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Enhancing the efficiency of space usage through multisensory systems by visually impaired in the working space

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Abstract

In the often visually-driven world of work, navigating and utilizing spaces efficiently can pose significant challenges for individuals with visual impairments. This dissertation delves into the transformative potential of multisensory systems to empower this population within the workplace, enhancing their spatial efficiency and creating a more inclusive environment. Through a mixed-methods approach, the research draws upon existing literature, data analysis, case studies, and participant surveys to explore the landscape of workplace accessibility and the specific needs of visually impaired individuals. It then examines a diverse range of multisensory technologies, encompassing tactile elements, auditory cues, and olfactory design, as potential solutions to optimize space usage. Central to the research is the hypothesis that implementing multisensory systems will significantly improve the efficiency of space usage for visually impaired individuals compared to traditional workplaces. This enhanced efficiency encompasses various aspects, including improved wayfinding, increased access to information and resources, and a more streamlined approach to daily tasks. Case studies of existing workplaces utilizing multisensory design offer valuable insights into practical implementation strategies and user experiences. Qualitative and quantitative data analysis further illuminate the impact of these systems, revealing user perspectives, behavioural changes, and potential challenges to address. Ultimately, the research culminates in practical recommendations and design guidelines for incorporating multisensory solutions into diverse workspaces. These recommendations prioritize user needs, accessibility considerations, and aesthetic integration, paving the way for inclusive and empowering work environments for all.

Keywords: Enhancing, multisensory, visually, working, space

1. Introduction

In an ever-evolving society striving for inclusivity, the enhancement of spatial efficiency is paramount, ensuring that every individual, regardless of their abilities, can fully and optimally utilize the spaces they inhabit. In the realm of interior design, a crucial aspect of this pursuit involves accommodating the needs of individuals with visual impairments. The visually impaired face distinct challenges when navigating and utilizing workspaces, necessitating innovative design approaches to enhance their spatial efficiency and overall experience. This thesis delves into the transformative potential of multisensory systems, leveraging touch, sound, scent, and spatial perception to craft an environment that caters to the specific requirements of visually impaired individuals within working spaces. By prioritizing an inclusive and user-centric design philosophy, we aim to explore the integration of diverse sensory modalities to unlock the true potential of these environments. Addressing the gaps in current design practices and embracing multisensory solutions can empower visually impaired individuals, providing them with an environment conducive to productivity, comfort, and equitable participation in the professional sphere. Through meticulous research, case studies, and collaborative engagement with the visually impaired community, this study endeavours to advocate for a design paradigm that goes beyond conventional aesthetics-embracing multisensory design as a fundamental tenet of creating spaces that are universally accessible, enriching, and truly efficient for all occupants.

2. Literature review

Research has underscored the pivotal role of interactive mapping technologies in facilitating accessibility. Tactile

maps, audio-based systems, and haptic interfaces empower individuals with visual impairments to independently navigate and engage with indoor spaces. The design of such systems should prioritize user-centric principles, ensuring intuitive, aesthetically pleasing, and integrated solutions that enhance the overall design of interior spaces. (de Almeida (Vasconcellos) & Tsuji, 2005) [2].

Interior designers must consider the specific needs and preferences of their target audience, the subject matter being taught, and the intended learning outcomes when implementing multisensory effects. Creating spaces that balance and integrate these elements can lead to more effective and enjoyable learning environments, ultimately benefiting both educators and learners. (Reese *et al*. 2016) [3].

Tactile maps are especially relevant in geography education, as they allow visually impaired students to gain a tangible understanding of the physical world. These maps incorporate various textures and raised elements to represent geographic features, making it possible for students to explore and comprehend the Earth's topography, landmarks, and spatial relationships. (Almeida (Vasconcellos)

Understanding how blind individuals develop cognitive maps of virtual environments is crucial for interior designers seeking to create inclusive spaces. This literature review delves into the differences observed in the cognitive mapping of blind people following proximity and distant exploration of virtual environments and discusses its relevance to interior design. (Cobo et al. 2017) [4].

3. Case study description and Discussion

3.1 The casa mac house (So & So Studio UG): Imagine a house where walls whisper directions under your fingertips, the air hums with subtle auditory maps, and even the scent of rosemary beckons you towards the kitchen. This is not a scene from a fantasy novel, but the lived reality of Casa Mac, a revolutionary home designed for a visually impaired woman in Vicenza, Italy. Berlin-based So & So Studio crafted Casa Mac with a singular mission: to transcend the limitations of sight and create a space that communicates through a chorus of senses. Every element, from the textured pathways to the fragrant gardens, becomes an intuitive guide, empowering the resident to navigate with confidence and independence.

- **Tactile Pathways:** Textured floor tiles, embedded ropes, and raised wall markings whisper directions underfoot, guiding the resident through different areas of the house.
- **Olfactory Landmarks:** Fragrant plants strategically placed throughout the house act as aromatic landmarks, differentiating rooms and offering a sense of familiarity.
- **Audible Cues:** Discreetly placed speakers provide contextual audio descriptions, announcing room transitions, identifying objects, and even reading aloud labels on appliances.
- **Smart Lighting:** Adjustable lighting settings adapt to the changing needs of the day, ensuring optimal visibility and comfort.
- **Universal Design:** Doorways are widened, furniture carefully positioned, and all elements conform to accessibility standards, creating a barrier-free environment.

