Understanding Library Wayfinding and Signage Through a Literature Review

Nur Areena Aqilah Mohd Sapri[1], Mohd Zool Hilmie Mohamed Sawal[2*], Noor Syakinah Mohd Ridwan[3], Suci Yanti Ramadhan[4], Chaw Siew Poh[5]

[1,2,3]School of Information Science, College of Computing, Informatics & Mathematics, University Technology MARA Cawangan Kedah Kampus Sungai Petani, Malaysia

[4]Universitas Pendidikan Indonesia

[5]Sunway JB Library & Learning Commons

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2025.909000024

Received: 20 August 2025; Accepted: 27 August 2025; Published: 27 September 2025

ABSTRACT

Wayfinding is essential for navigating complex environments, including libraries. Signage plays a critical role in guiding users, reducing confusion, and improving accessibility, yet research on its effectiveness in library settings remains limited compared to other public spaces. The objectives are to examine the effectiveness of signage types in library wayfinding, their impact on user experience and accessibility, key design principles for effective wayfinding, and practical strategies for improving signage usability. It also identifies research gaps and future directions for enhancing signage in libraries. Systematic approach is used, applying a structured search of academic databases, rigorous selection of peer-reviewed studies, and thematic analysis to evaluate signage effectiveness, wayfinding efficiency, and future research directions. Signage enhances wayfinding efficiency in libraries by guiding users, reducing cognitive overload, and improving accessibility through clear, consistent, and strategically placed designs. Integrating interdisciplinary insights from cognitive science, architecture, and user experience research can help libraries develop user-centred, inclusive signage systems that optimize navigation, accessibility, and overall user experience

Keywords: library wayfinding, library signage, spatial anxiety, user behaviour

INTRODUCTION

Wayfinding efficiency helps individuals navigating built spaces effectively. This is important and useful in complex public spaces like airports, hospitals, and cities to reduce cognitive load and enhance user experience (Arias-Flores et al., 2024). Similarly, because of complex and advanced layout of libraries as well as its roles as the information centres, libraries need a structured wayfinding systems to prevent confusion, maintain engagement, optimise usage of resources (Mandel, 2013).

Signage is a key element in wayfinding as it guides users through both public spaces including libraries. Signage directs users to their destination in public setting (Denis & Pontille, 2016), whereas it provides directions, identifies key areas, and conveys service information in libraries. Hence, clarity, visibility, placement, consistency, and accessibility are emphasised for effective signage (Su et al., 2022). Ongoing improvements are made but, many libraries are still struggling with the placement, design which will contribute to weak strategic wayfinding systems (Li & Klippel, 2012; Melcher, 2023).

Wayfinding research in libraries are limited, compared to public spaces which creates gaps in empirical research. However, valuable insights from this related fields are worth to be studied in library setting. Therefore, this review integrates interdisciplinary findings from cognitive science, UX research, architecture, environmental

psychology, and information behaviour. Research on spatial cognition explores how individuals navigate complex environment whereas architectural studies, just like UX research are more on examining the signage itself which leads to wayfinding efficiency and user experience. Findings from this interdisciplinary research will help to contextualise applicable best practices to libraries wayfinding system because it is important to understand user interaction with the physical signage.

This literature review aims to: (1) analyse the effectiveness of different signage types in library wayfinding, (2) examine their impact on user experience and accessibility, (3) identify key design principle for effective wayfinding system, (4) explore practical strategies to improve signage usability, and (5) identify research gap and future directions for effective library signage enhancement. Overall, insights from this research will be helpful for signage optimisation to improve user wayfinding and library usability. Additionally, this will also have practical implications for library administrators, researchers, designers, information professionals, and policymakers.

The discussion will start with theoretical perspectives on wayfinding, the role of signage in public spaces, and its application in libraries, then followed by a summary of key insights, research gaps, and recommendations for future studies. Eventually, this study will provide comprehensive understanding on the relationship between signage and library wayfinding and offers recommendations for future innovations in wayfinding systems.

METHODOLOGY

Extensive search strategy was conducted across multiple databases including Scopus, Web of Science, and Google Scholar to synthesise studies on library signage and wayfinding. Few keywords such as “library signage,” “wayfinding,” “spatial navigation,” “library wayfinding,” “signage and accessibility,” and “wayfinding efficiency” were used to retrieve relevant studies. Besides, for more accurate studies, Boolean Operators were used to refine the search results. Additionally, backward citation analysis was implemented to identify studies potentially overlooked in the initial search.

