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A Review of Color and Material Strategies for Inclusive Architectural Design: Enhancing Sensory Experience for People with Disabilities

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Abstract

This review examines the role of color and material strategies in enhancing inclusive architectural design for people with disabilities. As societies become increasingly diverse, architects face the challenge of creating environments that accommodate users with a wide range of cognitive and physical abilities. The study aims to synthesize existing knowledge on how color and materials influence accessibility, safety, and comfort in the built environment. A narrative review approach was adopted, integrating findings from international case studies and scholarly literature. The analysis emphasized sensory experience, tactile perception, and visual accessibility in architectural contexts. Evidence shows that appropriate color contrast and material texture can significantly improve wayfinding, safety, and psychological comfort, particularly for users with visual or mobility impairments. Furthermore, the integration of sensory-based design principles promotes emotional well-being and social inclusion. This study contributes to the growing discourse on universal design by highlighting practical design guidelines for architects, urban planners, and policymakers. It also underscores the need for future research on multisensory design frameworks that advance inclusivity and equitable access for all users.

Keywords: Accessibility, Color Theory, Inclusive design, Materiality, Sensory Architecture, Universal Design.

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1. Introduction

Designing inclusive environments that respond to the diverse abilities of users has become a central challenge for contemporary architects, planners, and designers. The increasing diversity of human populations comprising both able-bodied individuals and those with various physical, sensory, and cognitive impairments requires environments that ensure equitable access, comfort, and participation for all users. In recent decades, the architectural field has embraced the principles of universal design and inclusive design, emphasizing those spaces should not only meet functional needs but also foster dignity, autonomy, and sensory engagement.

Contemporary architectural discourse further recognizes that inclusivity extends beyond physical accessibility; it involves creating multi-sensory spatial experiences that engage users emotionally, cognitively, and perceptually. Within this framework, color and material selection play a vital role in shaping how individuals perceive, navigate, and interact with built environments. Both elements contribute to legibility, safety, and comfort factors essential for people with disabilities and beneficial for the general population alike.

However, despite the growing awareness of inclusive design principles, the specific relationship between color, materials, and sensory accessibility remains underexplored in existing architectural research. Few review studies have systematically synthesized how these visual and tactile components enhance inclusivity in practice. Therefore, this paper seeks to address this research gap by reviewing key theories, empirical studies, and practical applications that demonstrate how color and materials can be strategically employed to improve sensory experience and inclusivity in architectural environments.

The term inclusive design refers to design that emphasizes the connection between the conduct and concerns of individual people and the conduct and concerns of most of society, making existing and potential disparities less obvious and less easy to accomplish in the process. Additionally, there are several names for inclusive design, such as universal design in the United States and design for everyone in Europe [1]. But as shown in [2] the core concept is understanding users' capabilities, needs, and expectations. The goal of inclusive design is to eliminate any obstacles that would keep someone from freely and easily utilizing a space. In addition to being able to escape in the case of a fire or other emergency, everyone should be able to readily, comfortably, and independently access and use a facility and its amenities. Whether a facility is a school, office, hospital, gym, retail store, or another public institution, this method guarantees that it functions better for everyone [3]. An inclusive design approach can help to deliver the following five key benefits to users: 1. welcoming to all users 2. Responsive to all the needs of people 3. Intuitive to use for all 4. Offer flexible options, depending on the requirements of different users 5. Optimize independence [3].

This work explores the relationship between color and materials in the inclusive design process. The research focus is the exploration of the ability of color and material design to address the problem of inclusive design in an effective way. For inclusive design to be effective, it is necessary that the cognitive and physical abilities of end users be taken into account. The aim of this research is to understand what information about a product or service is 1) desirable and 2) necessary. With this information, the designer can create

knowledge and information structures that allow users to make informed decisions that are essential to their different abilities.

2. Literature Review

In recent years, inclusive design has attracted international attention as a means to promote human well-being and social equity across the expanse of human activities, such as the built environment, transportation, communications, products, and services. The purpose of inclusive design is to serve the full range of human diversity by providing attractive products with market potential [4].

Every person may have a disability at some point in their life for a variety of reasons, including disease, accidents, or growing older. Disability is a social phenomenon and an integral aspect of human life. According to statistics, as science and technology progress and the frequency of accidents rises, the number of people with disabilities not only does not decline but rather rises annually. Equal chances must be given to all members of society, as they have an equal right to use public facilities and services and to develop their skills. Given that some people lose some of their abilities and develop physical mobility disabilities as a result of natural or other causes, it is imperative that public buildings, whether owned by the government or privately, be modified to accommodate people by offering architectural and urban planning features. Utilizing the skills that are already present in a community is essential to its growth and development. [5]

The degree of a person's impairment, which is seen as a normal part of life, depends on their surroundings. It becomes apparent when someone is denied access to or encounters difficulties using amenities that society has made available to the broader population. Therefore, while building environments, designers must constantly take into account people's movement constraints at different phases of life. [6]

Designing disability-forward communities not only meets the overlooked and undersupplied housing needs of 1 in 4 people with disabilities but also creates better housing for all people. An approach focused on cross-disability access, choices throughout the design process, and intersection benefits all support the creation of truly inclusive housing that meets diverse community needs [7].

