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Exploring Emotional Impact: Multisensory Design And User Experience In Interiors

Suyash Joshi[1]*, Dr. Anand babu k.[2] Soumya B.K[3]

[1*]Ph. D Scholar, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore, India, MIT Institute of Design, MIT-ADT University, Pune, India, (ORCID: 0009-0000-3806-6177)

[2]Department of Civil Engineering, PIEMR, Indore, India, (ORCID: 0000-0001-8808-2116)

[3]MIT-ADT University, PUNE

Abstract- The Emotional Language of Space: A Study of Multisensory Design and User Perception in Interior Spaces examines how interiors speak to us emotionally through our senses. The study looks at visual cues such as color, light, and form; tactile qualities like materials and textures; olfactory signals through scent; and auditory experiences shaped by soundscapes. Together, these elements were explored to see how they influence emotions across different age groups and cultural contexts.

A qualitative-first survey was conducted with 64 participants, using scenario-based prompts that asked them to imagine and describe how they would feel in spaces with specific sensory conditions—for example, natural sunlight, warm lighting, soft music, pleasant fragrances, or textured surfaces. Responses were examined using descriptive statistics and thematic interpretation to identify common emotional patterns.

The findings highlight light as the strongest mood-setter: natural sunlight was almost universally associated with freshness and positivity, while warm light conveyed comfort and coziness. Sound shapes feelings of comfort, with noise increasing stress and soft music encouraging relaxation. Scent emerged as a subtle but powerful mood shaper, especially when matched to the function of a space. Textures also mattered, though reactions varied— smooth surfaces were often seen as calming, while rough textures were described as either natural and grounding or uncomfortable. Most importantly, spaces where light, sound, and scent worked in harmony created the most positive emotional responses, whereas mismatched combinations caused unease. Age-related differences were also noted, with younger participants favoring brighter light and energy, and older participants showing more comfort with softer lighting and calming scents.

The study concludes that interiors are not just visual environments but multisensory experiences. By weaving together light, sound, scent, and texture, designers can move beyond aesthetics to create spaces that feel emotionally supportive, engaging, and inclusive of different generational perspectives.

Keywords- Multisensory design; Interior spaces; Emotional perception; User experience; Color and lighting; Soundscapes; Olfactory cues; Cultural influence

1. Introduction

Interior spaces are more than just physical enclosures; they are environments that shape how people feel, behave, and connect with one another. Increasingly, research in environmental psychology and design shows that the influence of space extends far beyond visual aesthetics. What we see, hear, touch, and even smell contributes to how a place is experienced. It is this multisensory engagement that transforms a space from being merely functional into something meaningful and emotionally resonant. For instance, natural light can lift a person's mood, wooden textures can create warmth and familiarity, and subtle fragrances can ease tension and promote relaxation. Yet, despite growing awareness, interior design practice still tends to privilege the visual, often underestimating the power of the other senses to shape human perception.

Fig 1- Different types of senses.

Although interest in multisensory environments is rising, there remain important gaps in understanding. Much of the existing literature has examined isolated aspects such as lighting or acoustics, but fewer studies have looked holistically at how multiple sensory elements interact to shape emotional experience. In addition, most studies reflect expert or designer perspectives rather than the lived experiences of everyday users. Cultural and generational differences are also underexplored, limiting how well current findings apply across diverse populations. This highlights a need to identify not only which sensory elements matter most but also how different groups interpret and respond to them emotionally.

Understanding these dynamics is particularly relevant today, as interior spaces are increasingly expected to serve multiple purposes—supporting work, leisure, healing, and social interaction. Thoughtful design can use sensory cues to create environments that are both efficient and emotionally supportive. For example, healthcare settings can help reduce patient stress through calming light, sound, and scent; workplaces can foster focus and creativity with balanced lighting and gentle soundscapes; and homes can nurture comfort and belonging through personalized sensory layers.

This study therefore investigates the "emotional language of space" by exploring how visual, auditory, tactile, and olfactory design elements interact to influence user perception. Its objectives are threefold: (1) to identify and clarify the sensory elements in interior spaces that affect human emotions, (2) to analyze how individuals respond emotionally to different multisensory environments, and (3) to compare these responses across age and cultural backgrounds. Using a survey-based approach, the research provides empirical evidence of how everyday users interpret sensory cues and offers insights to guide more human centered and emotionally attuned design practices.

