ARPHA Proceedings

Proceedings CAUSummit 2026, 0324-0331
doi: 10.3897/ap.12.e0324

11th Anniversary
World Summit: Civil Engineering-Architecture-Urban Planning Congress

From Access to Meaning: How Blind Individuals Experience Interior Public Spaces

Ioana Antonia Tănase[1, a)], Cristina Maria Povian [1]

[1] *Faculty of Architecture and Urbanism, Politehnica University Timişoara, Str. Traian Lalescu, No. 2, 300223 Timişoara, Timiş County, Romania*

[a)] Corresponding author: ioana.tanase@student.upt.ro

Abstract. Inclusive design and accessibility in architecture for people with disabilities are usually approached through technical requirements and regulations such as physical access, circulation or safety. However, the quality of spatial experience involves more than basic access. It also includes comfort, identity, atmosphere and spatial aesthetics. This exploratory qualitative study investigates how visually impaired individuals perceive four levels of spatial experience: accessibility and use, safety, autonomy and comfort, aesthetics, and spatial poetics or meaning. Ten semi-structured interviews were conducted and analyzed through a thematic approach. The four predefined levels formed the analytical categories. The findings show that accessibility, orientation, and the completion of basic activities dominate participants' descriptions of interior public spaces. Aesthetic qualities are nevertheless perceived through texture, sound, smell, temperature, residual vision, spatial order, and material quality. However, these qualities often become secondary when participants must concentrate on avoiding obstacles, locating functions, or requesting assistance. Spatial poetics and architectural intention were rarely expressed explicitly and became more accessible when meaning was communicated through tactile, auditory, familiar, or culturally significant elements. The findings suggest that blindness does not eliminate aesthetic or emotional spatial perception; rather, visually centred design and unresolved accessibility needs limit opportunities for interpreting the broader poetic meaning of architecture.

Keywords: Visual impairment; inclusive design; architecture; spatial accessibility; multisensory perception

© 2026 Ioana Antonia Tănase, Cristina Maria Povian
This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Published by CAUSummit and peer-reviewed under the responsibility of "World Summit: Civil Engineering-Architecture-Urban Planning Congress - CAUSummit-2026".

INTRODUCTION

Globally, at least 2.2 billion people live with some form of vision impairment, while population growth and aging are expected to increase more the number of people by vision loss [1]. Visual impairment influences not only access to visual information, but also independent mobility, orientation and participation in everyday activities. In interior public spaces, these activities depend substantially on the predictability and sensory clarity of the built environment. Therefore, architectural accessibility should not be understood only by technical requirements, but as an essential condition that strongly influence quality of life and participation in everyday life of people with visual impairment [2].

Although, architectural accessibility is still understood by technical criteria such as access, circulation, orientation and safety. Even though these requirements are essential, they only integrate the functional dimension of spatial experience. For people with visual impairments the effort required to identify routes, avoid obstacles and locate essential functions can dominate attention and reduce engagement with comfort, atmosphere, materiality and spatial

meaning [3]. Existing research increasingly questions the assumption that architectural experience is primarily visual. Studies involving blind and visually impaired participants show that their interaction with space can reveal qualities that conventional design practice often overlooks usually when accessibility is reduced to technical standards [3], [4], [5]. Jenkins, Yuen and Vogtle demonstrate that the experience of public space depends not only on the presence if accessible features, but also on how clearly and consistently the environment supports orientation and independent use. From a broader design perspective, Heylingen and Herssens argue that the knowledge developed through blindness can challenge visually dominated architectural thinking and contribute to a more complete understanding of space [5]. At the same time, research on spatial cognition indicates that poorly structured environments increase the effort required for navigation [3].

Although these studies underline the need of a deeper understanding of how visual impaired experience architecture, they continue to focus on orientation, while aesthetics remain underexplored. This leaves an important question insufficiently explored: weather the limited attention given to aesthetics and spatial meaning reflects a reduced capacity to perceive these dimensions or, rather, the fact that more immediate needs continue to dominate the experience of space.

