Redefining Sensory Inclusivity in Urban Design: How Advancements in Visual Architecture Impact Multi-Sensory Experiences and Wayfinding.

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1.0 Introduction

We, as visual dominant creatures, often perceive the world predominantly thought sight; a bias that extends notably into architecture. Highlighted by Pallasma in his seminal work, The Eye of the Skin: Architecture and the Senses (1996), he observes and critics that often architects design with a visual-centric approach. Architecture, throughout the end of time has been designed for the eye of the beholder. Pallasma (1996) further remarks, “The architecture of our time is turning into the retinal art of the eye. Architecture at large has become an art of the printed image fixed by the hurried eye of the camera.” René Descartes, for instance, held the sense of sight as the most universal and esteemed sense, and thus his philosophy that objectifies reality is inherently based on the privileges of sight or seeing. This visual design, while catering to the sighted majority, often overlooks the needs and experience of those with visual impairments.

1.1 Thesis Statement

The central thesis of this dissertation is to synthesize and understand of the impact of visual-centric designs, empathizing how such approach often neglects the needs of individuals with visual impairment. By predominantly focusing on visual aesthetics, contemporary urban design fails to consider the diverse sensory experiences required for navigation and interaction in urban spaces. This oversight not only affects the inclusivity but also challenges the functionality for the visually impaired. This dissertation seeks to address to explore the implications of this imbalance and attempts to summarize methods for a more inclusive architectural approach that considers all sensory modalities.

Additionally, it includes to offer an overview of how human senses are integrated into architectural design practices; aiming to examine their roles both individually, and in a more complex, collective context.

1.2 Aim and Objectives

Aim 1: Investigate how the ocular-centric design in architecture overlooks the integration of a multi sensory experience.

- **Objective 1**: Conduct literature review on the influence of sensory perception in architecture beyond sight.
- **Objective 2**: Understand the effects of wayfinding design principles on individuals with visual impairments.

Aim 2: To develop an understanding of the fundamental principles required to design an inclusive space.

- **Objective 1**: Utilize findings from Aim 1 to establish qualitative criteria for assessing the inclusivity of a space.
- **Objective 2**: Conduct analyses of two case studies that exemplify inclusive design.
- **Objective 3**: Examine the findings to discern the relationship between sensory perception and wayfinding within built environments, specifically for individuals with visual impairments.

1.3 Limitations

The literature review of this dissertation identifies a notable gap in existing research regarding the integration of multi-sensory elements in architectural design. While considerable emphasis has been placed on visual aesthetics, there is a scarcity of comprehensive studies that explore the balance of sensory modalities in architecture. It is only in recent decades that studies have increasingly recognized the multi-sensory nature of human perception, a discovery primarily advanced through cognitive neuroscience research. This gap is particularly evident when considering the observations of many philosophers on the perceived superiority of sight in perceiving environments.

2.0 Background and context

2.1 Architectural history

The term architecture and its significance has evolved from its initial definition as merely the art of building to embody a more complex understanding of form, functionality and construction (Vermeersch and Heylighen, 2012). The border understanding of what architecture represents has evolved through debates over the essence of architecture expression; some posits that architecture attains its true unique character when it integrates symbolic form beyond the practical functions. Hans Poelzig critiques the mordents's strict adherence to mathematical precision and technological transition of processes. Conversely, Le Corbusier (1923) emphasis on the mathematical order and proportional harmony as elevating factors in architecture.

This tendency to consider architectural qualities in terms of abstraction can also be found in the ideas about the role of the body in Western architectural history. Classical architecture viewed architecture as entities with a 'mythical corporality', meaning they were designed with proportions analogous to the human body; thereby embodying a form of anthropomorphism. However, the Modernist Movement shifted this perspective towards organicism — an exemplary of functionalist thinking. "The organicism of the modernist [architects] tries to understand the principles that are working in nature and reduces them to mathematical-physical laws, in order to surpass the mimicking of nature" (Van Herck and Loeckx, 2001, cited in Vermeersch and Heylighen, 2012).

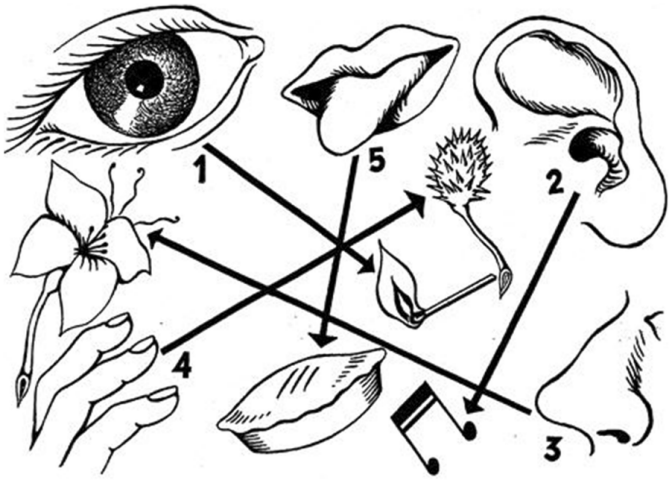

Fig. 1 Heilig (1992) ranked the order in which he believed the human attention to be captured by the various senses. According to Heilig's rankings: vision, 70%; audition, 20%; olfaction, 5%; touch, 4%; and taste, 1%.

