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How Public-Space Design Can Better Include Disabled and Neurodivergent People

Abstract

Public spaces are often evaluated through visible physical features such as ramps, lifts, step-free entrances, and accessible facilities. These features are essential, but they do not fully describe whether a person can understand, navigate, communicate within, or comfortably remain in a space. This research note examines how public-space design can better include disabled and neurodivergent

people, with particular attention to sensory conditions, predictability, wayfinding, communication, and opportunities to recover from overwhelming environments. The study uses a focused secondary synthesis of published scoping and systematic reviews rather than new human-participant research. The sources include a 2021 review of built-environment design and autism, a 2026 review that included 77 studies of sensory stimuli in built environments, and reviews of disability and public transport accessibility. Across these sources, accessibility emerges as multidimensional: physical access matters, but sensory balance, intelligible layouts, predictable information, and support throughout the travel journey also matter. The paper proposes a practical framework for evaluating public spaces across five dimensions. Because the sources differ in scope and methods, their study counts are not combined as a single dataset, and the proposed framework should be tested with users before being treated as a validated assessment tool.

1. Introduction

Public spaces shape whether people can participate independently in education, work, healthcare, recreation, and community life. A station, park, library, shopping area, or civic building may be physically open to the public while still presenting barriers for some users. A step-free entrance can reduce a mobility barrier, for example, but a visitor may also need clear signs, understandable announcements, consistent routes, manageable noise, and a place to pause when overwhelmed. These needs are not interchangeable, and no single design feature will suit every person.

The term accessibility is often associated with physical infrastructure and formal compliance. These are important foundations, but accessibility also concerns how people perceive and interpret their surroundings and whether they can use a space with safety, dignity, and as much independence as possible. Neurodivergent people, including some autistic people and people with ADHD, may experience public environments differently. Some may find unpredictable changes, dense visual information, loud or overlapping sounds, or crowded spaces difficult to manage. People with visual, hearing, mobility, intellectual, or other disabilities may face different barriers, and individuals within each group vary.

This paper asks: **Which design dimensions should be considered alongside physical accessibility when planning public spaces for disabled and neurodivergent people?** It synthesizes published research on sensory conditions, environmental intelligibility, predictability, and public transport journeys. It then proposes a framework that can guide a future evaluation of a station, park, library, or other public facility. The paper does not claim that every individual has the same needs or that the proposed framework has already been validated.

2. Background and Literature Review

2.1 Accessibility as more than physical entry

Physical accessibility is a necessary part of inclusive design. Steps, inaccessible entrances, missing lifts, narrow circulation routes, or inaccessible toilets can prevent people from using a facility. Yet reaching a destination is only one stage of using it. A person must often find the correct entrance, understand directions, identify a service, respond to changes, communicate with staff, and leave safely. Barriers at any stage can reduce independence even when the destination itself is technically accessible.

A 2024 scoping review of barriers and facilitators to public transport use among people with disabilities emphasizes that barriers differ across disability types and across elements of the travel chain. For example, an absence of audible announcements can create a barrier for some passengers with visual

disabilities, while other users may need information presented visually or in a format they can understand. The implication is not that every information channel must be identical, but that relying on only one channel can exclude users whose needs differ.

2.2 Sensory quality, intelligibility, and predictability

A 2021 scoping review of built-environment design and autistic people identifies three major themes: sensory quality, intelligibility, and predictability. Sensory quality concerns the conditions a person experiences through the environment, including light, sound, texture, and visual stimulation. Intelligibility refers to how easily a space can be understood, while predictability concerns whether its layout, sequence, and cues allow users to anticipate what comes next. The review argues that a mismatch between a person's spatial needs and the built environment can restrict independent interaction with that environment.

These themes are useful because they connect architecture with everyday tasks. A visually complex concourse may make it harder to identify a sign. A confusing layout can increase the effort needed to locate an exit. A sudden announcement or unexpected route closure may be difficult for someone who depends on predictable routines. These are plausible design mechanisms, not universal reactions: some users may prefer lively, stimulating places, and the same environment may affect two people differently. Inclusive design should therefore provide clarity and options rather than assume a single ideal sensory setting.

