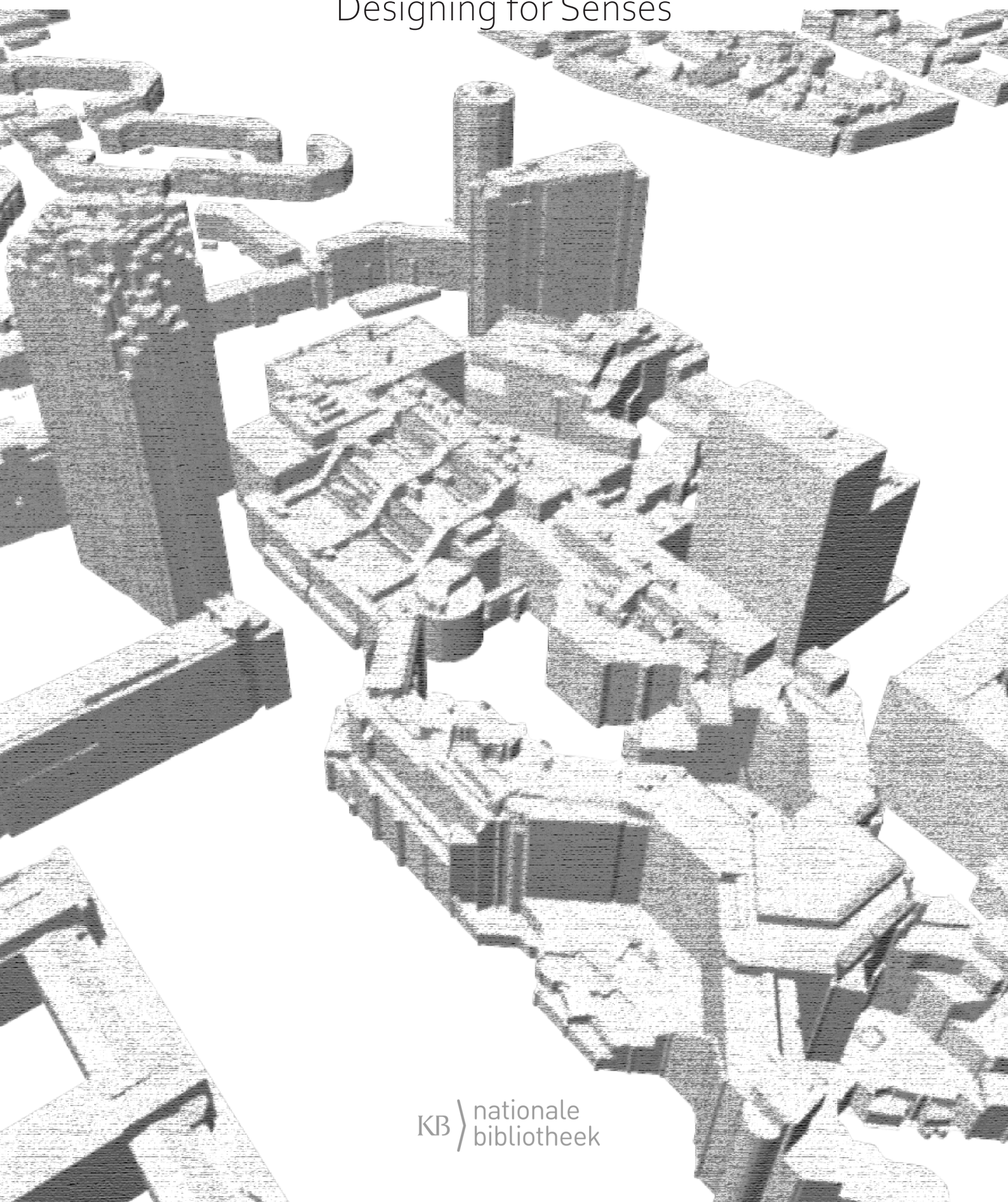


UNIVERSAL INCLUSIVITY

Designing for Senses



KB } nationale
bibliotheek

BEYOND SIGHT, BEYOND BARRIERS:

Reimagining Library Spaces through Multisensory Accessibility



Faculty of Architecture and the Built Environment

Elisabeth Veldkamp
4648056

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AR3A010

Instructor
Ir. L.G.K. Spoormans

Supervisors - Research
Dr. M. (Emeline) Lin
Dr. A.J. (Aart) Oxenaar

Supervisor - Design
Prof. Dr. Uta Pottgiesser

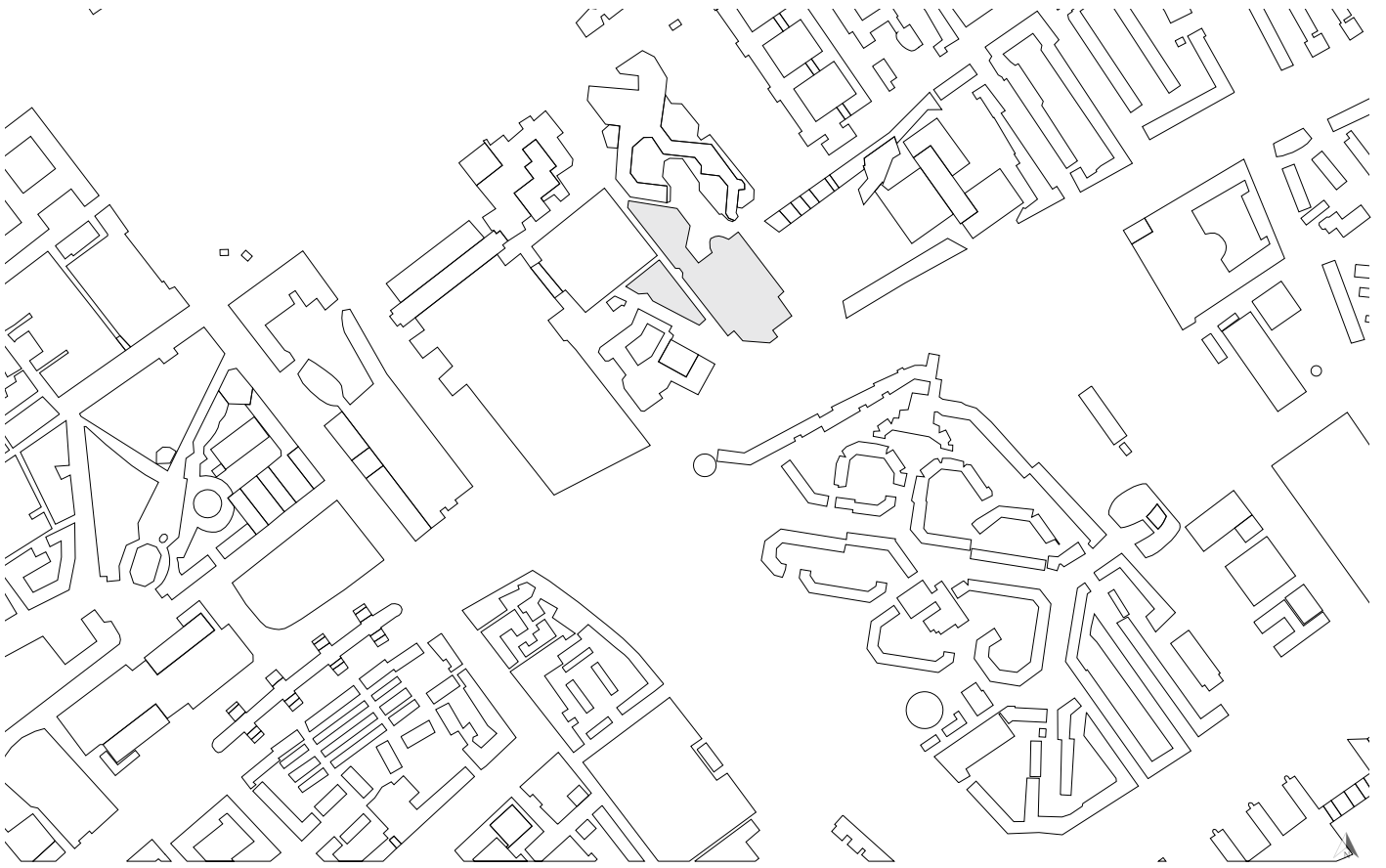


Figure 1. Context Map 1:5000 (reduced 70%). Compiled by author (Veldkamp, 2025).



