

Proceedings of Academic Research Community

Research Paper

Received: 21 December 2024, Accepted: 23 April 2025, Published online: 30 April 2025

DOI: 10.21625/archive-sr.v9i2.1160

Unveiling The Olfactory Architectural Design: A Sensory Voyage

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Abstract

Understanding sensory encounters in built environment requires a holistic approach that considers individual differences, contextual factors, and psychological states. While design features play a crucial role in shaping these experiences, they interact with a complex web of personal, social, and environmental factors. The olfactory architecture design is an innovative approach that integrates the sense of smell into the architectural experience. This concept goes beyond traditional visual and tactile elements, creating spaces that engage occupants through carefully curated smells. Factors to be considered in the science of smell and space through olfactory perception and behavior, applications in architecture, designing with smell including anchoring in mind and challenges in application. This study wants to revealing and exploring the essentials of how olfactory design is transforming the built environment based on sensory experience. Several tools and techniques are used for a captivating theories and approach in designing architecture by shaping smell sensory experiences and evoking specific feelings. From the results of this study, the olfactory architecture design offers a new dimension to the way we experience spaces, enhancing our emotional and psychological connection to our environment. As the field grows, architects and designers will continue to explore innovative ways to integrate smell, creating spaces that are not only visually and functionally appealing but also emotionally resonant. The future of built environment lies in these multi-sensory experiences, where the invisible power of smell plays a crucial role.

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Keywords

built environment; emotional connection; olfactory architecture; sensory experience; smell perception

1. Introduction

Sense experiences play a pivotal role in how individuals interact with their environment, serving as trigger points for feelings, thoughts, and meanings. Adopting a holistic approach that considers these sensory inputs, along with individual differences and psychological factors, can significantly enhance occupant well-being and performance. Clements-Croome (2005) proposes that intelligent buildings should provide multi-sensory experiences, recognizing that the environment affects people beyond health and safety. Incorporating elements that engage multiple senses can create more enriching and immersive environments, include visual aesthetics, acoustics, tactile materials, scents, and even flavors. Barrett & Barrett (2010) emphasize the importance of naturalness, individualization, and stimulation in design, based on neuroscience theories. Recognizing that each person has unique sensory preferences and sensitivities

is key. For instance, some individuals may be more sensitive to noise, while others might respond strongly to lighting conditions. Personalized spaces can help accommodate these differences.

The psychological impact of the built environment on occupants is profound. Factors such as natural light, color schemes, biophilic design elements (integration of nature), and spatial layouts can influence mood, stress levels, and cognitive function. Lara-Moreno et al. (2021) identified three distinct psycho-architectural profiles, demonstrating how individual characteristics influence architectural preferences and well-being. Incorporating programs and amenities that promote physical and mental well-being, such as fitness centers, meditation rooms, and green spaces, can support overall health. Pluess (2015) highlights the concept of environmental sensitivity, noting that individuals differ in their responsiveness to external factors. Involving occupants in the design process to understand their preferences and needs can lead to more effective and satisfactory outcomes. By designing adaptable spaces that can be easily reconstruct to meet different needs and user preferences can enhance the value of functionality and comfort. The design spaces that consider sensory experiences, individual differences, and psychological states can lead to more positive outcomes for occupants, emphasizing the need for a transdisciplinary approach in creating healthier and more sustainable environments.