Fig 2- Multi- sensory shift..

Aim- To investigate how multisensory elements in interior design- such as geometric forms, color schemes, textures, scents, and acoustics- collectively influence emotional responses in users, with a focus on both cultural and individual variations, using qualitative measurement tools.

2. Objectives-

(1)To identify and clarify the key sensory elements in interior spaces that affect human emotions,

(2)To analyze emotional responses to multisensory environments, and

(3)To compare emotional effects across age and culture.

3. Literature Review.

S.No.	Paper Title	Author(s) & Publisher	Year	Research Focus	Key Findings
1	The Interior Experience ofArchitecture: An Emotional Connection between Space and the Body	Lee, K. – MDPI	2022	Looked at how people emotionally connect with iconic architectural spaces.	Found that spaces speak to the body through light, texture, smell, and form. Materials and sensory layers create emotions like comfort, awe, and nostalgia, often linked with cultural memories.
2	Enriching Subjective Experiences through Design Research	Poldma, T. – Journal of Research Practice	2010	Explored how people talk about and experience different interior spaces.	People describe spaces in emotional terms like warmth, safety, and shelter. Their personal stories and metaphors help designers shape atmospheres that feel intentional and human-centered.
3	Contemplative Experiences and Implications for Interior Design	Shah, R. – Academia	2009	Studied how sacred and calming spaces are experienced.	Simple light, natural materials, and soft acoustics encouraged peace and focus. Many participants said such spaces felt cleansing and freeing from everyday mental pressure.
4	Multisensory Stress Reduction in Paediatric Waiting Rooms	Higuera-Trujillo, J. L., et al. – SciSpace	2020	Tested how sensory design could calm children in hospital waiting rooms.	Soft visuals, gentle sounds, and subtle scents lowered stress and made spaces feel safe and welcoming Families described these environments as comforting.

5	Immersive Multisensory VR (Thermal, Visual, Auditory)	Lyu, Y., et al. – PMC/Bohrium	2023	Used VR to test how adding multiple senses affects immersion.	When warmth and airflow were added to visuals and sound, people felt more engaged, comfortable, and emotionally present. It created stronger memories of the space.
6	VR Designs for Awe	He, X., et al. – arXiv	2024	Designed VR spaces to trigger feelings of awe.	Large scale, dramatic lighting, and perspective shifts made people feel awe and wonder. Emotional impact came from surprise and sensory harmony.
7	Multisensory Home Office in VR	Li, X., & Cooper, P. – PubMed/ResearchGate	2024	Looked at how VR offices with nature-inspired cues affect mood.	Adding greenery visuals and natural scents boosted focus, comfort, and productivity. Scents also triggered positive memories, making spaces more engaging.
8	Distinction: A Social Critique of the Judgement of Taste	Bourdieu, P. – Harvard University Press	1984	Examined how "taste" is tied to class and culture.	Showed that what people like in art, food, or interiors is not just personal— it reflects upbringing and culture. Taste becomes a way of expressing identity and social belonging.
9	Neuroaesthetics	Chatterjee, A., & Vartanian, O. – Trends in Cognitive Sciences	2014	Looked at how the brain reacts to art and aesthetics	Proved that sensory design has a direct effect on both emotions and thinking because our brains are wired to respond to beauty and harmony.
10	Color Psychology: Effects of Perceiving Color on Psychological Functioning in Humans	Elliot, A. J., & Maier, M. A. – Annual Review of Psychology	2014	Explored how different colors affect emotions and behavior.	Blue and green created calm, while red and orange increased energy but sometimes stress. Reinforces that color choices directly affect how spaces feel.

