

INTENTIONAL SPACES:  
THE POWER OF PLACE

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**FOUNDATIONS**

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# INTRODUCTION

Global interest in the effects of built environments on health and wellbeing has been steadily growing. Researchers and practitioners across diverse fields are exploring how spaces and experiences can be designed to optimize sensory effects and deliver positive outcomes toward wellbeing and flourishing. Despite evidence that thoughtfully designed environments can significantly enhance health, the practical application of this knowledge remains limited.

Recognizing the need for growth in this area, in 2021 the International Arts + Mind Lab Center for Applied Neuroaesthetics (IAM Lab) at Johns Hopkins University convened 13 experts from the fields of architecture, design, neuroscience, cognitive science, environmental psychology and technology for collaborative focus group discussions. Participants identified key opportunities to advance wellbeing through interdisciplinary approaches to design, architecture and environmental planning which were laid out in the peer-reviewed article *Intentional Spaces: Thought Leaders on Intersections of Health, Architecture, and Design*. The insights emphasized the potential to improve health equity by integrating robust, science-driven design strategies.

Building on this work, in 2023 the IAM Lab held the Intentional Spaces Summit where more than 300 participants engaged in two days of dialogue, strategic thinking and learning. Participants shared insights and brainstormed ways to inform practice in healthcare, education, workplace and civic spaces. The Summit demonstrated that there was a clear desire for interdisciplinary conversations and a global appetite for readily accessible information on designing for wellbeing.

To continue the momentum of the Summit, the Lab partnered with Thermengruppe Josef Wund (Wund), considered the world's leading developer and operator of thermal spas and bathing facilities. United by their shared commitment to health and wellbeing, IAM Lab and Wund formed a partnership to launch an impact-focused, interdisciplinary project with a goal to synthesize expertise from across sectors and create a cohesive set of actionable design principles that could be applied in real-world settings.

The project began by surveying 80 end-users of potential neuroaesthetic design knowledge to understand what types of design information, practices and outcomes would be most valuable in their work. Many of those end-users expressed interest in neurobiology and brain-behavior research. Some cautioned against overly

prescriptive design principles while others stressed the need to empower users and communities with knowledge as they embark on the design process. There was also a desire for examples illustrating principles in action. End-users expressed the importance of ensuring that design principles are easily translatable and understandable across sectors.

Drawing upon this feedback, the IAM Lab team developed a comprehensive interview guide to gather insights from researchers and practitioners across various sensory disciplines. The team interviewed 15 participants who research and work in design and the built environment, asking them to share their findings and practices, discuss intersections of their work with other disciplines, and suggest basic principles that could have immediate, real-world impact.

The resulting report provides a flexible framework to help designers navigate the complex and varied factors that influence design for health and wellbeing. Designed as a starting point to inspire intentional design and experimentation, this document outlines core principles and practical strategies while encouraging an adaptive approach through the integration of designers' expertise, local knowledge, and community and end-user input to create customized solutions.

This report incorporates key insights from the interviews conducted with researchers and practitioners specializing in design modalities. While some insights have not yet been substantiated through formal research, they represent valuable experiential knowledge and collective norms within the field. It is important to note that this report is not intended as a literature review, although a comprehensive review of existing research will be essential in future work. Instead, the emphasis here is on synthesizing qualitative insights gathered through conversations with researchers and practitioners to identify established principles and emerging trends. These insights point to potential areas for deeper exploration and serve as a foundation for further study.



# CORE CONCEPTS TO CONSIDER WHEN DESIGNING FOR HEALTH AND WELLBEING

Designing for health and wellbeing requires a thoughtful, holistic approach that acknowledges the complex ways people interact with their environments. This framework introduces four core concepts to guide effective design. First, successful design draws on interdisciplinary insights and diverse ways of knowing. By integrating knowledge from fields such as neuroscience, cultural studies and environmental psychology with local expertise and community input, designers can craft solutions that are both evidence-based and responsive to the lived experiences of users. Equally important is understanding the interconnectedness of sensory modalities.

Sensory experiences like sight, sound, touch and smell do not operate in isolation, but interact dynamically, profoundly shaping how spaces are perceived and used. Lastly, how individuals experience space is deeply influenced by context, including factors such as age, culture, health and personal preferences. Effective design accounts for these differences, creating spaces that support varied needs while empowering users to adapt their surroundings to suit their unique circumstances. Finally, to further advance this work, it is critical to explore methods and measures that support a deeper understanding of sensory modalities and their impact on health and wellbeing.



## INTERDISCIPLINARITY AND DIFFERENT WAYS OF KNOWING

Interdisciplinary collaboration and diverse ways of knowing are essential for designing environments that promote wellbeing. Human experience cannot be fully understood through a single perspective or discipline, prompting the need for broader frameworks that reflect how we make sense of and engage with the world.

Ways of knowing, as described by Perry and Duncan (2017), recognizes multiple forms of understanding, honoring foundational, artistic, generalized and practical knowledge rooted in indigenous wisdom, lived experience, creative expression, and scientific inquiry. This perspective broadens the concept of knowing to include both verbal and nonverbal communication, emotion, reason, intuition, memory, and other culturally and personally grounded ways of making meaning.

Breaking down silos of thought and incorporating these multiple perspectives not only advances equity and innovation but also enables disciplines to uncover solutions that may otherwise be overlooked.

Fields such as cognitive neuroscience, philosophy, psychology, sociology, and the arts are critical contributors in shaping effective design. Designers can create environments that are functional as well as culturally responsive and supportive of health and wellbeing by integrating interdisciplinary perspectives and varied forms of knowledge and understanding.

## INTERCONNECTED MODALITIES

Central to this work is the interconnectedness of sensory experiences. Spatial perception is inherently multi-sensory and body-centered: vision, touch, hearing and other senses interact dynamically, shaping how spaces are perceived and experienced. A key aspect of sensory design is modulating these inputs, enhancing or reducing sensory elements to create environments that support comfort, engagement and wellbeing. Conversations with researchers and practitioners specializing in design modalities reveal that auditory cues can direct visual attention, while changes in lighting, such as dimming, can influence the perception of music. Sensory interactions can also mitigate negative experiences or discomfort; for instance, specific scents or sounds can counteract unpleasant odors or uncomfortable temperatures, fostering a more balanced and comfortable environment.

Historically, design thinking has been heavily focused on visual perception. A multi-sensory approach, however, ensures that spaces engage all human senses, promoting a more comprehensive and holistic sense of wellbeing.

## CONTEXT MATTERS

How we experience and interact with our surroundings is influenced by factors such as age, culture, health, personal preferences and the environment. It is important to consider these factors when designing

spaces that promote health and wellbeing, acknowledging that there is no one-size-fits-all solution. Sensory perception varies not only between individuals, but also across cultural, temporal and situational contexts. Recognizing the limitations of generalized approaches allows for adaptable designs that encourage individuals to adjust lighting, soundscapes, and other sensory modalities to meet their unique needs.

A key challenge in design is determining which elements are universally relevant and which elements must be tailored to specific user needs. While much design is situational, certain principles such as the importance of sensory balance and adaptability can apply across different contexts. In considering how space affects behavior, designers must account for individual histories, including age, gender, race and cultural background.