In most countries around the world, measures have been implemented in urban design and architecture to enable individuals with mobility limitations to navigate the city independently and utilize urban services and facilities without the need for assistance. According to international definitions and the United Nations, a barrier-free environment refers to the accessibility of urban spaces and public buildings for all individuals, especially those with mobility limitations, without encountering obstacles. [8] The process of improving and modifying existing conditions to eliminate physical and architectural barriers, thereby creating a barrier-free and accessible environment for all individuals, particularly those with disabilities, is referred to as adaptation or accessibility enhancement. This ensures that everyone can move freely, with dignity, and without the need for assistance, while benefiting from public facilities and exercising their citizenship rights.

In addressing the challenges of creating accessible environments for individuals with disabilities, several critical issues emerge. One significant factor is the lack of awareness and understanding among designers regarding the capabilities and needs of individuals with disabilities, which often leads to the exclusion of essential accessibility considerations in architectural and urban designs. Additionally, employers and project stakeholders may either deliberately or inadvertently neglect the challenges faced by disabled individuals, further exacerbating the problem. Contractors also frequently lack knowledge of existing accessibility regulations and remain unfamiliar with the technical execution of construction details that accommodate the physical conditions of individuals with disabilities. Moreover, a comprehensive understanding of the technical and engineering requirements for a barrier-free environment is often missing, even among professionals tasked with implementing these measures. These barriers collectively hinder the development of inclusive spaces and highlight the need for enhanced education, training, and enforcement of accessibility standards in the built environment. [9]

According to [10], to effectively recreate urban environments, it is essential to analyze the current conditions of these spaces by considering both objective and subjective factors. Objective factors play a fundamental role in shaping subjective experiences, as individuals perceive and interact with their surroundings based on these physical characteristics. People's experiences within a space, including how they feel and behave, significantly influence their social interactions. Therefore, a primary focus on the physical elements of an urban environment is critical. This approach not only ensures the optimization of aesthetic features but also fosters social cohesion and creates spaces where individuals feel content and engaged.

1. Artificial and natural components, as subjective factors, contribute to forming the physical aspects of urban squares.
2. When suitable subjective factors are present, the area develops appropriate personal characteristics that enhance user experiences.
3. In environments where both subjective and objective factors are effectively integrated, individuals experience a sense of happiness and satisfaction within the space.

The environment plays a crucial role in determining the extent of an individual’s disability, which is considered a natural aspect of life. Disability becomes evident when a person is deprived of or faces challenges in accessing the facilities and resources that are universally available to others in society. Therefore, designers must consistently consider the mobility limitations of individuals at various stages of life when designing spaces, ensuring inclusivity and accessibility for all. [6]

2.1. Significance of Color in Inclusive Design and its basic theories

Wherever and however we live, and in whatever we do, we are surrounded by color. This color is believed to be a property of the things we see, but in reality, what happens is a specific process of color generation happening in the brain. The way in which the eye perceives color is a unique and personal experience for each individual. Any object where light falls can absorb, reflect, or transmit light. The parts that reflect light determine the

color perceived when they are illuminated or when they are struck by a light source of different wavelengths. These wavelength fractions form a stimulus for color perception. Considering the extreme sensitivity of the human eye to yellow light, illuminated objects that reflect a specific ratio of long and medium wavelength light are magenta objects. Therefore, green elements absorb light in the specified wavelength more than magenta ones. Similarly, a color is perceived as the opposite of what is reflected, as in the case of the black and white 'impossible trapezoid.' This property of perception can be used to demonstrate how multiple combinations of color can be realized without using excessive materials.