This advancement in abstraction in this context not only shaped architectural design but also profoundly impacted how individuals perceive architectural spaces. Van Herck and Loeckx (2001) proposed that the Modernist Movement created a paradigm shift in perception. "The intellectual comprehension of an immaterial ordering principle [e.g. mathematics] is seen as a superior form of perception, where sensory perception which cloud that perception, are by-passed" (Vermeersch and Heylighen, 2012). This perspective is reflected in modern architecture, leading to designs that prioritize visual perception, and aligning with the enduring notion that sight is the most refined and sophisticated of the senses.

2.2 Visual Impairment and spatial experience

The homogeny of the visual elements in modern architecture not only reflects a historical shift in design philosophy but also raises concerns about inclusivity and sensory engagement. However,

the over reliance on the sense of sight can inadvertently create barriers for those with visual impairments, often neglecting the full spectrum of sensory experience that constitutes the human experience and interactions with space.

For individuals with visual impairment, spatial experiences extends beyond visual apprehension; they require a more comprehensive interplay of sound, touch (including proprioception, kinesthesis, and the vestibular sense), smell, and on rare occasions, taste. The dominance of visual cues in architectural design not only presents challenges in navigation and way-finding for the visually impaired but also lacks the sensory markers that are intrinsic to the formation of spatial memory and the process of cognitive mapping. Furthermore, in his seminal work The Eyes of the Skin (1996), Juhani Pallasmaa critiques the ocular centrism in Western aesthetics takes away from the architectural experience for all users by neglecting the multi sensory nature of spatial perception.

2.3 Architecture phenomenology

In architectural discourse, particularly when addressing sensory experiences, the term 'phenomenology' is frequently referenced. Defined as an interpretive approach that studies human experiences and interactions (Pallasma, 1996). The outcome or insights derived from phenomenological studies contribute to a deeper understanding of the fundamental aspects of human experiences in the world framed within the Existential Phenomenology; a philosophical approach developed by Heidegger and Merleau-Ponty (1962). This framework further explores how individuals perceive, interacts with, and find meaning in the world around them through the lens of personal experience. Architectural spaces, as outcomes of the architectural process are considered phenomenal. This perspective examines how individuals engage and experience with a built environment through the unity of all sense. It questions the foundational principles of architecture in relation to sensorial and spatial experience, including but not limited to materials, places, and spaces. This approach aims to describe these experience beyond abstract terms. Pallasmaa (1996) argues:

"*Experiencing architecture is multi-sensory; qualities of space, matter and scale are measured together by the eye, ear, nose, skin, tongue, skeleton and muscle. Architecture strengthens one's sense of being in the world, and this is basically an enforced experience of self. Instead of mere vision, or the five classical senses, architecture involves several realms of sensory experience which interact and fuse into each other."* (p.41)

Furthermore, Rasmussen (1959) emphasizes the necessity of acknowledging the various sensory experience for the perception of spatial environments, which are frequently overlooked by individuals. This occurs as individuals often form an impression of an object or space without consciously considering which sensory experiences contributes to the specific sensation or feeling. For example, when a space feels impersonal and cold, it is often attributed to the dislike of the design or materials used within that space rather than referred to the cold temperature of the room. The visual stimuli can induce a sense of varying comfort based on the color of the wall , or objects present in the room, despite the room temperature remaining constant. The application of phenomenology in architecture reintroduces sensory perception as a functional and essential element in design of spatial experience. This approach holds substantial importance for visually impaired users, enabling them to interact with and comprehend their environment in the absence of visual cues.

However, in the field of environmental psychology, the methodologies used in similar studies examining the impact of the sensory experience of the built environments on individual psychological and physiological well being appears to contradict the phenomenological philosophy. Drawing from the foundational principles of semantic differential technique, environmental psychological studies often adopt to evaluate the approach-avoidance (eg., welcoming or repelling), active-passive (eg., dynamic and energized or calm and passive), and dominant-submissive (eg., controlling and powerful or yielding and submissive) characteristics in a building or urban environment. The methodologies in these studies, focused primarily on separate sense by sense (or occasionally unidimensional) attributes, reveal limitations in fully capturing the inherently multi sensory nature of the mind and the outcomes that arise from the

interactions among the senses. These limitations are similarly reflected in the field of architecture and interior design.

In my dissertation, I intend to conclude a qualitative standard to analyze various case studies through similar lens, a sense by sense analysis. However, it is recognized that this approach, while simplifies the complexity of studying the influence of design on the human experience in a built environment, it neglects the collective, complex context.

3.0 Design through each of the senses

This chapter investigates the foundational principles of sensory design within the disciplines of architecture and interior design through the lens of sense-by-sense, and when applicable the collective, complex context — emphasizing considerations imperative for individuals with visual impairments — through examining the phenomenological approach in architecture in relation to spatial experiences and the senses within the built environment.