Selection criteria were carefully designed to ensure all relevant studies or articles are included: (1) peer-reviewed journals and proceedings published between 2000 and 2024, (2) studies on architecture, UX, and cognitive psychology were included for their insights into spatial navigation and effective implementation, (3) studies focusing on digital and interactive signage were excluded, (4) articles without full-text availability and opinion-based studies were excluded to maintain review integrity.

Literature was categorised into five thematic areas for the analysis: (1) theoretical foundations of wayfinding, (2) signage as a wayfinding tool in libraries, (3) factors influencing wayfinding efficiency, (4) insights from other public spaces, and (5) challenges and future directions

With the implementation of structured search strategy, rigorous selection criteria, and thematic categorisation, this will provide a comprehensive analysis on library signage and wayfinding which will help to identify effective signage practices, their impact on user experience and accessibility, key design principles, practical improvements, and areas for further research.

DISCUSSION

Theoretical Foundations of Wayfinding

It is important to understand how individuals behave when navigating complex spaces, including libraries. Wayfinding theories and models provide a critical framework to analyse this. Formal Grammar-Based Model is widely used in wayfinding research. It applies modular concepts to study movement patterns which enables empirical testing and simulation (Kiefer et al., 2015). Similarly, Unified Routing Models will integrate spatial and cognitive aspects and use graph-based methods to represent decision-making in complex spaces and predict the movement patterns of the pedestrians (Kielar et al., 2018). Additionally, these models help predict people movement and decision-making process in a complex environment, which make them relevant for practitioners

such as librarians and designers. These approaches are exceptionally relevant to libraries because users need to navigate the complex layout of libraries with multiple floors, service areas, and resource sections.

Other than spatial structures, human factors also contribute to wayfinding efficiency. Bayesian Network Model suggests that in addition to the design, spatial anxiety and cognitive ability will have a greater impact on wayfinding (Ardi et al., 2019; Cardillo et al., 2017; Farr et al., 2014; Geer et al., 2024; Hund & Minarik, 2006; Mendez-Lopez et al., 2020). In libraries, different levels of familiarity and cognitive ability of the users will affect the overall wayfinding experience. This is supported by the model as it highlights the positive impact of habitual wayfinding to consistent navigation patterns, leading to more efficient orientation (Luo, 2018). Therefore, it is important for clear and consistent signage. Hence, both frequent and infrequent users depend on external navigation aids, such as directional signage, maps, and librarian assistance (Li & Klipple, 2012). When applied well, clear and standardized signage is crucial to reduce anxiety among first-timer or less confident users.

Library layout further influence wayfinding efficiency. Mandel (2013) proves with Space Syntax Theory that logically structured spaces enhance natural wayfinding, whereas separated sections or low visibility create more challenges and require additional wayfinding aids. Klipple et al. (2005) with Wayfinding Choreme Theory emphasise the role of landmark in wayfinding. This is supported by Fu et al. (2022) emphasise that architectural features, large signage, and strategically placed service points will help users to form cognitive maps which will improve the spatial orientation and reduce their dependence on signage. This suggests that both structural design and clearer signage are equally important in accommodating diverse users, including those with higher spatial anxiety or accessibility needs.

Agent-based simulations provide additional insights to user behaviours. Belief-Desire-Intention (BDI) framework is used by the Agent-Based Models to simulate the behaviours in wayfinding (Ma et al., 2024). This model provides insights on how various users navigate complex environments, make decisions at key wayfinding points, adapt to obstacles like unclear signage. This node-to-node navigation patterns are common in libraries as users connect familiar locations via personal routes while others depend on sequential signage at key decision points (Mandel, 2013). Hence, signage strategies must ensure consistent placement and minimal visual clutter. This balance between clarity and simplicity is essential if libraries are to create inclusive navigation systems that are usable by both confident and less confident users.

Empirical research further validates the influence of both human and environmental factors on wayfinding. Spatial familiarity identified from the visual attention and gaze pattern will significantly impact the wayfinding (Alinaghi & Giannopoulos, 2024). Additionally, decision-making process is eased with signage system because it reduces cognitive load and improves wayfinding efficiency (Zhou et al., 2023). From a practical standpoint, this indicates that signage should not only be theoretically efficient but also accessible, intuitive, and inclusive of users with varied backgrounds and abilities.