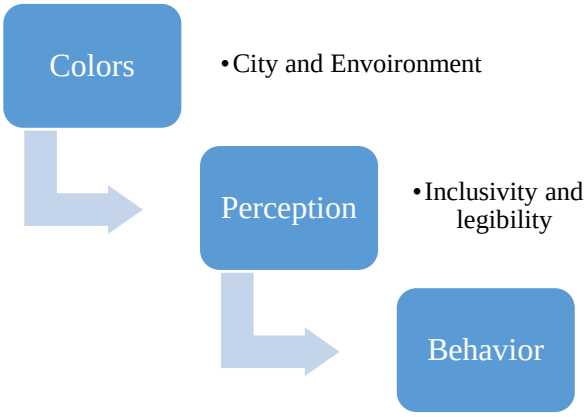


Fig. 1. Relationship between color, environment, and Human Behavior

Since Cityscape is an objective reality that every person experiences and attains through interaction with the city and mental evaluation that results in perception of perspective, when trying to make designs inclusive in the broadest sense of the word, this must include legibility and a user's ability to function well without feeling different or stigmatized. One of the things that may have a variety of effects on people is color, which can represent their culture, beliefs, and even feelings [10]. The Inclusive Design approach becomes significant. It suggests that inclusive design is not so much a question of special design for ‘special people’, but of broader design for everyone in which special needs are taken into consideration. The focus is on visual legibility in the built and urban environments.
On the other hand, the term for someone who has trouble seeing color is Color Vision Deficiency (CVD). Given the worldwide impact of CVD, this is especially crucial. According to Color Blind Awareness, there are actually about 300 million people with CVD worldwide. Red, green, and blue light cones can all be seen with normal vision. Nonetheless, there are four categories of people with CVDs: Protanopia: Diminishes red light sensitivity. Green light sensitivity is decreased by deuteranopia. Tritanopia: Diminishes blue light sensitivity. Achromatopsia: When all three colors are completely lost or diminished [11]. As shown in Fig. 2, three colors relationship in vision deficiency.



Fig. 2. Color vision deficiency *[11]*

2.2. Psychological and Emotional Impact of Color

The topic of color and its impact on human beings and their activities is complex, and the role of both psychological and physiological factors must be acknowledged. Bear in mind that ethnicity, cultural heritage, religious norms, and age can be significant influences on color selection and the interpretation and preference for color by different groups of people. One's preferences are also liable to change over time, especially during the aging process. A preference is not the same as a choice or selection, and what is emotionally appealing is not always functionally optimal. Color can help create a supportive environment, but it can also contribute to greater security by positively influencing moods and perceptions.

Humans, especially young children, unthinkingly learn a vast range of responses to different colors. For instance, green is linked to nature and therefore is a source of calm and reassurance. The color blue is often associated with being spiritual, with the ocean, and with peace. At the same time, the colors red, bright yellow, and orange are associated with danger, prompting some businesses to avoid the use of these colors in their premises. Designers know that they can create an illusion, a sense of extra space, or depth to a room by using light colors. They understand that the visual interest and emphasis can be created by using dark or textured colors and include focal points of rich colors for variety. Similarly, the 'feeling' of a material can also create a psychological response and be used to facilitate the purpose of the product in the same way that color can create a sense of reassurance, comfort, and mood.

2.3. Role of Materials in Inclusive Design

Materials can play in realizing successful and inclusive environments. Central to this discussion is the premise that materials are pivotal to the availability, design, and success of products and environments. It is emphasized that the range of inclusive design considerations throughout the design process must be reflected in the meaning and priorities of the term 'sustainable materials' and the direction and underpinning principles of materials education.

The potential benefits of inclusive environments are numerous. Encouraging inclusivity can enable societies to properly value the diversity of their citizenship. Inclusion in all environments can also add to perceptions of confidence and security, social cohesion,

independence, and quality of life. However, in discussing these considerations, it is important to be aware of the potential design problems that can severely restrict activities and interactions in products and environments. Equally, it is essential to identify and address the interconnection between design solutions and resources. The focus is particularly given to the role of materials in the inclusive and sustainable design of products and the built environment. For both types of design, a wide range of inclusive considerations needs to be made throughout the design process. Material theory is an intricate framework consisting of a variety of physical and natural resources that have physical traits and an influence over related characteristics.

2.4. Materials and Textures in Inclusive Design

Materials can be understood as both designers' tools and as a consequence of design treatment. This suggests that inclusive design could be facilitated and hidden and forgotten in plain sight, as tangible landmarks and conceptual materials, which are information-carrying materials that convey meaning for a person. The implications of the perceived attributes are discussed. As a result, development opportunities, namely new materials and textures, variables, and concerns, together with the design role, do and do not play in inclusive design.

In virtually all everyday human endeavors, materials and textures play a central role. Material determines what a box is by means of its properties, appearance, and tactility. The paper inside is hidden, but the box reveals and represents its presence. Thus, materials are more than just the stuff of which products are made. In essence, there is a twofold role. They are first raw tools for product design: attributes used to create solutions. While some attributes are aesthetic and used to evoke certain appearances, many have their inherent cultural and historical semantics and symbolism, while most concern functionality: the properties and behaviors that provide exemplars of solutions to problems raised by human behaviors, including physiological, cognitive, physical, and interaction problems.