Based in this premise, the study starts from the hypothesis that visually impaired individuals tend to evaluate interior public spaces primarily though basic spatial needs, while aesthetic and poetic dimensions become existent only when functionality is sufficiently resolved.

THEORETICAL FRAMEWORK

The proposed framework is inspired by Maslow's hierarchy of needs to the analysis of architectural experience. Marlow distinguished between fundamental needs, such as security or safety and higher needs like self-actualization [6]. In Maslow's original definition, needs do not operate as isolated stages, which means if one is unmet, the attention is not on to the next level, but tends to focused on solving it before advancing further. This principle helps by offering a useful analogy on spatial experience: when the basic needs like the capability of using a space are unmet, they are likely to receive priority over comfort, interest in aesthetics or the meaning of a space.

Within this framework, the experience of interior public spaces is organized into four analytical levels as illustrated in 'Figure 1':

- accessibility anf sunctional use;
- safety, autonomy and comfort;
- perception and aesthetic experience
- spatial poetics and meaning

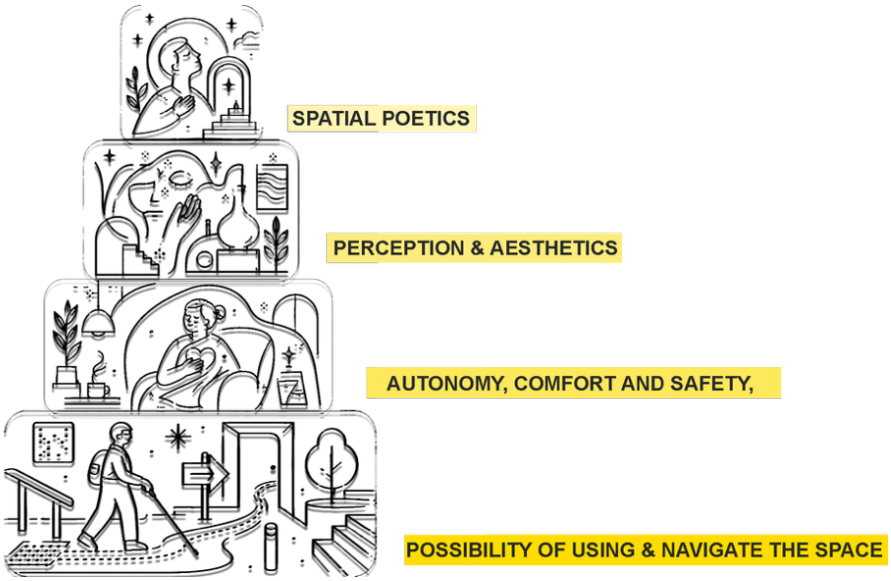

FIGURE 1. Pyramidal organization of the four dimensions of spatial experience
Source: author's representation

The first level, **accessibility and functional use,** refers to the possibility of entering, navigating, understanding and using a space according to its intended purpose. It includes the identification of entrances, circulation routes, informational points, sanitary facilities and exits. For visually impaired people, a technically accessible entrance is therefore insufficient when internal organization remains deficient.

The second level, **safety, autonomy and comfort**, concerns about the condition that a person should accomplish activities without constant assistance, requiring physical and mental effort, higher than would normally be expected. Studies of mobility among visually impaired participants indicate that environmental barriers influence not only movement but also feelings of anxiety, tiredness and dependence [7].