3.1 Sense of touch

When the sense of touch is regarded as an isolated sensory perception, the tactile experience of architecture often goes unnoticed, despite the fundamental importance it plays in shaping our interactions with buildings. Pallasmaa (1996) notes that the initial physical interaction with a building typically occurs when an individual enters or leaves the space. He once metaphorically described this interaction as “the door handle is the handshake of the building”. (Pallasmaa, 1996, p.33). Beyond the entrance, our physical interactions with a building extends to elements like flooring, handrails, elevator buttons, and furniture; these points of contact have gained more prominence and attention during the recent global health pandemic (Spence, 2020). However, Richard Sennett critiques the modern sensory experience, argues a prevailing sense of sensory deprivation; noting a pervasive dullness, monotony, and tactile sterility afflicts the urban environment (Sennett, 1994, p. 15). The is in stark contrast to the use of natural materials like stone, brick and wood, which traditionally encouraged tactile exploration of the textures, while communicating authenticity and age. In contrast, modern materials such as glass, enameled metals, and other synthetics surfaces offer little insight to their passage of time. For visually impaired individuals, the sense of touch is heightened to interpret the feel of varied surfaces—a skill developed through the frequent tracing of surfaces with their fingertips. This practice enables them to recognize and internalize the textural characteristics and materiality inherent to surfaces, discerning subtle variations in texture (Rasmussen, 1959).

In a more complex, collective context; In his seminal work The Eyes of the Skin (1996), Juhani Pallasmaa discusses the ocular-centric paradigm prevalent in contemporary architecture. He proposes that the tactile qualities of space by the sense of touch — or as he termed it: ‘hapticity’ — along with the ‘peripheral unfocused vision’, play an integral part of the phenomenological experience of architecture. (Pallasmaa, 1996, p. 10). However this perspective contrast the with the traditional emphasis on dominance of sight over other senses — and consequent bias in cognition — in contemporary architecture and other disciplines. René Descartes, for instance, held the sense of sight as the most universal and esteemed sense, and thus his philosophy that objectifies reality is inherently based on the privileges of sight or seeing.

Challenging this view, other theorists argues all senses, especially vision are not isolated but deeply interconnected with the sense of touch, and our tactile experiences are what enable us to understand and perceive the world around us. Maurice Merleau-Ponty’s philosophy in the Primacy of Perception (1964) states that all senses, including sight, are fundamentally an extension of the sense of touch; they are means by which the body extends its abilities to perceive the environment; there is an implicit, tactile dimension to the human gaze, it is not merely a passive reception of light but an active engagement; akin to a form of touching at a distance.
George Berkley’s philosophical stance argues the connection between the two senses further. Berkley believes that tactile experiences form a kind of haptic memory; by which human understanding of material and spatial relationship through sight is only possible because of prior

experience with touch. He argues that without the grounding of touch, our visual perception of space and form would be significantly deprived. When the sense of sight is compromised, touch assumes the role typically held by vision. Through texture, materiality, weight, density and temperature, tactile feedback replaces visual cues, providing information and orientation essential for individuals with visual impairments to perceive and interact with the built environment.

3.2 Sense of sound

The significance of sound in architecture is undoubtedly important. Sounds offer nuanced hints about a spaces identity, proportions and size, and even its intended use. Pallasmaa (1996, p.31) notes, “Every building or space has its characteristic sound of intimacy or monumentality, rejection or invitation, hospitality or hostility.” He further emphasizes the intimacy between the architectural acoustics and the human sensory experience: “Buildings do not react to our gaze, but they do return our sounds back to our ears.” (p.49). This reflects an interaction where when the gaze meets with the building, it does not change the building itself, but sound engages in a dialogic return, and thus affirming the presence of the individual within the space. Additionally, Rasmussen in his book Experiencing architecture (1959), presents a similar notion that architecture transcends the visual experience through auditory perceptions. Just as light reflects off surfaces enabling visual comprehension of architectural elements, sound, too, reflects off or is absorbed by the same forms and materials.

However, the importance of auditory perception in the context of spatial experience has been neglected. As architects and designers devoted greater attention to the science of acoustics—learning how to manipulate a room’s acoustical characteristics. There has been increasing focuses on how to absorb, reduce or minimize sound and reduce echo and reverberation. J. Douglas Porteous notes: “with the rapid urbanization of the world’s population, far more attention is being given to noise than to environmental sound … Research has concentrated almost entirely upon a single aspect of sound, the concept of noise or ‘unwanted sound.’” (Porteous, 1990, p.48). Therefore, resulting in an increasingly lack of variety in auditory experiences. Rasmussen (1959) criticizes the prevailing trend of contemporary interior designs that favors one glass wall and three other smooth, hard surfaces that acoustically deafened spaces. Such contemporary interior have become homogenized, making it increasingly challenging for visually impaired individuals in terms of identification and navigation. “The value of a sound source for way-finding is often reduced because of the unreliability of the source” (Arthur and Passini, 2002, p. 36) Hence demanding for a re-evaluation of the sensory experiences that inform architectural design and the importance of considering auditory design as a fundamental aspect of inclusive design, ensuring that spaces are navigable and meaningful for all users, regardless of their visual capacity.