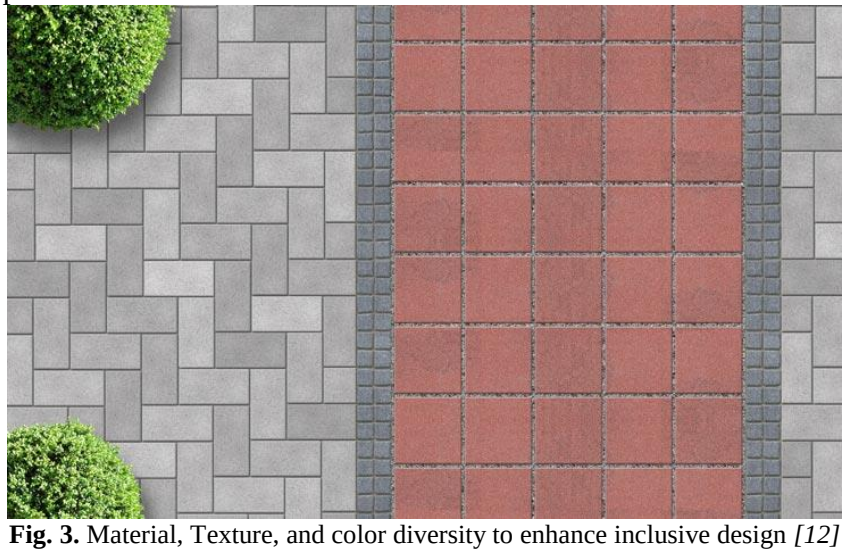


Fig. 3. Material, Texture, and color diversity to enhance inclusive design *[12]*

2.5. Sensory Considerations in Design

The function of sensory systems is to help us gather, sort, and organize sensations about the world in which we live, and to enable us to make sense of these sensations and act appropriately in our environment. Our sensory experiences stimulate our brain to respond emotionally, cognitively, and empathically. Sensory information is sought, evaluated, and analyzed before action is taken. The way we process sensory information may change with time due to accumulated knowledge and experiences, and also as a result of errors and successes. This process of acquiring and processing sensory information serves to help us develop a variety of strengths and preferences. These preferences manifest themselves in the products we use, the activities we do on a daily basis, the spaces we occupy, and the interactions we have with others on personal and professional levels. While some people may react very positively to a certain product, there will always be a small number who display a negative reaction to the same object or space. Therefore, knowledge about people's sensory strengths and definite preferences can be seen as the key to tolerance and inclusiveness in design. Knowing the association between specific sensory characteristics and reactions, and the preferences around them, could drive greater support for sensory diversity in general.

2.6. Tactile Sensitivity

Tactile sensitivity is another sense that is crucial in terms of delivering inclusive and successful design. Haptic qualities, the physical tactile aspects of materials, directly influence people's interaction and perception of the world around them. Studies have investigated how individuals respond to different tactile attributes, such as softness or hardness, color or specific materials, and the effect these have on the perception of the world around them.

Some of the studies have directly addressed universal design, discovering links between motor ability and skill development. As an example, it has been shown that the materials and colors utilized by toys provide additional tactile information that affects young children's responses. Furthermore, when toys are grouped together, similarities between materials are more prominent than when the toys are categorized by color. Overall, the research area reveals that how we are able to experience our environment very much depends on the interrelationship between our senses and the material qualities of our environment. As designers, we are able to adjust this relationship through the materials we choose and the way we realize them.

2.7. Tactile Materials for the Visually Impaired

The use of embossing and tactile materials provides an effective strategy for conveying visual information to people who are blind or visually impaired through non-visual sensory channels. Tactile surfaces enable users to perceive architectural and design environments by interpreting material qualities, proportions, spatial scales, and surface textures such as smoothness or roughness. This sensory engagement facilitates independent navigation, strengthens users' ability to recognize contemporary design products, and enhances their emotional and cultural connection to built spaces. In educational contexts, tactile representations and three-dimensional models serve as

valuable didactic tools, allowing learners to access and understand visual information through material culture. Such strategies not only support autonomous learning and interaction but also play a critical role in promoting social inclusion by ensuring that individuals with diverse sensory abilities can fully participate in design-related activities. Moreover, incorporating tactile communication in design reflects a broader commitment to inclusive and universal design principles, acknowledging individual differences and expanding accessibility for a wider range of users.