Space design in sensory experiences involves two key factors that work simultaneously: the overall given ambience of the place and the internal response of an individual to the atmosphere. Both factors are crucial for creating environments that enhance well-being and performance. The environment can communicate with the human body as we walk through the spaces, feel the texture with our hands, and hear the sounds around us as we walk, feel the breeze and even smell the air. It is thus the combination of all the senses together, which gives a holistic experience of the space. A person's physical state significantly influences their sensitivity and reaction to the smell. For example, the food aroma can be enticing to someone who is hungry but off-putting to someone who has just eaten a heavy meal. In the other hand, when we went at the spa or wellness center, identically, we smelling the aromatherapy in every particular space, it can be relaxing and calming our feeling. Nowadays, aroma therapy is widely accepted for its benefits for human physiology and psychology. This variability highlights the importance of thoughtful olfactory design in functional spaces, particularly concerning the placement, navigate and guidance our activities inside these room. Olfactory design is an innovative approach that integrates the sense of smell into the architectural experience. This concept goes beyond traditional visual and tactile elements, creating spaces that engage occupants through carefully curated smells. Olfactory design, strategic use of smell in architectural and interior design, is transforming the built environment by influencing how spaces are perceived and experienced. This sensory approach goes beyond aesthetics, impacting emotional well-being, productivity, and even physical health, that can be transforming the built environment.

2. Literature Review

2.1. The Human Smell

The olfactory system is highly sensitive, allowing us to detect a wide range of odors at very low concentrations. Our sense of smell is closely linked to the brain's limbic system, which is responsible for emotions and memory. Every human is provided with a fairly identical olfactory epithelium which gives us a first hint that individual differences in olfactory sensitivity and preferences are located beyond the actual organ of smell. This connection makes smell a powerful tool in shaping experiences and evoking specific feelings. The human nasal passages contain approximately 50 million primary sensory receptor cells within a small area of about 2.5 sq.cm (Bowman, 2017). The olfactory epithelium is covered by a mucous layer secreted primarily by Bowman's glands, which are present in all vertebrates except fish (M. L. Getchell & T. Getchell, 1992). This mucus contains important proteins, including odorant-binding proteins (OBPs) that may transport odorants to olfactory receptors, and xenobiotic metabolizing enzymes involved in odorant transformation and degradation (Heydel et al., 2013). Here, the molecules interaction with olfactory receptors and produce the signals that our brain interprets as "odour". Research indicates that certain smell can influence mood, productivity, and behavior. For example, lavender promotes relaxation, while citrus smell can enhance alertness and energy, there are eight categories to determining the smell (Figure 1). People are encouraged to share their experiences while they smell and associating with their emotions, become a tool to develop and strengthen social bonds.

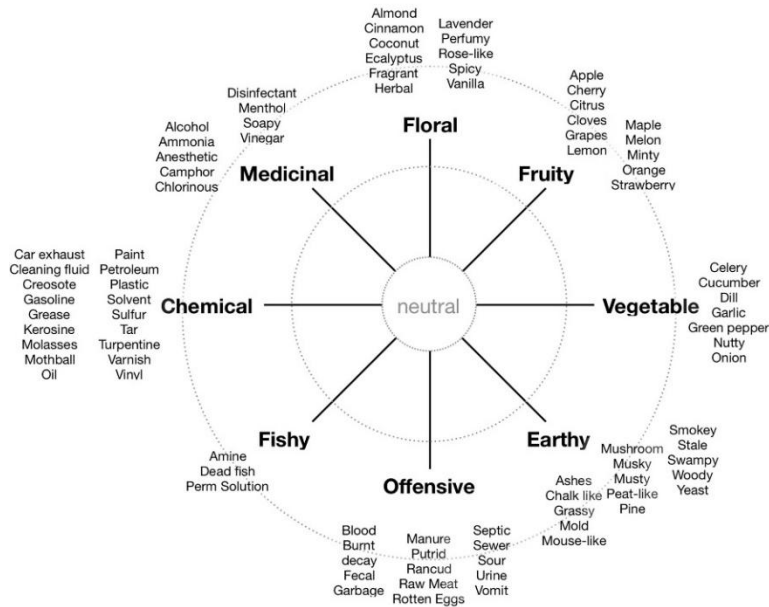


Figure 1 The smellwheel (Linborg, 2021)

2.2. Sense of smell in Architecture

The sense of smell plays a significant role in architectural design, gives another dimension of design process, and contributing to the creation of unique spatial experiences and identities.