2.3 Recent evidence on sensory-inclusive environments

Wang, Herman, Mansor, and Yan's 2026 scoping review examined 77 studies concerning sensory stimuli in built environments for autistic people. The authors identify four sensory modalities as central to the literature: visual, auditory, tactile, and olfactory. They organize environmental factors into eleven categories: lighting, color, visual complexity, material, thermal conditions, spatial configuration, acoustic parameters, sound-source attributes, odors associated with functional areas, wayfinding, and natural elements. The review proposes six design qualities: safety, sensory balance, adjustability, predictability, controllability, and recovery.

An important result of this review is the breadth of environmental factors involved. Sensory accessibility is not simply a matter of making a room quiet or using softer lighting. The interaction between stimuli, their intensity, their location, and the way people move through a space can matter. The authors also identify limited research integrating multiple sensory modalities. This suggests that studying lighting, sound, layout, and wayfinding separately may not fully explain how people experience real spaces, where several stimuli occur together.

2.4 Public transport as a chain of linked tasks

A scoping review on the whole journey chain for autistic people and people with ADHD included 11 studies from four countries. It highlights the importance of planning and preparation before travel, as well as the journey itself. Some travellers can learn routes with confidence, while others may struggle when routes change unexpectedly or services are cancelled. The review calls for attention to information-seeking, comprehension, safety, and opportunities for recovery between journeys.

This perspective matters for engineering because a transport journey is a system, not an isolated platform. Information on a website or app may affect whether a person can prepare; signs and announcements affect navigation; staff communication can matter during disruptions; and the physical station influences how a person waits and moves. A station may perform well on one dimension but poorly on another. Accessibility should therefore be evaluated across the sequence of activities that users need to complete.

2.5 Evidence on disability and transport

A 2025 systematic literature review by Elorduy and Gento examined research on public transport accessibility for people with disabilities. From an initial search of 2,224 documents, the authors selected 65 articles for their review. They reported that more than 60% of the selected articles had been published in the final four years of the period they studied, while physical disability and urban bus transport received more attention than some other disability groups and modes. This pattern indicates growing research activity but also a need to consider which users and settings receive less attention.

The numerical results from these reviews should not be added together. They answer different questions, use different search strategies, and include different sets of studies; overlap between reviews is possible. Their counts describe each review's own selection process rather than the total number of studies in the field. Taken together, however, they show that accessibility research covers physical infrastructure, sensory experience, and the practical demands of transport, while also revealing that some combinations of sensory conditions and real-world journeys remain under-investigated.

3. Method

This paper uses a focused secondary synthesis of published research. It draws on accessible records and abstracts for four relevant reviews: (1) the 2021 scoping review of built-environment design and autistic people; (2) Wang and colleagues' 2026 scoping review of sensory stimuli in built environments; (3) a scoping review of the whole public transport journey for autistic people and people with ADHD; and (4) Elorduy and Gento's 2025 systematic review of public transport accessibility for people with disabilities. A 2024 open-access review of barriers and facilitators to public transport use among people with disabilities provides additional context.

Sources were selected for direct relevance to public-space design, sensory experience, wayfinding, and public transport. The synthesis compared the topics each review addressed, the design factors reported in its findings, and the limitations or gaps described by the authors. The analysis then grouped recurring themes into a proposed five-part framework: physical access; sensory conditions; cognitive access and wayfinding; communication access; and control, choice, and recovery.

This method is not a new systematic review. It does not independently search every database, screen every paper, extract all underlying study data, or assess each included study's quality. The paper relies on the review authors' descriptions and reported findings. Consequently, it can identify recurring themes and propose a useful organizing framework, but it cannot calculate a pooled effect size or prove that a particular design feature improves outcomes for every user. Review counts are reported separately because the reviews have different inclusion criteria and may include overlapping primary studies.

4. Findings

4.1 Five recurring dimensions of inclusive access

The literature supports considering at least five dimensions when evaluating whether a public space is usable. The first is physical access: whether people can enter, move through, and use the facilities. The second is sensory conditions: how lighting, sound, materials, odors, temperature, and visual complexity shape the environment. The third is cognitive access and wayfinding: whether the layout, signs, and route sequence can be understood. The fourth is communication access: whether information is available in formats that different users can perceive and understand. The fifth is control, choice, and recovery: whether people have options when an environment becomes difficult to manage, including predictable alternatives and places to pause.

The five dimensions overlap. A sign is a communication tool, but its placement, contrast, and visual complexity also affect wayfinding. A quiet room is a physical space, but it may also support sensory regulation and recovery. A route map may support cognitive access before travel, while consistent signs support navigation during travel. This overlap is one reason accessibility should not be reduced to a single score without explaining what that score measures.