Image 1. Aerial view of the KB building (Gebouw Koninklijke Bibliotheek | 10-2020).

ABSTRACT

Libraries serve as vital social, cultural, and educational centers; however, their design frequently does not meet the needs of users with sensory impairments. Although ramps and elevators enhance physical accessibility, the overall sensory experience is primarily visual, which restricts engagement for numerous individuals. Libraries must advance beyond primary accessibility to create environments that engage multiple senses, thereby providing a more enriched and inclusive experience. This study investigates the potential of multisensory accessibility to transform the spatial experience of the Koninklijke Bibliotheek (KB) in The Hague, thereby enhancing its significance as an inclusive and socially engaging cultural landmark.

The study asks: "How can libraries be redesigned as resilient environments that foster social inclusivity and user engagement by integrating multisensory accessibility in both physical and digital spaces?" It further examines the sensory and physical barriers neurodiverse and impaired users face and how multisensory design interventions can improve accessibility, wayfinding and user engagement.

A qualitative, comparative case study analysis is employed, analyzing the Openbare Bibliotheek Amsterdam (Netherlands), Helsinki Central Library Oodi (Finland), and Durham County Library (USA), alongside a literature review of existing studies on multisensory accessibility. The hypothesis asserts that the integration of multisensory design within spatial organization and circulation networks can considerably improve the inclusivity, legibility, and user experience of libraries, thereby providing a framework for accessible and inclusive civic architecture.

KEYWORDS: Sensory Engagement, Multisensory Design, Inclusive Design, Accessibility, Barriers, Neurodiversity, Visually Impaired

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1 INTRODUCTION

Evolution of Libraries: from Book Lending to Collaborative Spaces

Historically, libraries were long seen as traditional spaces to store and preserve books and information materials (Momoh & Folorunso, 2019). Nevertheless, with the rapid development and changes in technology in the last century, the role and definition of the term 'library' has changed. With the introduction of new reading formats and electronic technologies, Adeniran (2017) as cited in Momoh and Folorunso (2019) defined the term 'library' as:

“a place where information resources are accessed and information services are rendered by professionals who specialize in identifying, collecting, organizing, processing information sources as well as interpreting information needs”.

In this respect, libraries have evolved from spaces that focused primarily on book-lending and knowledge preservation to dynamic hubs for immense information retrieval (Deines-Jones, 2007), collaborative learning, meeting and studying. This transition signals profound societal changes, wherein libraries play a pivotal role in community engagement and lifelong learning. Libraries are now viewed not merely as repositories for books but as drivers for change and agents that promote growth within their respective societies (Momoh & Folorunso, 2019). Moreover, Deines-Jones (2007) asserts that libraries are evolving to accommodate different user groups by providing environments that facilitate interaction, collaboration, and engagement with information beyond traditional text. The continued provision of this service by libraries depends on their ongoing efforts to remove obstacles that people with impairments encounter while trying to access library materials, as well as any existing resources that may assist them in doing so (Deines-Jones, 2007). This underscores the significance of inclusivity, ensuring that all users, including those with diverse sensory needs, possess equal access to these growing environments.

Barriers in Library Design for Diverse User Groups

Libraries, despite their evolution, still encounter considerable accessibility challenges, particularly for users with visual impairments (Deines-Jones, 2007). An article by Kwafoa (2019) supports this, asserting that individuals with impairments, particularly users with visual impairments, encounter difficulties in accessing library services and information resources. According to the World Health Organization (2023), globally there are at least 2.2 billion people that have near or distance vision. In the Netherlands, visual impairments have increased by an estimated 18% since 2008, potentially affecting up to 367,000 individuals (Limburg & Keunen, 2009).

Given that visual impairments are among the most prevalent disabilities, creating a pressing need for alternatives to conventional print, libraries must offer information in multiple formats to ensure inclusivity for both current and future users. (Deines-Jones, 2007, p. 3).

The term *visually impaired*, refers to a variety of conditions that restrict an individual's capacity to see. These impairments can be categorized into mild to moderate vision loss, restricted vision, and total blindness, as outlined in Table 1 (Wiethoff et al., 2008).

The experiences of individuals with visual impairments in modern cultural institutions such as libraries and museums are significantly influenced by the accessibility of the facilities and the effectiveness of the information communication strategies employed (Mesquita and Carneiro, 2016).

Table 1. Categories of Visual Impairments.

1. Mild or moderate visual impairments	Challenges in reading, recognizing symbols, and transitioning between displays and library environment.
2. Restricted nocturnal and coloured vision	Challenges in navigating obscurity or comprehending signs and symbols.
3. Total visual impairment, blindness	No light perception, central visual acuity of 20/200.

Note. Categorization of Visual Impairments. Based on Wiethoff et al. (2008). Compiled by author (Veldkamp, 2025).

Upon entering a cultural institution, individuals with visual impairments encounter ongoing challenges in navigating various spaces, with wayfinding identified as the most critical factor (Mesquita and Carneiro, 2016). This highlights the need for a more inclusive approach to library interiors.

Beyond Sight Design; a Need for a Multisensory Approach

The visually impaired depend heavily on their remaining senses (such as touch, sound and smell), which enhances their appreciation and perception for non-visual spatial attributes and qualities (Bakir et al., 2022). Research shows that inclusive design strategies, which include elements like tactile surfaces, and auditory signals, significantly enhance both the accessibility and safety of environments for visually impaired users (Goldsmith, 1997; Pallasmaa, 1996). This stems from the assertion that architectural design has typically given priority to the visual sense, often at the expense of other senses (Bakir et al., 2022).

Pallasmaa (1996), in *The Eyes of the Skin: Architecture and the Senses*, reinforces this argument by highlighting how traditional architectural approaches have predominantly emphasized visual aesthetics, frequently overlooking the sensory and spatial requirements of individuals with diverse sensory needs (Pallasmaa, 1996). Despite advancements towards creating more accessible environments, considerable limitations remain, especially in environments that lack a holistic, multisensory approach. The integration of tactile, auditory, and olfactory elements is essential for improving spatial navigation, comfort, and orientation for users with visual impairments (Image 2). This calls for a renewed perspective on libraries — as environments that actively stimulate all senses, rather than predominantly depending on sight. As Lupton and Lipps (2018) assert, multisensory design improves user experience by appealing to our intrinsic, embodied ways of perceiving space while rendering it accessible to people with sensory impairments.