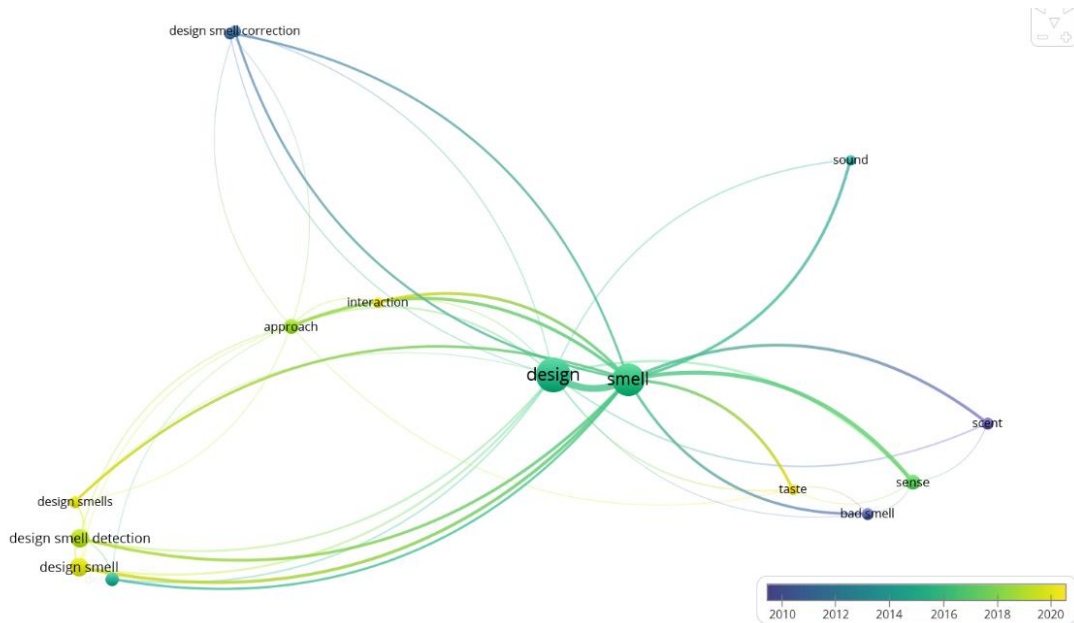


Figure 2 The relationship topic in smell and design (Author, 2024)

By using the Vos Viewer application (Figure 2), the bibliographic diagram suggests that the topic of smell frequently intersects with design, particularly in relation to human perception and sensory responses. While design is most commonly associated with visual aspects, the integration of smell in design allows for a more holistic sensory experience, expanding beyond visual aesthetics to engage people on deeper emotional and psychological levels. Historically, olfactory elements have also been integrated into design, including architectural designs, highlighting the importance of scent in shaping human experiences of space, but the 20th century saw a trend towards sterilizing indoor air (Barbara & Perliss, 2006). However, demonstrate a renewed interest in utilizing scent in architecture, such as interactive smell systems that create configurable fragrance zones (Haque, 2004). Different smells can influence emotions and mood, enhancing the psychological comfort and satisfaction of occupants. Smells can reflect cultural

or personal meanings, contributing to a space's unique identity and making it more meaningful and engaging for its users. Traditional buildings, like the Osing Tribe's houses, showcase how building materials, vegetation, and geographical conditions contribute to characteristic aromas, enhancing visitor comfort (Ariyanto et al., 2024). Contemporary architectural practice is increasingly recognizing the importance of multisensory design, incorporating not only visual elements but also sound, touch, smell, and occasionally taste. This approach aims to create spaces that better promote social, cognitive, and emotional development by leveraging cross modal interactions and multisensory integration (Spence, 2020). Smell is closely linked to memory and emotion. By carefully selecting and integrating scents, architects and designers can create spaces that evoke specific memories or feelings, making the experience more personal and impactful. A well-designed olfactory experience can enhance the overall quality of a space, making it more inviting, comfortable, and memorable.

2.3. Designing with Smell

- A) Aesthetical intuitive: Embed microcapsules of fragrance in materials used for art installations. When viewers approach or interact with the piece, the scent is gently released. Materials such as wood, stone, and textiles can be chosen for their natural smell or their ability to retain and diffuse added fragrances.