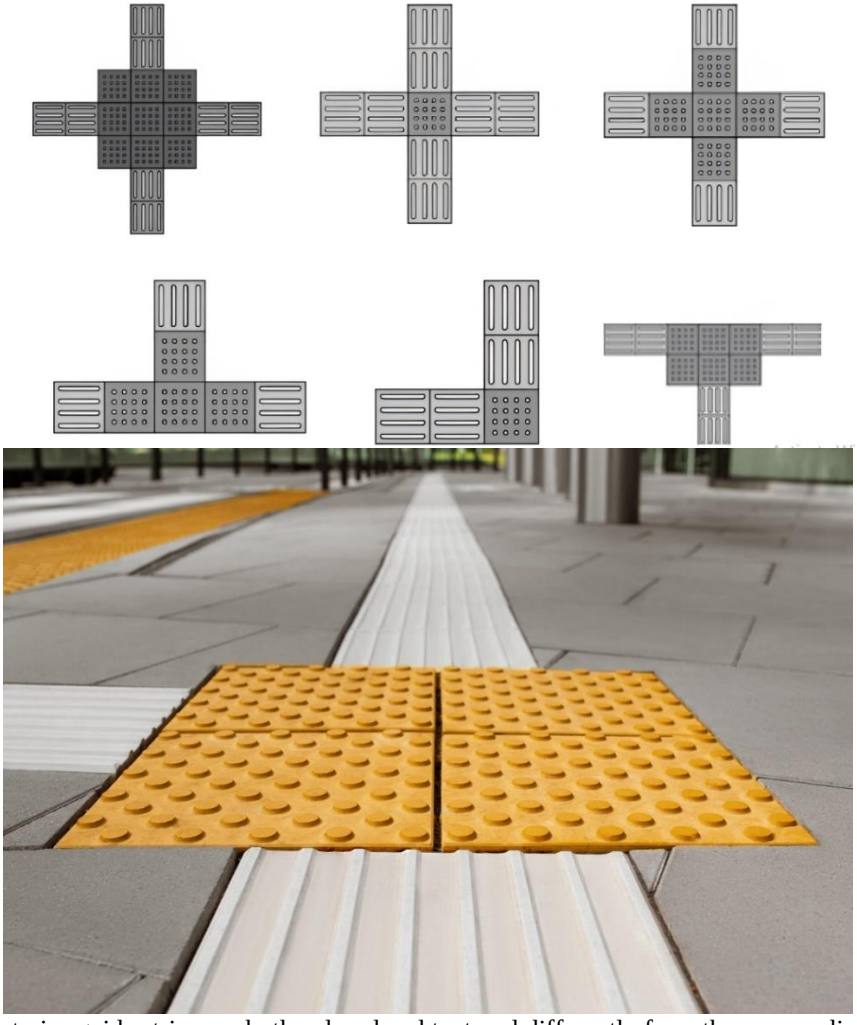


Fig. 4. Exterior guide strips are both colored and textured differently from the surrounding paving *[13]*

3. Research Methodology

This research adopts a qualitative narrative review approach to enable an in-depth exploration of textual resources related to inclusive design considerations, with a specific focus on the role of color and material in accessibility for individuals with diverse abilities.

The study begins with a comprehensive literature review, aimed at identifying and analyzing existing academic discourse on inclusive and universal design. Particular

attention is given to how color and material choices affect individuals with various disabilities, highlighting the intersection of design, psychology, and functionality.

Search Strategy

To ensure a systematic and transparent review process, a structured search strategy was employed across multiple academic databases and sources. The following databases were searched: Scopus, Web of Science, ScienceDirect, Google Scholar.

Additionally, relevant grey literature (e.g., reports from disability advocacy organizations, design guidelines, and policy documents) was reviewed to broaden the scope and include non-academic yet influential perspectives.

The search covered publications between 2000 and 2025, ensuring both historical and contemporary perspectives on inclusive design were considered.

The search strategy used Boolean operators and combinations of the following keywords and phrases:

- "Inclusive design" or "Universal design"
- "Color psychology" and "Accessibility"
- "Sensory design" and "Material selection"
- "Design for all" and "Human disabilities"

Each keyword was searched in titles, abstracts, and full texts where possible. Reference lists of key studies were also manually screened to identify additional relevant sources that were not captured in the initial database search.

Data collection was systematically structured to optimize the use of library and database resources. Multiple textual formats, including peer-reviewed journal articles, books, case studies, and theoretical papers, were examined to provide a multi-perspective understanding of how design interventions influence usability for people with disabilities.

Following data collection, a rigorous textual analysis was conducted. Key themes regarding the role of color in design and the contribution of different materials to accessibility were identified and categorized through qualitative coding, allowing for an organized and structured interpretation of findings.

A critical evaluation of the texts was then undertaken, examining how various designs address the needs of individuals with differing abilities, focusing on both the emotional and psychological impacts of color and the functional roles of materials in promoting accessibility. By comparing design practices and their outcomes, the study seeks to establish best practices to guide future inclusive design efforts.