As we interact with the world through all our senses, not solely vision, spatial perception and analysis should not be limited to visual input alone (Bakir et al., 2022). Thus, designing environments that engage multiple senses can enhance the quality of life and create more immersive and meaningful experiences, leading to more lasting and vivid multisensory interactions (Gallace & Spence, 2014, as cited in Bakir et al., 2022). Moreover, multisensory design promotes learning, inclusivity, and social participation by responding to a wide range of cognitive and sensory needs (Cho, 2021). Building on this foundation, **multisensory accessibility** extends the concept of multisensory design, by ensuring that environments actively engage various senses —such as auditory, tactile, and visual—to be inclusive and accessible for all individuals, especially those with diverse sensory needs.

Therefore, adopting a multisensory accessibility framework is not only a strategy for enhancing user experience but also to ensure social inclusivity and equitable accessibility in public spaces.

A brief definition is listed below to better understand the terms utilized in this proposal and research question:

Social Inclusivity

Lupton and Lipps (2018) state that inclusive design should embrace all human variations, with design for difference becoming a norm rather than an exception. Building on this, *Social Inclusivity* in library design refers to creating a welcoming environment that represents and enables everyone to engage, regardless of ability, background, or sensory perception. It moves beyond physical accessibility to address users' emotional, sensory, and social experiences within the space.

User Engagement

Lupton and Lipps (2018) underscore the significance of multisensory, embodied interactions in fostering meaningful relationships with a place, proposing that user engagement must transcend sight to incorporate all types of senses. Building on this, *User Engagement* refers to the significant, active interaction between visitors and their surroundings. In the context of library design, it encompasses the interaction between users with spaces, services, and experiences that foster curiosity, learning, and engagement.

Sensory Impairments

Sensory Impairments denote restrictions in one or more senses—such as hearing (Auditory), sight (Vision), touch (Tactile), taste (Gustation), smell (Olfaction), that affect individuals' perception and interaction with their environment. This research concentrates on creating environments that support, but not limited to, visual impairments through the incorporation of multisensory design elements.

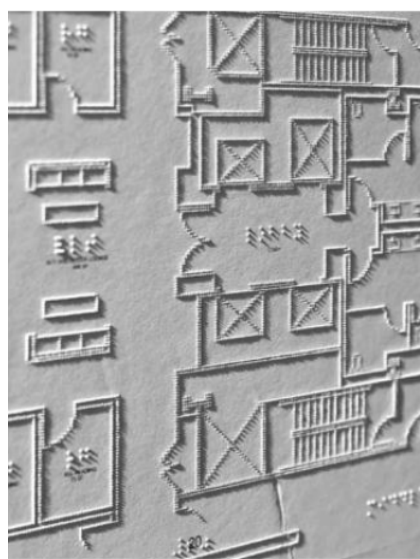


Image 2. Example of a tactile architectural detail drawing, including embossed digital print with ink, raised lines, and braille. Printed by San Francisco Lighthouse for the Blind and Visually Impaired (Photo by Don Fogg as shown in Lupton and Lipps (2018)).

2 PROBLEM STATEMENT

This research explores how multisensory accessibility can be integrated into library design to better accommodate diverse sensory needs. Although libraries have increasingly embraced user-centered design principles in recent years, the focus has predominantly remained on visual elements, often limiting the inclusivity of these environments. Multisensory design strategies—including tactile, auditory, olfactory, and spatial elements—offer valuable opportunities to engage a broader range of users, particularly individuals with sensory impairments. Despite growing interest in this field, a notable gap persists in both academic research and design practice regarding the effective implementation of multisensory experiences in library environments.

In response to this, the study contributes to the future redesign of the Koninklijke Bibliotheek (KB), the National Library of the Netherlands in The Hague, by proposing evidence-based design strategies that integrate multisensory elements to enhance both user experience and accessibility. By fostering an environment that actively engages multiple senses, the KB can evolve into a more accessible, navigable, and socially engaging public space for a wide and diverse audience, with particular attention to the needs of blind and visually impaired users. The research aims to address the existing gap in library design discourse by offering practical frameworks for incorporating multisensory accessibility, ultimately repositioning the KB as an inclusive, and culturally significant landmark within the city of the Hague.

Following this, this study will be guided by the research questions outlined in paragraph 3, with an emphasis on how libraries could transform into inclusive environments that promote social inclusivity and user engagement through multisensory accessibility.

3 RESEARCH QUESTIONS

The main research question driving this study is as follows:

How can libraries be redesigned as resilient environments that foster social inclusivity and user engagement by integrating multisensory accessibility in both physical and digital spaces?

This is further supported by the following sub questions:

1. What sensory and spatial accessibility barriers do visually impaired and neurodiverse users face in cultural institutions?

This question aims to identify and understand the obstacles visually impaired and neurodiverse users face when accessing libraries and museums.

2. How can multisensory accessibility be effectively integrated into library environments to enhance social inclusivity and user engagement?

This question explores how libraries might promote inclusivity and user engagement by implementing multisensory design strategies that expand beyond the visual sense (Figure 2).

The answers to these questions will be determined by conducting a comprehensive literature review in addition to a case study analysis, as outlined in paragraph 4.

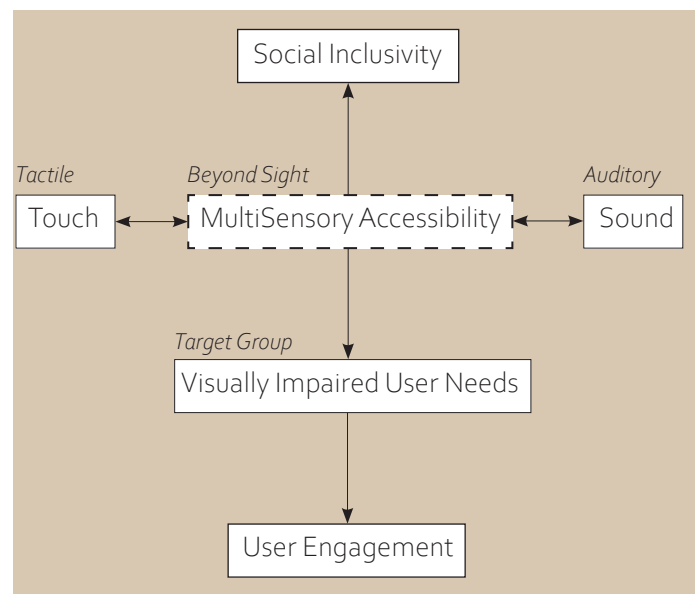


Figure 2. Conceptual diagram highlighting the relationship between the research's main principles of inclusivity, user engagement, and multisensory accessibility. Compiled by author (Veldkamp, 2025).

4 METHODOLOGY

This study will make use of a qualitative methodology, which will include both an analysis of case studies and a comprehensive review of the relevant literature.

Case Study Analysis (Qualitative)

This study will examine three public libraries that have effectively incorporated multisensory design elements into their architectural frameworks:

1. Openbare Bibliotheek (OBA) in Amsterdam, The Netherlands by Jo Coenen & Co Architecten – with emphasis on multisensory accessibility through tactile design features, soundscapes for wayfinding, sensory relief rooms, and interactive multimedia rooms.
2. Helsinki Central Library Oodi in Finland by ALA Architects – with emphasis on multisensory accessibility through sensory installations, tactile surfaces, wayfinding systems, and navigation through textures.
3. Durham County Library in North Carolina, USA by Vines Architecture – with emphasis on multisensory accessibility through multisensory environment rooms, assistive technologies, calming spaces, and flexible usage areas.