11	Soundscape and the Built Environment	Kang, J., & Schulte-Fortkamp, B. – CRC Press	2016	Reviewed how sound shapes the experience of built spaces.	Found that natural sounds reduce stress and create relaxation, while noise adds tension. Shows why sound design is just as important as visual design.
12	Biophilic Design: Dimensions, Elements, and Attributes	Kellert, S. R. – Wiley	2008	Explained the principles of biophilic design.	Natural light, plants, and organic materials support human well-being. Proves that connecting people with nature in interiors makes spaces healthier and happier.
13	The Impact of Light and Colour on Psychological Mood: A Cross-Cultural Study of Indoor Work Environments	Küller, R., Ballal, S., Laike, T., Mikellides, B., & Tonello, G. – Ergonomics	2006	Compared how people in different cultures react to light and color in workplaces.	Found that warm light and earthy tones feel cozy and personal, while cooler tones feel more spacious but less inviting. Light and color impact mood across all cultures.
14	Gender-Congruent Ambient Scent Influences on Approach and Avoidance Behaviors in a Retail Store	Spangenberg, E. R., Sprott, D. E., Grohmann, B., & Tracy, D. L. – Journal of Business Research	2006	Studied how scents affect shopping behavior.	Scents that matched gender preferences made people feel more comfortable and likely to stay. Shows that smell, even if subtle, changes how we emotionally respond to a space.

Looking across the studies, one thing becomes very clear: spaces don't just speak through what we see, but through a mix of sensory cues working together. Lee (2022) shows how architecture connects with the body through light, texture, and form, while Poldma (2010) reminds us that people often describe spaces in emotional ways—using words like warmth, shelter, or comfort. Shah (2009) echoes this, showing how calm and focus can emerge in contemplative spaces shaped by soft light and simple materials. In healthcare settings, the same lesson appears: Higuera-Trujillo et al. (2020) found that children felt less stressed when waiting rooms used gentle visuals, sounds, and scents. Technology has also expanded these
ideas—VR research by Lyu et al. (2023) showed that adding warmth and airflow makes environments feel more real and emotionally engaging, while He et al. (2024) and Li and Cooper (2024) proved that awe, focus, and productivity can all be influenced by carefully combining sensory elements like light, sound, and nature-inspired cues.

Theories from sociology and psychology add more depth. Bourdieu (1984) argues that our sense of taste—what we find beautiful or comforting—is not just personal, but shaped by
culture and social background. Chatterjee and Vartanian (2014) take this further, showing that our brain itself is wired to respond emotionally to aesthetics. Research on individual senses supports this too: colors shift moods (Elliot & Maier, 2014; Küller et al., 2006), soundscapes can calm or stress us (Kang & Schulte-Fortkamp, 2016), natural elements improve well-being (Kellert, 2008), and even subtle scents change how we feel and behave (Spangenberg et al., 2006).

Research Gap

Most existing studies focus on one sense at a time—such as light (Küller et al., 2006; Elliot & Maier, 2014), sound (Kang & Schulte-Fortkamp, 2016), or color (Elliot & Maier, 2014)—
rather than looking at how these senses interact together in real spaces. While VR research
has begun to combine multiple senses (Lyu et al., 2023; He et al., 2024; Li & Cooper, 2024), these studies are often experimental and do not fully reflect how everyday users experience multisensory design in lived environments. Other works highlight the role of culture and
personal memory in shaping preferences (Lee, 2022; Bourdieu, 1984), but very few directly explore how cultural or age differences change the way people emotionally respond to
interiors. Finally, even though studies confirm that sensory design influences emotion
(Chatterjee & Vartanian, 2014; Kellert, 2008; Spangenberg et al., 2006), there is still a lack of practical, designer-friendly frameworks to translate these insights into real-world
applications.

Research Questions

i. How do integrated sensory elements—such as color, geometry, texture, scent, and sound—collectively influence emotional experiences in interior spaces
ii. What kinds of emotional themes and personal narratives emerge when users interpret multisensory design elements?
iii. How do cultural and age-related differences shape the way people perceive and emotionally respond to multisensory interiors?
iv. How can qualitative insights from user experiences be translated into design principles that help create more emotionally supportive and inclusive spaces?

4. Methodology

This study employed a qualitative, survey-based approach to investigate the impact of multisensory elements in interior spaces based on emotional responses. A structured
questionnaire was created, focusing on four main sensory areas: visual (color, light, shape, materials), auditory (soundscapes, silence, background noise), Olfactory (Fragrances), and tactile/atmospheric (texture, warmth, spatial feel). The questionnaire contained 25 carefully crafted questions, offering a mix of descriptive, multiple-choice. Questions were written in simple, relatable language to be accessible to participants from different educational and
cultural backgrounds, while still exploring emotional connections with design features. For example, participants were asked: "How do you feel in a brightly lit space compared to a
dimly lit one?" and "What emotions come to mind when you think of natural materials like wood or stone in interiors?" This method enabled respondents to share emotions directly and reflectively, yielding nuanced insights into multisensory perception.