User experience can be enhanced by integrating these wayfinding theories especially when it is implemented through targeted improvements. From the models, both cognitive and environmental factors are required to design effective wayfinding systems. Ultimately, by applying these principles, libraries can create more intuitive and accessible spaces which will improve user engagement and overall library usability. However, these findings are limited by the lack of demographic and geographic diversity in existing studies, which means that future reviews should explore user experiences across public and academic libraries, different age groups, and individuals with disabilities to ensure broader applicability.

Signage as a Wayfinding Tool in Libraries and Public Spaces

The role of library signage to provide essential guidance, reducing confusion, and minimising dependence on staff for wayfinding assistance is imperative (Su et al., 2022) especially in large academic and public libraries due to their complex layouts that are challenging to users (Lee & Dazkir, 2015). Well-placed and consistent signage enable users to navigate spaces with minimal difficulty, enhancing wayfinding efficiency (Polger & Stempler (2014).

Apart from general wayfinding, stack signage is crucial in book retrieval efficiency. Using colour-coding or landmark-based as the signage system enhance user satisfaction and improves circulation services (Stempler,

2013). Moreover, signage must be accessible for diverse users including those with disability. Therefore, Sherman (2022) recommends incorporating high-contrast text, large fonts, and intuitive pictograms for more inclusive signage. Additionally, libraries can conduct regular signage audits to evaluate signage systems, eliminate redundancies, and implement improvements to improve wayfinding (Mandel & Johnston, 2019).

Even with limited research in library setting, the finding from the studies on public spaces such as hospitals, shopping malls, museums, and airports still provide valuable insights adaptable to library wayfinding systems. Signage is fundamental to satisfy patient in hospital as it enhances perceptions of professionalism and accessibility (Kalyan et al., 2024). They also suggest making signage more visible, linguistically inclusive, and aligned with logical spatial configurations to ease wayfinding process. Both hospitals and libraries require signage systems to help users locate key services efficiently while reducing spatial anxiety (Sahoo et al., 2024).

Signage has different roles in different settings. For example, it is for public safety in high-traffic spaces like shopping malls. Chew et al. (2021) emphasise that inconsistent safety messaging will lead to confusion. Hence, standardising the safety signage such as escalator signs is crucial. Additionally, this underlines the needs of libraries to adopt consistent design principles to enhance signage effectiveness.

Strategically placed signage is fundamental in high-foot traffic spaces, such as airports to avoid congestion and reduce passenger stress. Sauer (2005) agrees that wayfinding can be easier with clear and prominently placed signage. Nowadays, integration of digital signage does not stop the needs for traditional signage as it is useful for quick reference and unambiguous directional guidance. Libraries can place signage at key transition points such as staircases, service desks, shelves, and entryways to improve navigation and reduce disorientation

Similarly, museums require signage for both functional and aesthetic roles. It guides visitors while enhancing their overall experience. Therefore, museum signage should adopt culturally relevant symbols and clear directional indicators to improve visitor engagement (Zhou et al., 2024). Likewise, signage in libraries is not only a navigational tool but also to reinforce the institutional identity.

All studies on public spaces show the importance of visibility, placement, and standardisation in implementing effective signage system. For example, Kim et al. (2022) emphasise that signage should be highly noticeable and easily interpretable especially for emergency situations. Additionally, comprehension and responsive times in high-pressure spaces such as hospitals and airports can be improved with multidimensional signage designs (Supasumond et al., 2021).

Overall, these findings help libraries to refine their signage strategies to enhance accessibility, usability, and wayfinding efficiency. There are few strategies that can be implemented to improve wayfinding significantly: (1) place signage at key decision points, (2) ensure signage is linguistic accessible, (3) design visually appealing yet culturally meaningful signage. Furthermore, libraries can improve their evacuation guidance and safety signage by adopting best practices from hospitals. This will also ensure the accessibility and navigability of the libraries for all users. Ultimately, drawing insights from multiple fields and disciplines allows libraries to create more intuitive and user-friendly wayfinding systems that can cater to a diverse user base.

Factors Influencing Wayfinding Efficiency

There are three main factors influencing signage effectiveness in wayfinding through complex environments: (1) readability and visibility, (2) consistency and standardisation, and (3) multilingual and inclusive design. These will not only benefit frequent library users but also non-frequent and first-time library users.

Readability refers how users can comprehend the information on signage effortlessly while visibility is to ensure the signage is noticeable. Zhang et al. (2024) suggest using RGB and HSV contrast to improve readability and bright colours such as yellow to enhance visibility and user attention. Fonts also help the readability of the signage if clear, sans-serif fonts and adequate spacing between letters and lines are implemented on the signage (Priambodo & Siregar, 2018). This will also help users reducing the cognitive effort. Visibility depends on the placement, size, environmental factors, and observation angle of the signage as Xie et al. (2007) state that poorly positioned signage can go unnoticed even if the text is highly readable. Therefore, it is important for libraries to place the signage in locations where users need guidance the most.

