compliance rather than meaningful inclusion. As somebody with an unpredictable and evolving visual impairment, this has been a constant source of frustration, igniting my interest to explore the ignored disabilities.

The categorical framing in *Approved Document M* is not unique. It reflects a broader regulatory environment in the UK, where accessibility guidance is codified through British Standards. Key texts such as *'BS 8300:2018: Design of an accessible and inclusive built environment'* and *'BS ISO 23599:2019: Tactile walking surface indicators'* are intended to ensure a baseline of accessibility across public spaces and buildings. However, like *Document M*, they largely operate through prescriptive measures that assume standardised user groups. *British Standard 8300-2:2018* covers the same features of materiality, lighting and layout, but expands upon them to deliver more in-depth guidance towards creating inclusive buildings. It frequently refers to the importance of features that "contrast visually" and are "easily identifiable by people who are blind or partially sighted". Whilst it does begin to offer solutions for creating more inclusive environments, it still falls short of being inclusive by referring to people simply as "blind or partially sighted." Similarly, in *'BS ISO 23599:2019'* the focus on tactile paving and walking surface indicators directly addresses the needs of people registered as blind, but pays less attention to other impairments. Whilst these measures are undoubtedly beneficial for some users, they reinforce a binary model of vision: one either relies on full sight, or on tactile/auditory cues as a blind user. This risks reinforcing a compliance-driven, one-size-fits-all model that overlooks the realities of partial, monocular, or fluctuating vision. Furthermore, it leaves little room for those without the training to confidently navigate these cues, and for whom issues such as glare, monocular depth perception, and visual fatigue are rarely addressed.

Beyond statutory regulations and standards, a number of practice-based guides attempt to bridge the gap between compliance and lived experience. British Standards prove themselves to be more accepting of their limits by signposting to other published work for specialised guidance, for example, when *'BS 8300-2:2018'* mentions lighting, it directs readers to the Thomas Pocklington Trust's *'Lighting in and around the home: A guide to better lighting for people with sight loss'* (2021). Other documents such as Ross Atkin's *'Sight Line: Designing Better Streets for People with Low Vision'* (2010), and Howard Fletcher's *'The Principles of Inclusive Design'* (2006) are intended to provide designers with more tangible strategies to

support users with sensory or physical impairments. These texts often go further than regulation by grounding their recommendations in user testing or real-life scenarios - for instance, in *'Lighting in and around the home'* a number of people are observed, with solutions that are tailored to their individual needs. However, while such frameworks are valuable in highlighting diversity within user groups, they still rely heavily on categorisation, which risks oversimplifying the nuanced experiences of people whose impairments do not align neatly with these typologies. In this way, practice guides both advance the discourse by moving closer to lived experience, yet simultaneously reproduce the limitations of prescriptive approaches established in regulation.

Finally, to ground this discussion in practice, I will critique a few high-profile architectural precedents through the dual lens of biophilic and inclusive design; the former of which is a widely studied area, and the latter a well-established principle. Despite extensive research into both areas individually, intersections between the two topics are extremely scarce. Articles such as *'Biophilic Design for Inclusive Spaces: Creating Universal Nature Connections'* by Garden on the Wall begin to discuss the integration of these two concepts in architecture, noting it "creates environments that accommodate diverse physical abilities, sensory sensitivities, and cognitive differences while delivering the well-documented benefits of nature connection." However, it offers no built example, thus only contributes to the theoretical discussion of biophilia as a tool for inclusion. The first highly celebrated example of biophilic design I want to discuss is Bosco Verticale in Milan, a residential tower block scheme designed by Stefano Boeri Architects. Though widely hailed as successful biophilic design, it exemplifies the kind of project "where marketing of environmental benefits is overplayed in order to entice consumers" (Liu, 2023). The high maintenance costs of the scheme caused the prices of the apartments to sky-rocket, leading to green-gentrification – "the intention of improving environmental conditions and community aesthetics, while often overlooking increases in property values and the subsequent

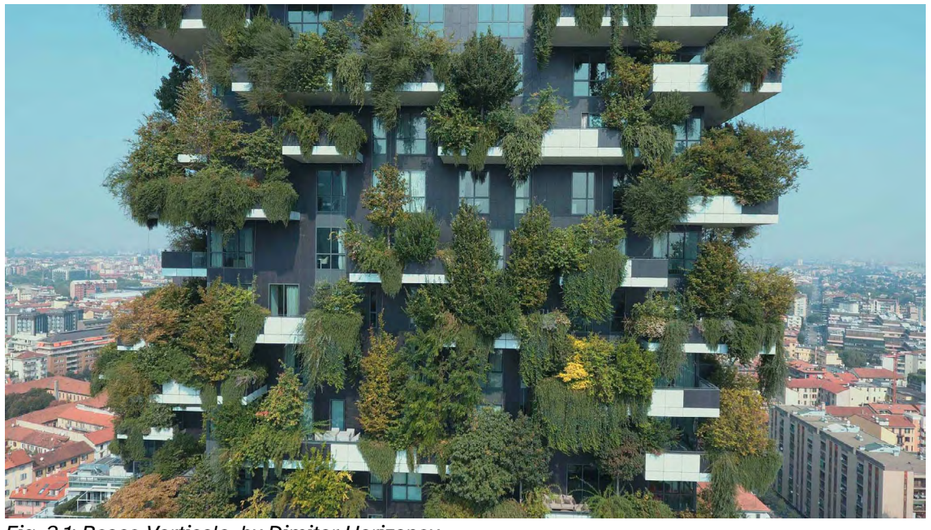


Fig. 2.1: Bosco Verticale, by Dimitar Harizanov

displacement of low-income, often marginalized, community members" (Chen, 2025). This is a prime example of current biophilic precedents, where nature is highlighted and inclusion is dismissed.

One example of biophilic design that addresses issues of accessibility and inclusion is Khoo Teck Puat Hospital (KTPH) in Singapore, designed by CPG Consultants alongside Architectural firm RMJM. The designers intended to build a hospital that "would not just serve patients, but would also enrich the neighbourhood with its architecture and landscaping, at the same time enriching biodiversity of the area" (Development Asia, 2017). Accessibility was fundamental to the success of this project, since it is within the healthcare sector. The entire complex was designed to be 'barrier-free', making it an exemplar of the co-existence between biophilic and inclusive design. Whilst KTPH is celebrated for its biophilic design success, it remains unique in its accessibility and enrichment of its neighbourhood. Critics therefore frame the design as an exception rather than a replicable model that should become standard.

Fig. 2.2: Photograph of exterior circulation, by KTPH

Finally, there are many design proposals that adopt biophilic principles, but lack the practicality or funding to be realised. Notably, architect Vincent Callebaut designed many of these biophilic utopian designs, which now serve as manifestos for future 'realistic' design. In a 2021 interview titled *'Building Through Biomimicry'*, Callebaut acknowledged that "it is the challenge of (his) generation of architects to invent new ecological, united, and inclusive ways of living." However, even these limitless, unrealised proposals show little consideration towards inclusivity, focusing on nature as the primary design inspiration, with accessibility largely overlooked.

Chapter 3

Pilot Study

To begin the transition from research to application, I undertook a pilot study – visiting and analysing two local, familiar spots to interrogate the ease with which I could navigate them. The intention behind this was to consider how my experiences of the built environment reflect or differ from those experienced by others, and how this could help to address the regulatory gaps. My selection of sites was purposeful. Firstly, I chose Walsall Art Gallery – a building that claims to be accessible for all. Secondly, I chose my local supermarket – Tesco, Walsall - where I frequently experience sensory-overload, eye fatigue and discomfort. I visited both locations at mid-day whilst the town was quiet. This timing ensured my experiences of both places were as free from external stimuli as possible, enabling me to fully immerse myself in the sensory qualities of the spaces.

I will analyse each building - and the case studies later in this dissertation - using the same architectural methods. Using photographs, I aim to capture real-life perspective and conditions, grounding my discussion in reality. Using floor plans I will discuss spatial clarity, orientation, and notable features. Finally, through axonometric drawings I will explore materiality and architectural elements that engage with biophilic ideas - such as daylight access and views to nature. For the sake of prioritising visual legibility, drawings will not be presented at conventional architectural scales, but indicative scale bars will be included as reference.

The New Art Gallery, Walsall

I documented my journey through this building in the series of photographs that follow, simultaneously sketching and recording my thoughts and feelings within the different spaces.

Circulation routes are highlighted in wood panelling to distinguish from the white walls

The stairwell relies on uneven, inadequate artificial light - the contrast from the bright main room made me feel uneasy about using the stairs

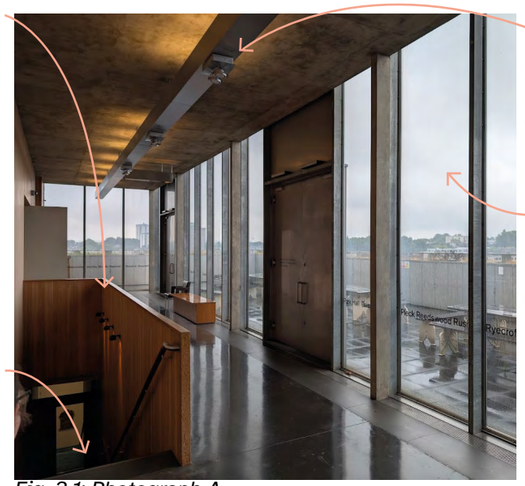


Fig. 3.1: Photograph A

Fixed glazing - thermal comfort relies on mechanical control

Full-height glazing without glare control - direct sunlight penetrates the space, heavily reflecting off the flooring and worsening glare and disorientation

Access to daylight is even and can be controlled through built-in blinds, its high position also reduces the intensity of light making the space more comfortable to navigate

Fig. 3.2: Photograph B

Light reflections on the floor made this room overwhelming to navigate for someone like me who watches the ground when walking to avoid trip hazards, especially with art installations like the one pictured, which was anchored in place by two bricks that I could've easily missed

Art is displayed at eye level, reducing visual clutter and therefore eye strain and over-stimulation

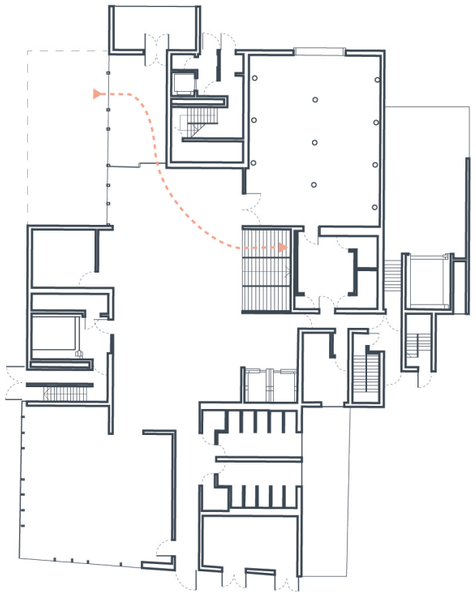
Wooden flooring minimises glare from daylight, creating a comfortable environment