The third level, **perception and aesthetic experience** concerns to perceive atmosphere, coherence, material quality, spatial order and general character of an environment. By this level it is usually where the challenge becomes more sensitive for architects and designers. Functional accessibility and safety can be addressed usually through measurable requirements, while aesthetic qualities are mostly communicated through visual aspects. Heylighen and Herssens argue that this focus on visual aspects prevent specialist from designing beyond the visible appearance of space and from considering the tactile, auditory and atmospheric qualities [5]. This difficulty does not indicate that visually impaired people are unable to appreciate aesthetics, but rather that designers often lack methods for translating aesthetics intention into non-visual spatial qualities [8]. In this study, aesthetic experience means more than visual attractiveness, but includes material quality, spatial coherence, atmosphere, rhythm and overall character through which a space may be perceived as pleasant, welcoming, calm, refined or distinctive. One approach that can support this method is haptic design, which involves understanding and perceiving architecture through touch, bodily movement, material contact and relationship between the body and its surroundings. Recent studies confirms that persons with visual impairment often build their spatial understanding more effectively when haptic information is integrated with other sensory information rather than an isolated accessibility feature [9].

The fourth level, **spatial poetics and meaning,** is focused on the ability of architecture to communicate the identity, emotion, symbolism or cultural association. This level represents more than the previous one is terms of sensing the unique character of a space and also the ability of interpreting what it represents or communicates. Reaching this level may depend on previous experiences, familiarity with architectural language, cultural knowledge and opportunities to engage with spaces beyond their practical use. These abilities are gradually developed through exposure, education, and repeated interaction with architecture and its meaning, regardless of visual ability. Research on access to art and cultural heritage shows that providing physical entry alone does not necessarily guarantee access to interpretation or meaning [10].

These four levels previously presented are closely linked and may be experienced at the same time. For example, materials differentiation may support orientation, but also contribute to aesthetic composition and give to an area a clearer identity. The model should therefore not be understood as a strict sequence in which one level must be fully satisfied before the next begins, yet when functional and safety related needs are unresolved, they may become dominant and limit the attention for aesthetic appreciation and the interpretation of spatial meaning.

RESEARCH METHODOLOGY

The methodology used in this study was primarily an exploratory qualitative research design based on semi-structured interview with ten adults with visual impairments. This approach was used in terms of understanding how participants describe, prioritize and interpret different dimensions of their experience in interior public space. The semi-structured interview format was structured on the same central topics across all interviews, while allowing them to introduce their personal experiences, spatial preferences and difficulties.

The study included ten adults with visual impairment, selected because they regularly interact with different types of interior public spaces. The participants differ in terms of age, occupation, level of visual impairment, onset of vision loss or use of residual vision. This diversity was considered relevant because spatial experience may be influenced not only by the level of visual impairment, but also by previous experience, mobility training, familiarity with the environment and the use of assistive devices. To protect confidentiality, all personal information was anonymized and participants were identified through codes from A_01 to A_10. The main characteristics of the participants are summarized in ‘Table 1’. The sample included seven men and three women aged between 18 and 44 years old. Six participants are totally blind, while six participants had congenital visual impairment and four experience vision loss during childhood. Most participants combine the use of a white cane with personal assistance or assistive technology.

TABLE 1. General characteristics of interviewed participants

Participant code	Gender	Age group	Visual impairment	Onset	Mobility and assistance strategies
A_01	Male	25-34	Total blindness	Congenital	White cane, personal assistance, assistive smartphone
A_02	Female	25-34	Total blindness	Congenital	White cane, assistive smartphone
A_03	Male	35-44	Total blindness	Acquired in childhood	White cane
A_04	Male	18-24	Partial vision	Congenital	White cane, personal assistance, assistive smartphone
A_05	Male	35-44	Total blindness	Congenital	White cane, personal assistance, assistive smartphone
A_06	Female	35-44	Partial blindness	Progressive	White cane, personal assistance, assistive smartphone
A_07	Male	25-34	Partial vision	Acquired in childhood	White cane, personal assistance, assistive smartphone
A_08	Male	25-34	Patial blindness	Congenital	White cane, personal assistance, assistive smartphone
A_09	Male	35-44	Total blindness	Acquired in childhood	White cane, assistive smartphone
A_10	Female	25-34	Total blindness	Congenital	White cane, personal assistance, assistive smartphone

Data were collected through semi-structured interview organized around four main areas corresponding to the proposed framework. The interview guide included questions about the frequency with which participants used different types of public interiors and strategies they use when entering an unfamiliar space, the difficulties met when trying to locate essential areas in a space and the environmental conditions that influenced safety and comfort. Participants were also invited to describe how they perceived the atmosphere and aesthetic quality of a space, what made an interior feel pleasant or welcoming. They were also asked if they could recognize a concept, identity or architectural intentions in a space.