Consistency and standardisation are equally important for intuitive wayfinding as it is proven by Petrie et al. (2009) that users are struggling to process various wayfinding cues is the signage placement and formatting are inconsistent. Zhou et al. (2023) recommend minimising environmental complexity and simplify the decision-making process by applying uniform colour schemes, font styles and symbols on the signage. This is further supported by Kalyan et al. (2024) in their wayfinding research at hospital which stressing the importance of standardisation. Ultimately, considering different familiarity levels of spaces by the users, libraries should ensure the signage is aligned with their expectations to enhance accessibility (Sherman, 2022). Therefore, regular signage audits will help maintaining consistency as it will identify outdated and redundant signs to ensure that wayfinding systems remain clear and effective (Stempler & Polger, 2013).

Multilingual and inclusive design address the diverse needs of library users. Multilingual signage helps users from different linguistic backgrounds understanding the information to reduce their confusion then improving the accessibility (Woo & Riget, 2020). This is important for directive signage related to safety regulations and emergency situations, such as safety warnings, emergency exits, and public health directives (Chestnut et al., 2023). Additionally, inclusive signage will focus on accessibility-focused design elements such as high-contrast text, large fonts, and intuitive pictograms to support disabled and cognitive-challenged users (Sherman, 2022). Users are more engaged with participatory design, and this further improves signage effectiveness (Wu & Xu, 2015).

Libraries can develop more effective signage system to enhance wayfinding efficiency by integrating all these factors of readability and visibility, consistency and standardisation, as well as multilingual and inclusive design. This will also ensure the accessibility and usability for diverse user groups. Additionally, these evidence-based strategies help reducing wayfinding challenges and fostering inclusive environments for all users. This eventually will contribute to an improved user experience.

Insights from Other Public Spaces

Architectural cues and cognitive mapping influence how users navigate, perceive, and interact with their surroundings. These two aspects play a crucial role in library wayfinding strategies. Well-designed architectural elements, such as floor layouts, landmarks, and lighting serve as intuitive wayfinding aids that help reducing navigational errors and improving spatial learning. For example, star-shaped pathway configurations facilitate more efficient wayfinding than traditional grid-like designs because they provide clearer decision points to prevent user confusion (Merhay & Fisher-Gewirtzman, 2023).

Placing informational and directional signage aligned with key structural features, such as entryways, staircases, and service desks, significantly benefits users especially those with high spatial anxiety or limited familiarity with the space (Su et al., 2022). Additionally, architectural landmarks, such as lobbies, colour-coded zones, and large decorative features serve as reference points that can help users navigate complex library layouts (Mandel, 2013). Lee and Dazkir (2015) recommends for open layouts with high visibility across library sections to reduce users' dependency on the signage so that they can navigate visually. This later is proven by Kuliga et al. (2019) highlight the absence of clear floor distinctions will lead to users struggling with wayfinding.

Library wayfinding, particularly individual wayfinding strategies is influenced by user behaviour as cognitive mapping is developed through user experience and environmental cues. Thus, frequent library users tend to navigate efficiently compared to new users as they depend more on signage, maps, and environmental markers (Fu et al., 2022). Therefore, they suggest integrating distinct architectural features and clear structural cues to make wayfinding more predictable and user-friendly. Moreover, cognitive mapping is also influenced by complex library layouts, such as non-linear floor plans and disorderly sections (Patel & Vij, 2008).

Wayfinding behaviours is further affected by individual differences in cognitive styles. For example, field-independent users who depend on internalised spatial awareness navigate more efficiently than field-dependent users who depend on external cues such as signage and maps (Frias-Martinez et al., 2008). These differences allow libraries to design more inclusive wayfinding systems to accommodate both independent and guided users. Patel and Vij (2008) explore virtual environments as a tool to enhance wayfinding skills as it can provide virtual training environments to help users developing accurate cognitive maps before navigating physical library spaces, ultimately improving their wayfinding confidence (Patel & Vij, 2008).

With proper understanding of user behaviour and cognitive mapping along with architectural cues, libraries can refine their wayfinding strategies to enhance accessibility, usability, and overall user experience. Logical spatial layouts, intuitive signage placement, and landmarks as navigational anchors create a seamless and inclusive wayfinding system. These strategies can improve the user library experience as it helps reducing navigational difficulties, fostering user confidence, and supporting more efficient access to information and services.