3.3 Sense of smell and taste

The intrinsic makeup of a memory of a spatial environment is profoundly influenced by the sense of smell — a sense that is frequently overlooked in the context of spatial design. Extensive research in various disciplines, such as perception, cognition, and anthropology, emphasizes on the importance of odor as a critical and intricate component that contributes to the definition and enduring memory of spaces (Anna and Anthony, 2006). Each space possesses a distinctive blend of odors that are shaped by an array of factors including the materials and finishes used in construction and the human activities that take place within it. However, similar to that discussed in the sense of sound, the predominant focus in architectural design practices concerning olfaction has often been the eradication of unpleasant odors rather than the introduction of new, pleasant one; the latter is primarily used to conceal to former.

Pallasmaa (2005) suggest that the smell often constitute the most lasting memories we associate with a space. He echos this sentiment in an anecdotal reflection quoting, “The strongest memory of a space is often its odor; I cannot remember the appearance of the door to my grandfather’s farmhouse from my early childhood, but I do remember the resistance of its weight, the patina of its wood surface scarred by a half-century of use, and I recall especially the scent of home that hit my face as an invisible wall behind the door.” (Pallasmaa, 1994, p. 32) These observation highlight how the sensory perception of a space is not just a passive experience but is actively formed by

the scents that pervade our surrounding, leaving profound and lasting impressions on our memories (Spence, 2020).

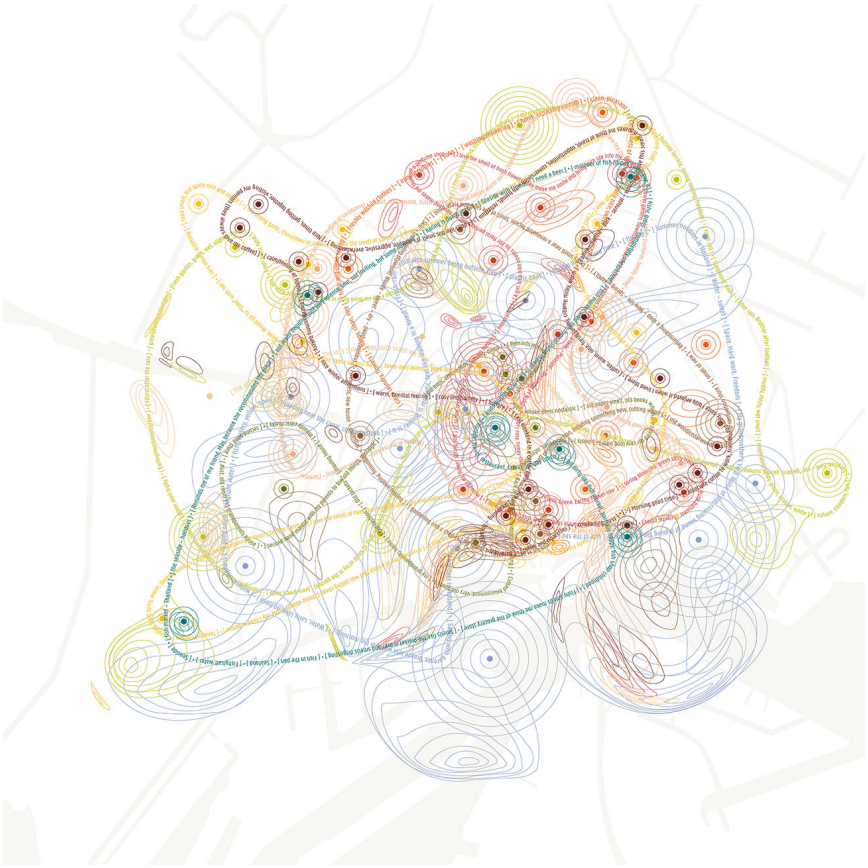

Fig. 2 Spring scents and smells of the city of Amsterdam by Kate McLean. [Credit “Spring Scents & Smells of the City of Amsterdam” © 2013-2014. Digital print. 2000 x 2000 mm. Courtesy of Kate McLean]

For those who are visually impaired, olfactory cues emanating from different material, activities or environmental factor within a space can help individuals construct a cognitive map of their surroundings. The olfactory guidance assists in orientation and can trigger spatial memories that act as landmarks. Not only does it enhance sensory perception, but smell acts as a critical tool for interaction, understand, and connecting with the world for visually impaired people. The ability to interact with various odor helps establishing a of place and safely, and in recalling and navigating through spaces with greater confidence and independence.

3.4 Conclusion

Chapter 3 presents a comprehensive examination of the significance of multi-sensory engagement in architectural design; beyond the conventional emphasis on visual elements in modern architectural practices. This chapter highlights the importance in incorporating tactile, auditory, olfactory and occasionally gustatory elements in the built environment; while illustrating how these multi-sensory approach can create spaces that are more inclusive, especially for individuals with sensory impairments. By examining various design strategies and principles, the chapter highlights how incorporating all senses are enhance spatial perception and experience. The insight gained from this chapter lay the foundation for rethinking traditional ocular-centric practices, advocating for a design philosophy that includes the full spectrum of human sensory experience. Allowing for a more empathetic responsive to the diverse needs of other individuals.