All the interviews were conducted exclusively by telephone, recorded with the participants agreement and transcribed for analysis. Each interview lasted approximately 60 to 90 minutes, which allowed sufficient time for participants to describe specific spatial experiences and develop their answers thoughtfully.

RESULTS

The thematic analysis identified a clear difference in the presence of the four proposed levels of spatial experience: L01 - accessibility and usability; L02 - safety, comfort and autonomy; L03 - perception and aesthetics; L04 - spatial meaning and poetics. As summarized in ‘Table 2’, themes related to accessibility and functional use appeared most consistently across the interviews mentioned by an average of 86% of participants, whereas aesthetic qualities and spatial meaning were expressed less frequently and often in a more indirect manner, decreasing substantially to 40%. A similar contrast was visible in the spontaneous responses: the first three levels reached 68%, 56% and 60% compared to only 24% for the fourth level. The pattern was not entirely linear, since aesthetic qualities were mentioned spontaneously slightly more often than safety and comfort. Prompted-only responses increased the frequency of themes at all four levels, but did not eliminate the substantial difference between spatial meaning and the other dimensions of experience. ‘Table 2’ summarizes the frequency of spontaneous and prompted only mentions for themes identified within each level.

TABLE 2. Frequency of themes identified across the four levels of spatial experience.

Level	Theme	Spontaneous mentions n/10	Prompted-only Mentions n/10	Total Participants mentioning the theme n/10
L01	Human assistance and staff support	7	1	8
	Tactile guidance, braille or relief information	6	3	9
	Auditory or olfactory landmarks	7	2	9
	Clear and predictable spatial arrangements	6	2	8
	Obstacles or unexpected spatial changes	8	1	9
Mean theme frequency within Level 1		**68%**	**18%**	**86%**
L02	Physical safety	8	1	9
	Independency in activities	6	2	8
	Sense of control and spatial confidence	5	2	7
	Reduced cognitive effort and stress	4	2	6
	Sensory and physical comfort	5	3	8
Mean theme frequency within Level 2		**56%**	**20%**	**76%**
L03	Material and tactile quality	7	2	9
	Acoustic atmosphere	8	1	9
	Olfactory atmosphere	6	2	8
	Lighting, colour and visual contrast	3	1	4
	Spatial order and aesthetic coherence	6	2	8
Mean theme frequency within Level 3		**60%**	**16%**	**76%**
L04	Emotional response and personal significance	4	2	6
	Familiarity and spatial memory	4	1	5
	Recognition of spatial identity	2	2	4
	Cultural or spiritual meaning	2	1	3
	Interpretation of architectural intention	0	2	2
Mean theme frequency within Level 4		**24%**	**16%**	**40%**

L01: Accessibility and functional use

Accessibility and functional use formed the most prominent level in the interviews, with a mean total frequency of 86% and a spontaneous frequency of 68%. The most common themes were obstacles or unexpected spatial changes, tactile or accessible information and auditory landmarks, each mentioned by nine participants.

Obstacles were usually described through furniture placed on circulation routes, changing layouts, steps, suspended elements, or other unexpected features. These elements made movement more difficult and reduced the chance of using already learned routes. Clear and predictable spatial arrangements were mentioned by eight participants. Direct routes, stable layouts and intuitive positioned functions were considered important for locating essential services and memorising the space.