Data Collection and Analysis

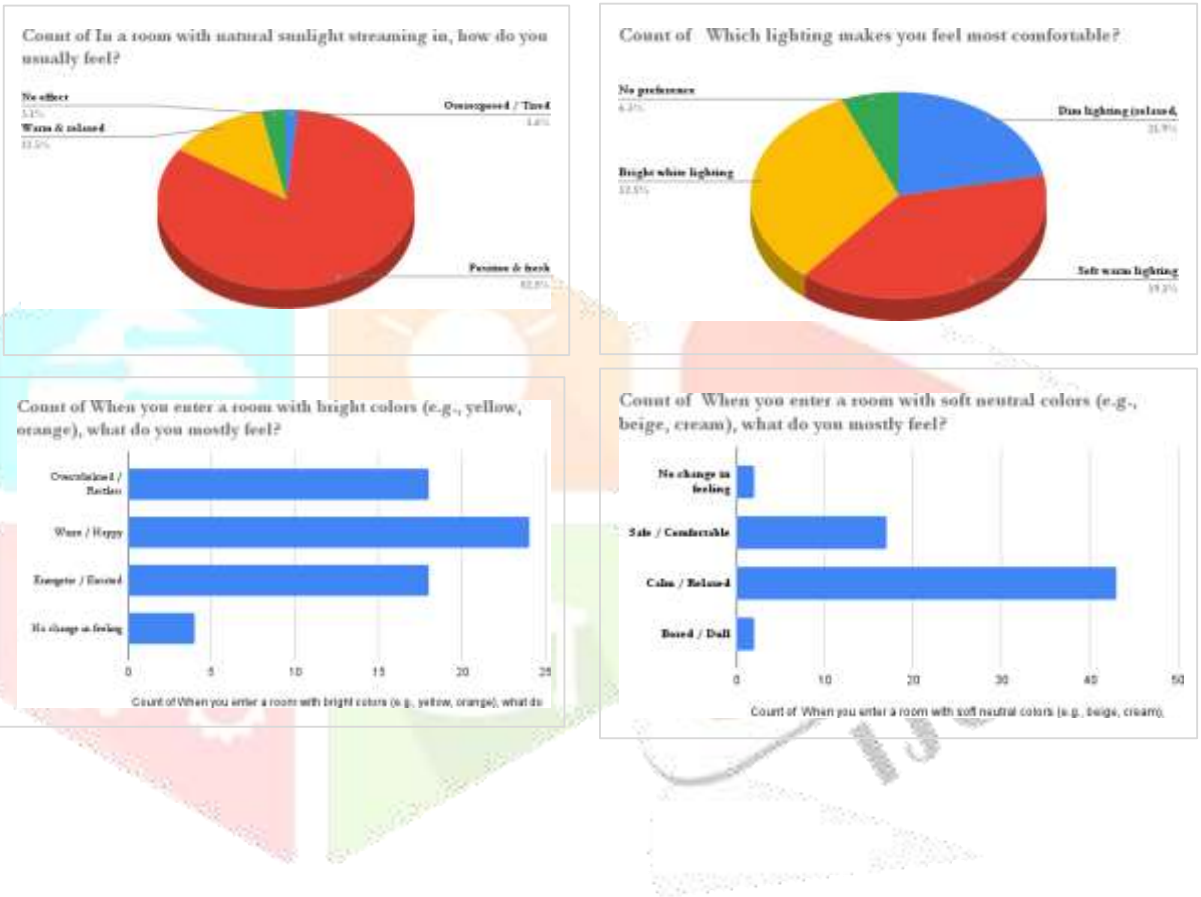
Fig 3- Screenshot of the survey conducted in Google forms.

The survey was conducted online using Google Forms and distributed across various social groups through email and social media platforms, ensuring a broad demographic reach. A
total of 64 valid responses were collected, representing different age groups, cultural backgrounds, and professional or educational fields.