Finally, the findings were synthesized to draw conclusions on the significance of color and materials in enhancing inclusive design. This synthesis contributes to existing theoretical frameworks and provides practical recommendations for designers,

highlighting effective strategies for implementing color and material choices that maximize inclusivity and accessibility.

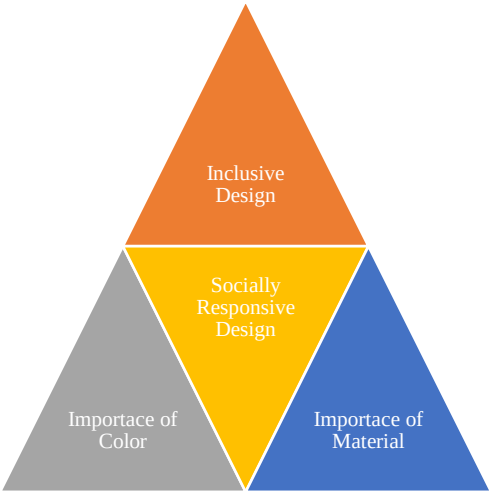


Fig. 5. Scope and the Way of the Research

4. Result and Significant findings

To achieve this objective, a comprehensive understanding of people's needs and aspirations is essential for enhancing the quality of life and experiences of individuals across all ages and abilities. Recognizing people's functional capacities and limitations establishes a strong foundation for best practices in the design of the built environment and, by extension, contributes to overall human well-being. Such insights can guide the development of innovative strategies and incentives that effectively address the needs of an aging population with enduring functional limitations.

Research on color contrast in inclusive design has shown that legibility is significantly influenced by the contrast between background and foreground elements. For example, participants could easily read text when a dark object (e.g., black or dark blue) was placed on a light background (e.g., white, light grey, or yellow), or when a light object (e.g., white or yellow) was placed on a dark background (e.g., dark grey, dark blue, red, or black). Conversely, low-contrast combinations, such as orange on dark yellow, black on dark grey, or yellow on white, were found to be difficult or impossible to read. These findings highlight the importance of careful color selection in creating accessible visual materials, particularly for older adults, and reinforce the role of inclusive design in supporting usability for diverse user groups.

Table 1. Key Findings about Color and Material in Inclusive Design

Condition or Disability	Action/ color and material
Alzheimer's Disease: A condition that worsens over time and is mostly irreversible, progressively reducing cognitive ability and functioning skills until complete care from others is required. Alzheimer's typically affects the	• Legibility: landmarks outside and inside buildings can aid with direction. • Interaction with people and chances for social interactions, Safe

elderly; however, it can also strike persons in their midlife.	• Walking routes should be provided both inside and outside of assisted living facilities.
Walking / mobility problems: Wheelchair users are by no means the only persons with both short-term and long-term mobility issues.	• Steps are typically easier for those who have had a leg amputated to use as a building entrance than ramps. • Handrails ought to be made of warm materials, like wood, and their colors should contrast with the surrounding area. The handrail section should be easy to grasp.
Ageing: can have effects such as decreased physical agility, movement, hearing, and vision	• Legibility and good landmarks, as well as buildings and areas that are easy to read.
Childhood: Characterized by restricted strength, grasp, height, and reach, which makes it challenging and occasionally hazardous to safely use facilities and reach commonplace objects. One of the characteristics of early life is the incapacity to comprehend the location and magnitude of danger.	• Safety in the home is a crucial factor because many accidents happen there. • Opportunities for both formal and unstructured play in both indoor and outdoor settings. Play areas must be designed and equipped with children with disabilities. • Safe and convenient routes to facilities, particularly schools, are necessary to promote independence and personal growth and to lessen traffic because cars are often used for school run transportation.
Hearing impairments: A wide variety of hearing loss kinds. British Sign Language, which is becoming more and more acknowledged as a language and culture unto itself, is used by some people.	• Install infrared systems or induction loops in public buildings. To guarantee that alarms warn of threats, the safety of those who are hard of hearing in the case of a fire must be considered. Consider the demand, especially in reception areas and entrances, elevators, escalators, phones, security phones, and smoke and fire alarm systems. • Avoid busy background textures, wallpapers, or graphics at communication points that could interfere with lip reading.
Visual impairments include a wide variety of conditions, such as tunnel vision, blurred or hazy vision, spots or dark patches that impair vision, and trouble identifying details. Many people with visual impairments struggle to assess distances; for example, losing one eye's vision or peripheral vision makes it harder to make decisions. Many people suffer from impaired color discrimination, particularly those in the red-green spectrum. Keep in mind that many people require glasses to help them see better, but circumstances, like	• Needs for wayfinding are undoubtedly a big problem. A logical layout facilitates wayfinding. Using a vocabulary of textures in streets and buildings might be beneficial. • Wayfinding and interpretation, such as of tourist destinations, can be facilitated by tactile models. To assist those who are blind or have low vision, use aromatic components. To guarantee inclusive emergency egress, implement safety zones, clear wayfinding signs, and audible and visible emergency alert signaling. • Paths and vehicle routes must have clearly marked edges. • Avoid obstacles like bollards, street furniture, and trip hazards in the streets and on the way to buildings. For those who are blind or visually impaired, low bollards can be very hazardous. There should be tactile alerts at crossings. • Advice on signage is especially crucial. • People should avoid navigating steps in their own shadow by using contrasting colors and well-lit areas. At the top