This analysis will examine how each selected library incorporates multisensory elements into both its physical and digital environments. Data will be gathered through a combination of site visits, official library documentation, and relevant secondary literature. To ensure a consistent and focused evaluation, a structured analytical framework has been developed to guide the case study analysis (see Appendix A).

Literature Review

The literature review will establish a theoretical framework by examining existing research on multisensory accessibility within cultural institutions, including libraries and museums. Topics include multisensory environments, obstacles faced by people with impairments, and physical and digital accessibility. The primary data will consist of guidelines such as WCAG for digital accessibility, in addition to peer-reviewed journals, articles, books, and policy documents.

Table B1 summarizes the data found in each source, along with a concise overview of its principal points (see Appendix B). Based on this, a checklist matrix has been created to identify the specific keywords and research indicators found in each source, as illustrated in Table C1 (see Appendix C). This matrix will facilitate the categorization and systematic analysis of the literature, ensuring comprehensive capture and alignment with the research focus on multisensory accessibility in libraries.

Research Limitations

There are certain constraints associated with this study. The number of case studies and sites that can be analyzed in depth will be limited by the time and scope of the research. The three selected libraries offer valuable insights; however, they may not completely represent the wide range of library contexts across various regions and scales. Furthermore, restricted access to specific library design documents or internal policies may impact the thoroughness of the analysis.

Additionally, given the limitations in time and scale, it is unrealistic to include the full spectrum of impaired and neurodiverse users in this study or for the proposed library redesign. Thus, those with visual impairments will be the main representation for the user groups, as they represent the most prevalent demographic among people with impairments. This is underlined further in a table based on Ted van der Togt's illustration (Figure 3) on neurodiverse and impaired users, which depicts their various accessibility and sensory needs (Appendix D).

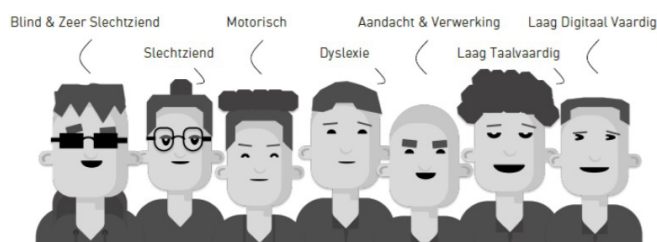


Figure 3. Neurodiverse and impaired users by expert Ted van der Togt, researcher KB.

Despite these limitations, the study aims to provide a focused framework for the integration of multisensory accessibility within library settings to enhance social inclusivity and user engagement.

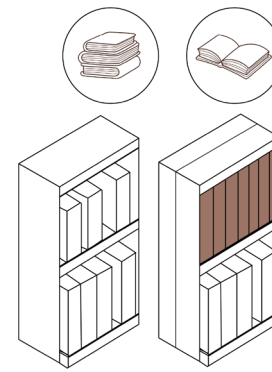
5 RESEARCH AND DESIGN

The results of this study will directly inform the spatial and thematic redesign of the Koninklijke Bibliotheek (KB), the National Library of the Netherlands in The Hague. By identifying multisensory design strategies and analyzing precedent libraries, the research will support the integration of tactile, auditory, and spatial features that improve accessibility, intuitive navigation, and overall user experience (Figure 5). The transformed KB offers a radical change: from a closed, confusing, and visually dominating institution to an open, navigable, and multisensory cultural landmark. This shift is based on the notion that space should communicate not only through sight but also through all of the senses, providing significant, inclusive experiences for all users, particularly those who are visually impaired, or neurodiverse.

Ultimately, this research will guide the development of a new multisensory-focused program—complementing the existing one—by determining which collections and functions should remain and how they can be spatially reorganized to foster greater social inclusivity (Figure 4).

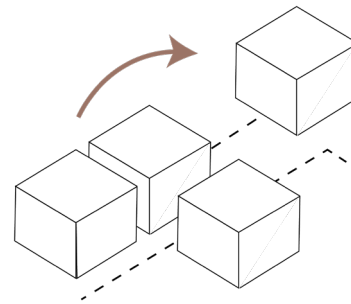
The insights gained will also inform key decisions related to layout, zoning, and circulation, ensuring a clear, comfortable, and equal environment for all visitors particularly, though not exclusively, those with sensory impairments or neurodiverse conditions. In doing so, the KB can evolve into a more adaptable, future-proof library—one that not only preserves its national significance but also sets a precedent for inclusive, user-centered design across public spaces. An environment where inclusivity is no longer a concept, but a lived experience (Figure 6).

For a comprehensive summary of the research and design schedule, containing important dates, phases of research, and implementation stages, please consult Appendix E. This appendix presents a detailed timeline of the project's chronological progression up to the second presentation (P2).



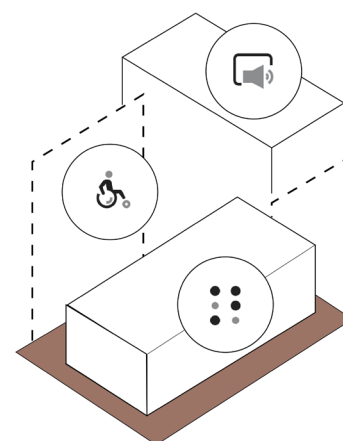
1. Identify Collections

Strategic selection and curation of the library's physical and digital collection in the new program



2. Spatial (Re)organization

Altering the spatial layout to facilitate enhanced circulation and accessibility as well as multisensory design elements



3. Multisensory Accessibility Zones

How sensory elements will be included into the library user experience to improve inclusivity and engagement

Figure 4. Research and Design goals. Compiled by author (Veldkamp, 2025).

