Filling The Gaps

SENSORY-FRIENDLY MATERIALS AND INCLUSIVE DESIGN FOR NEURODIVERGENT SPACES

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Introduction

In interior architecture, inclusivity remains a critical yet often overlooked aspect of design. While contemporary practices often emphasize aesthetics and functionality, they frequently overlook the sensory experiences of neurodivergent individuals, whose sensitivities to texture, sound, and visual stimulation significantly impact their interactions with built environments. This research initially aimed to investigate both furniture and materials, but to maintain a focused and manageable scope, it evolved to focus solely on materials. This shift enabled a deeper exploration of static sensory qualities and facilitated the development of a targeted digital sensory assessment toolkit, which is further detailed in the methodology section.

The foundation of this research is rooted in the principles of inclusive design, which emphasize creating environments that accommodate a diverse range of sensory and cognitive needs. The rationale for this study arises from the growing recognition of neurodivergence in educational settings. However, despite increased awareness, current design methodologies lack standardized tools to assess and improve sensory inclusivity. This study aims to address this gap by developing a dynamic and customizable sensory rating system that enables users to evaluate materials according to their sensitivities and preferences.

This dissertation employs a mixed-method approach to collect both qualitative and quantitative data from design professionals and neurodivergent individuals, with student feedback gathered through the university's Accessibility Office. The study examines existing gaps in sensory inclusive design through interviews and surveys, highlighting discrepancies between design intentions and user experiences. Additionally, the research includes the testing and development of an interactive digital tool designed to assess materials based on sensory needs.

At the core of this research is the creation of a digital sensory assessment toolkit, structured around three key sensory categories: tactile**,** visual**,** and auditory. The scale prompts users to evaluate materials through guided questions, allowing them to reflect on sensory factors such as surface texture, reflectivity, and sound absorption. Rather than applying a one-size-fits-all score, the toolkit adapts to the user's sensory priorities, offering a personalized assessment of whether a material is likely to be overstimulating, neutral, or supportive. This scalable toolkit is designed not only to guide inclusive material selection but also to empower users to better understand and articulate their sensory needs within designed spaces.

Research Question, Aims, and Objectives

Building on the findings of the literature review, this study refines its focus with the following research question:

How can a flexible and user-centred sensory assessment tool improve inclusivity in furniture and material selection for neurodivergent individuals in interior architecture?

To achieve this, the research aims to develop a digital sensory assessment toolkit that enhances inclusivity and usability for both designers and neurodivergent users. The specific objectives include:

1. **Understanding Design & User Perspectives**
    - To conduct interviews to gather insights from designers and end-users.
    - Identifying gaps between design intentions and actual user experiences.
2. **Refining the Sensory Rating Scale**
    - Transitioning from a fixed scale to a customizable tool.
    - Develop an interactive website where users can prioritize sensory aspects relevant to them.
3. **Creating a Practical, Guiding Framework**
    - Designing a specification sheet with tailored questions for material selection.
    - Providing structured guidance for designers on improving sensory inclusivity.
4. **Bridging the Gap Between Design and Accessibility**
    - Ensuring the tool is practical for both designers and accessibility professionals.

By addressing these objectives, this study aims to establish a user-focused methodology for evaluating sensory inclusivity in interior architecture, ultimately contributing to more accessible and accommodating spaces for neurodivergent individuals.

Literature Review

Sensory-friendly design is an essential consideration when creating inclusive environments that cater to the diverse needs of neurodivergent individuals. Sensory overload, triggered by factors such as noise, bright lights, overwhelming visual patterns, and certain textures, can cause significant discomfort and distress for individuals with sensory sensitivities. According to Love

(2022), sensory-friendly spaces are designed to minimize such triggers, fostering supportive and inclusive environments.

The importance of sensory-friendly design lies in its ability to create spaces that prioritize comfort, functionality, and accessibility. When environments are not designed with sensory needs, individuals may experience increased stress, diminished engagement, and difficulty navigating their surroundings. Conversely, sensory-friendly spaces can empower neurodivergent individuals by reducing overstimulation and enabling them to feel more at ease. This approach highlights the need for intentional design choices, such as selecting appropriate materials, incorporating adaptable furniture, and ensuring balanced lighting and acoustics. By addressing these elements, sensory-friendly design fosters inclusivity and supports the well-being of those with sensory sensitivities.