swimming pools, they might need to take them off. In recreation centers and swimming pools, inclusive design is especially crucial.	and bottom of the stairs, place tactile warning signs. For visually challenged people, different flooring textures, for example, can convey messages like this is a circulation area. • Illumination: Avert areas of glare and darkness, particularly at entrances, and take note of the challenges that arise when transitioning from darkness to light by taking entry illumination into account. Keep in mind that too much white on white, such as white floors and white tiles combined with sanitary fixtures, might produce glare. Doors and walls should have different colors. Because fully glazed entrance doors are hard to read, they frequently have stickers, notes, and other warning signs to alert people to potential hazards. The end result is an ugly appearance. People with low vision may become distracted by busy design elements. Simple color palettes are usually the most effective. • Avoid glossy surfaces, walls, and floors as they reflect and glare. • Lifts should have audible announcements. • Security devices, such as entry phones and swipe card systems, must be used for sensory impairment people

5. Conclusion and Recommendations

The integration of color, material, and texture plays a critical role in inclusive design, and these elements should no longer be overlooked as secondary considerations. Through a comprehensive literature review and analytical examination of two contrasting retail environments, it became evident that the careful incorporation of color and material can significantly influence mood an essential factor in emotional interaction. Moreover, the combined use of color and materials can serve as a conduit for engaging multiple senses, providing alternative modes of interaction for individuals with visual or other sensory impairments. Colors of medium to high saturation were observed to capture attention effectively, while materials with distinct tactile qualities proved particularly important. When employed together, color and texture can amplify sensory differences, enhancing perception and supporting a more inclusive design. The interrelationship of sensory perception in the built environment should not be underestimated, as it fundamentally informs how users experience and navigate spaces.

Designing with a focus on color and material should be recognized as a strategy to enhance both physical and emotional well-being, fostering a multi-sensory engagement with the environment. Evidence from the literature supports the learning, health-promoting, and emotional benefits of such design approaches, suggesting that color and material considerations should be prioritized in inclusive design. Harmonized textures and color schemes can provide spatial identity and organization, acting as implicit guides and educational tools within the built environment. Pedagogical materials, in particular, can help children develop individualized perception skills, supporting interaction with their surroundings in a way that accommodates diverse abilities.

In conclusion, this research demonstrates that the strategic use of color and materials positively enhances three core aspects of inclusive design. At the physical level, appropriate colors and material finishes improve safety, legibility, and wayfinding. Socially, the thoughtful application of color fosters a more welcoming and inclusive environment, while the selection of appropriate materials contributes to comfort and accessibility. Beyond aesthetics, color perception influences internal biological processes, including visual and circadian responses, and plays a vital role in social and emotional inclusion. Similarly, materials possess not only functional and physical qualities but also social, cultural, and experiential significance, shaped by historical, economic, and geographic contexts, all of which impact human perception and well-being.

The findings also provide practical guidance for future design interventions, emphasizing considerations such as material junctions, tactile properties, and historical and cultural context. These recommendations offer a foundation for further academic research, contributing to the development of inclusive environments that reflect the cultural, social, and material dimensions of design while promoting accessibility, equity, and human well-being.

References

[1] R. Coleman, inclusive design: design for the whole population, Springer, 2003, pp. 1-25.

[2] D. Johnson, "Capability measurement for inclusive design," Journal of Engineering Design, vol. 21, no. 2-3, pp. 275-288, 2010.

[3] A. ABLOY, "Inclusive design – Why should you care?," ASSA ABLOY Opening Solutions, Willenhall, 2020.

[4] G. Lee, "Inclusive Colour and Information Design," School of Design, Faculty of Arts, Humanities and Cultures, 2022.

[5] K. Sarihi, "Majmū‘eh Zavābet Jahat-e Monāsebsāzī-ye Mohīt-e Shahrī, Edārī va Maskūnī Jahat-e Estefāde-ye Ma‘lūlīn-e Jesmī–Harekatī," Faslnāmeh-ye Motāle‘āt-e Ravānshenāsī va ‘Olūm-e Tarbiyatī, vol. 2, no. 4, 1395.