5 RESEARCH AND DESIGN

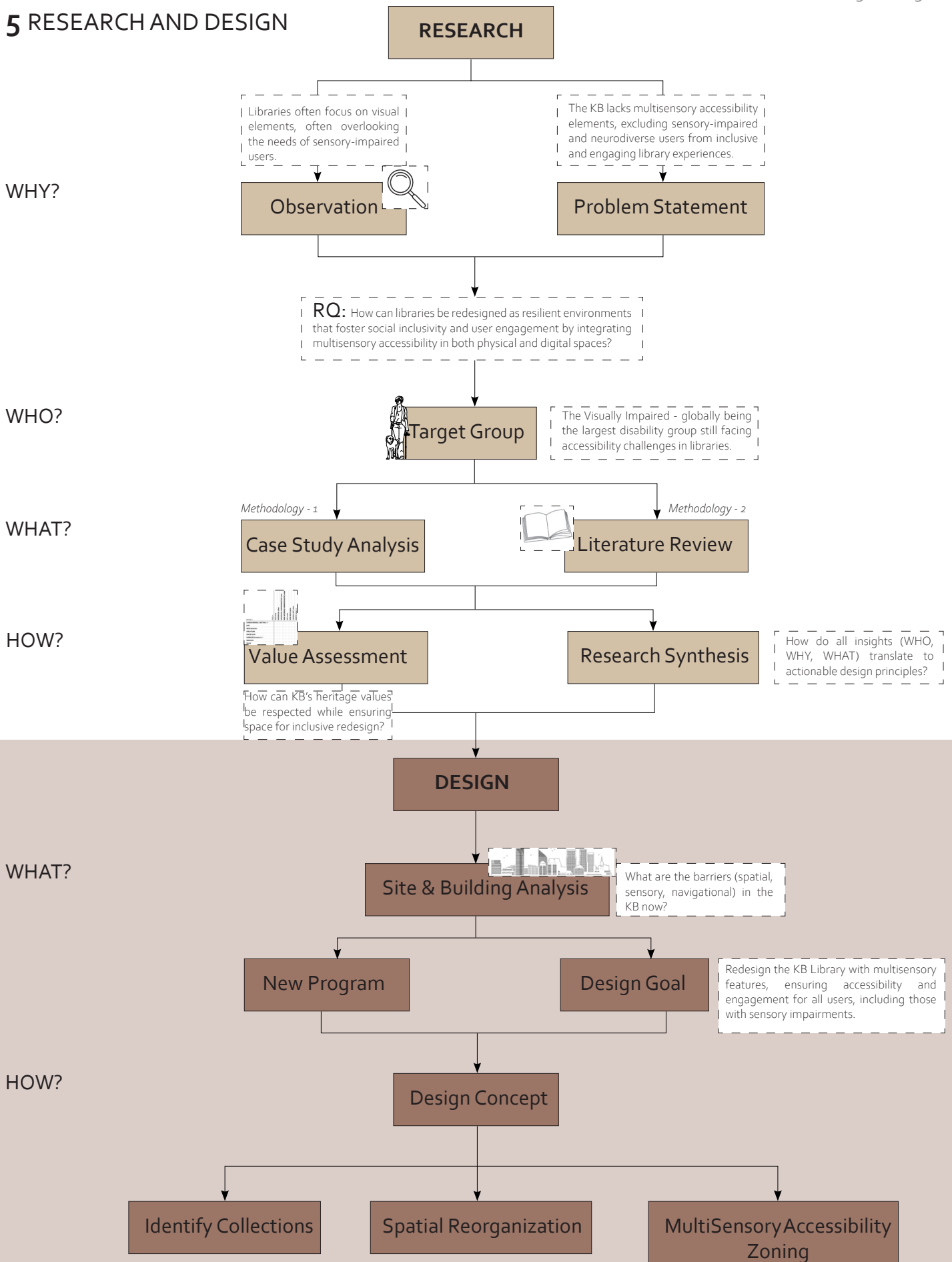


Figure 5. Research-Design diagram. Compiled by author (Veldkamp, 2025).

5 DESIGN VISION

An inviting entrance where visual, tactile, and olfactory sensations intersect. Illuminated tactile lettering, aromatic plant beds, and textured pathways foster an inclusive, multisensory experience that directs each visitor to the core of the KB Library. What was once a closed-off and uninviting facade can transform into a light, transparent, and welcoming threshold — a sensory gateway to knowledge, belonging, and shared community space.



Figure 6. A vision for an inclusive and multisensory entrance at the KB Library. This proposal integrates transparent design, tactile wayfinding, illuminated landmarks, and sensory plant indicators to foster an accessible, engaging, and inviting experience for all visitors. Edited by author (Veldkamp, 2025).

6 REFERENCES

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6.1 FIGURES

Figure 1. Context Map 1:5000 (reduced 70%). Compiled by author (Veldkamp, 2025).

Figure 2. Conceptual diagram highlighting the relationship between the research's main principles of inclusivity, user engagement, and multisensory accessibility. Compiled by author (Veldkamp, 2025).

Figure 3. Neurodiverse and impaired users. Compiled by expert Ted van der Togt, researcher KB.

Figure 4. Research and Design goals. Compiled by author (Veldkamp, 2025).

Figure 5. Research-Design diagram. Compiled by author (Veldkamp, 2025).

Figure 6. A vision for an inclusive and multisensory entrance at the KB Library. This proposal integrates transparent design, tactile wayfinding, illuminated landmarks, and sensory plant indicators to foster an accessible, engaging, and inviting experience for all visitors. Edited by author (Veldkamp, 2025).

APPENDIX A

Table A1.
Framework for Case Study Analysis

CATEGORY	FOCUS POINTS	GUIDING QUESTIONS
Narrative and Identity	Mission and public identity of the library	What is the narrative or ambition of the library, and how is this communicated spatially?
Spatial Organization	Centralised, Linear, Radial, Cluster, or Grid lay-out, Transition Spaces, Openness vs Enclosure	Is the library structured around a central atrium/hub? How is the space organized? Are there buffer zones between quiet and nosy areas? Is there a relationship between public and private zones?
Program and Functions	Building Services, Functional Spaces and overall Program	What kind of functions are housed in the library infrastructure? Are the functions responsive to diverse user groups? Are there any multi-functional spaces available to meet changing needs?
Zoning and Circulation	Space division, User Flow, Hierarchy of Spaces, Relationship between Public, Private and Semi-public zones	How are different zones (public, private, semi-public) distributed and connected in the spatial lay-out? And what differentiates these zones (visuals, acoustics, texts)? Vertical circulation: How are stairs, elevators, and ramps organized? Horizontal circulation: How are the corridors designed and connected? Wayfinding: Are there any sightlines, tactile or auditory elements guiding the movement?
Multisensory Design Elements	Integration of Tactile, Auditory, Olfactory, and Visual elements in the design	Are there any multisensory design elements integrated in the spatial organization and program of the building?
Accessibility Strategies	Design features addressing sensory and physical impairments	How does the library provide inclusive access to its collections, programs, and services through multisensory strategies? To what degree do the library's design elements cater to various sensory and physical capabilities, and how are these integrated into both the physical and digital environments?

Note. Compiled by author (Veldkamp, 2025). Framework for Case Studies: guiding questions for analyses.