### **AGE AND SENSORY EXPERIENCE**

Age can affect how sensory stimuli are perceived, influencing how modalities operate within different contexts. Vision changes with age, for example: as the lens yellows over time, blue light transmission is reduced (Kessel et al., 2011; Tamura & Sato, 2020). Older adults may experience altered circadian rhythms as a result. In workplaces where multiple generations share spaces due to extended retirement ages, varying sensitivities to sensory stimuli also become apparent. Older adults may have heightened sensitivity to noise, which can affect focus and concentration, highlighting the need for adaptive workspaces (Herrmann et al., 2018). At the other end of the spectrum, infants engage with their environments in a distinctly multi-sensory way, relying on sight, sound, touch and taste to make sense of the world around them (Ganea et al., 2024; Seidl et al., 2024).

### **CULTURE DIFFERENCES IN SENSORY PREFERENCES**

Cultural backgrounds also shape sensory preferences and experiences. In Scandinavian design culture, for example, there is a trend toward warmer, candle-like lighting to evoke comfort and a sense

of *hygge*, while Asian homes tend to have cooler light sources. Geographic location also influences circadian rhythms, affecting individual responses to light exposure (Leocadio-Miguel, 2017). Scent is another highly contextual factor, with certain scents evoking strong emotional or nostalgic reactions based on cultural background and personal histories (Majid, 2021; Reid et al., 2015).

### **SPECIFIC HEALTH CONDITIONS AND SENSORY PROCESSING**

Specific health conditions, including neurodiverse conditions, also affect sensory processing (Kooij & Bijlenga, 2014; MacLennan et al., 2021). Individuals on the autism spectrum may experience heightened discomfort or distress in response to bright or flickering lights, emphasizing the need for tailored lighting strategies that minimize sensory overload (MacLennan et al., 2021). For those who are blind or partially sighted, incorporating non-visual sensory cues such as sound, touch, and spatial orientation can improve accessibility. For individuals with hearing loss, environments with poor acoustics can amplify communication difficulties leading to greater psychological distress (Bigelow et al., 2020; Timmer et al., 2023). A multisensory approach can reduce barriers to engagement, especially for individuals with sensory impairments.

### **PERSONAL PREFERENCE AND ENVIRONMENTAL FACTORS**

Beyond age, culture or diagnosis, each person has unique sensory preferences. These are shaped by physical characteristics, emotional associations and environmental contexts. Variations in ear canal geometry, for example, can affect how individuals perceive sound (Kimura et al., 2022). Sound itself interacts with the person, acoustically reflecting differently around each body based on physical and environmental factors. Even within similar demographic groups, individuals can have vastly different sensory needs and preferences. Recognizing these individual differences is essential for creating more responsive and inclusive

design solutions. Factors such as personal history, emotional associations and biological rhythms all shape how a person perceives and responds to their environment.

### **IMPORTANCE OF AUTONOMY AND AGENCY**

Empowering individuals with autonomy and agency to make personal choices within their environments is foundational for wellbeing and satisfaction. In healthcare, for example, integrating tailored care allows patients to personalize their treatment experiences to better align with their needs and preferences (Dekkers & Hertroijs, 2018). In urban design, a varied streetscape can create a greater sense of control and engagement (Ewing et al., 2015). When buildings and businesses incorporate unique, small-scale design choices, people feel more engaged and empowered in their environment, reinforcing the sense that they have choices and control over their experiences.

The role of autonomy and agency, however, can be shaped by cultural norms. In some cultural contexts, greater autonomy in environmental control enhances wellbeing, while in others, excessive choice can feel overwhelming rather than empowering. Conversations with researchers and practitioners specializing in spatial perception suggest that cultural differences influence how people prioritize body-centered experiences over external spatial relationships. Some cultures, for example, place more emphasis on personal space and tactile perception, even from infancy. Recognizing cultural nuances can help designers create environments that balance autonomy with cultural preferences and ensure more meaningful experiences across multiple populations.

### **SPATIAL AND TEMPORAL CONTEXT**

Spatial and temporal context further shape how environments are perceived and experienced. For example, research indicates that long, stressful commutes negatively impact wellbeing, increasing

fatigue and stress when employees arrive at work (Chatterjee et al., 2019; De Reuver & Biron, 2023). An office that serves these employees may benefit from calming arrival spaces such as using quiet zones, biophilic elements, or soft lighting to ease the transition to work. In contrast, employees who arrive after walking or cycling to work tend to have lower stress and higher energy levels, suggesting that these workplaces may be better complemented by more energizing and engaging design features (Chatterjee et al., 2019; Loong et al., 2016). Beyond physical context, the user's state of mind, both upon arrival and the desired emotional outcome, should also be considered. Spaces intended for exploratory, open-ended behavior differ significantly from those designed for focused, goal-driven tasks. Effective design acknowledges these nuances and contexts, creating environments that align with people's lived experiences and psychological states while offering flexibility to support diverse needs and intentions.

The experience of the built environment happens not just within individual spaces but across sequences of interconnected ones. A key component of this spatial context is wayfinding, how people navigate and make sense of spaces, whether in goal-directed or exploratory ways. For example, effective wayfinding in hospitals has been shown to reduce stress in patients, while in urban areas, well-designed signage has been associated with increased engagement (Hardwicke et al., 2024; Jiang et al., 2022). Clear environmental cues and information support spatial orientation, helping people perceive, navigate and engage with their surroundings as they move through them.

### **MEASURING AND OPTIMIZING SENSORY DESIGN**

A clear understanding of the impact of how sensory modalities influence health and wellbeing is essential to advancing this work. To guide this process, a range of qualitative and quantitative methodologies can be used, from simple surveys to advanced technologies. Regardless of the methods



used, it is critical to focus on realistic, scalable solutions that can be implemented across diverse environments.

Collaboration with stakeholders such as staff, patients, and visitors can help ensure that practical insights guide the execution of multisensory design. Designers can develop interventions that are both effective and contextually appropriate by integrating user perspectives early and often. A comprehensive evaluation of spatial quality should involve a combination of observational, behavioral, and physiological assessments. User-friendly feedback mechanisms, such as QR code surveys and portable monitoring equipment, can easily gather user feedback and spatial quality data. Observational techniques, such as video analysis of postures, movements, and attentional shifts, can offer further insights into behavioral responses to an environment. Physiological measures can provide deeper insight into how spatial qualities impact individuals. For example, EEG technology can track brain activity in response to environmental factors. Similarly, heart rate variability (HRV) can provide insight into an

individuals' physiological response to their surroundings, helping to gauge levels of stress or relaxation within a space.

Specialized tools and metrics also exist to help assess and inform design decisions for specific sensory modalities. For lighting, tools such as portable light sensors with spectral resolution and The Light Exposure Behavior Assessment (LIBA) can collect detailed data on individual light exposure and its impact on human behavior. Metrics like melanopic lux enable designers to align lighting strategies with visual needs, circadian rhythms, and physiological wellbeing. Similarly, for acoustics, established noise criteria helps define acceptable ambient sound levels in different environments. These criteria guide designers in creating soundscapes that support the intended functions and atmosphere of a space, contributing to more comfortable and functional environments.