[6] N. Rafizada, "Vākāvī-ye ‘Ellal-e Adam-e Matlūbīyat-e Monāsebsāzīhā-ye Anjām Shode dar Masīrhā-ye Piyāde-ye Shahr-e Tehrān be Manzūr-e Tas’hīl-e Taraddod-e Afrād-e Dārā-ye Mahdūdīyat-e Harakat," Me‘mārī va Shahrsāzī Ārmānshahr, 1995.

[7] B. Hurd, D. Howell , L. X. Z. Brown, J. Cowing and L. Craig , "Inclusive Design Standards," U.S..

[8] UN, "www.un.org," 2024. [Online].

[9] N. Rafizada, "Vākāvī-e ‘Ellal-e Adam-e Matlūbīyat-e Monāsebsāzīhā-ye Anjām Shode dar Masīrhā-ye Piyāde-ye Shahr-e Tehrān be Manzūr-e Tas’hīl-e Taraddod-e Afrād-e Dārā-ye Mahdūdīyat-e Harakat," Me‘mārī va Shahrsāzī Ārmānshahr, vol. 17, no. 2, pp. 37-51, 1992.

[10] R. KHALILI, "The Role of Color in Sense of Place," Tehran, 2019.

[11] KOMODO, "Common misconceptions about colour accessibility," 2023.

[12] produces, "alfa-lacke.de," [Online]. Available: https://alfa-lacke.de/industrie-lack-bestellen/lack-fuer-hofflaechen-lackierung-bodenflaeche/lackierung-verbundstein-2/.

[13] M. Architecture, "INCLUSIVE DESIGN STANDARDS," Kelsey, 2023.

[14] Stratton, Victoria, Lanteigne and Peter, "INCLUSIVE BUILDING PERFORMANCE GUIDELINES, A Pathway for Advancing Equity in the Built Environment," 2021.

[15] G. Raheja, A. Isha and B. Amrendra, HARMONISED GUIDELINES & STANDARDS FOR UNIVERSAL ACCESSIBILITY IN India 2021, New Delhi: Ministry of Housing and Urban Affairs (MoHUA), 2021.

[16] Silva and F. Moreira da, "Colour and inclusivity: a visual communication design project with older people," IOS press, pp. 4746-4753, 2012.

[17] Shahrsāzī and Markaz-e Tahqīqāt-e Rāh va Maskan, Zavābet va Moqarrarāt-e Shahrsāzī va Me'mārī barāye Afrād-e Dārā-ye Ma'lūlīyat-e Jesmī va Harekatī, Tehran, 1398.

[18] S. Manley, INCLUSIVE DESIGN IN THE BUILT ENVOIRONMENT, Design Commission for Wales, 2016.

[19] K. A. Finnigan, "Sensory responsive environments: A qualitative study on perceived relationships between outdoor built environments and sensory sensitivities," Land, vol. 13, no. 5, p. 636, 2024, doi: 10.3390/land13050636.

[20] S. E. Chidiac, M. A. Reda, and G. E. Marjaba, "Accessibility of the built environment for people with sensory disabilities—Review quality and representation of evidence," Buildings, vol. 14, no. 3, p. 707, 2024, doi: 10.3390/buildings14030707.

[21] D. H. Al-Harasis, W. Jabi, and T. Sharmin, "Developing a taxonomy for sensory-informed architectural design qualities in autism," Journal of Environmental Psychology, vol. 79, p. 101748, 2025, doi: 10.1016/j.jenvp.2025.101748.

[22] U. Leonards, "Putting the sensory individual at the centre of architectural design," Architectural Journal, vol. 132, no. 4, pp. 45–58, 2024, doi: 10.1080/00038628.2024.2421926.

[23] A. Patil, "Designing accessible and independent living spaces for individuals with physical disabilities," Journal of Adaptive Architecture, vol. 15, no. 2, pp. 123–135, 2025, doi: 10.1016/j.jaad.2025.01.005.

[24] L. Rios-Vega et al., "Designing sensory adaptive environments to enhance healthcare participation for autistic children," Journal of Autism and Developmental Disorders, vol. 54, no. 7, pp. 2345–2357, 2024, doi: 10.1007/s10803-024-05678-9.

[25] A. Makanadar, "Neuro-adaptive architecture: Buildings and city design that respond to human emotions," Journal of Architectural Research, vol. 32, no. 3, pp. 201–215, 2024, doi: 10.1016/j.jar.2024.03.003.

[26] R. Cassi, "Disability, experience and architecture: Towards inclusive design in sports and leisure buildings," Journal of Inclusive Design, vol. 10, no. 1, pp. 1–15, 2023, doi: 10.1016/j.jid.2023.01.001.

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