APPENDIX B

Table B1.
Literature Overview with Short Summary

Title:	Type:	Content:	Reference:
Accessibility and provision of digital library resources to the visually impaired students in academic libraries: A case study of University of Oslo Library.	Master thesis	The research highlights significant obstacles consisting of insufficient assistive devices, absence of accessible digital content, and a lack of awareness among librarians concerning the requirements of visually impaired users, using the University of Oslo Library as a case study.	Agabirwe, P. (2019). Accessibility and provision of digital library resources to visually impaired students in academic libraries: A case study of University of Oslo Library (Master's thesis, Oslo Metropolitan University). Retrieved from https://oda.oslomet.no/odaxmlui/handle/10642/69227
The spatial experience of visually impaired and blind: an approach to understanding the importance of multisensory perception	Article	Bakir et al. (2022) investigate the spatial experiences of visually impaired and blind individuals through multisensory perception. The research highlights the significance of non-visual sensory stimuli—such as auditory, tactile, and spatial memory—in navigation and spatial cognition.	Bakir, D., Mansour, Y., Kamel, S., Moustafa, Y., & Khalil, M. H. (2022). The spatial experience of visually impaired and blind: an approach to understanding the importance of multisensory perception. <i>Civ Eng Archit</i> , 10(2), 644-58.
Spaces speak, are you listening?	Book	Blesser and Salter investigate the often-overlooked role of sound in architectural design. They think that rooms have innate acoustic properties that influence how individuals perceive and experience their surroundings. The book investigates the sensory influence of sound, highlighting its role in producing immersive and meaningful experiences. The authors investigate how sound influences emotional responses and social interactions in physical settings, as well as how spatial architecture might engage aural senses in ways that complement visual and tactile experiences.	Blesser, B., & Salter, L.-R. (2007). <i>Spaces speak, are you listening? : experiencing aural architecture</i> . MIT Press. http://site.ebrary.com/id/10173546
Multi-sensory interaction for blind and visually impaired people	Article	Cho (2021) investigates the significance of multisensory interaction in improving accessibility for those who are blind or visually impaired. The research examines the enhancement of digital and physical navigation experiences through the integration of tactile, auditory, and spatial interactions.	Cho, J. D. (2021). Multi-sensory interaction for blind and visually impaired people. <i>Electronics</i> , 10(24), 3170.
Improving library services to people with disabilities	Book	Deines-Jones (2007) examines methods for improving library services to cater to people with impairments.	Deines-Jones, C. (Ed.). (2007). <i>Improving library services to people with disabilities</i> . Elsevier.
Designing for the disabled	Book	Goldsmith focuses on the ideas of creating environments that are accessible to people with disabilities. The book emphasizes the significance of recognizing and meeting the different needs of impaired users via thoughtful and inclusive design. It offers practical recommendations for designing spaces that are not only functional, but also visually pleasant and inspiring for people with a variety of disabilities.	Goldsmith, S. (1997). <i>Designing for the disabled</i> . London: Architectural Press.
Assessment of accessibility and inclusivity in the design of public library in Lagos.	Article	The article explores the challenges of accessibility and inclusivity within public libraries, focusing on Lagos as a case study. It emphasizes the ways in which physical and sensory obstacles restrict access for individuals with disabilities, especially those who are visually impaired.	Itoabasi, U., George, O., & Daniel, A. C. (2024). Assessment of accessibility and inclusivity in the design of public library in Lagos. <i>International Journal of Multidisciplinary Research and Growth Evaluation</i> , 5(2), 594-599.
Multi-sensory environments and inclusive sensory engagement at Durham County Library	Article	This article by Jamsky and Alverson outlines Durham County Library's innovative initiatives in creating specialized Multi-Sensory Environments (MSEs) to improve accessibility for users of all ages, especially individuals with different sensory needs	Jamsky, J., & Alverson, S. (2024). Multi-sensory environments and inclusive sensory engagement at Durham County Library. <i>North Carolina Libraries</i> , 82(1). 10.3776/ncl.v82i1.5435
Conceptualising benefits of user-centred design for digital library services	Article	Kautonen and Nieminen analyze the implementation and assessment of user-centered design (UCD) in the implementation of digital library services in this article.	Kautonen, H., & Nieminen, M. (2018). Conceptualising benefits of user-centred design for digital library services. <i>LIBER Quarterly</i> , 27(1), 1-28. https://doi.org/10.18352/lq.101737
Visually impaired access to library services: The role of library infrastructure.	Article	Kwafoa (2019) examines the influence of library infrastructure on the accessibility of services for visually impaired individuals. The research underscores the significance of physical and digital infrastructure in either promoting or obstructing access to knowledge.	Kwafoa, P. N. Y. (2019). Visually impaired access to library services: The role of library infrastructure. <i>Library Philosophy and Practice</i> , (e-journal), 1-19.

Note. Compiled by author (Veldkamp, 2025). This table presents a concise overview of the selected literature, including a summary relevant to the study.

APPENDIX B

Table B2.

Continuation of table B1: Literature Overview with Short Summary

The multisensory museum: Cross-disciplinary perspectives on touch, sound, smell, memory, and space	Book	Levent and Pascual-Leone (2014) examine how museums might captivate visitors beyond visual stimuli by integrating multimodal experiences, encompassing touch, sound, olfaction, and spatial memory.	Levent, N., & Pascual-Leone, A. (Eds.). (2014). <i>The multisensory museum: Cross-disciplinary perspectives on touch, sound, smell, memory, and space</i> . Rowman & Littlefield.
Blindness and low vision in The Netherlands from 2000 to 2020—modeling as a tool for focused intervention	Article	This study focuses on estimating the causes and magnitude of severe visual impairments (blindness) and mild visual impairments (low vision) in the Netherlands, from the year 2000 up to 2020.	Limburg, H., & Keunen, J. E. E. (2009). Blindness and low vision in The Netherlands from 2000 to 2020—modeling as a tool for focused intervention. <i>Ophthalmic Epidemiology</i> , 16(6), 362–369. https://doi.org/10.3109/09286580903312251
The senses: Design beyond vision	Book	This book examines why we should design beyond sight, while examining how this can enhance accessibility and inclusivity. It includes case studies, articles, and design projects that incorporate sensory stimulation through tactile surfaces, sound, olfaction, and motion.	Lupton, E., & Lipps, A. (Eds.). (2018). <i>The senses: Design beyond vision</i> . Chronicle Books.
Accessibility of European museums to visitors with visual impairments	Article	In this study, Mesquita & Carneiro (2016) examine the accessibility of European museums for individuals with visual impairments, assessing current obstacles and inclusive approaches. The research underscores that museums frequently depend on visually oriented exhibitions, hence restricting interaction for visually challenged users.	Mesquita, S., & Carneiro, M. J. (2016). Accessibility of European museums to visitors with visual impairments. <i>Disability & Society</i> , 31(3), 373–388. https://doi.org/10.1080/09687599.2016.1167671
The evolving roles of libraries and librarians in the 21st century	E-journal	Momoh and Folorunso (2019) examine the evolving purpose of libraries and the shifting duties of librarians within a digital and user-centered context. The article examines the evolution of libraries to meet changing societal demands, highlighting the significance of technological integration, user engagement, and inclusive design.	Momoh, E. O., & Folorunso, A. L. (2019). The evolving roles of libraries and librarians in the 21st century. <i>Library Philosophy and Practice (e-journal)</i> , 2867.
The Eyes of The Skin: Architecture and the Senses (3rd Edition)	Book	Pallasmaa underscores the significance of multisensory design in architecture, notably in how surroundings may stimulate all senses beyond mere sight. He claims that contemporary architecture has grown excessively preoccupied with visual stimuli, disregarding the other senses that enhance a comprehensive perception of space.	Pallasmaa, J. (1996). <i>The eyes of the skin: Architecture and the senses</i> (3rd ed.). Wiley. [ISBN 978-1-1199-4128-6].
The multisensory experience of handling and reading books.	Article	In this study, Charles Spence examines the multisensory dimensions of engaging with physical books, especially classic and historical texts. He examines how the tactile experience of using a book, the aesthetic allure of its design, the unique aroma of old paper, and the auditory effect of page turning enhance a profound, multisensory reading experience.	Spence, C. (2020). The multisensory experience of handling and reading books. <i>Multisensory Research</i> , 33(8), 902–928. https://doi.org/10.1163/22134808-bja10015
On making libraries and museums more accessible for autistic people	Article	This article examines measures to improve the accessibility and inclusivity of libraries and museums for individuals with autism.	Svaler, T. B. (2023). On making libraries and museums more accessible for autistic people. <i>IFLA Journal</i> , 50(1), 42–52. https://doi.org/10.1177/03400352231202516
Perspectives of Visually Impaired Visitors on Museums: Towards an Integrative and Multisensory Framework to Enhance the Museum Experience.	Article	The research underscores the shortcomings of conventional museum designs, which predominantly rely on visual stimuli, and examines how tactile, auditory, and interactive components can enhance visitor engagement. Vaz, Freitas, and Coelho (2021) suggest a multisensory framework to improve accessibility and inclusivity.	Vaz, R., Freitas, D., & Coelho, A. (2021). Perspectives of visually impaired visitors on museums: Towards an integrative and multisensory framework to enhance the museum experience. Proceedings of the 18th International Conference on Digital Accessibility, 343–350. https://doi.org/10.1145/3439231.3439272
User needs for mobility improvement for people with functional limitations	Book chapter	This chapter by Wiethoff et al. examines the mobility requirements of individuals with functional limitations, investigating how technology and design might enhance their mobility and mitigate obstacles.	Wiethoff, M., Sommer, S., Valjakka, S., Van Isacker, K., Kehagias, D., & Tzouvaras, D. (2008). User needs for mobility improvement for people with functional limitations. In S. Pinder (Ed.), <i>Advances in human-computer interaction</i> (pp. 595–604). I-Tech Education and Publishing. https://repository.tudelft.nl/islandora/object/uuid%3A8b8d9egg-d456-4b44-906b-1eaa6be4b481