The survey responses show that the emotional experience of interior spaces is deeply affected by sensory elements, with visual, auditory, tactile, olfactory, and cultural aspects each playing a unique role in shaping the perception of atmosphere. The following sections present the findings, organized by themes, to emphasize how different senses work together to influence users' emotional reactions.

a) Visual Perception

Visual qualities proved to be the strongest factor influencing emotional responses in interiors. Participants consistently associated **cool and neutral colors like blue, green, white, and beige with feelings of calmness, clarity, and relaxation**. Warmer hues, including red and orange, were chosen less often and were often described as stimulating or even overwhelming, indicating they're more suitable for energetic or social spaces. Lighting was another key element: bright, well-lit environments were linked to energy, positivity, and focus, while dimly lit spaces evoked intimacy and relaxation but could also feel dull for some**. A clear preference for natural light over artificial lighting** emerged, with daylight described as refreshing, life-giving, and emotionally uplifting.
Geometry and form also influenced responses: curvilinear shapes were associated with softness, comfort, and creativity, whereas straight lines and rigid geometries conveyed order, structure, and formality.

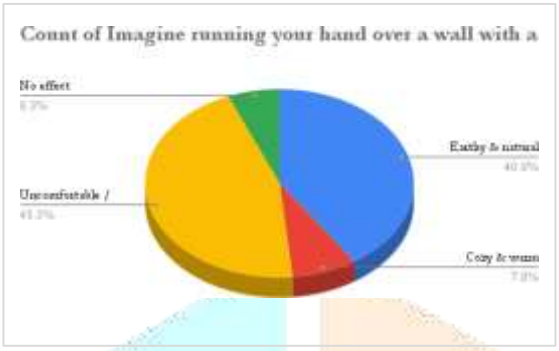


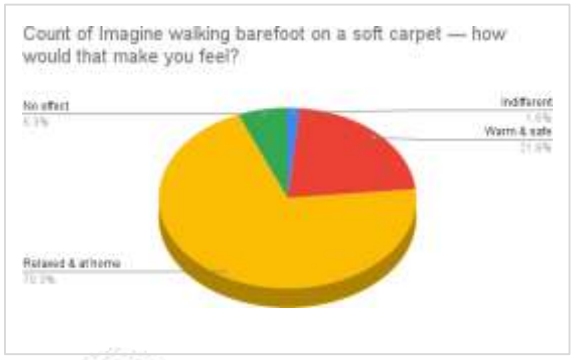
b) Auditory Perception

Sound played a secondary yet significant role in shaping emotional comfort. Many participants emphasized the **calming effects of natural soundscapes**—such as water, rustling leaves, or birdsong—which were perceived as stress-reducing and restorative. Mild background sounds, like soft music, were described as comforting and socially engaging, creating an inviting atmosphere. These findings highlight how soundscapes can act important in designing the interior spaces.

c) Tactile and Material Perception

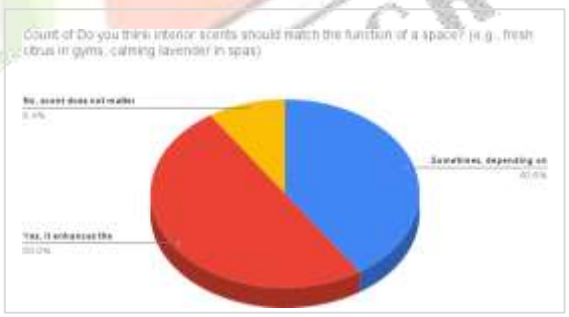
The materiality of interiors strongly influenced emotional impressions. **Natural materials such as wood, clay, and stone** were described as warm, grounding, and authentic. While wood and clay generated comfort and a sense of closeness to nature, stone was sometimes
regarded as cold or heavy, suggesting that tactile qualities are interpreted both physically and emotionally. A frequently mentioned scenario combining natural light, greenery, wooden furniture, and soft background music evoked feelings of relaxation, coziness, and happiness for most respondents. These findings underscore the emotional resonance of **biophilic design**, where natural textures and materials contribute to a restorative sensory experience.





d) Olfactory and Atmospheric Perception

Though less frequently emphasized, olfactory cues were nonetheless acknowledged as meaningful. **Fresh, natural scents**—from plants, flowers, or untreated wood—were
associated with relaxation and comfort. Artificial or absent odors, by contrast, were described as neutral at best or unpleasant at worst. While smell is often an overlooked design
dimension, the responses suggest that olfactory experiences subtly reinforce the overall emotional tone of a space.