Tactile guidance, Braille and relief information were recognised by nine participants, but three mentioned them only after prompting. Bu comparison, auditory landmarks appeared more often spontaneously, suggesting that these cues were already part of participants' usual orientation strategies. Several participants described locating entrances through light and air currents, toilets through smell, cash registers through acoustics signals and waiting areas through the sound of other people waiting.

Human assistance was mentioned by eight participants and appeared spontaneously in seven interviews. Staff support was often described as the fastest and safest solution in unfamiliar interiors, particularly when the spatial organisation was unclear.

Overall, the small difference between spontaneous and prompted only mentions shows that accessibility-related concerns were already strongly existent in participants' initial descriptions. Prompted mainly brought additional solutions into discussion rather than introducing new concerns.

L02: Safety, Comfort and Autonomy

Safety, autonomy and comfort reached a mean total frequency of 76%, with 56% spontaneous and 20% prompted-only mentions. Safety during movement was the most frequent theme, identified in nine interviews. Participants referred to steps, slippery surfaces, suspended furniture, sharp edges and crowded circulation areas.

The ability to complete activities independently was discussed by eight participants. Examples included reaching the toilet, placing an order, finding a table, using gym equipment or completing a task at an institutional counter. One participant described going independently to the toilet after several visits as a significant achivment, showing that autonomy was often developed through familiarity rather than supported by the first use of space.

Sense of control and spatial confidence was identified in seven interviews, while reduced cognitive effort and stress appeared in six. Participants associated confidence with predictable layouts, known routes and intuitive furniture arrangements. By contrast, unfamiliar environments require continuous concentration. A_06 described even independent movement along familiar routes as highly demanding: "Going alone on a familiar route consumes so many resources that I get home with a headache"

Sensory and physical comfort was mentioned by eight participants and produced the largest prompted-only frequency at this level. Participants discussed moderate noise, suitable temperature, comfortable and stable furniture. The difference between spontaneous and prompted responses suggests that immediate safety and independence were more likely to be a priority for them, whereas environmental comfort was more often developed after follow-up questions.

L03: Perception and Aesthetics

Aesthetic experience reached a mean total frequency of 76%, with 60% spontaneous and 16% prompted-only mentions. This shows that aesthetic qualities were not introduced only because they were explicitly asked about; in most cases, participants referred to them directly when describing pleasant or unpleasant interiors.

Acoustic atmosphere and material or tactile quality were the most frequently discussed themes, each identified by nine participants. Participants evaluated spaces through music, reverberation, background noise, surface texture, furniture quality and material condition. Softer materials, wood, upholstery and well-maintained surfaces were generally associated with warmer or more refined environments, while damaged, rough or poorly maintained elements negatively influenced the overall impression.

Olfactory atmosphere was identified by eight participants. Smells associated with coffee, food, flowers, cleanliness or materials contributed to the perceived character of a space. These responses show that smell was not used only as an orientation cue, but also as part of the aesthetic atmosphere.

Spatial order and aesthetic coherence were also mentioned by eight participants. Participants associated pleasant interiors with simplicity, sufficient open space, aligned furniture and a clear relationship between spatial elements. Order therefore had both a functional and an aesthetic role: it supported orientation while also making the environment feel calmer and more coherent.

Lighting, color and visual contrast were mentioned by four participants, mainly those with residual vision or light perception. Their lower frequency reflects differences in visual ability within the sample rather than the absence of aesthetic relevance. One participant, for example, described preferring bright interiors and finding dark spaces uncomfortable, while another used light and color to distinguish areas within a space.

L04: Spatial Meaning and Poetics

Spatial poetics and meaning were the least frequently expressed level, with a mean total frequency of 40%, including 24% spontaneous and 16% prompted-only mentions. Emotional response and personal significance were

the most common themes at this level, identified by six participants. These responses referred to feelings of calm, familiarity, belonging, curiosity, or personal attachment to a place.