By employing a combination of these methods, a more holistic approach to creating spaces that support health and wellbeing can be achieved, ensuring that design decisions are data-driven and responsive to user needs.

# SENSORY MODALITIES IN DESIGN

Our experience of space is deeply connected to how aesthetic qualities influence biological processes and overall wellbeing. Sensory modalities can affect a range of health outcomes including mood, stress levels, cognitive function, sleep and social interactions. Light, for example, plays a vital role in regulating circadian rhythms with impacts on sleep, hormone production and overall health (LeGates, et al, 2014). Proper exposure to light at the right times can synchronize these rhythms and align biological clocks, while improper exposure can lead to disruption of systems under circadian control, including sleep-wake behavior, hormone secretion, cellular function and gene expression associated with increasing incidence of certain cancers, metabolic dysfunction and mood disorders (Duffy & Czeisler, 2010; Bedrosian & Nelson, 2017).

Similarly, auditory stimuli such as nature sounds or rhythmic vibrations can reduce stress and improve mood by lowering cortisol levels and synchronizing brain waves (Buxton et al, 2021; Chen et al, 2020; Saskovets et al, 2024). Conversely, excessive noise or overstimulating sounds may be harmful to mental and physical health (Münzel et al, 2014; Hahad et al, 2024). Thoughtful and informed use of these sensory modalities is crucial for designing spaces that promote health and wellbeing. The section below lays out how we experience space through specific sensory modalities.



## VISUAL

### LIGHT

‘When it comes to light and wellbeing, the most important thing is to be aware of how much it matters. Not so much to look for the magic number that will solve it all. There is no such number. It depends on you. It depends on how you live, where you live, how you spend your day... the priority is that people are aware of how much it matters’

#### Interview participant, Light

Light has a profound impact on our biological systems, influencing not only how we see the world but how we feel and function. It plays a central role in regulating circadian and hormonal rhythms, neuroendocrine function, body weight, and temperature (Brown et al., 2022). A key component of this connection are the intrinsically photosensitive retinal ganglion cells (ipRGCs), specialized photoreceptors that help synchronize internal clocks and support various bodily functions. The intrinsic connection between light and physiology underlines the crucial role of timing, intensity and quality of light exposure in supporting overall wellbeing.

Research highlights the importance of timed light exposure in maintaining these biological rhythms. Morning light, for instance, can synchronize circadian rhythms, while improper or inconsistent exposure throughout a 24-hour light-dark cycle can disrupt these systems (Wirz-Justice et al, 2021; Figueiro, 2023; Zeman et al, 2023). Even with adequate morning

light, unregulated light later in the day can diminish its benefits (Duffy & Czeisler, 2010; Bedrosian & Nelson, 2017). These disruptions are particularly evident in environments like intensive care units where minimal variation between day and night lighting can disrupt patients’ sleep-wake cycles, potentially hindering their recovery (Engwall et al, 2015; Blume et al, 2019).

In addition to biological effects, daylight offers emotional and psychological benefits. Access to natural light and sky views helps create a sense of orientation, openness, and connection to the natural environment. Studies show that daylight exposure can reduce stress, as well as improve sleep and mood (Blume et al., 2019; Figueiro et al., 2017). In office settings, windows and sky views have been associated with enhanced cognitive performance and greater overall satisfaction (Boubekri et al., 2014; Jamrozik et al., 2019). Dynamic daylight conditions, such as shifting sunlight and shadows over time, can also help register the passing of time. This process of "temporal anchoring" supports orientation in time and is especially important in built settings that otherwise hinder natural cycles.

The quality, color, and intensity of light can evoke feelings of comfort or discomfort, directly influencing mood and perception (Xie et al., 2022). Insufficient morning light, especially during winter, can exacerbate Seasonal Affective Disorder (SAD), while exposure to adequate light improves sleep quality and overall wellbeing (aan het Rot et al, 2008; Boubekri et al, 2014). Light therapy, particularly blue light, has been shown to alleviate symptoms of SAD by stimulating ipRGCs and reinforcing circadian alignment.

Light can also shape our perception of comfort. Through a cross-modal effect, daylight can influence how we experience temperature: lower daylight levels may make colder conditions feel less comfortable, while brighter daylight may cause the same conditions to be perceived as more comfortable (Chinazzo et al., 2019). This effect appears to be psychological rather than physiological, suggesting that daylight's presence can shape our subjective sense of comfort.

Lighting also plays a role in social engagement and cognitive performance. Well-designed lighting environments can enhance creativity and encourage positive social interactions (aan het Rot et al, 2008; Lan et al, 2020). In educational and work settings, proper lighting enhances concentration and alertness (Viola et al., 2008; Golmohammadi et al., 2021). Dynamic lighting that shifts in response to time or activity can further enhance cognitive functions (Shishegar & Boubekri, 2022), and exposure to gamma wavelength dynamic light has even shown potential in reducing cognitive decline in Alzheimer's disease (Manippa et al., 2022).

These insights illustrate the broad influence of light on biological processes, emotional states, and cognitive performance, and offer possibilities for designing spaces that support human wellbeing and growth.

## **COLOR**

'I think what we need to get away from is that color is something that's an afterthought. It's something that is aesthetically pretty. It's something that's on trend. It's something that is beautiful...Color influences behavior. Color is emotion.'

### **Interview participant, Color**

Color has the ability to influence human perception, emotion, and physiological responses. Its influence extends beyond subjective experience and can be observed in measurable physiological and cognitive changes. Research shows that color can

affect physiological processes including heart rate and brainwave activity (Oh et al., 2021; Khadir et al., 2023). Color psychology also identifies consistent associations between certain hues and emotional or cognitive states.

Short-wavelength colors like blue and green are commonly associated with calmness and relaxation. Blue, in particular, is frequently used in workspaces because of its associations with emotional regulation, cognitive performance, and sustained concentration. In a study exploring color's influence in virtual reality, participants exposed to a blue environment, compared to white or black, exhibited increased breathing range and skin conductance, indicating a heightened physiological response (Bower et al., 2022). The same study also found that blue modulates brain activity related to emotional processing.

In contrast, longer-wavelength colors such as red are often associated with heightened stimulation and attention (Pomerleau et al., 2014). Red has been shown to reliably capture attention, especially in emotionally charged contexts (Kunieciecki et al., 2015). Its strong visual impact may stem from cultural associations with warning signals and urgency, as well as its physiological effects like increased heart rate, blood pressure and adrenaline release.

These findings help inform our understanding that color is not only aesthetic but is integrated into cognitive, emotional and physiological processes. Understanding how different colors influence attention, mood, and other responses can help designers strategically use color to create effective and engaging environments.