4.2 Sensory design needs to account for multiple stimuli

The 2026 review's 77 included studies and its classification of four sensory modalities and eleven environmental factors suggest that sensory design is broad. For design practice, this supports checking lighting, sound, visual complexity, material choices, thermal comfort, odors, spatial arrangement, and access to natural elements rather than focusing on one feature in isolation. It also supports offering adjustability where feasible, because a single fixed setting may not serve all users.

The evidence does not establish that one universal lighting level, color scheme, or sound level is optimal for every autistic person. The more defensible design implication is to avoid unnecessary extremes, make information easier to process, offer choices where practical, and evaluate spaces with people who have varied sensory profiles. Any numeric design standard would need support from applicable technical guidance or direct testing; this review synthesis does not generate such a standard.

4.3 Predictability and intelligibility support navigation

The 2021 built-environment review's emphasis on intelligibility and predictability aligns with the journey-chain literature's concern about route changes and unexpected disruptions. Public spaces can support these needs through consistent sign placement, clear route hierarchy, landmarks, maps that match the physical environment, and advance information about changes. When disruption occurs, updated information should be visible, understandable, and available through more than one channel when possible.

Predictability should not be confused with preventing all change. Public transport and public buildings inevitably experience closures, crowds, maintenance, and emergencies. An inclusive system should communicate changes clearly and provide a usable alternative route or support. This is an engineering and operations issue as much as an architectural one: the design of signs, digital information, staff procedures, and physical circulation needs to work together.

4.4 Communication access must be multimodal

The disability transport literature demonstrates why information delivery matters. If essential information is available only as audio, some passengers may miss it; if it is available only visually, other passengers may miss it. Information may also be technically present but difficult to understand, poorly placed, or inconsistent with the environment. A stronger approach combines clear visual information with audible or other accessible formats when appropriate and maintains consistency across websites, apps, signs, and staff instructions.

Multimodal information should not mean flooding the space with more signals. Too many competing announcements, screens, symbols, or alerts may increase complexity. The goal is accessible redundancy: the same essential message can be obtained through different channels, presented in a consistent and comprehensible way. Testing with users is needed to determine whether a specific implementation is genuinely helpful.

4.5 Recovery and user choice are part of usability

The 2026 review identifies recovery, controllability, and adjustability as design qualities. In practical terms, this points to considering places where a person can pause, routes that avoid the most crowded areas when alternatives exist, seating, clear exits, and quiet or lower-stimulation areas in suitable

facilities. These options should not be treated as substitutes for making the main route accessible. They are additional choices that may help some people use a public space.

Designers should avoid assuming that a separate quiet space is always possible or that it will solve every barrier. Its usefulness depends on location, access, safety, signage, and whether users can reach it without asking for special permission. A recovery option that is hidden, locked, or difficult to find is not a meaningful option. User choice should be considered during planning and evaluated after implementation.

5. Proposed Framework for Public-Space Evaluation

Based on the literature synthesis, the following framework is proposed as a practical checklist for a future study. It is a research-informed proposal, not a validated instrument or an official standard.

Dimension	Questions to investigate	Example evidence
Physical access	Can users enter, move through, and use essential facilities?	Step-free routes, lift availability, circulation space, accessible toilets.
Sensory conditions	Are major sensory demands considered, and are options available?	Lighting and sound observations, visual clutter, seating, quieter areas.
Cognitive access and wayfinding	Can users understand the layout and anticipate the route?	Consistent signs, landmarks, route maps, clear change notices.
Communication access	Can essential information be perceived and understood through suitable channels?	Visual and audible announcements, legible signs, accessible digital information.
Control, choice, and recovery	Can users choose alternatives or pause safely when needed?	Rest areas, alternative routes, clearly marked exits, accessible assistance.

A future assessment could apply this checklist to one specific facility, such as a train station, library, or public park. Each item would need a clear operational definition before scoring. For example, an evaluator would need to specify how to record sign consistency or whether a quiet area is available and accessible. The assessment should also distinguish between direct observation, official facility records, and user-reported experience. These types of evidence answer different questions and should not be treated as interchangeable.

A next-stage design project could create two alternative wayfinding layouts or information boards and ask a diverse group of users to complete a simple navigation task. If human participants are involved, the project must follow the science fair's rules, obtain appropriate consent, protect privacy, and provide accommodations. The current paper does not report such a test and therefore makes no claim that the proposed framework has been experimentally validated.