Familiarity, memory and personal association were mentioned by five participants. In these cases, meaning developed through repeated use and personal experience rather than through the formal concept of the space. Familiar places were valued not only because they were easier to navigate, but also because they carried memories and a stronger sense of connection.

Recognition of spatial identity and character appeared in four interviews. Participants described spaces as elegant, welcoming, religious, calm, or distinctive, showing that they could recognize a broader character beyond isolated sensory qualities. Cultural or spiritual meaning was identified by three participants, especially in museums, religious interiors, and other places with clear symbolic associations.

Interpretation of architectural intention or concept was the least frequent theme. It did not appear spontaneously and was identified only in two prompted responses. This suggests that participants could describe how a space felt and what associations it created, but rarely referred directly to the designer's concept or intended message.

Compared with the other levels, prompted responses had a greater relative role in L04. This indicates that spatial meaning was not absent, but was less likely to structure participants' initial descriptions. It became more visible when the interview explicitly directed attention toward memory, symbolism, identity, or architectural intention.

DISCUSSION, LIMITS AND FUTURE RESEARCH

The findings partially support the initial hypothesis. Accessibility and functional use were the most prominent dimensions, while spatial poetics and architectural intention were mentioned considerably less often. However, the pattern was not fully linear, as aesthetic experience appeared spontaneously slightly more often than safety, autonomy and comfort. This suggests that visually impaired participants do not experience architecture only through practical needs. Rather, several levels coexist, while unresolved functional demands tend to receive greater attention.

Accessibility was often achieved through familiarity, personal strategies or staff assistance, not necessarily through the clarity of the environment itself. Participants could reach essential functions while still experiencing uncertainty, high cognitive effort or dependence on support. Accessibility should consequently be evaluated not only through task completion, but also through the effort and assistance required.

The strong presence of aesthetic themes challenges the assumption that visual impairment limits aesthetic engagement. Participants described materials, sound, smell, lighting, spatial order and maintenance as important to the character of an interior. These qualities were usually expressed through direct sensory and atmospheric impressions rather than through formal architectural terminology. This may reflect the fact that architectural concepts are still mainly developed and communicated visually, while non-visual aesthetic strategies remain less established in practice [5].

Spatial poetics and meaning were the least prominent dimensions. Participants could often describe how a space felt, but rarely referred spontaneously to symbolism, cultural meaning or the designer's intention. This should not be interpreted as a limited capacity for interpretation. It may instead reflect the limited availability of historical, artistic and conceptual information in tactile, auditory or descriptive forms [10]. The distinction between spontaneous and prompted-only responses supports this interpretation. Functional and safety-related concerns usually appeared without prompting, while higher-level meanings were more often identified after follow-up questions. The results therefore support the model as a hierarchy of attention, not as a strict sequence of perception.

From a design perspective, inclusive architecture should go beyond minimum technical compliance. Clear organization, predictable routes and accessible information should be integrated with material quality, atmosphere, identity and meaningful communication. The same element can support several levels at once: a material transition may guide movement, improve safety, contribute to aesthetic coherence and strengthen spatial identity.

The study is limited by the small sample of ten participants and by the diversity of their visual conditions, mobility experience, and familiarity with public spaces. The findings are therefore exploratory and cannot be generalized statistically. In addition, the use of predefined levels and follow-up questions may have influenced how some themes were expressed.

Future research will apply the same interview framework to two comparison groups: design professionals and sighted participants without training in architecture or design. This comparison will help identify which priorities are related to visual impairment, which are influenced by professional knowledge, and whether aesthetic and spatial meaning are approached differently across the three groups.

CONCLUSION

This exploratory study examined how visually impaired individuals describe four levels of spatial experience in interior public spaces: accessibility and functional use; safety, autonomy and comfort; aesthetic experience; and spatial poetics and meaning. The findings show that accessibility-related themes were the most prominent, while spatial meaning and architectural intention were mentioned considerably less often.