## **AUDITORY**

### **SOUND**

'But in a holistic way, even just having a sound beautifully reverberating in the right spatial context triggers a lot of subtlety in the

[body] system again, both mentally, but also physiologically in a way that we are actually not aware of, but we may feel afterwards... or we can just measure that, okay, the [body] system is really adjusting itself in a way that is quite precise to the sound'

### **Interview participant, Spatial Sound**

Sound has a powerful effect on how our bodies regulate essential biological rhythms. Hearing is our primary warning sense; we process sound much faster than visual input. Auditory information can trigger instinctive responses like the fight-or-flight reflex. In urban environments, exposure to loud and persistent noises, such as from public transportation or construction, can elevate cortisol levels, especially when occurring during sleep (Gabinet, 2024). Chronic exposure to these stressors is associated with sleep disturbances and increased risk of stress-related health problems.

On the other hand, nature sounds have been found to have a positive impact on wellbeing. Sounds like birdsong, wind and water enhance positive perceptions of visual environments, and after stress or fatigue, nature soundscapes can improve mood, cognitive performance and reduce tension (Ratcliffe, 2021). Incorporating nature sounds in design, like those from a water feature, may reduce stress by lowering cortisol levels and releasing dopamine and endorphins or 'happy hormones' that promote wellbeing.

Rhythmic sounds, often referred to as 'entrainment signals', can influence the body's physiological state by promoting homeostasis and relaxation (Chaieb et al, 2015). These sounds can synchronize brain activity, which can be observed through EEG across various brain regions. Numerous studies have recognized that sound influences brain activity. Spatial sound, for example, compared to stereo sound, has been shown to enhance gamma wave activity, which is associated with memory processing, learning and emotional regulation (Oomen et al, 2021). Low-frequency vibroacoustic therapy, or the use of sound vibrations, has also shown potential

benefits in reducing pain, decreasing muscle tension, and improving circulation by engaging the body's nervous and musculoskeletal systems (Bartel & Mosabbir, 2021).

Sound can have a significant impact on mood and emotions, but its impact depends on the space in which the sound is experienced (Oomen, 2022). While certain sounds can promote relaxation and positive emotions, poor acoustics such as excessive background noise from air conditioners or reverberant social spaces, can hinder conversation, reduce comfort and discourage participation (Mu et al, 2021), potentially fostering feelings of isolation. Elevated road traffic noise exposure has also been associated with increased use of psychotropic medications, including antidepressants, suggesting that reducing noise exposure could potentially alleviate some mental health burdens (Okokon et al, 2018).

Additionally, the direction of sound affects psychological and physiological reactions. Sounds from behind, especially those that are negative or emotionally charged, may heighten alertness and arousal, probably due to their association with potential unseen threats (Olszanowski et al, 2023). In contrast, front-directed sounds are generally perceived as less threatening and may promote a lower-arousal, more relaxed state.

Both the quality of sound and the space in which it is heard are integral to the impact of sound on health and wellbeing. Thoughtful acoustic design can help create environments that support relaxation, focus, and social connection.

### **PROMISING AREA: SPATIAL SOUND**

Spatial sound simulates how sound travels in real life, creating the illusion that sounds are coming from different directions and distances. This field is quickly evolving, with growing research exploring its diverse and innovative applications. By precisely positioning sound sources and tuning specific frequency ranges, designers

and researchers are beginning to shape environments that influence psychological responses and cognitive functions.

Recent studies show that both sound frequency and spatial geometry impact psychological responses. In one study, researchers examined the effects of singing bowls played at 73 Hz and 110 Hz across nine different geometric shapes. The 73 Hz frequency was found to enhance gamma waves, linked to focus and memory, when played within tetrahedron and cube shapes. Meanwhile, the 110 Hz frequency promoted relaxation and alertness by stimulating theta and beta waves in the same shapes. Additionally, the shape of the space itself affected participants' arousal levels: cubical, icosahedral, and dodecahedral shapes reduced arousal, while pyramidal, tetrahedral, and spherical shapes increased it (Oomen et al., 2024). These findings highlight the relationship between spatial conditions and sound frequency, and the need to consider both when designing for wellbeing.

Spatial sound technology is also being explored as a non-invasive method to promote physiological homeostasis in the human body. One prototype, the Sphere, is a fully immersive, spherical construct designed for a single user equipped with omnidirectional loudspeakers and vibro-transducers to project sound with precise spatial characteristics (Oomen et al., 2021). It also enables measurement of human responses to sound stimuli, such as brain wave activity and vital functions, so the impact of these experiences can be understood on multiple levels.

The combination of sound frequency and spatial design plays a key role in how our bodies and minds respond, suggesting that sound-based interventions can be tailored to promote relaxation, focus, and physiological balance. As research and practice progress, the ability to design soundscapes in this way has important implications for the future of sensory-responsive design.

## TACTILE

### TOUCH AND PROPRICEPTION

'It's there at the start. It's the sensory framework on which we learn then to perceive its relationship with vision, its relationship with hearing, its relationship with chemosensory information through smell and taste and all of those sensory systems'

#### **Interview participant, Touch Perception**

Touch is a foundational sense that shapes how we perceive both the external world and our own bodies. The combination of cutaneous touch (sensation on the skin) and proprioception (awareness of body position) allows us to understand the shape, size, and texture of objects. Without touch, people can experience a disorienting sense of detachment from their own bodies, as seen in some neurological conditions.

As one of the first senses to develop in the womb, touch forms a sensory foundation upon which other senses like vision and hearing are built (Begum Ali et al, 2015; Bremner, 2020). Although humans are often seen as highly visual creatures, our perception is inherently multi-sensory, meaning what we see is often informed by our history of touch. Neglecting the role of touch overlooks its influence on human experience and development. Touch serves a dual function, offering both established discriminative input including texture, pressure and temperature, and an affective component that influences emotions and wellbeing (Proskurnina et al, 2021).

Material qualities also play a role in how touch is experienced in the built environment. The textures, temperatures, and responsiveness of surfaces influence our physical relationship with space, grounding abstract spatial experience in tangible sensory terms. Research shows that natural materials like wood can evoke emotional and physiological responses, such as improved mood and reduced stress, effects that often

occur before we are fully aware of them (Lipovac & Burnard, 2020). This suggests that materials convey emotional meaning: warm woods, soft fabrics, or rough stone each shape how we feel and our perception of a space. Similarly, materials with natural or tactilely rich textures can promote calm, reduce stress, and enhance a sense of groundedness (Dijkstra et al., 2008; Fujisaki et al., 2015). Tactile engagement with these materials can activate touch pathways, such as C-tactile afferents in the skin, which are tuned to gentle, slow contact and contribute to emotional wellbeing (McGlone et al., 2014). The material palette of a space is not just a visual or structural consideration, but a tactile and psychological one, shaping how we live and feel within our environments.

Beyond its perceptual role, touch has also long been acknowledged as essential in social communication, influencing emotional and interpersonal interactions (Morrison et al., 2010; McGlone et al., 2014). One interviewee described touch primarily as a social sense, evolving from inter-individual grooming behaviors into complex mechanisms for filial attachment and bonding. Tactile input from others can foster connection, trust and emotional regulation, reinforcing its crucial role in human interaction.