4.0 Way-finding

The term way-finding describes the process of "moving purposefully through the environment toward a destination," involving the utilization of an extensive array of pre-existing cognitive, motor and perceptual skills previously acquired by the traveler (Wiener, 2010, p. 324). The subconscious practice heightens and only escalates to conscious effort when individuals enter an unfamiliar spatial context or is lost.

For the sighted community, the way-finding system constitutes of an intricate network of information framework that guides an individual within a physical environment through mostly a successions of visual cues; eg. symbols and signs.

For individuals who are blind, possess low vision, or other visual impairment (VI) along with deaf blind, way-finding can be referred to as 'orientation and mobility' (O&M). Within this framework, Mark A. Foltz (1998) in *Designing Navigable Information Spaces* devised three criterions that asses the navigability of a space: decision making, decision execution and information processing.

The first criterion, successful recover of location or orientation. Orientation is defined as the "process of using sensory information to establish and maintain ones position in the environment." (Hill & Ponder, 1976, p. 3). This requires the navigator to be able to confidently address the queries, "Where am I?" and "Which way am I facing?"

The second criterion, decision execution or 'mobility' pertains to the ability to successfully perform way-finding task. It assess the navigator's proficiency in executing way-finding tasks effectively. Effective way-finding is achieved when navigators are able to make informed choices that enable them to proceed from the current beginning location to the end location, even if the location of the destination is imprecisely known. Examples of such decisions might involve determining whether to proceed on the current path or to retrace steps, dividing which direction to take at a crossroad, or deciding whether it is necessary to father additional information from the built environment to ensure they are on the right path. Arthur and Passini describe way-finding as a form of spatial problem solving (Arthur and Passini, 1992).

Fig. 3 Well-structured path; in abstract. (Foltz, 1998)

Beyond O&M, Mark A. Foltz, also concludes a third criterion when determining the navigability of space; information processing or how well the navigator can accumulate way-finding experience in the space. A navigators ability to develop a clear internal visualization or cognitive layout of a large area is termed 'imageability'. This concept was pioneered by Kevin Lynch, an urban planner who studied the impact of a urban environment's features on memory retention (Lynch, 1960). In his study, Lynch evaluated data collected have resident from various locations produce a memory-based sketch maps of different cities. He evaluated the imageability of these cities by examining how accurately these sketch are compared to the actual structures of the cities. Lynch's study is particularly intriguing as it highlights the similar features people use as distinct and memorable aspects of an environment to aid in wayfinding; these include paths, landmarks, regions, edges (barriers), and nodes (intersections) (Foltz, 1998).

Passini (1988, pg. 228) noted, “To move freely in the large-scale architectural and urban environment can be a difficult task for any personal it can be an exasperating gone for the visually impaired.” In the absence of sight, the complexity of way-finding without sight often lead individuals with visual impairment or blind individuals to retire their travel to familiar routes. The highlights the necessity for a re-evaluation indesign to enhance the navigability of spaces. Creating environments that are more navigable involves integrating sensory element mentioned in previous chapter that is beyond visual cues. The inclusive approach to spatial design not only benefits the visually impaired but also creates a richer, more accessible experience for al users.

4.1 Design principles of way-finding for the visually impaired

In the absence of sight, individuals predominantly rely on their tactile/kinesthetic, auditory and olfactory senses to navigate the environment. They employ cognitive skills — particularly focusing on logic and memory — to gain spatial awareness and navigate the built environment. However, this approach encounters several challenges including limitations in previewing and pre-processing spatial information (Golledge, 1991); difficulty in avoiding obstacles and detecting hazards; the absence of distinct landmarks; and the lack of access to spatial representations (Rashitan, N/A). Most existing navigational aids that focus on orientation and mobility (O&M) are primarily designed to detect immediate hazards and obstacles. While these tools are invaluable for the immediate movement, it falls short in helping users acquire the broader frame of spatial knowledge or understanding of the general layout crucial for navigating through various environment.

Beginning in the 1970s, there has been an increased focus in the development of principal way-finding design and navigational aids within interior spaces. I have intentionally selected to assess six out of the eight principles proposed by Mark A. Foltz in his paper as they pertain to visual impairment. Principles for effective way-finding is summarize by Foltz (1998) to the following points:

Principle	Characteristics	Applicability and design consequences in consideration of visually impaired individuals
Location Identity Distinct perceptual identities	• Create an identity at each location, distinct from others. (Foltz, 1998) • Arthur and Passini (1992) introduced the idea further with 'identity' and 'equivalence'. Identity defines the unique features that make one area of a space different from another; equivalence groups areas together based on shared characteristics.	• Addresses the first criterion for navigability; ability to ascertain one's position and direction. • Identifiable places are essential in creating cognitive maps. • However, these perceptual characteristic must translate beyond visual cues in the absence of sight.
Create **well-structured paths**.	• Paths are clear and continuous with a defined beginning, middle with indicators of progress and the remaining distance to the destination, and end. • Directionality or "sidedness" of paths should be evident, ensuring easy navigation and progress assessment. (Arthur and Passini, 1992)	• Aid in forming cognitive maps, crucial for visually impaired navigators to understand their progression and relationship to the surrounding environment. • Enhance spatial orientation and navigation for VI individuals, reducing reliance on visual cues by providing consistent, predictable navigation patterns.
Develop areas with varying **visual characteristics**.	• Subdividing a space into regions with unique visual attributes, divided by function or use. • Region often have flexible or subjective boundaries. (Foltz, 1998)	• Regions enable navigators to differentiate between parts of a space and recognize when they cross boundaries, acting as markers along a structured path. • For many visually impaired individuals who retain partial sight, consistent elements like colors, shapes in archways, and lighting can reinforce the concept of regions, aiding in navigation and spatial understanding. • Other sensorial markers for blind individuals could be textures of the wall or floor, echos or sound in the space, or scent indicating the use of space.
Minimalism Limit number of navigational choices available to users.	• Minimize navigation choices to maintain structured path.	• Limit navigational choices to prevent confusion. • Designed prior to use by navigators, not tailored to any specific senses.
Implement survey views, such as vista or maps.	• Maps provide individuals with information on their orientation, nearby features, available destinations with potential routes, the overall size of the space, and their progress along a chosen path (Foltz, 1998).	• Facilitates an overall understanding of the environment, thereby enabling informed decisions in orientation and mobility (O&M). • May not always be necessary in smaller or familiar environments. • For visually impaired users, survey maps can be adapted into tactile or audio formats; enhancing their ability to form cognitive maps through external representation of the space.
Decision Points Place signage at key decision-making points to aid in wayfinding.	• Placed at decision points; embeds with additional information relevant to next directional move and destination to aid mobility.	• Vital for informing navigators about correct route, especially when the is a lack of prior understanding of the space. • Similarly, can be adapted to other sensorial perceptions; eg. change in texture of tactile tiles at a junction or stop.

Table 1.0 Principle of way-finding and the design consequences in consideration of visual impaired individuals (by Author).

5.0 Case study

chapter examines further the prevalent focus on visual-centric designs in contemporary architecture and urban designs; and the marginalizing impact on individuals with visual impairments. This section justifies the selection of case studies that are seemingly antithetical to the central thesis — spaces designed specifically for the visually impaired. The purpose of this analytical choice is to provide a grounded understanding of the inclusive design principles explored in the earlier chapter. By investigating spaces that prioritizes for non-visual sensory experiences, I seek to to highlight the shortcomings of conventional urban design and identity a qualitative standard that can be used to identify opportunities for inclusive enhancement.

The selection process was guided by several key criteria explored in theory in the dissertation throughout: (i) the space must be a dedicated focus on accommodating the needs of the visually impaired; and (ii) must have focus of multi-sensory design principles; (iii) the availability of comprehensive information on the design of the building, including but not limited to the orthographic drawings, 3D rendering, photographs, contextual information and other visual documentations.

This chapter discusses two projects, School for the Blind by SEALab Architect in India and Centre for Scottish War Blinded by Page Park Architects, Edinburgh, UK.

5.1 School for the Blind and Visually Impaired Children

The Gandhinagar School for the Blind and Visually Impaired Children in India specifically caters to students of all ages with visual impairments from Gujarat's remote villages and towns. Designed by SEA-lab Architects, the project was completed in 2021 and occupies a total area of about 750 square meters.

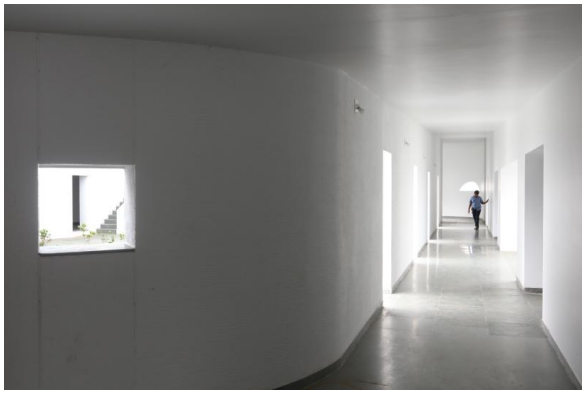

Fig. 4 Image of the School for the Blind and Visually Impaired Children by SEAlab (Shukla, 2021)

Given the project’s purpose as a school for the blind, the lead architect, Anand Sonecha, prioritized enabling students to confidently navigate and interact with the space, while clearly understanding their exact location within the school. SEA-lab Architects tailored the building design to encourage exploration through sensory perception.