Challenges and Future Directions

Empirical studies on library signage remain limited, especially those examining its relationship with finding. This gap presents a persistent challenge for library users as Rakshikar and Powdwal (2020) stress the students struggling with their wayfinding even after orientation sessions. Almeida and Tidal (2020) later prove that the absence of clear and standardised signage lead to confusion, disorientation, and anxiety, especially among first-time users and those unfamiliar with library's spatial organisation. Without evidence-based strategies in the field, libraries often rely on ad-hoc solutions to improve signage effectiveness. This limitation is further compounded by the fact that most available studies originate from higher education or Western contexts, which restricts the transferability of findings to public libraries, developing regions, or linguistically diverse communities.

Some studies have attempted to address these challenges by conducting signage audits to evaluate and improve library environments. For example, a health library manages to identify several areas for improvement from the audit, such as reducing excessive signage, updating language and design, and eliminating redundant signage contributing to information overload (Wise, 2024). Similarly, a study an academic library finds a colour-coded signage system will significantly improve wayfinding efficiency and increase book checkouts, demonstrating the impact of structured signage on user experience (Stempler, 2013). Despite of suggestions on systematic signage assessments and redesigning efforts to enhance wayfinding, still few libraries have undertaken formal studies to comprehensively evaluate signage effectiveness.

Language barriers, especially in multilingual library settings can dampen wayfinding efficiency. Using inconsistent terminology and library jargon in signage is challenging for users with low English proficiency (Bridgeman, 2023). Terminology used on signage and verbal explanations should be aligned as this can also hinder navigation and cause miscommunication as proven by Fauchelle (2017). This issue underlined the needs for more research on multilingual and inclusive signage practices to ensure that libraries can accommodate to diverse users as this will help elderly users, individuals with disabilities, or those experiencing spatial anxiety, who may require more accessible and universally designed wayfinding systems.

Undeniably, digital signage is recognised for its adaptability and ability to provide real-time updates, traditional static signage is still widely used in libraries, but it is still under-researched (Maceli, 2024; Onwuchekwa, 2021). Most empirical studies focus on hospitals, transportation hubs, and other public spaces (Mandel, 2017). This gap highlights the need for systematic evaluations of static signage, including its placement, visibility, readability, and its overall effectiveness in supporting user wayfinding.

A user-centred approach to signage evaluation is practicable to improve wayfinding efficiency, accessibility, and user satisfaction. However, lack of user-driven insights into its effectiveness due to limited research in the field, requiring more robust methodologies for evaluating signage usability and impact. This approach will ensure signage meet not only cognitive, but also linguistic and spatial wayfinding needs of all library users.

One critical area for future research is the application of formative and summative evaluations in assessing signage systems. When in designing phase, formative evaluation can help researchers understanding user preferences and needs to ensure signage is intuitive and effective before implementation (Kim et al., 2011). Additionally, summative evaluation during post-implementation measure wayfinding efficiency and user satisfaction (Park et al., 2011). Integrating these evaluation stages would provide more comprehensive understanding of signage effectiveness in enhancing wayfinding and usability.

Then future research should also examine wayfinding performance and usability metrics to assess the effectiveness of directional, informational, and regulatory signage. Research on the relationship of signage placement, readability, and consistency should be conducted, particularly in large and complex library

environments (Yang et al., 2020). Libraries can develop clear and accessible signage systems for diverse user groups by evaluating signage completeness, continuity and readability.

Understanding cognitive and emotional responses of users to signage is worth to be studied. It is important to understand how users' interaction with signage, processing directional cures, and developing cognitive maps of library spaces relate with more user-friendly wayfinding strategies (Wu & Xu, 2015) just like how eye-tracking studies could provide insights into how users visually engage with signage that can reveal potential design improvements (Su et al., 2022). Additionally, participatory research is encouraged as users can actively contribute to signage design and can enhance engagement for more effective wayfinding solutions (Purschke, 2020).

Future research should also prioritise special user groups, including those with physical and cognitive disabilities, elderly users, and users with high spatial anxiety. Besides, research on signage for people with cognitive impairments, highlighting the needs for signage that considers both intrinsic and extrinsic wayfinding factors (Gresham et al., 2019). Similarly, clarity and inclusivity of signage with unfamiliar library terminology for non-native speakers and users should be evaluated (Bridgeman, 2023). Accessible and inclusive signage can be ensured by addressing these user-specific needs.