## OLFACTORY

### SCENT

'It's to do with the remote potential for increased or heightened emotional responses. It's to do with memory and memorability. And it's to do with engagement, and you know, all of which are thinking about creating an experience rather than creating a space'

#### **Interview participant, Scent**

Smell is a unique sense in its ability to directly connect to the limbic system, the brain's network for emotions, memories, and motivations. Unlike other senses which

typically relay information through the thalamus, scent bypasses this pathway and extends straight to limbic structures in the brain (Herz & Engen, 1996). This allows for an immediate response and enables scent to influence both unconscious physiological reactions and conscious cognitive processes. Given its close ties to the limbic system, odor has the ability to shape an individual's emotional experience within an environment.

The impact of scent often goes beyond our conscious awareness. Studies show that smells can subtly affect human behavior unconsciously. Participants who were exposed to the fresh, clean scent of citrus, for example, were not only more likely to keep their surroundings tidy but also found their thoughts more attuned to the concept of cleanliness (Holland et al, 2005). Similarly, peppermint, lavender and rosemary have each been associated with cognitive and emotional benefits, including enhanced focus, attention, memory, mood and stress reduction (Sowndhararajan & Kim, 2016). This research highlights how olfactory cues in our environment can influence both our actions and our cognitive associations.

Beyond behavior, scent also has the ability to support memory and learning. Scent can help individuals connect past experiences to current ones through autobiographical memory and evoke memories of past experiences in specific places by stimulating neural structures responsible for memory, emotions and meaning (Herz et al, 2004; Herz, 2016).

Scent can also be used to differentiate spaces, helping to create distinct sensory identities for different rooms or areas. Scent can enhance wayfinding and contribute to a more immersive sensory experience by signaling transitions between spaces. It is also dynamic, changing over time and in response to environmental conditions. Much like lighting or temperature, scent can be adjusted to support different activities or times of day, creating environments that feel alive and responsive.

# INTEGRATED AND IMMERSIVE DESIGN

## MULTISENSORY DESIGN

‘Even when we talk multi-sensory, we don’t talk cross-sensory. We have been limiting ourselves with acoustic experts working on acoustics and lighting experts working on lighting. The brain does not fragment. [What is] really, really needed is experienced designers and researchers coming together to say how does it weave together?’

### **Interview participant, Multi-disciplinary**

Considering multisensory modalities is a powerful tool in designing environments that support health and wellbeing. Integrating light, sound and tactile experiences can have profound effects on cognitive and emotional states, shaping how we think, feel and interact with our surroundings.

The importance of multi-sensory engagement has been increasingly validated through research. Studies of aging populations, for example, suggest that multi-sensory stimulation can positively affect cognitive and emotional wellbeing, including memory, mood and overall brain function (Hirst et al, 2022; Calderone et al, 2025). Visual and tactile integration also plays an important role in spatial awareness and body perception. The Rubber Hand Illusion, for example, demonstrates how the brain synthesizes sensory input to create a sense of ownership over observed objects, reinforcing the perception of those objects as parts of one’s own body.

When thinking about the impact on the brain and biological process we know that specific brain wave frequencies are closely linked to distinct mental states. Alpha waves (8–13Hz), for instance, are associated with alertness, while Theta waves (4–7Hz) foster deep relaxation, creativity and meditation. Delta waves (0.5–4Hz) promote sleep, healing and regeneration, and Gamma waves (above 30Hz) support cognitive processes like

problem-solving and information processing. Modulating light and sound to match these frequencies can enhance both cognitive and emotional states (Godley, 2023). One researcher described how delta transducers embedded in beds, for example, can help people fall asleep more easily and rhythmic sounds like gentle ocean surf, with a cadence that mirrors sleeping breath patterns, can ease insomnia and promote restful sleep. These subtle environmental cues tap into the brain’s natural rhythms, helping individuals align with states conducive to health and wellbeing.

Combining sensory inputs can amplify these effects. Audio-visual entrainment (AVE), a technique using flashing lights and pulsed tones to influence brain waves, has shown effectiveness in treating Seasonal Affective Disorder (SAD). In one study, participants who experienced 20Hz AVE reported significant reductions in depression and anxiety, along with increased happiness, social engagement and energy levels (Berg & Siever, 2009). Another study found that audiovisual stimulation (AVS) significantly improved mood, reduced anxiety and depression, and enhanced cognitive performance. Even brief five-minute sessions had effects comparable to or greater than longer meditation practices, highlighting AVS as a powerful and accessible tool for emotional regulation and cognitive enhancement (Johnson et al, 2024).

The benefits of multisensory modalities extend beyond light and sound. Tactile stimulation, like sound-activated vibrotactile feedback combined with auditory gamma-frequency stimulation, has shown promise in maintaining cognitive function and improving mood in individuals with Alzheimer’s disease or mild cognitive impairment (Clements-Cortes et al., 2016). These approaches create a richer sensory experience that can impact cognitive outcomes by engaging the body’s sense of touch alongside auditory cues.

These insights align with the broader concept of enriched environments: settings that offer diverse and meaningful sensory, cognitive, and social stimuli. When

environments include multisensory features such as dynamic lighting, varied tactile elements, and responsive or layered auditory input, they can transform otherwise static spaces into engaging contexts that enhance overall health and wellbeing.

## PROMISING AREA: DESIGNED EXPERIENCES AND VIRTUAL ENVIRONMENTS

Advancements in the design of virtual environments and curated experiences are opening new possibilities, driven by emerging research and innovative technologies. These developments are influencing how we engage with virtual and physical spaces, enhancing a sense of interactivity and immersion.

Haptic feedback is transforming virtual experiences by allowing users to physically feel and interact with virtual elements. By simulating touch sensations, haptic technology fosters a stronger emotional connection and sense of physical presence (Gao & Spence, 2025). Recent advances in wearable systems, such as soft actuated interfaces, are enabling more immersive and nuanced haptic feedback (Frisoli & Leonardis, 2024). These innovations make virtual interactions more dynamic and responsive, further bridging the gap between the digital and physical worlds.

The potential of augmented reality (AR) to transform educational and cultural spaces is also gaining attention. A study examining AR’s effects on learning in museums found that high-quality AR information enhances imagination and academic performance. Rich, interactive information was shown to directly boost academic achievement, while comfortable wearable devices amplified the user’s sense of immersion and imagination (Cheng et al., 2025). These findings suggest that AR has the ability to transform learning into an interactive, immersive experience that captures attention and deepens engagement.

Beyond education and entertainment, evidence points to multisensory experiences

having a powerful impact on wellbeing. For example, during the height of the COVID pandemic, Mt. Sinai Hospital created multisensory, immersive, nature-inspired recharge rooms for their healthcare workers (Putrino et al., 2019). The rooms included projected scenes of soothing natural landscapes, high-definition audio recordings of nature sounds paired with relaxing music, and an infusion of essential oils and calming scents. Healthcare workers reported a significant drop in stress and high satisfaction with the experience. While further research is needed, these findings have the potential to be applicable across varying environments to help support wellbeing.

Similarly, new media art, particularly dynamic light-based installations, provides opportunities to create immersive environments that can have positive health benefits. These installations engage viewers in unique ways that stimulate emotional responses, encourage relaxation, and enhance overall wellbeing. By adjusting colors, patterns, and intensity, light-based art can evoke a range of feelings from calmness and tranquility to heightened alertness and excitement, depending on the design. These dynamic installations can be particularly beneficial in spaces where people spend extended periods of time, such as hospitals, offices, or public spaces, providing not only aesthetic appeal but also creating an environment that supports health and wellbeing.