Fig. 3.3: Photograph C

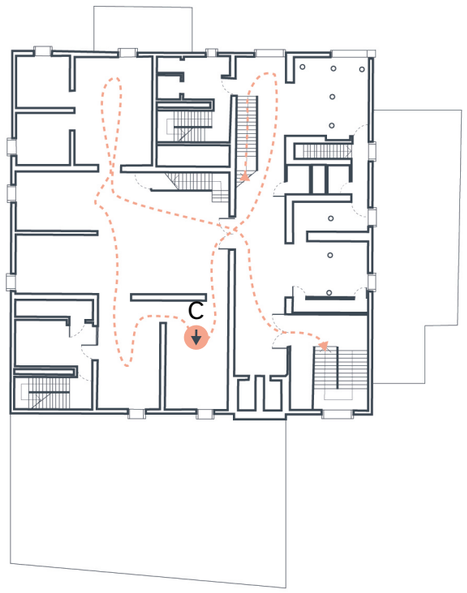
The off-centre artificial light creates an imbalance in the space due to it being the strongest light source

Dominance of the window and daylight immediately drew my focus to the outside rather than the artwork

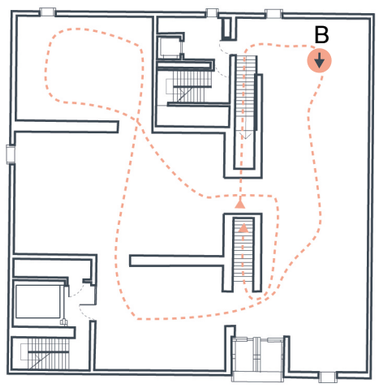
The floor plans below show my journey through the building - entering through the main entrance, taking the lift to the fourth floor, and then working my way down through the gallery spaces using the central staircase. Unaware of access restrictions, taking this core stairwell meant I passed by the second floor (which acts as a sort of mezzanine above the first floor gallery). For this reason, it has not been included within my analysis. To locate my observations within the context of the building, I have highlighted the points at which the previous photos were taken. Additionally, I have added a North arrow to orient the building and show how daylight is able to penetrate the building throughout the day.



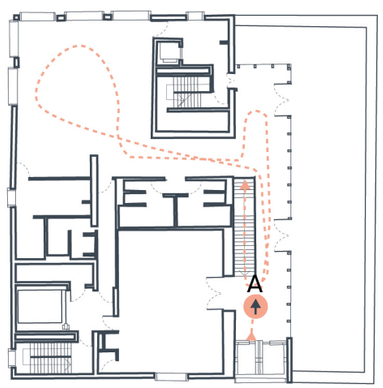
Ground Floor



First Floor



Third Floor



Fourth Floor

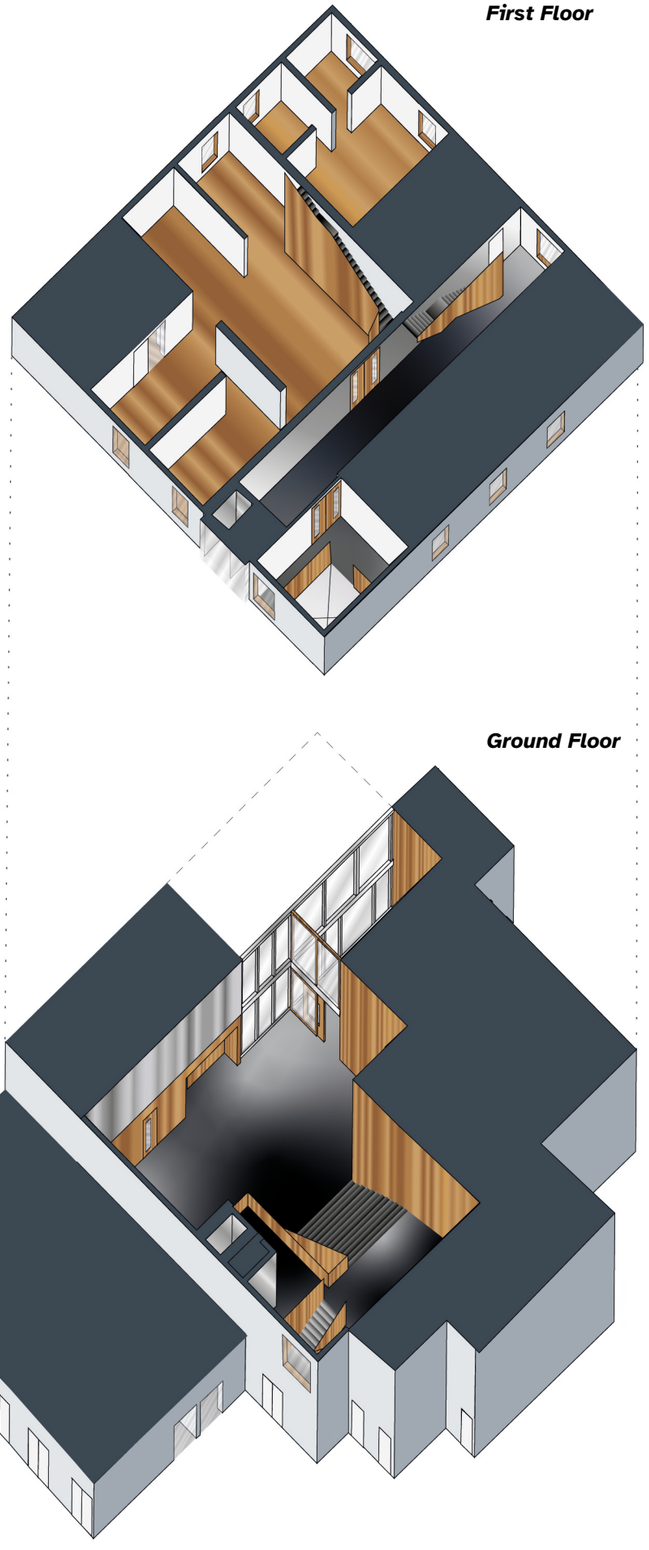
Location of Photograph

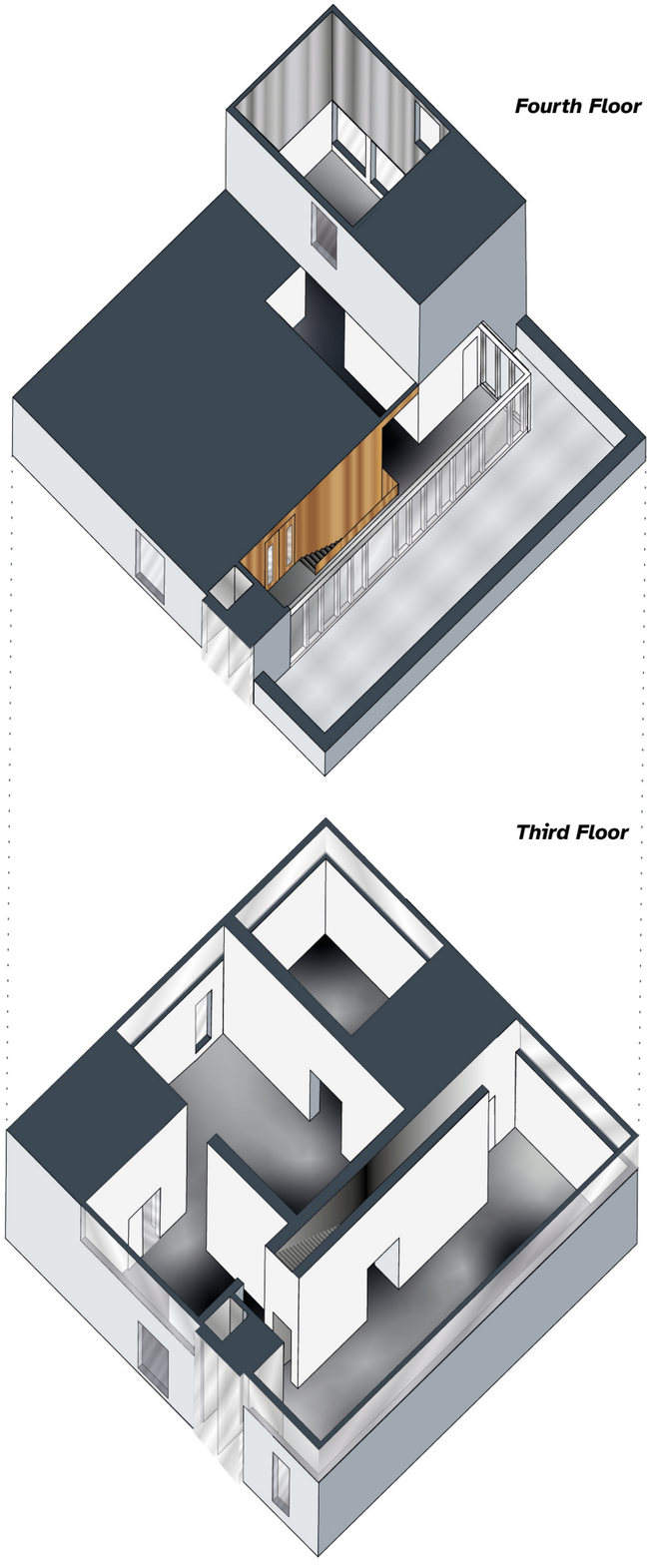
Circulation Route

Fig. 3.4: Floor Plans of Walsall Art Gallery, showing spatial relationships

My main observations concerned lighting, materiality and overall sensory stimulation. I noticed that spaces in which I preferred spending time had similar traits; with soft, wooden flooring, an equal balance of natural and artificial lighting (significantly reducing glare) and had a logical arrangement of furniture. The use of wooden flooring alone emphasises the value of natural, renewable materials in creating both sustainable and accessible spaces - with a low carbon material providing reduced glare and acoustic comfort. This was in stark contrast to rooms in which I felt discomfort. In those areas, visual clutter was overwhelming and the flooring was a highly reflective black rubber – a synthetic material that lacked the warmth and environmental benefits observed elsewhere. Artificial lighting also over-compensated for the subdued natural lighting brought in from clerestory glazing. This reliance on artificial lighting raises concerns over energy efficiency as well as accessibility. These observations are reflected in figure 3.5, where I aimed to represent the atmospheric qualities of the spaces I visited through an axonometric drawing.