Field experiments and user surveys should be employed to collect real-world data on signage effectiveness as these will provide more practical insights into best practices for signage designs (Rodrigues et al., 2020). Hence, future research should aim to develop standardised evaluation frameworks that libraries can use to conduct regular signage audits and implement improvements.

User-centred approaches remain underdeveloped. Without direct user insights, signage strategies risk overlooking diverse needs. In particular, participatory design approaches can give users an active role in shaping signage systems, helping libraries ensure inclusivity rather than relying solely on top-down design strategies.

CONCLUSION

Signage is fundamental in enhancing wayfinding efficiency within libraries by guiding users through complex spaces, reducing cognitive overload, and improving accessibility. Theoretical models such as Formal-Grammar-Based Model, Bayesian Network Model, Space Syntax Theory highlight the cognitive and environmental factors that influence spatial navigation, reinforcing the need for well-structured wayfinding systems. It has been proven empirically that signage with clear, consistence, and strategic placement will significantly improve wayfinding for both experienced and first-time users. In practice, efficiency and inclusivity are vital in signage design as it will ensure different demographics of groups of users, including elderly users, non-native speakers, and users with disabilities navigate confidently.

Integrating architectural cues, such as open layouts, landmark-based navigation, and high-visibility entry points can further enhance library wayfinding as it helps users form cognitive maps and navigate intuitively. Additionally, research from other public spaces underline the importance of standardisation and multilingual accessibility which will provides insights into library signage optimisation. By addressing these factors, more user-friendly library environments can be implemented as it minimizes disorientation and supports seamless resource access.

Despite these strengths, library signage research remains limited. Future reviews should also acknowledge the geographic and contextual limitations of current literature, which remains skewed toward certain regions and library types. Addressing these gaps will ensure findings are more globally relevant and adaptable. More robust, user-centred evaluations are needed, especially those incorporating participatory methods, usability testing, and accessibility-focused design.

By leveraging interdisciplinary findings and prioritising inclusivity, libraries can transform signage into intuitive, efficient, and equitable wayfinding tools that minimise disorientation and improve user confidence. Ultimately, effective signage fosters greater engagement and a more accessible library experience for all.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Research Management Unit, UiTM Technology MARA Cawangan Kedah for the generous funding provided under the Tabung Penyelidikan Am. This support was crucial in facilitating the research and ensuring the successful publication of this article.