These emerging technologies and practices point to a future in which designed experiences can educate, heal, and inspire, bridging the digital and physical worlds in meaningful ways.

## BIOPHILIA

Nature is perhaps the ultimate example of an enriched environment. Natural environments are inherently multisensory experiences, engaging sight, sound, smell, and touch in ways that create a rich, immersive experience. Even small urban green spaces like parks have been shown



to elevate mood and encourage social interaction (Henderson et al, 2024; Peters et al, 2010). People in vibrant public spaces such as markets are more likely to engage with others, fostering community and connection.

These insights have informed biophilic design approaches indoors, where nature-inspired elements are increasingly used to support health and wellbeing. Surroundings that mimic nature tend to evoke positive emotional and cognitive responses, often leading to higher job satisfaction and improved performance (Elsbach & Pratt, 2007). A virtual reality study by Yin et al in 2020 found that participants in biophilic office settings experienced faster recovery from stress and anxiety. In addition, natural elements like greenery in built environments have been shown to improve mood, enhance working memory and accelerate recovery from stress (Coburn et al, 2017).

Biophilic design can extend beyond building materials and layout to the atmosphere of interior spaces. The concept of 'indoor weather' explores how natural elements like shadows or reflections can be brought indoors to make spaces feel more dynamic and alive. Studies have shown that digitally recreating these natural effects can influence how people perceive and experience space (Nute, 2016). This approach draws from the theory of soft fascination, which emphasizes the restorative effects of nature on health and wellbeing (Kaplan, 1995). Combining digital technologies and natural elements to create atmospheric, biophilic environments has the potential to transform how we experience space.

As discussed in the above sections, biophilic design also includes principles such as natural light, sounds and materiality. Daylight offers both biological benefits as well as psychological and emotional ones, such as reducing stress and improving sleep and mood (Blume et al., 2019; Figueiro et al., 2017). Similarly, natural sounds like birdsong, wind, and flowing water can reduce stress, improve mood, and enhance cognitive function by lowering cortisol levels and stimulating the release of dopamine and endorphins (Ratcliffe, 2021). Materiality plays a key role as well: the textures, temperatures, and tactile qualities of surfaces shape how we physically and emotionally relate to space. Natural materials like wood can subconsciously improve mood and reduce stress, while textured surfaces can promote calm and a sense of groundedness (Lipovac & Burnard, 2020; Dijkstra et al., 2008; Fujisaki et al., 2015).

Frameworks such as Terrapin Bright Green's 14 Patterns of Biophilic Design help guide the integration of these principles (Browning et al., 2014). Biophilic strategies are increasingly recognized not only for their aesthetic and functional benefits, but also as essential tools to ensure that communities have access to healthy, nature-informed spaces.

# TAKEAWAYS AND USABLE KNOWLEDGE

This discussion has outlined core concepts that are fundamental to designing for health and wellbeing, focusing on how we experience space and how different sensory modalities affect our biological processes. To create environments that truly support wellbeing, it is important to consider these concepts in the design of spaces and experiences. The following recommended practices, drawn from interviewee input, offer practical guidance on how to apply them effectively.

## Recommended practices to consider when designing for health and wellbeing

- Design spaces considering their primary functions – work, play and socializing – each requiring unique design strategies to support specific activities.
- Design with human behavior and emotional responses in mind from the outset. Use prompts to help guide the design process, ensuring that spaces cater for how people will feel and behave, not just how they look or function.
- Design spaces that maintain a connection with the outside world, providing access to nature and the changing seasons to enhance mental wellbeing.
- Use multi-sensory design solutions to create harmonious environments where visual, auditory, tactile and other sensory experiences work together to enhance the space's impact.
- Effective sensory experiences do not need to be complex or expensive. Simple, well-considered implementations using everyday products can be impactful.
- Stay updated with standards like the WELL Building Standard, which incorporates the latest research findings and adjusts periodically based on new insights.
- Clearly define goals when incorporating sensory elements. Understanding the purpose behind using sensory tools is essential for meaningful outcomes.

## LIGHT

- Expose individuals to blue light in the morning for alertness, but limit exposure in the evening to prevent disruption of melatonin production and sleep cycles.
- Follow guidelines that specify optimal light levels throughout the day. Aim for around 250 melanopic lux during the day, for example, reduce to 10 lux in the evening and maintain low levels at night to support circadian rhythms.
- Utilize dynamic or biodynamic lighting that mimics the natural daylight cycle, starting bluish in the morning, peaking with white light in the afternoon, and ending with reddish tones in the evening to promote comfort and natural rhythms.
- Highlight the stark contrast in light intensity between outdoor (up to 100,000 lux) and indoor environments (generally no more than 1,000 lux), advocating for solutions that increase indoor light exposure.
- Consider cylindrical illuminance and distribution on walls and ceilings to create well-lit spaces.
- Investigate how the effects of natural light can be replicated with artificial lighting to meet the biological needs of humans.
- Aesthetic elements of natural light, like dappled sunlight, are linked to a sense of calm and belonging. Komorebi refers to the calming effects of natural light filtering through foliage and can inspire designs that create a more positive atmosphere.



## COLOR

- Start with the desired behavior and emotional response, then choose colors accordingly
- Consider how people should think, feel, and behave in a space before selecting a color palette.
- Use lighter, softer colors such as blue to create calming, focused environments.
- Use saturated, vivid colors such as red to create stimulating and energizing environments.

## SOUND

- Use soft materials and acoustic treatments on walls and ceilings to improve acoustics.
- Avoid unintended amplification of high-frequency sounds caused by hard or reflective structures, such as glass, steel and stone, which can make spaces uncomfortable.
- Use directional loudspeakers to focus sound where people are in order to minimize reflection from surfaces.
- Incorporate design elements that minimize exposure to loud environmental noise, such as traffic and construction noise.
- Use padded chairs or seating to enhance absorption and reduce echo in large spaces.
- Utilize rhythmic, entrainment-based sounds in spaces designed for relaxation, such as meditation rooms, spas or therapy centers.
- Be mindful of how sound direction influences psychological responses. Avoid placing high-alert sounds behind occupants in workspaces or relaxation areas.
- Avoid removing all noise from a room; over-absorbed or excessively dampened sound can create negative psychological effects. A low level of ambient sound is beneficial.

### **Effective sound environments should have:**

- A measured repetition rate (not too fast or too slow) for entrainment signals.
- Subtle fluctuation in sound patterns to avoid monotony.
- Balanced sound levels (ideally 80–85dB).
- Proper reverberation to maintain a sense of spatial continuity.

## TOUCH

- Use proprioception, the sense of body position, and cutaneous sensations to engage users with objects and environments.
- Design touch experiences that encourage people to use their hands and bodies actively to explore and understand the space.
- Include varying textures, temperature and resistance to make tactile experiences more meaningful.
- Ensure that touch opportunities are clearly marked to avoid confusion.