The results only partially support the initial hypothesis. Participants did not experience architecture exclusively through basic functional needs. Aesthetic qualities were frequently described through materials, sound, smell, lighting, spatial order and atmosphere, often without prompting. However, these qualities became secondary when participants had to concentrate on locating functions, avoiding obstacles or obtaining assistance.

The distinction between spontaneous and prompted-only responses was particularly relevant. Accessibility, safety and aesthetic atmosphere were commonly introduced directly, whereas symbolism, cultural meaning and design intention appeared more often after follow-up questions. This suggests that the proposed model functions better as a hierarchy of attention than as a rigid sequence of perception.

The study also indicates that technical accessibility alone does not ensure a complete architectural experience. Inclusive design should support not only entry, circulation and safety, but also autonomy, comfort, aesthetic engagement and access to spatial meaning. Architectural concepts should therefore be communicated through coherent multisensory relationships rather than relying primarily on visual form.

Although the findings cannot be statistically generalised, they provide a basis for further comparative research and for developing design approaches that extend accessibility beyond basic usability toward a richer and more meaningful spatial experience.

REFERENCES

[1] "Vision impairment and blindness." Accessed: Aug. 04, 2026. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

[2] "Article 9 – Accessibility | United Nations Enable." Accessed: Aug. 04, 2026. [Online]. Available: https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/article-9-%20accessibility.html?utm_source=chatgpt.com

[3] S. H. Creem-Regehr, E. M. Barhorst-Cates, M. R. Tarampi, K. M. Rand, and G. E. Legge, "How can basic research on spatial cognition enhance the visual accessibility of architecture for people with low vision?," *Cogn. Research*, vol. 6, no. 1, p. 3, Jan. 2021, doi: 10.1186/s41235-020-00265-y.

[4] G. R. Jenkins, H. K. Yuen, and L. K. Vogtle, "Experience of Multisensory Environments in Public Space among People with Visual Impairment," *International Journal of Environmental Research and Public Health*, vol. 12, no. 8, pp. 8644–8657, Aug. 2015, doi: 10.3390/ijerph120808644.

[5] A. Heylighen and J. Herssens, "Designerly Ways of Not Knowing: What Designers Can Learn about Space from People Who are Blind," *Journal of Urban Design*, vol. 19, no. 3, pp. 317–332, May 2014, doi: 10.1080/13574809.2014.890042.

[6] A. H. Maslow, "A theory of human motivation," *Psychological Review*, vol. 50, no. 4, pp. 370–396, 1943, doi: 10.1037/h0054346.

[7] T. Campisi, M. Ignaccolo, G. Inturri, G. Tesoriere, and V. Torrisi, "Evaluation of walkability and mobility requirements of visually impaired people in urban spaces," *Research in Transportation Business & Management*, vol. 40, p. 100592, Sep. 2021, doi: 10.1016/j.rtbm.2020.100592.

[8] D. Bakir, Y. Mansour, S. Kamel, Y. Moustafa, and M. Khalil, "The Spatial Experience of Visually Impaired and Blind: An Approach to Understanding the Importance of Multisensory Perception," *Civil Engineering and Architecture*, vol. 10, pp. 644–658, Mar. 2022, doi: 10.13189/cea.2022.100220.

[9] L. Ottink, H. Buimer, B. van Raalte, C. F. Doeller, T. M. van der Geest, and R. J. A. van Wezel, "Cognitive map formation supported by auditory, haptic, and multimodal information in persons with blindness," *Neuroscience & Biobehavioral Reviews*, vol. 140, p. 104797, Sep. 2022, doi: 10.1016/j.neubiorev.2022.104797.

[10] P. Pistofidis *et al.*, "Design and evaluation of smart-exhibit systems that enrich cultural heritage experiences for the visually impaired," *Journal of Cultural Heritage*, vol. 60, pp. 1–11, Mar. 2023, doi: 10.1016/j.culher.2023.01.004.