Due to the artistic nature of the furnishings and building itself, it is difficult to fully critique what I considered to be ‘visual clutter’ - such as clusters of vibrant patterns with no distinct focus, where it may be an intention of the artist to disorientate the viewer. However, installations anchored to the ground by stand-alone bricks and artwork far below or above eye level seemed to be unnecessarily hazardous. In addition, the auditory stimulation throughout the building was often overpowering and disorienting. Videos and music played throughout different spaces, with little to no acoustic control to offer any kind of separation or structure to the flow of rooms. More sustainable design solutions such as passive acoustic zoning or material-based buffering could reduce the reliance on electronic solutions as well as improve inclusivity. Taken altogether, these observations show the impact of lighting, materiality and sensory input in enhancing or undermining an inclusive spatial experience.





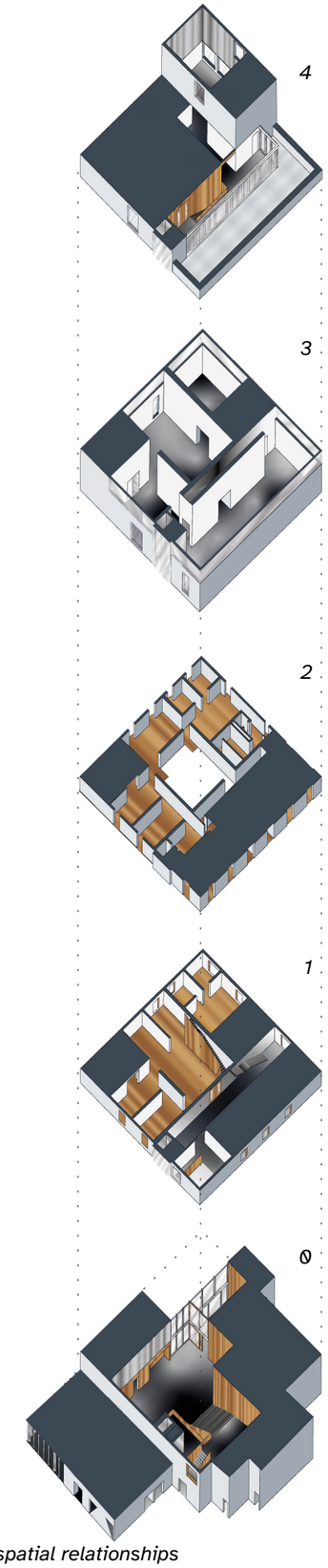
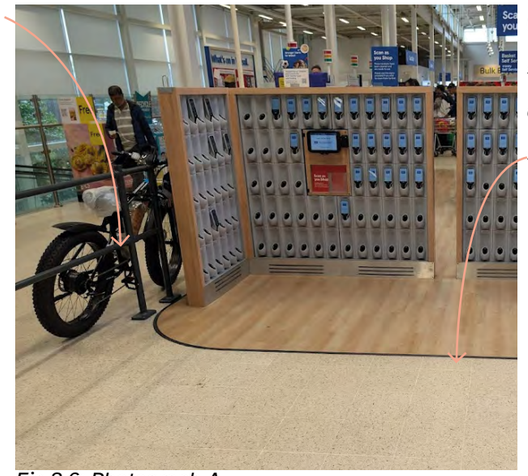


Fig. 3.5: Axonometric drawing of Walsall Art Gallery, showing materiality and spatial relationships

Tesco, Walsall

I approached this building in the same way as the gallery, recording my observations through the following photographs.

Black barriers are used to provide a stark contrast against the flooring, clearly marking the boundary between shop and circulation, though when obscured by items such as the bike pictured, it may introduce navigational confusion



Using flooring to create separate zones helps improve circulation and clarity in a subtle yet effective way

Fig.3.6: Photograph A

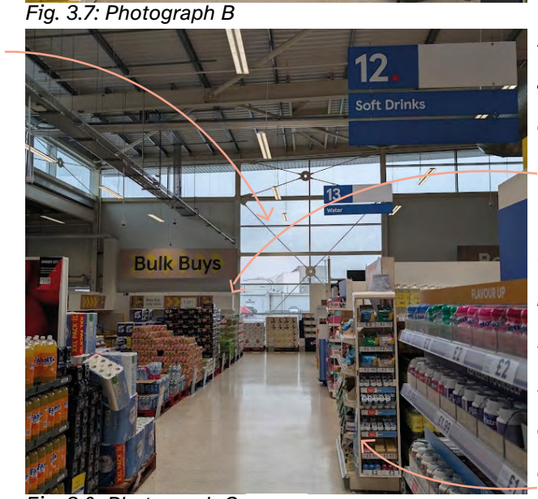
The addition of skylights to provide daylight helps distribute light more evenly across the store, but the contrast in brightness between natural and artificial light creates eye strain

Organisation and frequency of lighting is overwhelming and difficult to avoid eye contact with, causing eye fatigue

Light reflection and shadows on the tiled floor contribute to disorientation

Fig. 3.7: Photograph B

The glazing makes this part of the store feel much more navigable, casting even light and fostering a connection to the outside, breaking the monotony of the superstore



Inconsistent signage and colours can become overwhelming and cause eye fatigue

Shelves act as obstructions, blocking views to aisles - poor spatial planning also places structural columns in key circulatory paths, causing disorientation

Fig. 3.8: Photograph C

The typology of a supermarket is complex, with a heavy emphasis on functionality. Although the program of a supermarket is more consumer-driven than a gallery, there were noticeable similarities between my experiences in the Gallery and Tesco. Upon entering the store, I was immediately confronted with overbearing overhead lighting, which was consistent throughout. The glare from these made it highly challenging to navigate the aisles, especially since shopping relies so heavily on reading product information. Shoppers may spend up to an hour in environments like this. The bright white reflective surfaces, harsh artificial lighting and constant sensory stimuli (from glaring product displays to the beeping of check-outs) created an environment that I was relieved to leave. Much like in the Gallery, the reliance on artificial lighting raises sustainability concerns, especially given the store's long opening hours. Despite the increased intensity of the sensory input in the supermarket setting, there were still some successful elements to the store. Most notably, a curtain wall along the front of the store allows natural daylight to flow into the aisles. This daylight partially extends down one side of the store, but shelving is prioritised in the layout – interrupting and reducing its impact. Approaching this naturally lit section I finally felt relief, escaping from the monotony of the artificial lighting. This highlighted how passive daylighting can ease visual strain whilst also offering a more energy-efficient lighting solution. Another positive design element was a change in floor finishing near the check-out area – highlighting the scan-as-you-shop section. At this point, the surface transitioned from a white tile to a warm, wooden laminate. This flooring change helps provide clear way-finding in a high-footfall area of the store, but is a technique applied so sparingly in the store that it has little impact on the overall experience.

Another challenging aspect of navigating this store was it's questionable layout. A feature that particularly stood out to me was the misaligned locations of shelves and columns. As touched on previously - due to the nature of the store - shelving is prioritised and therefore maximised. This ultimately creates tension with the rigid structural grid, creating awkward moments in aisles where structure becomes obstruction, as shown in figure 3.9. Whilst no floor plans of the store were publicly available, I created a diagrammatic plan (see figure 3.10) showing the rough locations of key elements such as the shelving, columns and entrances.

Fig. 3.9: Photograph D

1 - Entrance from Ground Floor (via escalator)
2 - First Floor Entrance (via roof car park)
3 - Toilets
4 - Check-outs
5 - Scan-As-You-Shop
6 - Cafe
7 - Kitchen & Customer Service
8 - Escalator to Mezzanine Floor
9 - Staff Only

Location of Photograph

Circulation Route

Structural Columns

Fig. 3.10: Floor Plan of Tesco, showing spatial relationships

Summary of Findings

In both buildings, choices of material and the balance between artificial and natural lighting had the largest impact on my level of 'comfort'. The fact that soft, natural materials such as wood, and earthy tones were preferable over man-made, reflective finishes such as tile and rubber reinforces the connection between inclusive and biophilic design – with natural materials and daylighting reducing glare and discomfort, supporting sensory comfort, and minimising the reliance on artificial systems. I am not alone in experiencing this, as the lighting guide by Pocklington Trust acknowledges, people prefer windows and daylight within their homes with "blind and partially sighted people (appreciating the) sense of connection to the external environment."

My personal findings support the idea that biophilic design is innately universal - since conditions that better suit a person with fluctuating vision coincide with the foundations of biophilia. This initial study suggests that engaging with biophilic principles from the onset of a project could tackle numerous issues in one. Such an approach would address sustainability concerns by incorporating natural systems as foundational elements rather than a 'nice to have' add on at the end. Additionally, it would exceed basic accessibility requirements by catering for less-obvious disabilities through a holistic consideration of all senses.

Chapter 4

The 14 Patterns of Biophilic Design

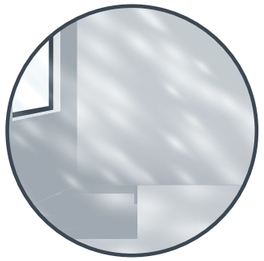
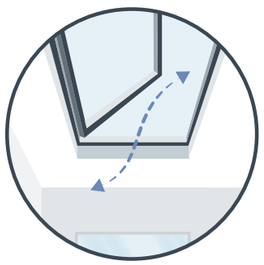
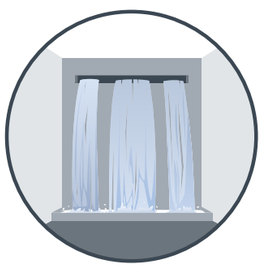
As discussed in the introduction, architects need to shift from ocularcentrism to a multi-sensory design approach. This chapter addresses that shift by exploring the 14 patterns of biophilic design as a framework. Given the current climate crisis, one could easily dismiss inclusive, multi-sensory design as a non-urgent issue; after all, immense weight within the industry is currently placed on how we can reduce our carbon emissions. However, if a multi-sensory design approach can be shown to improve the experience of those with visual impairments and increase the sustainability of our built environment, then it can no longer be justified as a low priority. This chapter will explore that potential.

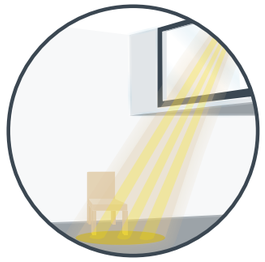
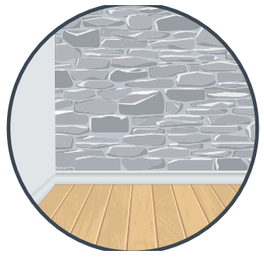
My pilot study showed the importance of good lighting, materiality and spatial layout in creating navigable spaces for people with fluctuating vision. The focus of these findings overlap with the aims of biophilic design. As mentioned in the introduction, the report *'14 Patterns of Biophilic Design: Improving Health & Well-being in the Built Environment'* offers clear guidance on how to engage with biophilia in architectural practice.