5.1.1 Texture/touch, sound and smell as orientation tools

The incorporation of varying textures and patterns plays a pivotal role in the school's design. Contrasting material textures are used for both walls and floors to aid in orientation. The entrances to classrooms are marked by rough Kota stones on the floor, contrasting with smoother Kota stone in other areas. The texture of the floor acts as an intuitive guide at key decision-making junctions, signaling the approach to a classroom entrance. The walls feature five distinct plaster textures, serving as tactile guides to assist students in identifying their location within the

school. The inner court wall is characterized by a tactile semicircle motif, while the walls on the opposite side of the rectangular corridor display contrasting horizontal and vertical patterns. This design element effectively subdivides the space into distinct regions, substantially aiding students in orientation and navigation.

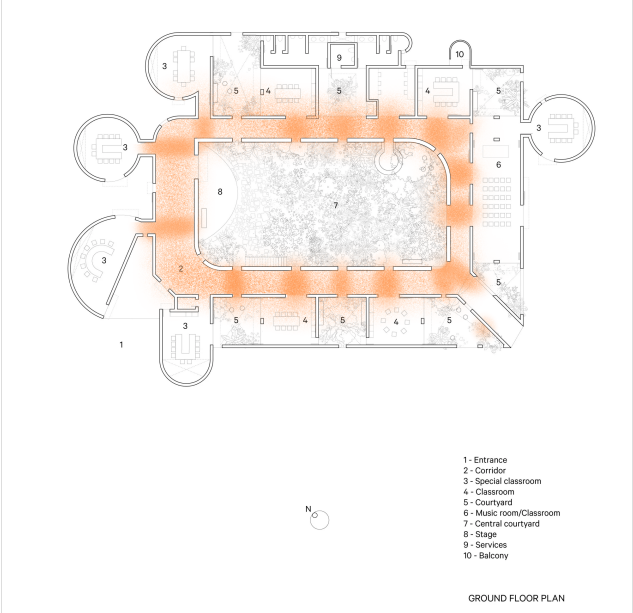

Fig. 5 Textural differences in floor materials: Opaque areas depict rough Kota stone, while translucent areas depict a smooth surface. Ground floor plan originally created by SEAlab and annotated by the author.

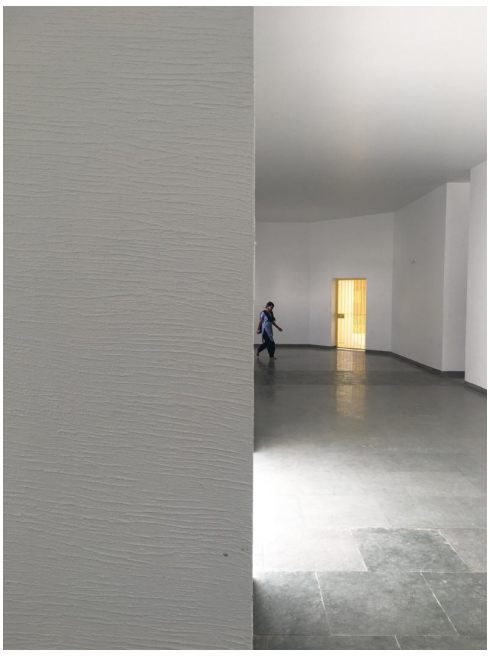

Fig. 6 Image of a wall of the School for the Blind and Visually Impaired Children by SEAlab (Shukla, 2021)

While the sense of touch aids orientation in the corridor, sound is used when students enter semi-enclosed classrooms or other spaces. The dimensions of these spaces, both in width and height, vary according to their functions. This variance creates distinct echo patterns in each part of the school, enriching students' auditory engagement with the built environment.

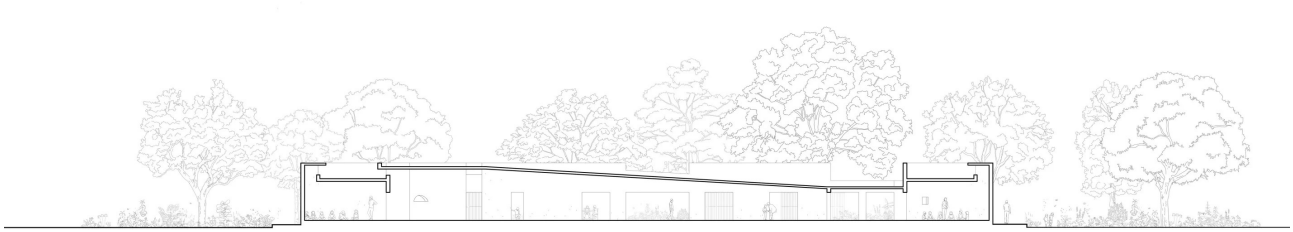

Fig. 7 Orthographic drawing by SEAlab of School for the Blind and Visually Impaired Children depicting a long section through the building.

Guided by the unique fragrance of plants and flowers, the focus on olfactory senses highlights the transition from enclosed spaces to open spaces, such as courtyards or playgrounds. This multi-sensory approach enriches the children's spatial experience.

5.1.2 Sight

While this thesis criticizes the ocular-centric nature of human experience, sight remains important. Visual impairment is often misconstrued as complete blindness, while in fact, the majority retain partial sight to various degrees. Colors are incorporated on doors frames and arches, and furniture to create distinct perceptual identities, warning students of barriers and hazards ahead. Additionally, due to light sensitivity among some students, the design team incorporated indirect light, shining through the open courtyard into enclosed classrooms as the main source of illumination. This warmth plays a similar role to the sense of smell in this context, identifying an open or enclosed space.