REFERENCES

1. Almeida, N., & Tidal, J. (2022). Library Wayfinding and ESOL Students: Communication Challenges and Empathy-Based Intervention. Portal: Libraries and the Academy 22(2), 453-474. https://dx.doi.org/10.1353/pla.2022.0025.
2. Ardi, R., Fikri, S., & Rahayu, P. D. (2019). Investigating effectiveness wayfinding on terminal navigation in Terminal 2 Soekarno-Hatta Airport: Bayesian network approach. ACM International Conference Proceeding Series, 212-217. https://doi.org/10.1145/3364335.3364340
3. Arias-Flores, H., Valencia-Aragón, K., Sanchez-Gordon, S., & Calle-Jimenez, T. (2024). Evaluating signage accessibility for individuals with visual impairments: A case study in Ecuador. Lecture Notes in Computer Science. https://doi.org/10.1007/978-3-031-60884-1_26
4. Bridgeman, M. (2023). Miscommunication and employee power dynamics may affect student navigation of library resources. Evidence Based Library and Information Practice, 18(3), 72–75. https://doi.org/10.18438/eblip30287
5. Cardillo, R., Vincenzi, I., & Gallani, A. (2017). Spatial tasks and emotional factors: A study conducted with the Italian adaptation of the Child Spatial Anxiety Questionnaire (CSAQ). Psicologia Clinica dello Sviluppo, 21(1), 27–43. https://www.rivisteweb.it/doi/10.1449/88504
6. Chesnut, M., Curran, N. M., & Kim, S. (2023). From garbage to COVID-19: Theorizing 'Multilingual Commanding Urgency' in the linguistic landscape. Multilingua, 42(1), 25–53. https://doi.org/10.1515/multi-2022-0009
7. Chew, C.-C., Chang, C.-T., Lim, X.-J., Ibrahim, H.-A., Azmi, H., Wahabi, N.-I., Hamdan, N.-S., Nazan, N.-A., Karim, N.-H., Ahmad Malawi, N.-F., Oon, Y.-L., & M.S., N.-J. (2021). The quality of escalator signage for public safety in Malaysia: An observational study. Global Health Journal. https://doi.org/10.1016/j.glohj.2021.10.002
8. Denis, J., & Pontille, D. (2016). The graphical performation of a public space: The subway signs and their scripts. In G. Sonda, C. Coletta, & F. Gabi (Eds.), Urban Plots, Organizing Cities. Routledge.
9. Farr, A. C., Kleinschmidt, T., Johnson, S., & Mengersen, K. (2014). Investigating effective wayfinding in airports: A Bayesian network approach. Transport. Retrieved from https://www.scopus.com/record/display.uri?eid=2-s2.0-84896911258&origin=scopusAI
10. Fauchelle, M. A. (2017). Libraries of Babel: Exploring library language and its suitability for the community. Library Review, 66(5), 374–387. https://doi.org/10.1108/LR-04-2017-0034
11. Frias-Martinez, E., Chen, S. Y., & Liu, X. (2008). Investigation of behaviour and perception of digital library users: A cognitive style perspective. International Journal of Information Management, 28(5), 355–365. https://doi.org/10.1016/j.ijinfomgt.2007.10.003
12. Fu, Y., Lomas, E., & Inskip, C. (2022). Cognitive mapping and its implication for understanding cultural behaviors and experiences in libraries. Library and Information Science Research, 44(4), 101123. https://doi.org/10.1016/j.lisr.2022.101181
13. Geer, E. A., Barroso, C., Conlon, R. A., & Ganley, C. M. (2024). A meta-analytic review of the relation between spatial anxiety and spatial skills. Psychological Bulletin, 150(4), 464-486. Retrieved from https://psycnet.apa.org/doi/10.1037/bul0000420
14. Gresham, M., Taylor, L., Keyes, S., & Cunningham, C. (2019). Developing evaluation of signage for people with dementia. Housing, Care and Support, 22(1), 5–19. https://doi.org/10.1108/HCS-12-2018-0035
15. Hund, A. M., & Minarik, J. L. (2006). Getting from here to there: Spatial anxiety, wayfinding strategies, direction type, and wayfinding efficiency. Spatial Cognition and Computation, 6(3), 179–193. https://doi.org/10.1207/s15427633scc0603_1
16. Kalyan, B. A., Rani, M. Y., Shouri, S., & Reddy, N. S. (2024). A study on patients' perception of signage system in a tertiary care teaching hospital. Heart, Vessels and Transplantation, 8, 356-363. https://doi.org/10.24969/hvt.2024.499