Figure 3 Capturing Aromas, TEMPA-ARTJOG (Author, 2024)

Aroma exists as a medium that mediates the structure of imagination regarding the scope of past and future events. Aroma is a medium that is fragile and ephemeral but at the same time capable of generating atmospheric tension. Smell can be very personal and subjective, but it also exists as a sensory, aesthetic experience. Through the distinctive aroma of fragrances from RAI (Rumah Atsiri Indonesia), visual stimulation to see and reread writings from data that is still stored in the RAI museum became harmonious. There, Tempa interprets our memory of smelling an aroma will be very sensitive to our subjective imagination in visually projecting the aroma as a representation that is open to wider public understanding.

- B) Smell as the space navigation: Humans have long relied on visual cues to navigate and make sense of their surroundings. Studies have shown that humans can use odors as landmarks for wayfinding, performing well in odor-based navigation tasks (Hamburger & Knauff, 2019). Smell, in particular, has a unique relationship with memory and emotion, potentially offering a rich and underexplored avenue for enhancing our understanding of how individuals perceive and interact with their environments. The concept of smell-scape is built upon the relationship between human experiences of smell, the physical environment, and the context of a place. Perception plays a central role in shaping the smell-scape. (Xiao, 2020)



Figure 4 Smell-scape Mapping Marseille (Williams, 2019)

Noailles Marketplace, often referred to as the "soul of Marseille," is a vibrant microcosm of the city's diverse and multicultural identity (Williams, 2019). The bustling streets and stalls of this iconic market immerse visitors in a sensory symphony where smells and sights converge in an authentic expression of daily life.

C) Play with nature: incorporating natural elements, particularly plants and water features, into urban and indoor environments can significantly enhance sensory experiences and well-being. Fragrant plants and water features in public spaces can improve urban smell-scape, contributing to positive emotions and place-making (Xiao et al., 2017). The subtle smells from flowers, herbs, or even the earthy scent of soil can evoke feelings of relaxation and connection to nature, making the space feel more inviting and serene. Similarly, the use of natural materials in building design, such as wood, stone, or clay, introduces distinct organic smells that enhance the sensory appeal of a space. Wood, stone, and other organic materials are often perceived as more natural and appealing than synthetic alternatives. These materials can emit distinct odors that contribute to the sensory appeal of a space (Wilkins et al., 2007). These materials also age and change over time, continuing to release subtle, evolving smells that can make the environment feel alive and dynamic. By integrating plants and natural materials, designers can create spaces that not only look beautiful but also engage the sense of smell, promoting a deeper, multi-sensory connection to the environment. This approach can reduce stress, enhance comfort, and even boost cognitive function by creating a more holistic and immersive experience.



Figure 5 Scented Sphere, Sentosa Sensory-scape (ArchDaily, 2024)

The "Scented Sphere" showcases an arrangement of concentric "stalks and buds" designed to suspend aromatic flowers. Its structure features a grid shell formed by four interwoven steel strips, creating the stalk-and-bud framework. The garden's plant species are carefully chosen for their therapeutic flower fragrances (rose, chamomile, lavender, etc.) and curated to maintain a diverse, year-round olfactory experience.

D) *Anchoring in Mind*: Designing spaces with varied smell in different areas can create distinct memory anchors. Smells have the power to influence emotions, recall memories, and enrich our understanding of places (Xiao et al., 2022). Designers can use fragrances to create configurable soft zones and boundaries, moving beyond simple branding purposes to develop evocative and memorable experiences (Haque, 2004). By integrating olfactory elements into various environments, designers and architects can create spaces that are not only visually and functionally appealing but also rich with memorable experiences. Understanding the science behind smell and memory allows for innovative applications that enhance well-being, learning, and emotional connections, making olfactory design an exciting frontier in architecture and beyond.