6. Discussion

The central finding of this synthesis is that public-space accessibility is multidimensional. Physical access remains fundamental, but it cannot stand as a complete proxy for usability. The reviewed literature points to sensory conditions, spatial intelligibility, predictability, communication, and

opportunities for recovery as additional considerations. These dimensions are especially relevant in transport settings because users must often move through a sequence of environments and respond to information that can change.

This finding has implications for engineering and public policy. First, evaluation measures should state clearly what they capture. A count of accessible stations can help monitor a defined infrastructure feature, but it cannot by itself show whether signs are understandable, announcements are accessible, sensory demands are manageable, or users can navigate disruptions. The U.S. Department of Transportation's ADA Summary Long dataset, for example, describes annual counts of ADA-accessible and non-ADA-accessible rail stations and the percentage of accessible stations from 2014 to 2024. It is a useful example of a measurable physical-accessibility indicator, but its stated variables do not directly measure the broader sensory and cognitive dimensions discussed here.

Second, design needs to consider the whole system. A building may contain good signs but still be confusing if the route map, digital information, and actual layout contradict one another. A station may have an accessible entrance but become difficult to navigate during a service disruption if information is not updated. Inclusive engineering therefore includes the physical environment, information systems, maintenance, staff procedures, and contingency planning.

Third, a neuroinclusive approach should provide options rather than define one ideal user. Sensory needs differ across people and contexts. A person may prefer a quiet route at one time and tolerate a busy environment at another. A feature intended to help one group may not help every member of that group. The design objective should be to reduce avoidable barriers, provide clear information and choices, and involve people with varied disabilities in evaluating solutions.

Fourth, the research base has limitations. Reviews differ in their search methods, populations, settings, and definitions. The reported 77 studies in the 2026 sensory review, 11 studies in the journey-chain review, and 65 articles selected by the 2025 transport review are not directly comparable. They may overlap, and their counts should not be interpreted as a combined estimate of all available research. The 2025 review also notes that some modes and disability groups receive more research attention than others. Further research should examine a wider range of locations, age groups, sensory profiles, and real-world contexts.

Finally, the proposed framework is a synthesis, not a validated measurement scale. Its value is that it organizes design questions in a way that can guide a later empirical project. To validate it, researchers would need to define measurable indicators, consult disabled and neurodivergent users, test reliability between evaluators, and investigate whether the checklist predicts outcomes that matter to users, such as successful navigation, perceived safety, independence, or comfort. The current evidence supports the need to ask these questions, but does not establish the effectiveness of every proposed design feature.

7. Limitations

- This is a focused secondary synthesis, not a new systematic review. The source-selection process was not exhaustive and did not include independent screening of all primary studies.
- The paper relies on published reviews and their reported summaries. It does not independently reanalyse all 77 studies in the 2026 review or all studies included in the other reviews.
- Review counts come from different research questions and methods; they are reported separately and are not added together.
- The paper does not include new observations of a specific station, park, or building, nor interviews or experiments with disabled or neurodivergent users.

- The U.S. DOT dataset is described as a possible physical-accessibility indicator, but its underlying CSV values were not retrieved and analysed for this paper. No year-to-year trend or percentage-point change is therefore claimed.
- The proposed five-dimension framework has not been validated and should not be presented as an official accessibility standard.

8. Conclusion

Public spaces should be designed and evaluated not only for physical entry but also for how people understand, navigate, communicate within, and recover in those spaces. The reviewed research identifies sensory quality, intelligibility, predictability, wayfinding, multimodal communication, and user control as important considerations for inclusive environments. These findings support a practical framework with five dimensions: physical access; sensory conditions; cognitive access and wayfinding; communication access; and control, choice, and recovery.

The framework is intended to guide further assessment, not replace legal standards or direct consultation with users. A next step would be to apply it to one real facility, define observable indicators for each dimension, and evaluate the findings with disabled and neurodivergent people. Accessibility is best treated as an ongoing design and evaluation process. Measuring what is already accessible is valuable, but identifying what current measures leave out is also necessary for public spaces to become more usable by a wider range of people.

References

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Research Integrity Note

This paper is a secondary synthesis of published research. The study counts and findings are attributed to the reviews that reported them; they are not presented as the results of an independent reanalysis. The U.S. DOT dataset is included as an example of an official physical-accessibility indicator