Way-finding Principles	Sight	Sound	Smell	Touch	Taste	Light and temperature
Distinct perceptual identities		Y		Y		Y
Create well-structured paths.				Y		
Diving regions with varying sensory characteristics.		Y	Y	Y		Y
Limit number of navigational choices available to users.	acquired through design rather than sensory perception					

Implement survey views, such as vista or maps.				Y		
Place signage at key decision-making points to aid in wayfinding.	Y	Y	Y	Y		Y

Table 2.0 Principles of wayfinding; table for School for the Blind and Visually Impaired Children (by Author)

However, the limitation in this project lies in the lack of material diversity. While sensory inclusive is important in providing Orientation & Mobility (O&M) clues, the constant similar texture of concrete and plaster may result in a sensory monotonous environment. Additionally, the sense-by-sense approach in identifying which classrooms (sound) or where in the corridor (touch) may not fully accommodate students who have additional disabilities or sensory processing differences. The spatial complexity required to identify one location within the school, eg, the texture of the floor, with the sound of the room and the 'warmth', might also pose a struggle to some student with mobility to cognitive impairment.

5.2 Hazelwood School, Glasgow, UK

Similarly, Hazelwood School caters to a younger demographic, children ranging from 2 to 18 years old. However, many of the student here has a combination of two or more following impairments: visual, hearing, mobility or cognitive impairment in addition to autism. Alan Dunlop Architect was commission to craft an environment that accommodates for students with multiple impairments. Every element of design within the building has been meticulously considered to aid in students to be able to safely and independently navigate the school.

Fig. 8 Orthographic drawing (plan) by Alan Dunlop Architect of Hazelwood School

5.2.1 The ‘street’

The design of the building’s interior from the entrance actively mitigates the visual expansiveness by introducing a curved path throughout the circulation area, also known as the ‘street’ by the firm. This design element allows the street to be open and straight forward, yet reduces the sense of confinement and overwhelm found often when navigating large, open spaces. Signage has been made redundant in the school, and is replaced with braille, visual images or other tactile touches. This form of communication is effective in meeting the diverse needs of the children. The design also utilizes subtle color schemes, contrasts, and lighting to enhance the use of sight those with remains vision.

Fig. 9 Image of interiors of Hazelwood School (photographer unknown)

The installation of tactile flooring and ‘trail rails’ along the cork wall is used to guide navigation and provide cues within certain areas of the school. The material choice of cork to line the walls of the corridor offers a warm and tactile experience. Visual impaired stund had remarked that the uniquely shaped panels serve as landmarks. They are able to understand their orientation and it acts a decision point, revealing information relevant to the next directional move. The cork also bring alongs a pleasant olfactory dimension to the corridor.

Way-finding Principles	Sight	Sound	Smell	Touch	Taste	Light and temperature
Distinct perceptual identities	Y	Y	Y	Y		Y
Create well-structured paths.	Y			Y		

Create well-structured paths.	Y			Y		
Diving regions with varying sensory characteristics.		Y	Y	Y		Y
Limit number of navigational choices available to users.	acquired through design rather than sensory perception					
Implement survey views, such as vista or maps.						
Place signage at key decision-making points to aid in wayfinding.	Y	Y	Y	Y		Y

Table 2.0 Principles of wayfinding; table for Hazelwood School (by Author)

6.0 Conclusion

In conclusion, the purpose of this study is to emphasize the need for a deeper understanding and recognition that public spaces are utilized by a diverse population, including individuals with visual impairments. As critic David Michael Levin puts it: 'I think it is appropriate to challenge the hegemony of vision – the ocular-centrism of our culture. And I think we need to examine very critically the character of vision that predominates today in our world. We urgently need a diagnosis of the psychosocial pathology of everyday seeing – and a critical understanding of ourselves as visionary beings.' (Levin, 1993, p. 205). It challenges designers to enhance the inclusiveness of public spaces by incorporating wayfinding principles that address the needs of the visually impaired.

One of the aims and objectives of this research is to develop a fundamental understand of standard principles that designers and architects can use to evaluate the effectiveness of wayfinding and the inclusivity of sensory perceptions utilized within a space. The findings seek to address the deficiencies in current building regulations concerning wayfinding for the visually impaired.

The research into the sensory perceptions and wayfinding principles is designed to pinpoint areas within the design that need enhancement. The table, as showcased through case studies, is crafted with the user in mind, prompting designers to consider the type of experience they are crafting within the space. This tool not only raises questions but also offers a moment of reflection and potential solutions for designers and architects to incorporate into their designs.

While the proposed standard is an novel construct with its inherent limitations and potential for error, it serves as an appeal to designers to refine and conscientiously adopt a multi-sensory approach and wayfinding principles. The aim is for it to become as recognized and fundamental to the design process as the existing assessment regulations and guidelines.

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