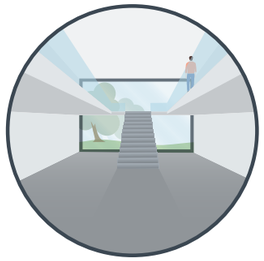
To simplify these 14 patterns, they are defined by three categories. The first is nature in the space, which concerns the literal integration of nature into the environment, whether real (such as plants) or simulated (such as landscape paintings). The second category is natural analogues, where natural forms and patterns are reflected within architectural features. The third category, nature of the space, considers different spatial layouts and their impact on our perception of space, based on our evolutionary preferences for refuge and exploration. As discussed in table 4.1, each of the 14 patterns has the potential to address the challenges faced by people with partial and fluctuating vision. However, without careful consideration they could also exacerbate those same issues. Using these patterns as a starting point, I will reinterpret them through the lens of visual impairment, suggesting how inclusivity and sustainability could develop to become intertwined, symbiotic goals in the future of design.

Though each pattern can impact the experience of a person with fluctuating vision, some of them are significantly more important than others. Patterns 1, 3 and 6 all directly correlate with visual input, making them important factors in design for the visually impaired. Lighting and views are key to aiding navigation, but ill-considered design in this area can create spaces that trigger sensory overload or light-sensitivity. Patterns 2, 4 and 9 engage with multiple senses – harbouring the potential to provide alternative way-finding measures, or further contribute to sensory overload if not executed effectively. Finally, all the 'nature of the space' patterns equally contribute to how space is perceived and how easily it can be navigated.

Table 4.1: The 14 Patterns of Biophilic Design and their impact on the visually impaired

	Pattern & Example	Benefits	Challenges
1 - 7: Nature IN the Space			
	1: Visual Connection to Nature *Picture windows providing direct views to nature*	*Provides visual respite from over-stimulating artificial environments, reducing the likelihood of eye fatigue*	*Over-use of this strategy could lead to over-exposure, creating glare and an uncomfortable space for those with light sensitivity*
	2: Non-Visual Connection to Nature *Air vents that carry sounds and scents from outside*	*Natural ventilation engages sound and scent to enhance spatial awareness and comfort*	*Less easy to control compared to mechanical alternatives - overpowering stimuli could cause distractions*
	3: Non-Rhythmic Sensory Stimuli *Natural shadow projections that change throughout the day*	*Creates natural depth within spaces and helps provide a sense of time and movement*	*Depending on the lighting and surface finishes of the room, projected shadows could be disorienting, and harsh contrasts could make spaces illegible*
	4: Thermal & Airflow Variability *Operational roof lights to increase air-flow*	*Variations in temperature and air-flow can help to signal transitions between spaces, aiding with orientation*	*If too varied, the experience could become disorienting, with the potential to overrule more subtle environmental cues such as sound and smell*
	5: Presence of Water *A water wall feature*	*As well as offering a soothing visual presence, water provides interaction for the senses of touch, smell and sound - able to mask unwanted noise*	*Without proper consideration, water features can easily dominate a space, leading to over-stimulation or disorientation if other auditory cues have to compete, glare from reflections could also become problematic*

Pattern & Example	Benefits	Challenges
 6: Dynamic & Diffuse Light *Indirect light from clerestory windows*	*Allows soft daylight to flood into rooms, creating even illumination that supports comfortable navigation*	*Excessive variation in brightness can induce disorientation and visual fatigue*
 7: Connection with Natural Systems *Seasonal garden roofs*	*Provides visual respite from artificial scenery and serves as a reminder of temporal change, helping to ground the viewer in time*	*Has the potential to become visually dominating and unsightly if not maintained, strong shifts in colour and light level could also challenge legibility*
8 - 10: Natural Analogues		
 8: Biomorphic Forms & Patterns *Structural columns resembling trees*	*Helps foster feelings of comfort and familiarity within spaces, softening spatial transitions*	*Overly complex or repeated use of these elements can become visually overwhelming, thus being perceived as unnecessary clutter*
 9: Material Connection with Nature *Using natural materials such as wood and stone*	*Provides tactile variation to help distinguish surfaces and aid with way-finding through touch and sound*	*Textural differences could become hazardous if smooth underfoot transitions are not maintained*
 10: Complexity & Order *Natural patterns such as the beehive hexagon on a building facade*	*Provides visual harmony through repetition and recognition, reducing visual monotony*	*Complex patterns could become overwhelming, ruining the clarity of form and orientation*

11 - 14: Nature OF the Space		
 11: Prospect *Open-plan views, mezzanines*	*Provides good visual access to the area, allowing users to perceive obstacles and plan the best route through spaces*	*Excessive openness can lead to confusion and a loss of spatial focus, with no visual cues to guide movement*
 12: Refuge *Intentional areas for rest such as a reading nook in a wall*	*Provides a safe retreat in what might be an otherwise overstimulating environment, allowing a rest from visual fatigue*	*Without consistent lighting, these spaces could offer challenging transitions when moving between the retreat and the main areas, becoming illegible and uninviting*
 13: Mystery *Corridors that lead somewhere you cannot see*	*Gradually revealing spaces encourages curiosity and exploration, with subtly layered spaces being able to entice users*	*Too much ambiguity or shadow in these spaces could distort and obscure routes and obstacles, providing visual obstruction*
 14: Risk/Peril *A glass floor*	*Controlled exposure to perceived danger can stimulate engagement and awareness*	*Users with limited depth perception may experience spatial disorientation and anxiety with these features, and should therefore be optional and clearly signposted*

In the next chapter I will take this analysis of the 14 patterns further, identifying their prominence within two different case studies and how this impacts upon the overall function of both buildings, specifically regarding users with fluctuating or partial vision.

Chapter 5

Case Studies

To explore the links between biophilic design and sensorially inclusive design I will be analysing two case studies. For consistency, the chosen case studies both sit within the healthcare sector, though their specific requirements and approaches differ significantly. I will be analysing which of the 14 patterns introduced in the previous chapter are evident within each design, determining whether they enhance or hinder the experience of users with partial or fluctuating vision.

Case Study 1:

Maggie's Centre

Location: West London, Architect: Rogers Stirk Harbour and Partners

Firstly, I will be looking at Maggie's Centre in West London, designed by Rogers Stirk Harbour and Partners. As of 2025 there are 24 Maggie's Centres across the UK and 3 international locations. The first one was designed in 1996 in Edinburgh by Richard Murphy Architects, with married couple Maggie and Charles Jencks as the clients. Maggie suffered with cancer and the couple recognised the need for a place of respite for patients like her; somewhere to contrast with the monotonous, sterile environments of hospital and promote mental recuperation as well as physical. Whilst this was unfortunately the only centre Maggie was able to experience herself, Charles continued her legacy after her passing, engaging with more architects to create a portfolio of centres each with their own character. Although no two of the centres have been designed by the same team, the importance of and engagement with biophilic principles is something that underpins each. The centres are not designed for any specific impairment but rather take a holistic approach to cater for a range of complex and evolving needs. The unpredictability of cancer is reflective of fluctuating eye conditions, and both have impacts on sensory engagement - thus, I would expect to see design moves that ultimately benefit the user group I am focusing on.

The West London Centre by RSHP was completed in 2008, covering 370m2. The architects' vision was of an 'open house' with an orange steel wall (1) that wraps around to guide movement and offer protection, ending at the kitchen (2) which acts as the central hub. All other rooms lead off this central area, divided by sliding timber partitions (3) to enable control over the privacy of the spaces and regulation of environmental conditions.

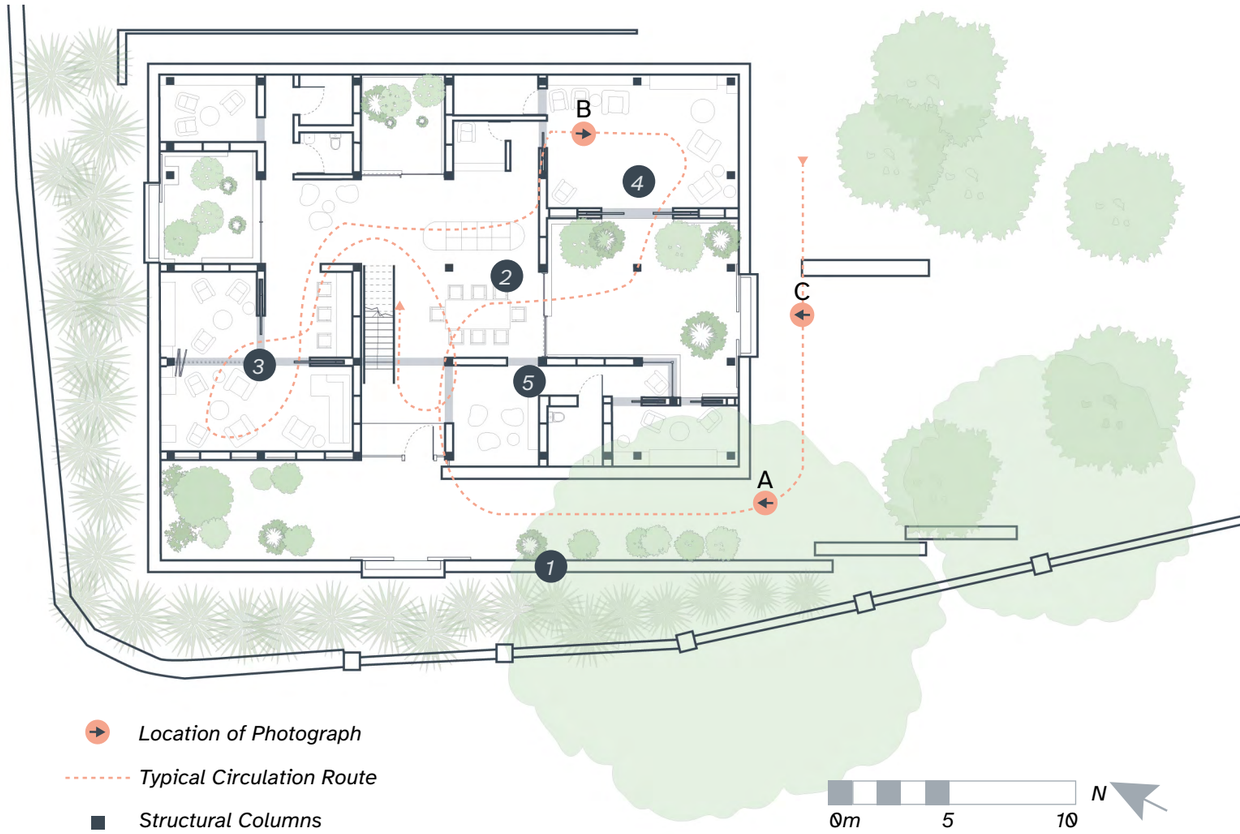


Fig. 5.1: Floor Plan of Maggie's, showing spatial relationships

The floor plan shows how the structural elements of the building were carefully integrated into the design. The rigid structural grid was used by the architects as a design feature rather than a limitation, resulting in a clear spatial arrangement where walls and partitions sit between columns. This results in a legible floor plan where structure does not become obstruction. The few instances where columns do sit within usable space (4), they are finished in a different material, ensuring they become visually obvious. Also evident on the plan is how contrast is used within the design to identify thresholds. Where there is a sliding partition or change of function - such as the transition from the kitchen to a quiet reading space (5) - timber strips are integrated into the concrete floor, marking the transition both through the visual contrast and underfoot tactility of the different materials.