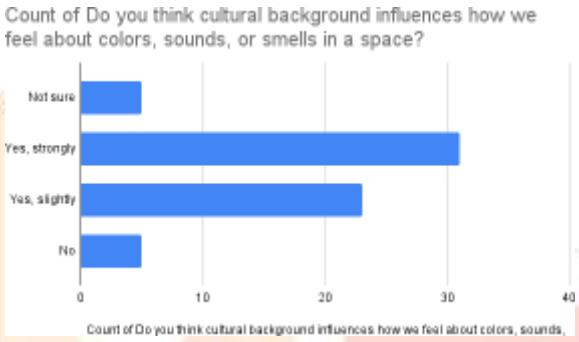


e) Cultural and Emotional Associations

Beyond sensory modalities, cultural references and personal memories played an important
role in shaping emotional connections to interiors. Younger participants favored minimal and modern spaces for their clarity and simplicity, while traditional interiors resonated more strongly with older respondents, evoking warmth, a sense of belonging, and nostalgia.
Cultural familiarity was described as a source of emotional security, identity, and comfort, suggesting that design cannot be evaluated purely through sensory universals but must also account for **personal and cultural narratives** embedded within space.

The third objective was to explore how people of different ages and cultural backgrounds respond emotionally to interior spaces. In practice, most of the participants in this study were young (18–25 years) and from India, with only a handful of older respondents and very few based outside the country. Because of this imbalance, it was not possible to run reliable statistical tests.

Even so, the responses reveal some interesting patterns. Younger participants often described daylight as giving them a sense of freshness and energy, while older participants tended to appreciate dimmer, warmer light that felt more comfortable, and they highlighted the calming role of pleasant scents. Cultural comparisons were limited, but one notable difference emerged: people who had traveled or lived in diverse environments were more likely to emphasize the harmonious interplay of light, sound, and scent, rather than focusing on individual sensory elements.



Age Group	Number of people	Key Observations
18–25	57	Daylight → refreshing/energizing; soft music & pleasant scents calming
26–35	5	More comfort with dim/warmer lighting; still value natural light
36–50	1	Single response: high ceilings → calmness
50+	2	Pleasant scents strongly linked to calmness; warm/dim light preference

Overall Insights

Taken together, the data illustrate that **visual elements**—particularly color and light—dominate emotional perception, while **natural materials, sounds, and scents** consistently foster positive responses by creating a sense of balance and connection with nature. Extreme conditions—such as overly bright lighting, silence, or rigid geometries—were found to be less favorable, highlighting the importance of moderation and sensory harmony. Cultural identity and memory further contextualize these experiences, anchoring them in personal meaning and familiarity.

5. Findings and Discussion

The results of this study provide insight into how multisensory design elements shape emotional responses within interior spaces. The findings confirm that sensory cues— particularly visual stimuli—play a dominant role, while tactile, auditory, and olfactory dimensions work together to create holistic experiences. Importantly, cultural identity and personal memory further modulate these responses, making the emotional language of space both universal and deeply individual.

a. Visual Stimuli as Primary Emotional Drivers

Survey results demonstrated that **color and light** are the strongest determinants of mood in interiors. Cool and neutral colors (blue, green, white, beige) consistently evoked calmness and relaxation, aligning with existing research that links blue and green with restorative psychological effects (Küller et al., 2009; Elliot & Maier, 2014). Conversely, warm colors such as red and orange, though stimulating, were seen as overwhelming by some participants, reinforcing prior studies on the arousing and sometimes stressful qualities of saturated hues.

Lighting also emerged as a key determinant: **natural light** was overwhelmingly preferred, described as refreshing, uplifting, and energizing. This supports the biophilic design framework (Kellert, 2008), which emphasizes daylight as both a physiological and psychological regulator. Dim lighting, although associated with intimacy, was perceived by some as dull or heavy, suggesting that designers must carefully calibrate light levels according to the function of the space.

b. The Role of Soundscapes in Emotional Regulation

Although less dominant than visual elements, **sound was shown to significantly influence emotional comfort**. Natural soundscapes (birds, water, wind) were consistently linked with calmness and restoration, echoing findings from soundscape research (Kang & Schulte-Fortkamp, 2016). Soft background music was associated with social warmth and relaxation, whereas silence produced mixed reactions—peaceful for some, isolating for others. This suggests that designers should approach acoustic design as an active component of spatial experience rather than a passive background condition.

c. Tactile and Material Experiences as Emotional Anchors

The tactile dimension of design revealed that **natural materials such as wood, clay, and stone** were highly valued for their warmth, authenticity, and grounding qualities. These responses align with neuroaesthetic perspectives, which argue that natural textures stimulate positive emotional and cognitive responses (Chatterjee & Vartanian, 2014). At the same time, certain materials like stone were described as cold or heavy, illustrating how tactile associations can be both comforting and alienating depending on context.