17. Kiefer, P., Scheider, S., Giannopoulos, I., & Weiser, P. (2015). A wayfinding grammar based on reference system transformations. Spatial Information Theory: 12th International Conference, 447-467. https://doi.org/10.1007/978-3-319-23374-1_21
18. Kielar, P. M., Biedermann, D. H., Kneidl, A., & Borrmann, A. (2017). A unified pedestrian routing model for graph-based wayfinding built on cognitive principles. Transportmetrica: A Transport Science, 14(5-6), 406–432. https://doi.org/10.1080/23249935.2017.1309472
19. Kim, S., Park, E., Hong, S., & Del Pobil, A. P. (2011). Designing digital signage for better wayfinding performance: New visitors' navigating campus of university. Proceedings - 4th International Conference on Interaction Sciences: IT, Human and Digital Content (ICIS 2011), 27–32. https://ieeexplore.ieee.org/document/6014528
20. Klippel, A., Tappe, H., Kulik, L., & Lee, P. U. (2005). Wayfinding choremes—A language for modeling conceptual route knowledge. Journal of Visual Languages & Computing, 16(4), 311-329. https://doi.org/10.1016/j.jvlc.2004.11.004
21. Kuliga, S. F., Nelligan, B., Dalton, R. C., & Hölscher, C. (2019). Exploring individual differences and building complexity in wayfinding: The case of the Seattle Central Library. Environment and Behavior, 51(5), 469–495. https://doi.org/10.1177/0013916519836149
22. Kusumarini, Y., de Yong, S., & Thamrin, P. (2012). Signage system and universal design approach in shopping malls: A study in Surabaya, Indonesia. Procedia - Social and Behavioral Sciences, 68, 515–525. http://dx.doi.org/10.1016/j.sbspro.2012.12.245
23. Lee, S., & Dazkir, S. S. (2015). User experience and wayfinding in an academic library. International Journal of Visual Design, 9(2), 73–88. https://doi.org/10.18848/2325-1581/CGP/v09i02/40895
24. Li, R., & Klippel, A. (2012). Wayfinding in libraries: Can problems be predicted? Journal of Map & Geography Libraries, 8(1), 21–38. https://doi.org/10.1080/15420353.2011.622456
25. Luo, T. (2018). Habitual wayfinding in academic libraries: Evidence from a liberal arts college. Library & Information Science Research, 40(3), 285-295. https://doi.org/10.1016/j.lisr.2018.09.011
26. Ma, L., Brandt, S. V., Seipel, S., & Ma, D. (2024). Simple agents – complex emergent path systems: Agent-based modelling of pedestrian movement. Urban Analytics and City Science, 51(2), 479-495. https://doi.org/10.1177/23998083231184884
27. Maceli, M. G. (2024). “Tinkering is underrated”: Librarians' use of single-board computers and microcontrollers outside of makerspaces. Library Hi Tech, 42(3), 749-764. https://doi.org/10.1108/LHT-11-2021-0378
28. Mandel, L. H. (2013). Finding their way: How public library users wayfind. Library and Information Science Research, 35(4), 264-271. https://doi.org/10.1016/j.lisr.2013.04.003
29. Mandel, L. H. (2017). Wayfinding research in library and information studies: State of the field. Evidence Based Library and Information Practice, 12(4), 234–252. https://doi.org/10.18438/B8395P
30. Mandel, L. H., & Johnston, M. P. (2019). Evaluating library signage: A systematic method for conducting a library signage inventory. Journal of Librarianship and Information Science, 51(1), 150-161. https://doi.org/10.1177/0961000616681837
31. Melcher, A. (2023, November 21). Signage refresh: An academic library and a graphic design class collaborate to improve library wayfinding. The Journal of Creative Library Practice. https://creativelibrarypractice.org/2023/11/20/signage-refresh/
32. Mendez-Lopez, M., Fidalgo, C., Osma, J., & Juan, M.-C. (2020). Wayfinding strategy and gender: Testing the mediating effects of wayfinding experience, personality, and emotions. Psychology Research and Behavior Management, 13, 669–685. https://doi.org/10.2147/prbm.s236735
33. Negar, A., & Ioannis , G. (2024). Wayfinding stages: The role of familiarity, gaze events, and visual attention. Leibniz International Proceedings in Informatics (LIPIcs), 315, 1–21. https://doi.org/10.4230/LIPIcs.COSIT.2024.1
34. Polger, M. A., & Stempler, A. F. (2014). Out with the old, in with the new: Best practices for replacing library signage. Public Services Quarterly, 10(2), 67-95. https://doi.org/10.1080/15228959.2014.904210
35. Powell, B., E. Young, S., & Duvall, A. (2023). The evolution of wayfinding within airports. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy24osti/83211.pdf
36. Rakshikar, N. N., & Powdwal, S. (2020). Wayfinding behavior of university library users in Mumbai: An explorative study. DESIDOC Journal of Library and Information Technology, 40(2), 113-121. https://doi.org/10.14429/djlit.40.02.15308

37. Sahoo, B., Pillai, J. S. K., Md, S., & Sahoo, M. C. (2024). Implementation of wayfinding signage in public hospitals and its evaluation towards quality improvement. Cureus, 16(7), e65435. https://doi.org/10.7759/cureus.65435
38. Sherman, M. (2022). Accessibility in libraries: A landscape review. American Library Associations. https://www.ala.org/sites/default/files/tools/content/220928-ppo-ltc-access-landscape-review.pdf
39. Su, W., Lu, Z., Sun, Y., & Liu, G. (2022). Let eyes tell: Experimental research on university library signage system and users' wayfinding behaviour. Library Hi Tech, 40(1), 198-221. https://doi.org/10.1108/LHT-01-2020-0007
40. Woo, W. S., & Nora Riget, P. (2020). Linguistic landscape in Kuala Lumpur international airport, Malaysia. Journal of Multilingual and Multicultural Development, 43(5), 404–423. https://doi.org/10.1080/01434632.2020.1742724
41. Zhang, M., Xu, R., Chen, T., Jiang, Y., Ding, Y., & Luo, X. (2024). Evaluating path signage visibility for equitable design through BIM-enabled agent-based simulation. Journal of Building Engineering, 98, 111306. https://doi.org/10.1016/j.jobe.2024.111306
42. Zhou, T., Xia, P., Zhu, Q., & Du, J. (2023). Cognition-driven navigation assistive system for emergency indoor wayfinding (CogDNA): Proof of concept and evidence. Safety Science, 162, 106100. https://doi.org/10.1016/j.ssci.2023.106100