To analyse the building in more detail I have created an axonometric diagram, identifying areas within the design where patterns from the previous chapter are demonstrated. To enhance this, I have built upon the brief inclusion of daylight on the floor plan, showing how daylight enters the building and contributes to the spatial experience. I will discuss the patterns one by one, using the axonometric diagram as reference for my discussion.

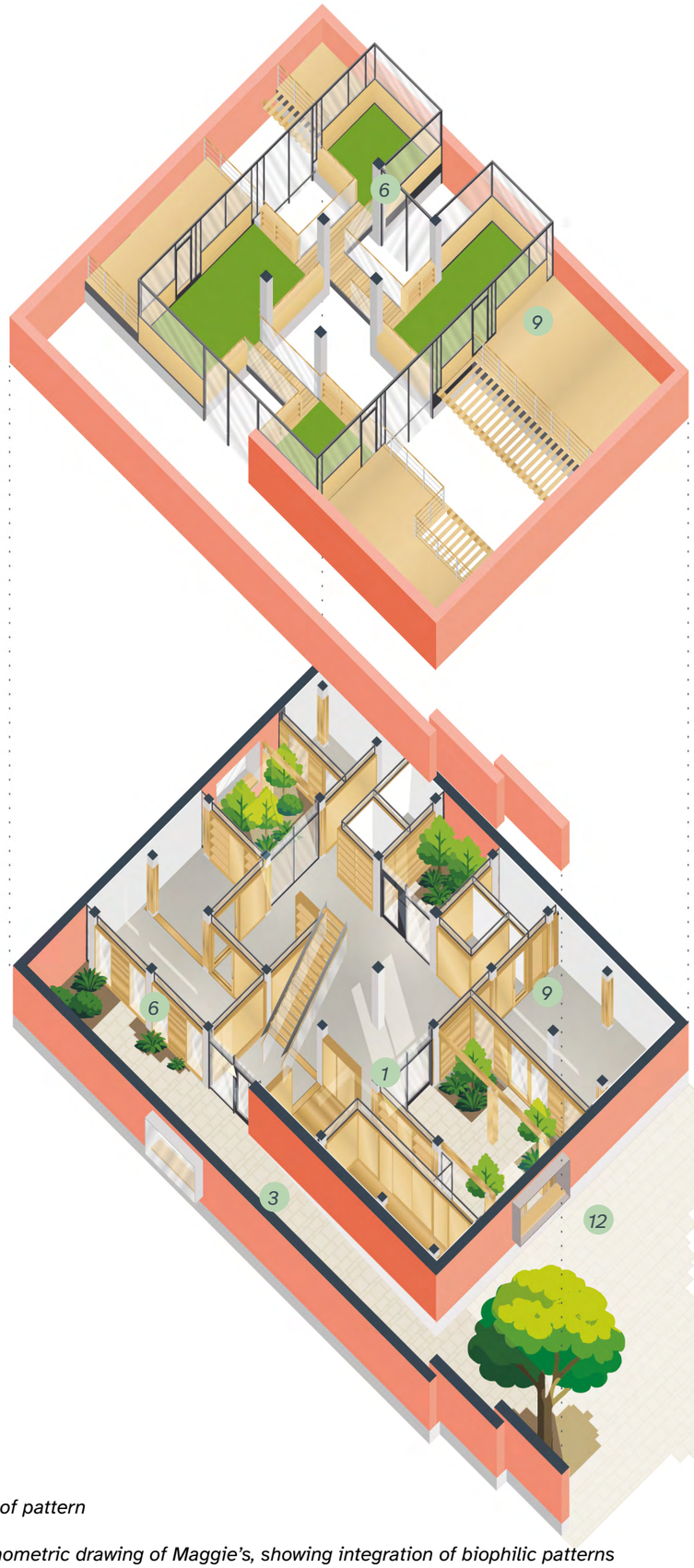


Fig. 5.2: Axonometric drawing of Maggie's, showing integration of biophilic patterns

1: Views to Nature

The building was designed in collaboration with nature, with courtyards and winter gardens situated throughout, accessible from each public room via sliding doors and visible through full-height glazing. The seamless integration of these spaces enables visitors of the centre to feel grounded in their environment, offering an escape from the confinements of the man-made. For people with fluctuating vision, these views into the courtyards offer moments of relief from artificial lighting and overwhelming interiors.

3: Non-Rhythmic Sensory Stimuli

The orange wall that encompasses the building is surrounded by trees, which cast shadows upon it that shift throughout the day (see figure 5.3). The patterns they project onto the facade offer a point of visual interest for approaching visitors, also creating a sense of immersion in nature - giving the sense of wandering through a forest, although the trees are not directly visible themselves. For users with fluctuating vision, these subtle patterns break up the monolithic nature of the solid, colour-blocked facade that may otherwise distort their perception of the space. Without the shadows to provide a sense of scale and depth, the orange corridor on the building's approach may seem overwhelming and defensive rather than welcoming.

Fig. 5.3: Photograph A

6: Dynamic & Diffuse Light

The extent of glazing throughout the design opens the building up to natural daylight, which is maximised in every space. As well as full height glazing for windows and doors, solid timber walls throughout the building have been intentionally stopped short of the ceiling, leaving space for clerestory glazing to further draw in natural light. For users with partial or fluctuating vision the subject of lighting is a complex one. An over-reliance on artificial lighting - or lighting that is too bright - can lead to eye-fatigue and headaches. On the other hand, over-reliance on natural lighting - an environmental condition that is intrinsically beyond our control - can create spaces that are unevenly lit, leaving potential for contrasting interior conditions that could lead to eye-strain from the inability for the eyes to properly adjust. The best solutions are often those that employ a hybrid of natural and artificial - where indirect or diffuse sunlight is maximised, and low-level artificial lighting is available to compensate when this is not sufficient. Whilst the extent of glazing within this building has the potential to create issues of overexposure, the design of the roof helps to combat this issue - overhanging the external walls to provide some protection from direct and overpowering light.

9: Material Connection with Nature

The building has a restrained and industrial material palette, with the vibrant, orange boundary wall, polished concrete columns and flooring, and black steel for the glazing supports. The most evident contrast to this is the integration of timber; used for built-in furniture, walls with openings and handrails, it appears to be carefully implemented in the building as an indication of desired interaction. Design moves like this are highly beneficial for people with partial vision, as we can detect changes in colour even with low vision, and changes in texture either in conjunction with shadows from lighting or the additional sense of touch. Using a natural material like wood for objects that require physical interaction is also significant as it is warm to the touch, encouraging people to investigate, rather than the cold, harsh feel of concrete or steel. An interesting move within the design was to clad some of the concrete columns with timber, and leave others exposed. Those that were clad either sit within walls or connect to built in furniture, free-standing columns remain as exposed concrete, allowing them to be easily recognisable as a potential collision hazard. (See figure 5.4).

12: Refuge

The main concept of 'nature of the space' implemented in this design is the idea of refuge. The large picture windows within the orange boundary wall have recessed frames, creating seating for people as they pass the spaces. The location of these - on the border between the outside world and the tranquillity of the centre - creates an intentional pause for visitors. Either on the way into or out of the building, one can take a moment to reflect, easing their transition between the two environments and combating any sense of being overwhelmed. This is beneficial for visual respite in those with partial vision just as much as it is for mental respite. These 'window seats' also feature sliding wooden-slat panelling, meaning one can be enclosed by soft timber whilst enjoying the space, or open it up to increase their connection to their surroundings. (See figure 5.5).

Fig. 5.4: Photograph B

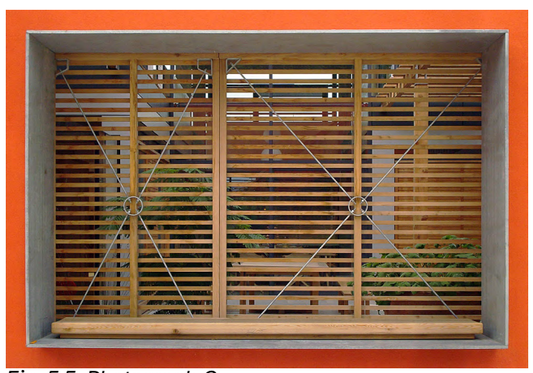


Fig. 5.5: Photograph C

Critique

Despite the user group being different to the one I am advocating for, the design of the West London Maggie's Centre and its encapsulation of biophilic principles creates a design that is widely accessible. The patterns mentioned previously work together to create spaces that guide, protect and encourage a wide range of users, seeing nature as a design tool, with its "inherent qualities of health-giving physical rigor and vitality" (Gissen, 2020). It is important to note that this centre was the first one to be built in England, with its predecessors in Scotland. Due to the timing of the project in terms of the charity's life, it may be excused for perhaps not being the most successful at encompassing biophilia. However, it is important to analyse earlier attempts and discuss where they fall short to achieve greater success in future projects. Its use of clerestory glazing and its engagement with daylight is where this centre shines, intended to enhance connection to the outside world and create a sense of openness with the building. The fact it incidentally benefits the visual experience of those with fluctuating vision is a bonus. Unfortunately, there are several things within the design that highlight the need for intentional consideration of varying disabilities. Internally, shelving doubles as partitions between rooms, which could distort the perception of space for someone with partial sight, if they can see through to another area but not identify how to access it. Additionally, it lends itself to creating a cluttered environment which - whilst creating a homely feel - can be visually confusing and overstimulating. The extent of full height glazing in the design contributes to a similar issue, where navigation routes are not always immediately clear.