3.2 Center for the blind and visually impaired-Mauricio Rocha-Mexico (Taller de Arquitectura-Mauricio Rocha): Situated in a town in Mexico with the maximum number of individuals with visual impairment, Iztapalapa is a district where Taller de Arquitectura-Mauricio Rocha architects designed the Center for the Blind and Visually Impaired. A design developed on three “filters” that run on parallel lines consists of unique functions like cafeterias, touch, and sound gallery, and private courtyards each lying on separate paths. A retaining wall that acts as a sound barrier, creates several courtyards by modifying its shape, height, and orientation. To enhance the five senses for a person walking through, channels of water run along the pathways that act as guidance with their sound. Apart from that, fragrant flowers in the gardens help orient individuals within the complex by being constant sensors.

- The 14000 sqm. complex is on corner plot bordered by two avenues.
- A blind wall encircles the complex on its four sides and acts as an acoustic barrier as well as a retaining wall/blank to hold the earth moved from neighbouring wasteland areas.
- In contrast to the abstract exterior, the internal facade of the boundary wall creates banks that change shape, height and orientation thus creating various courtyards.
- The building plan meanwhile can be read as a series of filters which stretch out from the entrance in parallel strips.
- The building contains administrative office, cafeteria, and utility area. ¬ The two parallel lines of buildings organized symmetrically along a central plaza. These buildings contain a store, a sound and touch gallery and five arts and crafts workshops.
- Classrooms facing the gardens and the most courtyards.

The Centre for the Blind and Visually Impaired in Mexico City, designed by Taller de Arquitectura-Mauricio Rocha, is a haven of sensory symphony. It transcends the limitations of sight by weaving a tapestry of touch, scent, and sound, empowering its residents to navigate and utilize the space with independence and confidence.

4. Survey analysis and Results

The survey findings underscore the growing interest in multisensory systems and their potential to enhance efficiency, productivity, and overall well-being for visually impaired individuals in the workplace.

- The majority of respondents are between the ages of 25 and 44, accounting for 53.4% of the total. This is followed by respondents aged 18- 24 (23.3%), 55+ (20%), and 45-54 (16.7%).
- The survey results show that the majority of respondents (63.3%) are not visually impaired. However, a significant minority (36.7%) do have some degree of visual impairment. Of those with visual impairment, the majority (43.3%) have mild visual impairment, followed by moderate (33.3%) and severe (16.7%) visual impairment.
- The survey results show that 36.7% of respondents rate the neutral space usage for visually impaired individuals in their current workspace. 33.3% of respondents rate the inefficient space for the visually

impaired and 20% respondents rate efficient space for visually impaired.

- The survey results from the image you sent show that 63.3% of respondents are aware of the concept of multisensory systems designed to enhance space usage for visually impaired individuals, while 36.7% are not.
- 53.3% of respondents believe that auditory usability would be most beneficial for enhancing efficiency in space usage. This is likely because auditory cues can be used to identify objects that are close to each other, as well as objects that are not close to each other. With 53.3% of respondents selecting this option, spatial awareness is closely related to auditory usability, as it allows people to identify the location of objects in their environment. Tactile usability, on the other hand, was only selected by 33.3% of respondents.

While most visually impaired individuals (63.3%) know about multisensory systems for better space usage, a significant minority (40%) remains unaware. Audio cues top the list of preferred features (53.3%) for their spatial awareness benefits. Overall, these systems are seen as improving orientation (73.3%), independence (66.7%), productivity (60%), and well-being (56.7%). However, cost (46.7%) and accessibility (46.7%) concerns exist. To address these, cost-effective and user-friendly solutions are needed for seamless integration into existing workspaces. Interestingly, common areas (60%) and hallways/corridors (46.7%) are seen as the most promising locations for such systems, suggesting their perceived potential for improved navigation in these crucial areas. This summary condenses the original paragraph while retaining key points about awareness, preferred features, perceived benefits, and challenges related to multisensory systems for visually impaired individuals in workspaces. It also highlights the specific areas considered most suitable for implementing these systems.

5. Infrences and Conclusion

The research on enhancing space usage through multisensory systems reveals a clear need and promising potential for creating more inclusive and accessible workplaces for visually impaired individuals. While challenges like awareness, affordability, and accessibility remain, the perceived benefits and user preferences provide a strong foundation for designing effective and impactful solutions. By prioritizing comprehensive, user-centred design that addresses auditory dominance, integrates seamlessly with existing infrastructure, and targets key areas for improvement, we can pave the way for workplaces where everyone, regardless of sight ability, can navigate with confidence, contribute effectively, and experience a sense of belonging and well-being. This not only empowers visually impaired individuals but also enriches the workplace environment for all.

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