Note. Compiled by author (Veldkamp, 2025). This table presents a concise overview of the selected literature, including a summary relevant to the study.

APPENDIX B

Table B3.

Continuation of table B1: Literature Overview with Short Summary

Enhancing usability of digital libraries: Designing help features to support blind and visually impaired users.	Article	Xie et al. (2020) investigate the potential of digital libraries to improve usability for blind and visually impaired individuals through the development of efficient assistance features. The research examines the difficulties encountered by users in navigating digital library interfaces and assesses assistive technologies that enhance accessibility.	Xie, I., Babu, R., Lee, T. H., Castillo, M. D., You, S., & Hanlon, A. M. (2020). Enhancing usability of digital libraries: Designing help features to support blind and visually impaired users. <i>Information Processing & Management</i> , 57(3), 102110. https://doi.org/10.1016/j.ipm.2019.102110
Multisensory reading promotion in academic libraries	Article	In this study, Yu et al. examine the execution of multisensory reading promotion in academic libraries, concentrating on the Reading Together with Library Echo (RTLE) initiative at Zhejiang University of Technology Library. The RTLE software integrates auditory and visual components to foster an immersive reading experience, with the objective of augmenting user engagement and facilitating comprehensive reading.	Yu, W., Jiang, Y., Wu, Y., & Cheng, Y. (2023). Multisensory reading promotion in academic libraries. <i>Frontiers in Psychology</i> , 13, 987180. https://doi.org/10.3389/fpsyg.2022.987180

Note. Compiled by author (Veldkamp, 2025). This table presents a concise overview of the selected literature, including a summary relevant to the study.

APPENDIX C

Table C1.
Multisensory Accessibility in Libraries: A Literature Review Matrix

REFERENCES	Multisensory Accessibility				Accessibility & Inclusivity				Accessibility for the Visually Impaired				User Experience and Engagement			
	Sensory Design	Multisensory	Beyond Sight Design	Embodied Interaction	Barriers	User needs	Inclusivity	General Accessibility	Assistive Technologies	Sound	Wayfinding	Tactile Design	Sensory Stimulation	User Engagement	User Experience	User Satisfaction
Agabirwe, P. (2019)																
Bakir et al. (2022)																
Blesser, B., & Salter, L. (2009) [Book]																
Cho, J. D. (2021)																
Deines-Jones, C. (Ed.). (2007)																
Goldsmith, S. (1997) [Book]																
Itoabasi et al. (2024)																
Jamsky, J., & Alverson, S. (2024)																
Kautonen, H., & Nieminen, M. (2018)																
Kwafoa, P. N. Y. (2019)																
Levent et al. (2014) [Book]																
Lupton, E., & Lipps, A. (Eds.). (2018).																
Mesquita, S., & Carneiro, M. J. (2016)																
Momoh, E. O., & Folorunso, A. L. (2019)																
Pallasmaa, J. (1996) [Book]																
Spence, C. (2020)																
Svaler, T. B. (2023)																
Vaz, Freitas, & Coelho (2021)																
Wiethoff et al. (2008)																
Xie et al. (2020)																
Yu et al. (2023)																

Note. Compiled by author (Veldkamp, 2025). This matrix presents a checklist derived from the literature overview in Table 2, illustrating the research indications found in each source.

APPENDIX D

Table D1.
Accessibility needs for Neurodiverse and Impaired User Groups

Group	Characteristics	Inclusive Design through	
Visually Impaired	Impaired visual perception, dependence on non-visual senses (e.g., auditory – sound, tactile - touch).	<i>Physical</i>	<i>Digital</i>
		More accessible environment through soundscapes, tactile surfaces, non-visual navigation.	Incorporation of braille and auditory technology (European Accessibility Act, EAA).
Mobility Impairments	Challenges with fine or gross motor abilities, restricted mobility, and the necessity for assistance devices such as wheelchairs.	Physical spaces that are accessible (e.g., ramps, elevators, widened paths and ergonomic design).	
Dyslexic	Challenges with text comprehension and letter reversal; difficulty with penmanship, reading, and writing.	Modifications to text-based design (e.g., streamlined typefaces, text-to-speech functionality, visual indicators). Transparent arrangement for information distribution.	
Attention Span Disorders (ADHD)	Challenges in concentration, frequent attentional shifts, inattention, hyperactivity, and impulsivity (NIMH, n.d.).	Engaging design elements (e.g., audio or visual stimuli), information presented in a clear and direct matter.	
Low Literacy	Restricted proficiency in reading and writing, dependence on visual aids, frequently constrained vocabulary.	Multimedia support, literacy programs.	
Low Digital Skills	Insufficient knowledge or comfort with digital technology may hinder effective navigation of interfaces.	Clear digital interfaces, detailed technology usage instructions, and user-friendly designs.	

Categorization based on sketch by Ted van der Togt, researcher KB, European Digital Reading Lab and Future Libraries Lab.