Ultimately, the design succeeds where it thoughtfully integrates the biophilic patterns, but limits itself by not taking a holistic approach to biophilia. For example, its integration of refuge spaces is beneficial to those who need moments of visual calm, but without contrasting moments of prospect to offer positionality within spaces, it can quickly lead to feelings of isolation and entrapment. Much like nature itself, biophilic architecture requires balance to achieve harmony. To contrast the analysis of a design where biophilia was a key driving factor, I will compare it to a building where the primary focus was inclusivity.

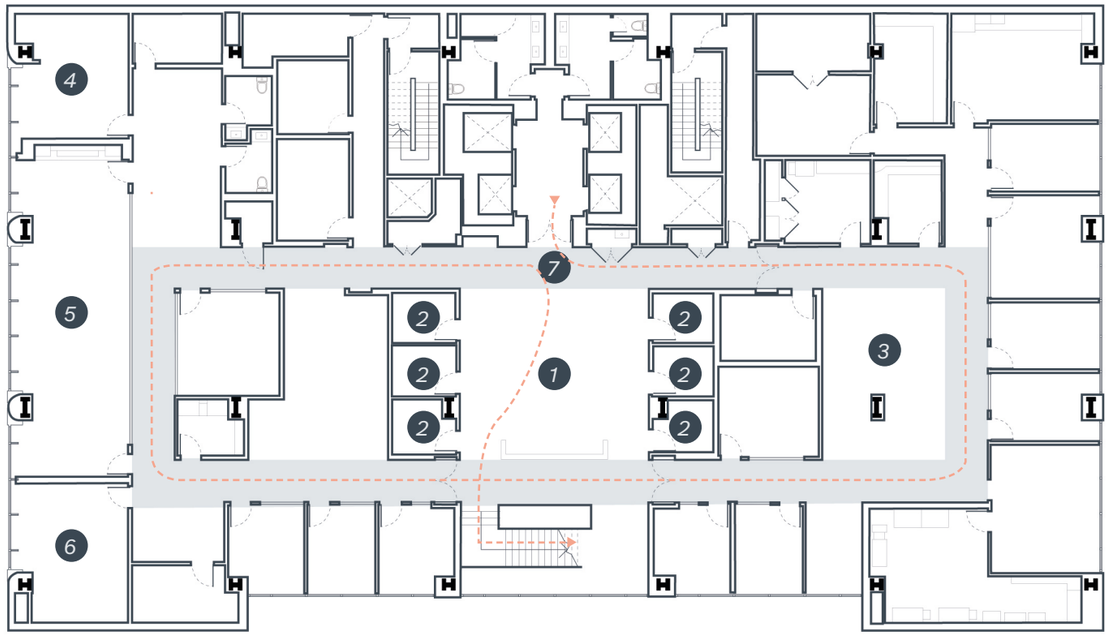
Case Study 2:

LightHouse for the Blind and Visually Impaired

Location: San Francisco, Architect: Mark Cavagnero Associates

The Lighthouse for the blind and visually impaired was a design completed in 2016 by Mark Cavagnero Associates in San Francisco. The project brief was to create a new headquarters for the 114-year-old Chicago-based charity for the blind and people with low vision. They work with people to help rebuild their confidence after sight loss, offering recreational activities to build skills as well as rehabilitation and more. “True to the principles of universal design, subtle design moves are utilized to make the spaces function well for everyone” (Mark Cavagnero Associates). Since the architect claims that the building caters for ‘everyone’, it feels necessary to analyse its design and scrutinise the extent of its inclusivity.

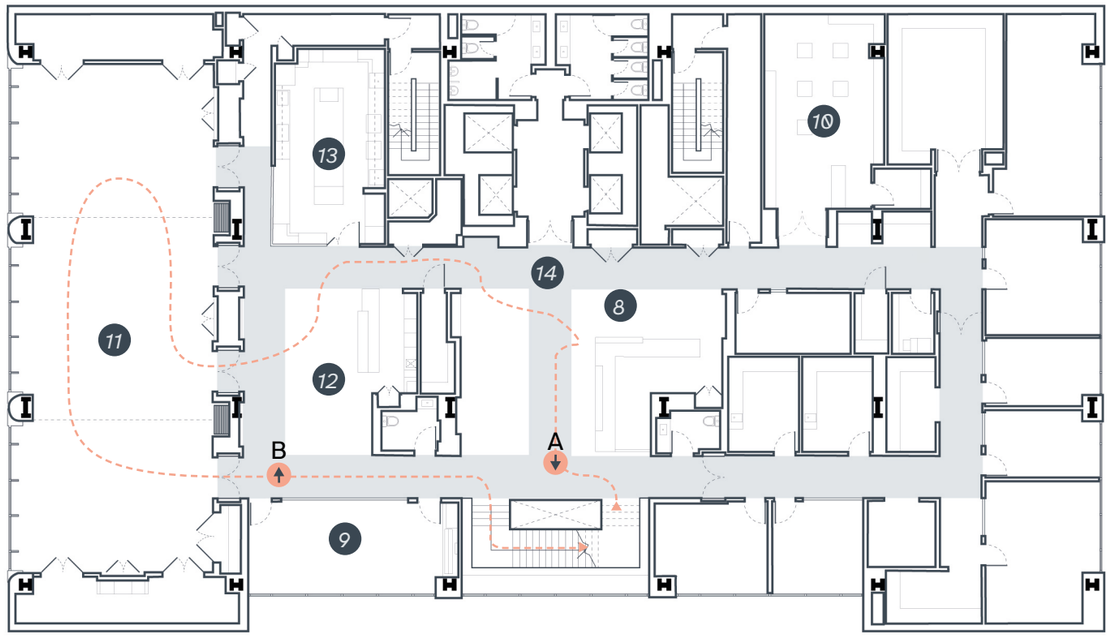
Though the architects designed the building with universal design in mind rather than biophilic design, I will again analyse how the 14 patterns of biophilic design are present within the building. Rather than examining how a holistic approach would have improved the design like in Maggie’s Centre, I will identify how further engagement with biophilic principles could have enhanced the project, better suiting a wider range of visual needs.



1 - Reception
2 - training Rooms
3 - Open Office
4 - Meeting Room
5 - Private Office
6 - Board Room
7 - Concrete Circulation ‘Track’

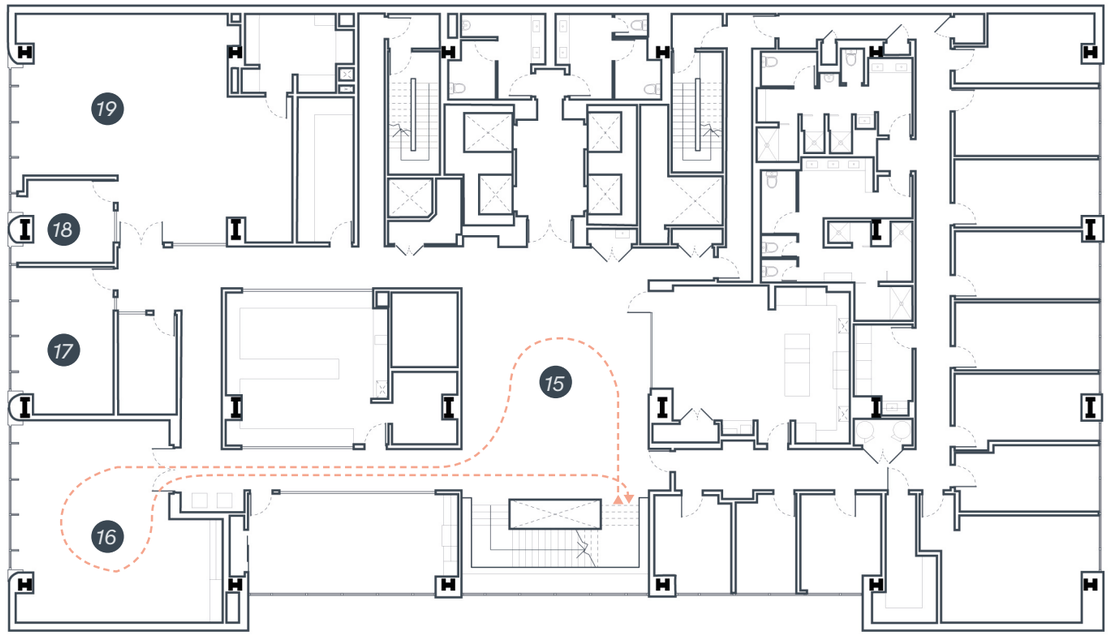
Ninth Floor

Location of Photograph
Typical Circulation Route
Structural Columns



8 - Reception Area
9 - Video Conference Room
10 - Adaptations Store
11 - Multi-Purpose Room
12 - Pre-Function Space
13 - Training Kitchen
14 - Concrete Circulation ‘Track’