## SCENT

- Use scents that align with the goals of the space. For example, peppermint may enhance focus, attention, alertness, memory accuracy, and mood. Lavender has stress-reducing effects and may boost arousal and concentration. Rosemary may improve overall memory quality. Be mindful of how strong or overpowering a scent might be, as it could overwhelm individuals or detract from the overall experience of a space.
- Consider sensory overload and sensory sensitivities. For people with different neurotypes, offering choice and variety in scent exposure can help accommodate sensory sensitivities and preferences.

Practical applications and real-world examples of the effects of sensory modalities on health and wellbeing.

Designing for health and wellbeing requires a flexible and adaptable approach, especially when considering the varied settings, populations and individual needs involved. The following examples demonstrate how sensory modalities can be thoughtfully applied in different contexts to support wellbeing:

## WORKSPACES

- Lighting can improve employee health and productivity. Investing in quality lighting can yield substantial savings by enhancing workplace efficiency, outweighing traditional energy cost savings.
- Position workspaces to face windows rather than sit against them to ensure optimal exposure to daylight. This promotes better mood and productivity.
- Incorporate dynamic lighting such as adjustable background lighting to enhance focus and cognitive performance.
- Ensure lighting in meeting spaces supports both task visibility and social interactions, allowing people to recognize and engage with one another comfortably.
- Incorporate warm, inviting lighting design elements to foster connection and collaboration.
- Maintain reverberation time under two seconds in offices and one second in meeting spaces to enhance clarity and communication.
- Incorporate natural sounds, such as running water, to reduce distractions and improve focus.
- Use natural elements, like water reflections and daylight, to positively influence occupants' perceptions.
- Introduce natural scents to enhance perceptions of self-efficacy, support goal setting and effective work strategies, and encourage collaboration.

## HEALTHCARE

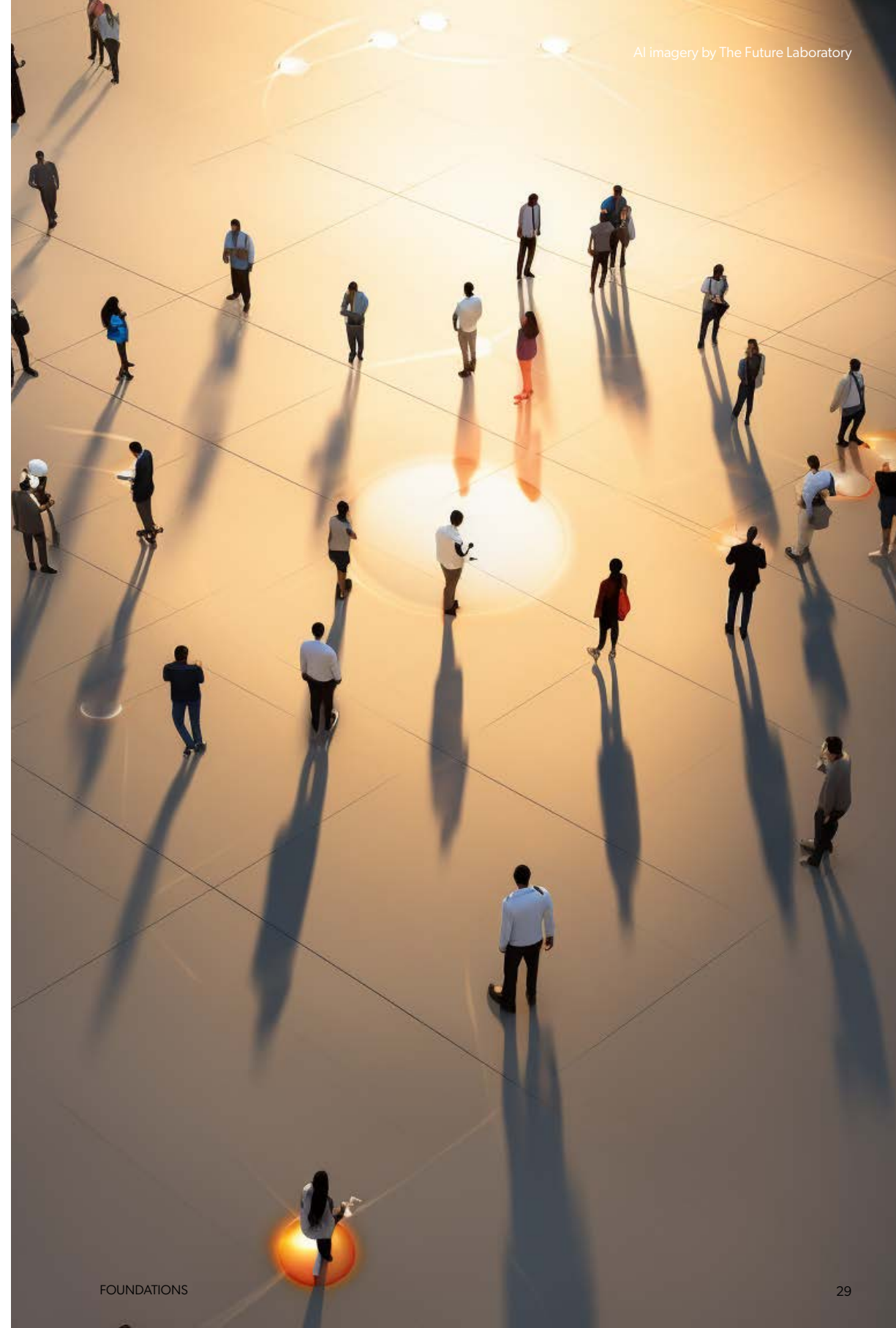
- Create flexible environments where patients can choose to engage with immersive experiences, static artwork or simply look outside. This empowers users to control their surroundings based on personal preference.
- Use technology to enable patients to personalize their environments, allowing control over lighting, sound, or other elements to meet individual needs.
- Incorporate positive distraction elements such as calming visual media, interactive displays or engaging art installations into hospital waiting areas. The presence of engaging visual stimuli has been shown to enhance environmental appeal and reduce perceived waiting times (Pati & Nanda, 2011).
- Display realistic nature photographs in patient rooms or lounges to potentially reduce the need for anxiety-related medication (Nanda et al., 2011).
- Address the challenges faced by shift workers by integrating light hygiene practices to optimize light exposure and mitigate disruptions caused by irregular work hours. Studies on night shift nurses using various light conditions (blue, red and dim white) indicate that red light may enhance alertness and reduce sleepiness without suppressing melatonin production, offering a promising alternative to blue light for night-time settings (Figueiro & Pedler, 2020).
- Balance conflicting lighting needs between staff and patients, as bright lighting supports alertness among shift workers, while patients require darker settings for rest and recovery.
- Retrain staff to reduce unnecessary noise, such as avoiding opening binders at patient bedsides late at night, wearing soft shoes, and refraining from shouting across large distances to minimize disruptions.
- Use ergonomic auditory interfaces to replace overwhelming beeping sounds with more perceptually effective tones.
- Implement intelligent sound systems in waiting rooms that enhance important audio signals, while reducing overwhelming background noise.
- Apply circadian-effective lighting interventions that provide bright light during the day and low light at night in patient rooms, which has been shown to improve sleep quality and mood in patients with dementia (Figueiro et al., 2023).
- Reduce background noise, such as air conditioning noise, in senior living facilities to help residents feel more comfortable and encourage social interaction.
- For elderly individuals, focus on optimizing light quality to prevent glare and scattering that can reduce effective light exposure.