Importantly, participants frequently described ideal multisensory scenarios that combined **wooden furniture, greenery, natural light, and soft sounds**, which together generated feelings of relaxation and happiness. This reflects the holistic essence of **biophilic and multisensory design**, in which materials, light, and sound function collectively rather than in isolation.

d. The Subtle but Significant Role of Olfaction

Although smell was not emphasized to the same extent as visual or tactile elements, participants nonetheless highlighted the importance of **fresh and natural scents**. The presence of greenery, flowers, or untreated wood was associated with comfort, while artificial or absent odors were generally perceived as neutral or unpleasant. This echoes studies in environmental psychology, which show that olfactory cues—though often subconscious—can profoundly affect mood and memory (Spangenberg et al., 2006). Designers therefore should not overlook olfaction as a subtle yet impactful component of spatial atmosphere.

e. Cultural Context and Emotional Meaning

A significant finding was the influence of **cultural and generational differences** on spatial preferences. Younger participants tended to prefer minimal, modern interiors for their clarity and simplicity, while older respondents valued traditional elements that evoked nostalgia, belonging, and warmth. This reflects Bourdieu's (1984) argument that aesthetic preferences are socially and culturally constructed, shaped by personal history and identity. Thus, while sensory elements provide a baseline emotional impact, cultural context determines how these stimuli are interpreted and internalized.

Integrated Insights

The findings suggest that **visual design remains the dominant language of emotional perception**, but that its effects are amplified—or mitigated—by tactile, auditory, and olfactory dimensions. Spaces that balance multiple sensory inputs in harmony were consistently rated as more emotionally positive. Extreme conditions—such as overly bright lighting, silence, or rigid geometry—tended to create discomfort, highlighting the importance of moderation and sensory balance. Finally, cultural and generational differences emphasize the need for **context-sensitive design strategies** that respect diversity in emotional associations with space.

6. Conclusion

This study explored how interiors communicate emotionally through light, color, sound, scent, and touch. Visual cues, especially lighting and color, emerged as the strongest drivers of feeling, but textures, natural sounds, and subtle fragrances also played a vital role in creating spaces that feel immersive and memorable.

Age and cultural background added nuance to these responses. Younger participants often linked daylight to energy and freshness, while older respondents valued the comfort of warmer lighting and the calming effect of scents. Though cultural comparisons were limited, those with wider travel experience stressed the importance of harmony across senses rather than any single element.

Overall, the findings remind us that interiors are not just seen but felt. The emotional impact of a space comes from the interplay of multiple senses, shaped by personal identity and experience. Designing with this in mind can move interiors beyond aesthetics toward environments that truly support comfort, well-being, and connection.

7. Design Implications

The findings of this study provide several practical insights for interior designers and architects:

- **Light and Color Matter Most**

Natural light lifts mood and makes spaces feel alive. Artificial lighting should avoid glare but also not feel too dull. Colors should be chosen for how they make people feel, not just how they look.

- **Use Natural Materials**

Wood, clay, and stone bring warmth and authenticity. They help people feel grounded and can soften cold or sterile interiors.

- **Think About Sound**

Gentle music or natural sounds like water and birdsong can make spaces feel calm and welcoming. Sound design should be a key part of creating comfort.

- **Add Subtle Scents**

A light touch of natural fragrance—plants, wood, or soft aromas—can make spaces feel more memorable and emotionally engaging.

- **Design for People, Not Just Spaces**

Preferences change with age and culture. Younger users may like modern simplicity, while older ones may feel more connected to traditional styles.
Designing with these differences in mind makes spaces more inclusive and personal.

All of this shows that multisensory design brings together looks, feelings, and culture to create spaces that people can truly connect with.

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