Tenth Floor

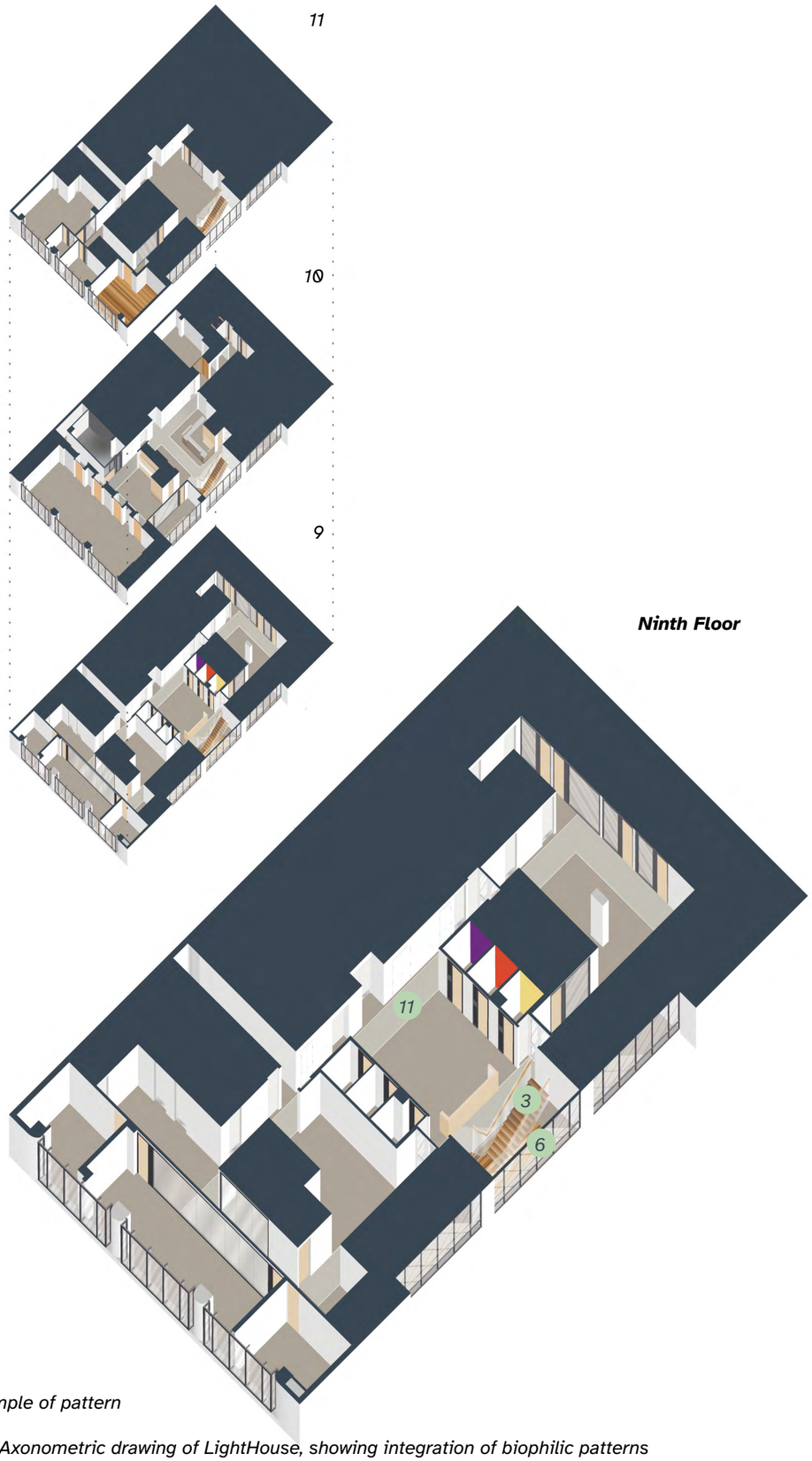


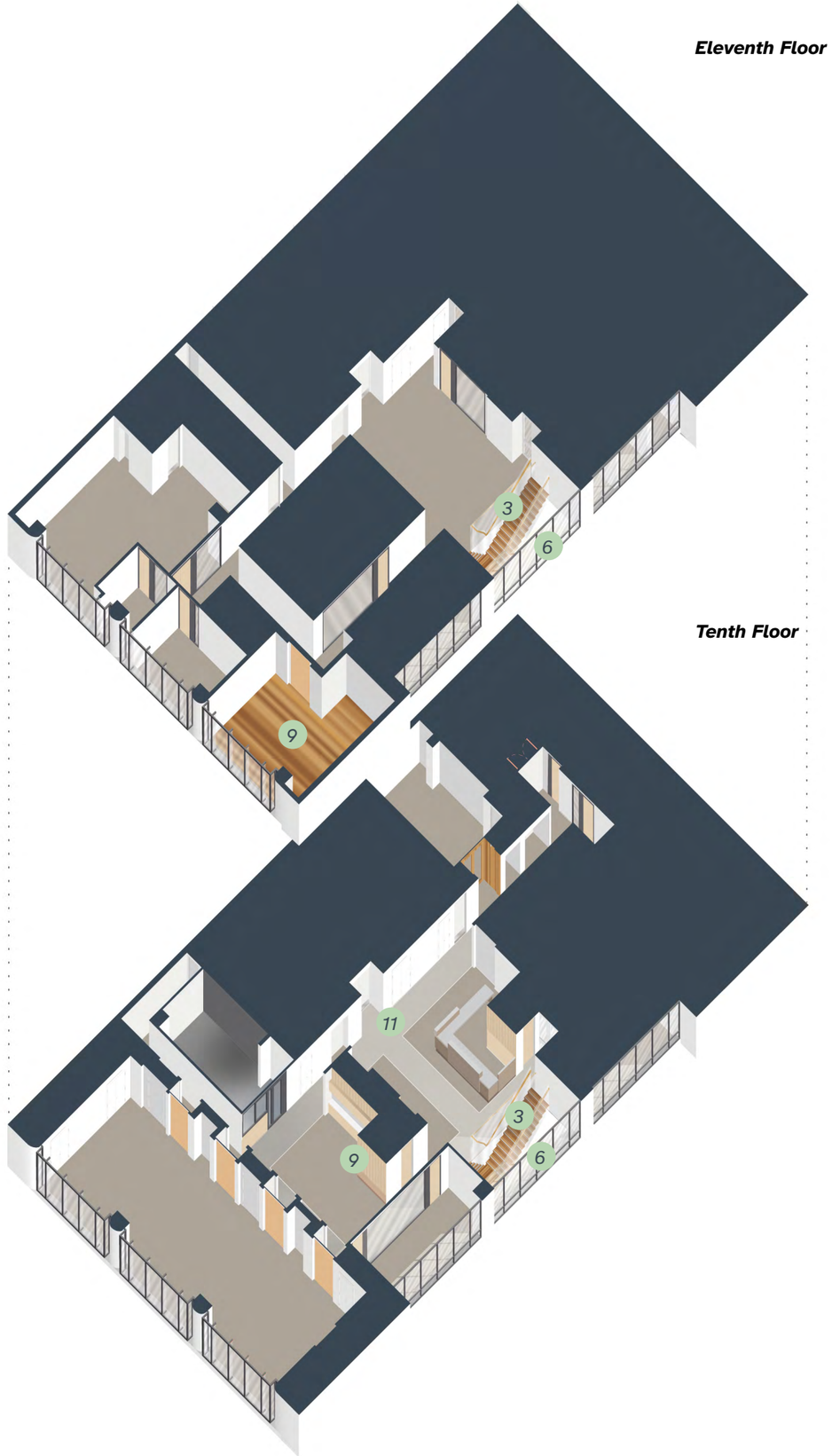
15 - Lounge
16 - Fitness Room
17 - Meeting Room
18 - Private Office
19 - Open Office

Eleventh Floor

0m 5 10 N

Fig. 5.6: Floor Plans of LightHouse, showing spatial relationships





Example of pattern

Fig. 5.7: Axonometric drawing of LightHouse, showing integration of biophilic patterns

From the floor plans in figure 5.6 you can see how the circulation tracks help to define movement through the space, as well as defining functional zones. Whilst the concrete tracks mark the perimeter of the core spaces on floors nine and ten, spaces such as the reception areas and lounges are finished with carpet - contrasting both visually and tactically. This is a beneficial navigational cue for people with fluctuating vision, as the two surfaces are easily distinguishable underfoot. Having navigational cues that can be identified using multiple senses is a fundamental element of inclusive design, where choice enables autonomy. Another important element of the floor plans is the orientation of the building, shown using the north arrow to the bottom right. Glazing within the building sits on the South East, South west, and North West facades. The South East facade mostly houses offices and student dorms, which only receive direct sunlight during the morning. The South West houses the central staircase, with sunlight not entering until around midday. Finally, the North West facade, which hosts a wide range of different activities - from multi-function spaces to fitness rooms and meeting rooms - only receives limited sunlight towards the evening. This shows the challenges of retrofit architecture, where new functions have to work in spaces that were not designed for them.

Moving onto the axonometric drawing in figure 5.7, I will now analyse how certain biophilic patterns can be found within the design. In contrast to Maggie's Centre, where biophilia was an intentional design feature, I will also identify patterns that are missing, discussing how - if they were implemented within the design - they would have enhanced the experience of the space for people with partial or fluctuating vision.

3: Non Rhythmic Sensory Stimuli

Due to the elevated nature of the project, sitting on the ninth to eleventh floors within an existing building, this pattern is less obviously apparent within the design. With no direct connections to nature, the only place this is hinted at is in the stairwell. The main stairs are positioned directly in front of South-West facing glazing - shown in figure 5.8 - causing the steps to cast moving shadows throughout the day. Whilst on one hand this may help visually impaired users to orient themselves and estimate the time of day, it may also negatively impact navigation, with shadows upon the steps potentially distorting the perception of depth and creating confusion and discomfort. Beyond this, there are no obvious non-rhythmic sensory elements – no internal planting, airflow variability or water features to offer subtle environmental cues for users to position themselves within the space. This may be a deliberate strategy, prioritising reduced sensory stimuli for blind users, allowing them to focus on intentional elements such as tactile flooring or auditory cues. However, it may simply be a downfall of being housed in a retrofit building – where very little could be done to improve the integration of passive strategies within the building.

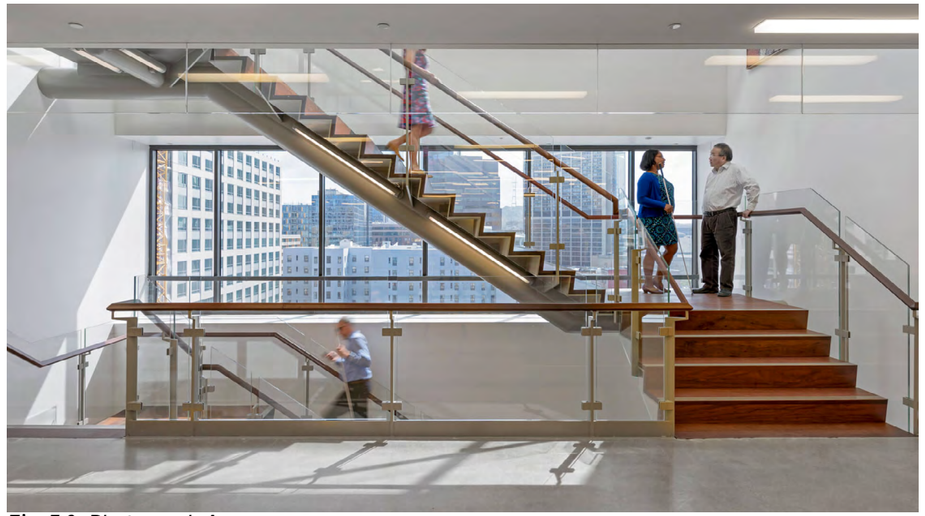


Fig. 5.8: Photograph A

6: Dynamic & Diffuse Light

Lighting is a key component of this building, designed in a way to aid the navigation of people who are blind or have very low vision. According to the Royal National Institute of the Blind, 93% of people who are registered as blind or partially sighted are able to see something, most commonly materialising as the perception of light and shadow. For this reason, lighting can become a significant aid, as shown in figure 5.9 where backlit walls and regular overhead lighting help to illuminate pathways. In contrast, this reliance on artificial lighting creates a challenging environment for people with fluctuating vision who experience light sensitivity. Where the design succeeds in accommodating both those with fluctuating vision and those with low vision is in its exposure to natural light.