3. Practical Evidence: Olfactory Cues and Architectural Typologies

Smell often marks our memory of a place more powerfully than sight. Across architectural typologies residential, commercial, religious, and public olfactory cues not only enhance the experience but also deepen our emotional connection to space. Here, practical examples illustrate how smell interacts with function in built environments.

3.1. Residential: The Smell of Materials and Memory

At Fogo Island Inn in Newfoundland, Canada, designed by architect Todd Saunders, the use of untreated timber in both interior and exterior cladding allows the building to retain the smell of the forest and the ocean mist. The natural smell becomes part of the guest experience evoking a connection with place and memory, especially for local residents who associate the smells with their upbringing in the region (Saunders, 2015). The smell reinforces the typology of the home or inn as a site of comfort, retreat, and belonging.

3.2. Market: Olfactory Identity of Urban Food Spaces

The Tsukiji Fish Market in Tokyo, once the world's largest wholesale fish market, had a distinct and unforgettable smell raw seafood, seawater, and ice. Although pungent to some, it embodied the identity and function of the market. As Ashmore (2020) notes, the olfactory character of Tsukiji was not incidental but integral to its authenticity and social function. Its smell was a form of informal signage that told you exactly where you were and what the space was for.

3.3. Religious: Smell as Ritual and Sacred Atmosphere

The Church of the Holy Sepulchre in Jerusalem provides a striking example of how smell creates spiritual atmosphere. The regular use of frankincense and myrrh during ceremonies gives the space a dense, layered aroma that contributes to the sacredness of the site. Smell becomes part of the liturgical experience enhancing the building's function as a place of prayer, reverence, and reflection (Bille & Sørensen, 2007).

3.4. Public Space: Nature and Familiarity in Urban Design

In Parque Biblioteca España in Medellín, Colombia, the surrounding public park is filled with native flowering plants like guayacanes and jasmine, chosen not only for their color but their smell. These plants create a calming, welcoming olfactory environment for local residents, reinforcing the function of the space as both a public library and a community gathering point (Brand, 2013). This strategy ties olfaction to public life, memory, and cultural recognition.

3. Results

Olfactory architectural design opens up a new dimension in how we perceive and interact with spaces, enriching our emotional and psychological connection to the environment. As this field evolves, architects and designers are increasingly exploring innovative ways to incorporate smell, crafting spaces that not only offer visual and functional appeal but also resonate emotionally. The future of architecture lies in creating multi-sensory experiences, where the often overlooked, yet powerful, sense of smell plays a pivotal role. Smell becomes a form of "aesthetic intuition," subtly guiding how people move through and experience spaces. Whether it's smell-inspired navigation, where certain smells lead people through environments, or playing with nature's organic aromas to evoke a sense of tranquility, olfactory design can anchor memories and emotions, leaving a lasting imprint on the mind.

In practical terms, Smell plays a crucial role across different architectural typologies, enriching how we experience and remember space. In residential, natural materials like timber carry familiar scents that evoke comfort and identity. Markets such as Tokyo's Tsukiji use strong olfactory cues like the smell of seafood to define their function and authenticity. Religious spaces often rely on ritualistic aromas, such as incense, to create a sacred atmosphere, while public areas benefit from fragrant plants that foster a sense of place and emotional connection. These examples show that smell is not merely a sensory detail, but an essential part of how architecture supports human function, memory, and cultural meaning. By incorporating smell into architectural design, spaces can become immersive, dynamic, and more deeply connected to the people who inhabit them. This multi-sensory approach, where the invisible element of smell is seamlessly woven into the design, allows for richer, more intuitive interactions with the built environment.

Acknowledgments

The extended abstract of this paper was presented at the Sustainability in Creative Industries(SCI) Conference –3rd Edition which was held on the 6th - 7th of November 2024.

Funding declaration:

This research was supported by the School of Creative Industry Faculty, Universitas Ciputra Surabaya, Indonesia under the Research Internal Funding Scheme 2024

Ethics approval:

Not applicable

Conflict of interest:

The authors declare that there is no competing interest.

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