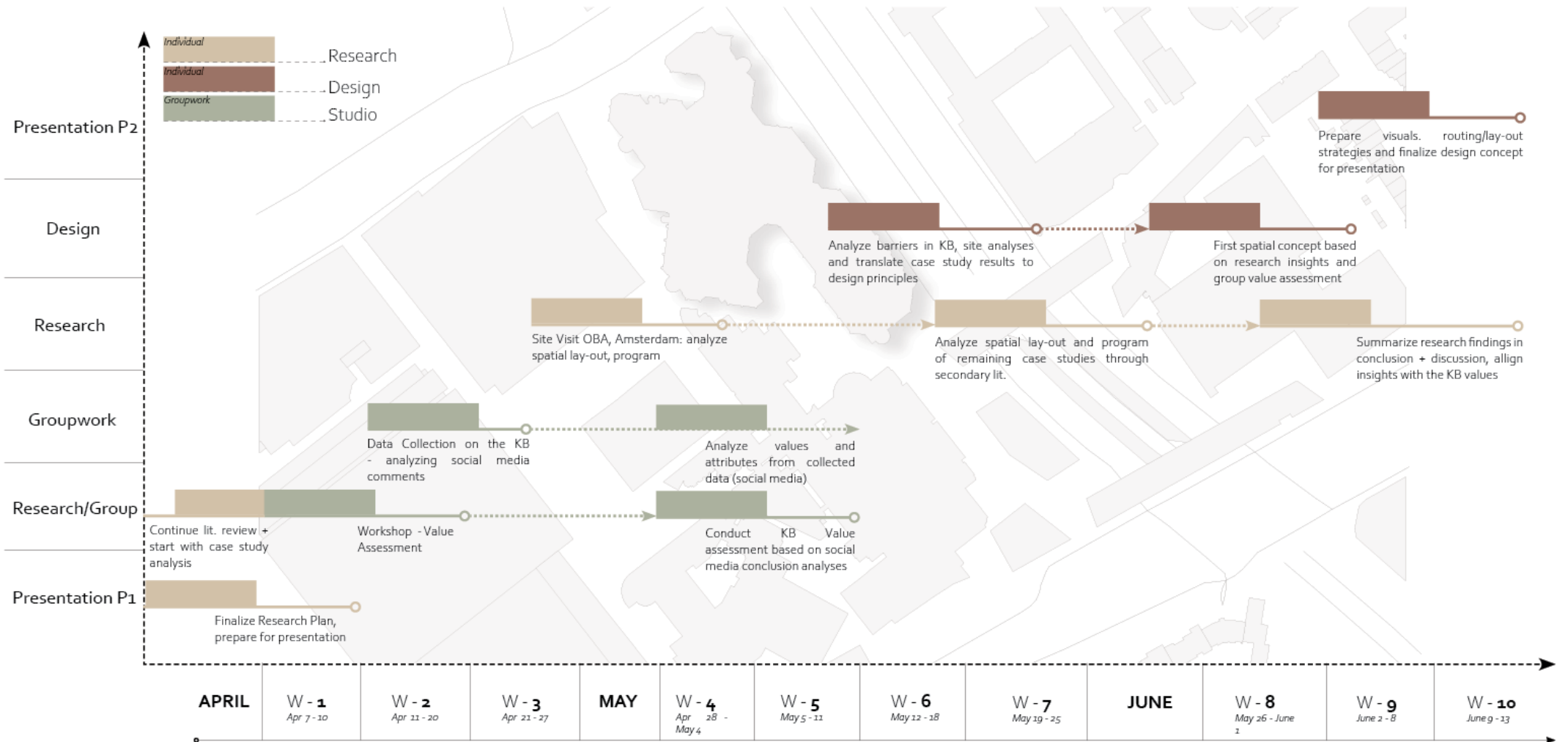
Design strategies based on: European Parliament. (2018). Assistive technologies for people with disabilities. European Parliamentary Research Service. <https://europa.eu>

Attention-Deficit/Hyperactivity Disorder (ADHD). (n.d.). National Institute of Mental Health (NIMH). <https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd>

Note. Compiled by author (Veldkamp, 2025). Categorization based on Ted van der Togt, researcher KB, European Digital Reading Lab and Future Libraries Lab.

APPENDIX E

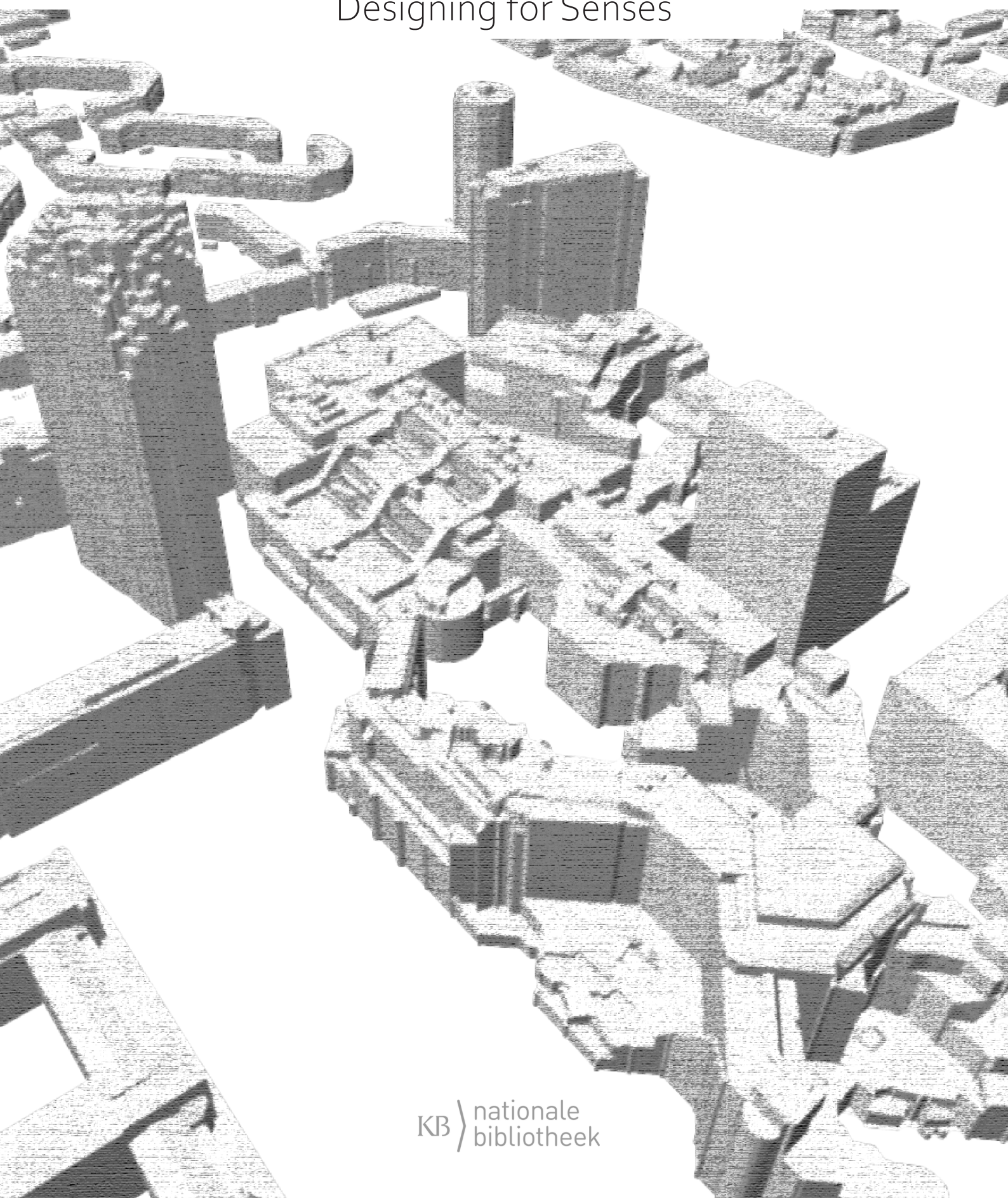
Diagram E1.
Research & Design Timeline



Note. Compiled by author (Veldkamp, 2025). This diagram shows the planning for the 10 upcoming weeks concerning research, design and groupwork.

UNIVERSAL INCLUSIVITY

Designing for Senses



KB } nationale
bibliotheek

BEYOND SIGHT, BEYOND BARRIERS:

Reimagining Library Spaces through Multisensory Accessibility