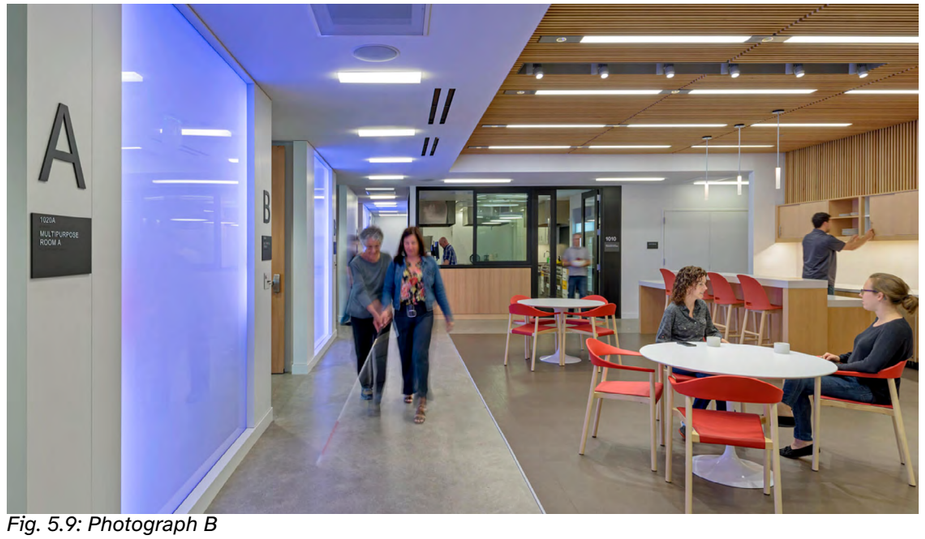


Fig. 5.9: Photograph B

9: Material Connection with Nature

Materiality is used throughout the design as another key tool for navigation. Timber is used in areas of interaction such as the handrails – meaning it is warm to the touch and therefore inviting to hold onto. The central stairs are also covered in timber, providing a clear visual contrast against the muted grey flooring of the reception areas as well as softening the acoustics created by footfall due to the material's natural properties – ensuring sound does not become overwhelming and the other senses remain able to process navigational cues such as smell. Where glazing is used within the building to provide views into rooms and foster a sense of community, it is surrounded in black steel framing, helping to highlight its presence and limit its risk by visually contrasting.

11: Prospect

The floor plans were designed in a specific way to create a 'concrete test track' circling the central facilities, intended to provide a clear and safe route for blind people to traverse and test out adaptive tools such as canes. The ability to provide uninterrupted movement through the spaces also makes it easier for way-finding cues such as material changes and tactile elements to be understood.

On the other hand, for people with fluctuating vision it can become overwhelming when there is no visual separation within a vast space. When approaching a space, if there is a lot of visual information to process at once it can lead to eye fatigue and general discomfort. This is where moments of refuge are key, providing a place to remove oneself from an environment where sensory overload is possible.

12: Refuge

As mentioned above, the open-loop layout offers a strong sense of prospect, but the design largely lacks areas of refuge. What seating is provided within the design is mostly within the aforementioned circulation track (see example in figure 5.8), meaning anybody wanting to remove themselves from the stimulating environment still remains in the centre of activity, with no clearly defined quiet zones. Whilst this is beneficial for blind people who can find their way to seating without any obstacle simply by following the designated path, it means that people with partial or fluctuating vision are left exposed to a visually overwhelming environment – with bright lighting and constant activity – exacerbating symptoms of visual fatigue.

Critique

As expected, the building was clearly designed for the benefit of blind users. However, the limited consideration for people with less severe or fluctuating visual impairments challenges the claim of it functioning for 'everyone'. It is possible that the designers felt that by designing for the most severe form of visual impairment, it would naturally become a more inclusive environment. Yet the building's strong integration of tactile orientation and clear way-finding for blind users is often so specific that it unintentionally excludes people with other visual impairments within the broader spectrum. Additionally, the design would have no doubt been devised by a range of specialists, with best practice guidance and measures for complying with accessibility. However, "it is not just the objective safety and accessibility of an environment that affects a person's independence but also their perception of it" (Atkin, 2010).

Whilst physical accessibility measures such as ramps and lighting levels are important factors in inclusive design, the consideration of experience has equal weighting. Designers must acknowledge the significance of psychological and sensory comfort in a person's experience of space, not just how easily they can walk from A to B; they should feel at ease in a building that includes them, not uncomfortable and waiting to leave.

Chapter 6

Conclusion

When buildings designed for the ‘sighted’ become visually overwhelming, and buildings for the blind rely too heavily on specialised cues, people with fluctuating or partial vision are left wondering where they are welcome. I acknowledge that it is a near impossible task to deliver a design where all the nuances of human needs are successfully addressed. To put it into the context of the more widely understood terms of physical mobility, for every wheelchair user who relies on ramped access, there is a person who prefers to use stairs to avoid muscle fatigue in their legs. What is accessible and what is not is highly subjective, varying greatly between individuals. For this reason, it will never be possible to eradicate one design approach in favour of what may be seen as a ‘more accessible’ one. Inclusive design is about consideration and choice; to respond to the nuances of life and disability, design itself must be nuanced.

This dissertation set out to question whether the integration of biophilic design can enhance both sustainability and visual inclusivity. Through the analysis of two contrasting case studies, it became clear that biophilic design can support both – but only when approached holistically. As previously mentioned, to be inclusive we must embrace complexity, and nothing embodies this more profoundly than the layered variability of nature. Both case studies show weakness in the way they approach key design principles as isolated concerns. For Maggie’s, biophilic principles drove the design, and for LightHouse, inclusive principles became key. However, neither acknowledged the importance of a holistic approach where biophilia and inclusivity work in tandem, rather than in isolation. Their goals are inherently linked; nature does not discriminate, and inclusive does not mean artificial.

A useful starting point in the comparison of the case studies is their contrasting design intentions and outcomes. Maggie’s Centre was designed to enhance general well-being and comfort, to be a centre for support and provide a break from the adjoining sterile medical environment. By following biophilic design principles, the centre features sensory design strategies that not only create a calming environment but also support the navigation of visually impaired users. In contrast, LightHouse’s focused approach to designing for the blind results in environments that may not accommodate the needs of people with other types of visual impairments. While it could be argued that the facilities within the building are not intended for users with fluctuating or partial vision, this reasoning overlooks the realities of communal space. Family members, staff, and other visitors to the building also need to navigate safely - any of whom may have a visual or other sensory impairment.

From my pilot study, I already concluded that natural lighting and materials were preferable

to the artificial and man-made when it comes to navigating a space with fluctuating vision. My analysis of the two case studies supports this further. Where Maggie’s centre depends on clerestory glazing, using artificial lighting in a supplementary manner to maintain light level throughout the day, LightHouse relies on bright artificial lighting to act as a guide for blind users with light perception. Whilst the artificial lighting within LightHouse inevitably benefits blind users, it can lead to the disorientation of people with fluctuating vision, highlighting once again the need for balance. The approach in Maggie’s centre is more aligned with the biophilic pattern of dynamic and diffuse lighting, and is more successful in creating an environment that is visually inclusive.

Materiality within both buildings also contributes to the ease of navigation. Both handle this in a similar way, with timber used on elements that require interaction – such as handrails and doorways. This is highly effective in both designs, showing how the simple integration of a multi-sensory design strategy (tactile variation) can determine the navigability of a space. Materiality also contributes to the spatial legibility within both designs. LightHouse uses contrasting flooring to distinguish circulation routes from functional spaces, which – in conjunction with its use of prospect – creates spaces that can be traversed with ease by blind users. Subtle differences in flooring can be picked up by footwear and canes, helped by the uninterrupted route throughout the floor plan. However, this same tactile logic that assists the navigation of blind users leads to confusion in the partially sighted, where visual hierarchy is lacking. In contrast, the spatial flow within Maggie’s Centre is controlled by soft divisions and sliding doors, all in timber. The spaces in Maggie’s are much smaller and easier to navigate, but the lack of contrast between what is door and what is wall could create a sense of confusion and lead to disorientation for people with fluctuating vision. Considering these two alternative approaches together, it is evident that designing for one mode of perception – either tactile or visual – leads to partial solutions.

The final point of comparison between the two case studies is their approach to the idea of refuge. In Maggie’s centre it becomes a key design feature, driven by the desire to create a place of respite for cancer patients. It provides quiet zones and offers adaptability within its spaces through sliding doors and partitions that can be moved as desired. This approach also allows for sensory control, with wooden partitions offering acoustic softness to reduce auditory input if needed. In stark contrast, LightHouse relies heavily on its open, continuous arrangement – enabling blind users the freedom to orient themselves. This approach reinforces the fact that inclusion relies upon adaptability and control – as spaces that lack this are much less usable by people with fluctuating vision than those that offer it.

The analysis of these two case studies reflects the tensions revealed in my earlier discussion of architectural precedents in chapter 2; where Bosco Verticale is celebrated for its

greenness but remains exclusive and ocular-centric, Callebaut's proposals show the ambition of biophilic design but lack meaningful inclusivity, and Khoo Teck Puat Hospital – a rare example of the integration of biophilia and inclusivity that remains isolated in practice.

My own experience with fluctuating vision has enabled me to approach this topic from a significantly under-represented perspective. Beginning with my pilot study I was able to offer personal insight into the issues of sensory overload and visual fatigue, aspects that are absent from regulations and often overlooked in design guides. In using a personal narrative, I have been able to offer my subjective view on the issue of inclusion, drawing to light the need for change around the current idea of a binary visual scale.

In addressing the issues within this dissertation, and showing the potential benefits of using biophilic design – beyond just making greener buildings – I hope to inspire architects and designers to look beyond current ways of doing, and identify overlaps that prove the most successful designs are holistic in nature. In terms of designing for visual impairments beyond the blind and sighted binaries, it is crucial to engage with a range of people with first-hand experience. Whilst my perspective is considered and valuable, it is unique to me. Therefore, continual communication with different user groups is the only way to deliver truly inclusive design. Ann Heylighen's *'Sustainable and inclusive design: a matter of knowledge?'* captures this profoundly by likening people with disabilities or impairments to the 'miner's canary' - "vulnerable to exclusion by inappropriate design" but key actors in "(analysing) the characteristics of the misfit and to help in finding better universal design solutions" (Froyen, 2003).

Inclusive biophilic design is not something that can be found in small, individual gestures. "it focuses on difference and empowerment through multi-sensory approaches to design. The challenge to designers is to (1) open sensory choices, (2) avoid the dangers of sensory overload, and (3) practice multi-sensory design with precision and balance" (Preiser & Smith, 2010). It requires designing for complexity – designing for the nuances of humanity – through spaces that are adaptive, multi-sensory and resilient.

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