## EDUCATION AND RECREATION

- Adapt lighting to activities in schools and recreation facilities, such as reducing glare for work and using dynamic lighting for movement and play.
- Implement spatial sound technologies in learning environments to support memory retention, focus, and emotional regulation.
- Introduce subtle auditory stimulation, such as 15 Hz tones, to improve concentration in students with ADHD.
- Prioritize classroom acoustic design that enhances speech clarity to support learning outcomes.
- Use appropriate materials and layouts to reduce background noise and improve speech intelligibility, especially for early-grade students.
- Research shows a connection between speech clarity and reading performance. A study of 94 second-graders found that improved speech clarity (C50) in classrooms was correlated with faster reading speeds across tasks (Puglisi et al., 2018).
- Design environments that encourage safe and meaningful tactile interactions to support sensory development in infants and young children.

## PUBLIC AND SHARED SPACES

- Use acoustic panels that blend with the environment to improve sound quality in offices, restaurants and other shared spaces without compromising on aesthetics.
- Choose sound frequencies based on the room's size, shape and acoustics to enhance auditory clarity and effectiveness.
- Consider ergonomics in seat design in creating calming environments. Researching and tracking people's natural limb positions can help optimize body posture, reduce sensory conflicts, and enhance overall comfort.
- Incorporate tactile elements that encourage connection and positive interaction between people, such as collaborative environments or sensory-friendly relaxation areas.
- Use visible markers in environments, like colorful crosswalks and greenery, to enhance feelings of neighborly trust. These symbols may foster a sense of care and sociability among community members (Negami et al., 2018).
- Integrate technologies that allow users to control or move sound to foster a sense of community and support engaging, shared experiences in public settings.
- Highlight accessibility features visibly to increase psychological ownership and help individuals feel more invested in a space. This sense of stewardship extends even to those without specific accessibility needs.
- Introduce olfactory elements into public or shared spaces, such as museums, libraries, lobbies, or community centers, to create more immersive experiences and foster deeper emotional engagement. In a recent study involving over 800 participants, museum visitors reported that the addition of scent made exhibitions more memorable and meaningful (Ehrich et al., 2023). Scents evoked vivid memories and strong emotional responses.



# CHALLENGES

Several challenges that underline the complexities of integrating effective design with health and wellbeing were identified in this work. These challenges highlight the need for innovative approaches, interdisciplinary collaboration, and the continued evolution of design practices to address the nuanced needs of individuals and communities.

## DESIGN CHALLENGES

Sensory needs are often considered too late in the design process, leading to the need for corrections instead of proactive planning. This often limits the ability of sensory design experts to implement effective solutions. Constraints such as limited budgets and a lack of understanding about the long-term benefits of well-designed spatial elements hinder meaningful integration.

Education gaps contribute to these challenges. Many design and architectural schools overlook foundational knowledge about sensory experiences, which limits practitioners' ability to understand and address spatial factors. As a result, issues such as poor design quality and excessive noise have become widespread and normalized in many environments.

A core issue is the disconnect between research and practice. Much scientific knowledge related to sensory design and human experience isn't communicated in a way that makes implementable insights accessible. This science-communication gap often prevents valuable findings from influencing real-world projects. Additionally, science-informed design is often perceived as an added burden to already complex processes. However, when applied early, it can streamline decision-making, reduce costly revisions, and improve outcomes, ultimately saving time and resources.

## RESEARCH CHALLENGES

Updating design standards to reflect new scientific findings is a slow and complex process, resulting in a persistent gap between research and their real-world application. More comprehensive research is needed to validate the impact of multisensory design on health and wellbeing. While individual studies explore these connections, research remains fragmented, making it difficult to integrate findings into practical applications. Without comprehensive integration, designers and decision-makers struggle to apply evidence-based strategies effectively.

Another key limitation in current research is the lack of demographic diversity, with many studies overlooking factors like gender, age, and culture, restricting the generalizability of findings across populations. Additionally, the complexity of interactions between factors makes it difficult to isolate and study individual effects on areas such as affect, cognition, and behavior. This challenge is especially evident when attempting to demonstrate direct health benefits, often resulting in clients favoring cost-effective solutions over potentially more beneficial but less proven designs.

To advance this work, future research must adopt more inclusive, interdisciplinary and rigorous approaches that better capture the complexity of human responses to sensory modalities and design interventions.

Addressing these challenges requires a shift toward a more proactive, research-informed, and interdisciplinary approach to design. Bridging the gap between scientific findings and practical applications will ensure that spaces better support health and wellbeing. Increased investment in research diversity, early integration of sensory considerations, and improved education for designers are essential steps in overcoming current limitations.



# CONCLUSION

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Meaningful progress has been made at the intersection of design and wellbeing, deepening our understanding of how spaces influence human health and behavior. Designing for health and wellbeing requires a thoughtful and holistic approach that integrates interdisciplinary perspectives, acknowledges the interconnectedness of sensory experiences and considers the diverse contexts in which individuals experience space. This document has outlined core concepts that emphasize the dynamic relationship between sensory modalities and built-environment factors, demonstrating their profound impact on physical and mental wellbeing, from influencing biological processes to enhancing outcomes such as mood, stress reduction and productivity. While challenges remain in integrating design and health effectively, these complexities provide opportunities for innovation and growth.

It is important to acknowledge the limitations of this guide. Its scope focuses primarily on individual sensory modalities, rather than how multiple sensory inputs work together to influence health and wellbeing. Additionally, the qualitative insights, while valuable, are drawn from a limited set of conversations with researchers and practitioners and do not constitute a comprehensive literature review of the current field. Much work remains to fully harness the opportunities this field presents. Nonetheless, this guide offers a foundation for further inquiry and action, underscoring both the potential and the responsibility of researchers and practitioners to create environments that not only serve functional needs, but also promote lasting health and human flourishing.



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- **Upali Nanda**, Partner and Executive Vice President, HKS Architects, USA



# RESOURCES

## PROVIDED BY INTERVIEW PARTICIPANTS

- [TU/e Human-Technology Interaction \(HTI\)](#)
- [OCULIGHT Dynamics](#)
- [EPFL Pavilions: Reading the Light](#)
- [L4H Health Research for Lighting Design Online Course](#)
- [CADRE Live-Learn Laboratory](#)

## REPORTS AND TOOLKITS

- [The Olfactory Storytelling Toolkit](#)
- [Aural Diversity Toolkit](#)
- [TESTING, TESTING!](#)
- [Enriched Environments for Brain Health](#)
- [Getting to a Brain Healthy Workplace](#)
- [Sensory Well-Being for Adolescents with Developmental Disabilities](#)

## VIDEOS

- [Creating AWE | Lyn Godley | TEDxPenn](#)
- [Lyn Godley: We're all moths to a flame - Imagine a Place](#)
- [Kang: Designing soundscape in urban open public spaces · PAADtalks!](#)

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