The need for sensory-friendly design in interior architecture has gained significant attention recently, in particular institutional spaces like schools, libraries and healthcare facilities. Neurodivergent means having a brain that performs or works differently than someone who may be neurotypical, meaning neurodivergent individuals have different strengths and weaknesses from people whose brains don't have those differences (Cleveland Clinic, 2024). For many people who are neurodivergent, sensory sensitivities play a critical role in their daily lives, facing many accessibility challenges in the spaces that architects and designers create. 94.4% of individuals with autism spectrum disorder (ASD) describe sensory impairments that have a major influence on their day-to-day life, according to research. (Morgan, 2019). Hypersensitivity makes certain spaces very overwhelming, affecting comfort, focus, and overall quality of life. Morgan notes that creating sensory-friendly environments can mitigate these challenges and enhance accessibility and well-being for the autistic community.

Materials and Colours in Sensory Design

Materials and textures play a critical role when creating sensory-friendly spaces. Natural materials such as wood, concrete, and cotton-based fabrics are commonly associated with calming and uplifting environments. Mickocski (2022) exclaims how textures and patterns also contribute to sensory friendliness, with organic, irregular patterns encouraging focus and engagement. Colours also play a pivotal part when it comes to designing for accessibility, colours influence sensory responses, and muted tones like blues and greens are known to promote calmness, whereas harsh

tones like white and red can overstimulate users (Mickocski, 2022). Figure 1 is a proposed palette of colours that are not overstimulating

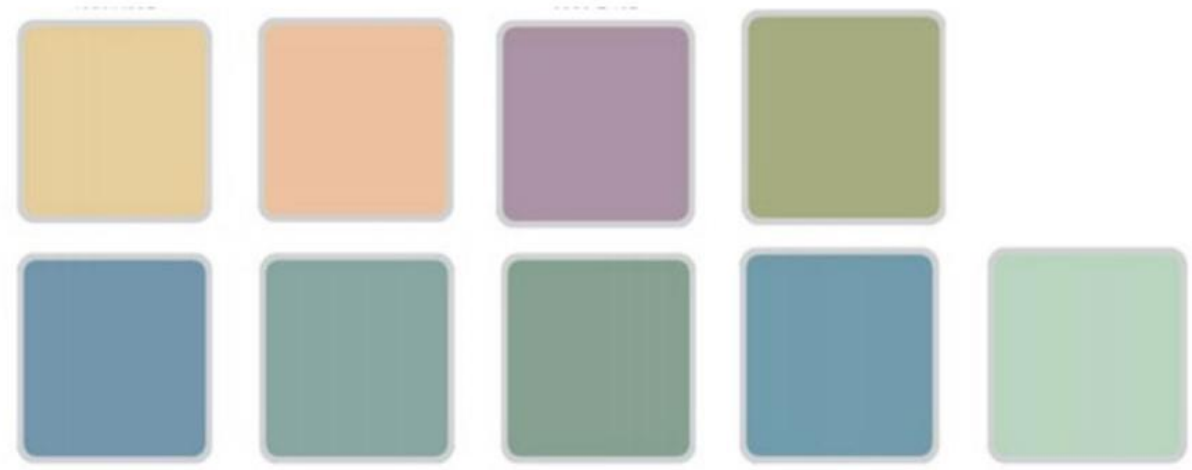


Figure 1: Proposed color palettes (Source: Mickocski, 2022)

The *Autism Friendly University Design Guide* serves as a valuable resource for designing institutions with inclusivity and accessibility in mind. Beyond its focus on university settings, the guide offers broad insights into design principles that played a critical role in shaping my research pilot. Mostafa (2021) emphasizes the importance of "neutral first" design principles, advocating for a neutral palette as a foundational base. Purposefully selected accent colors can then be introduced to define spaces and aid navigation. Additionally, the tactile qualities of materials are crucial; surfaces that come into direct contact with users, such as seating, walls, and flooring, should be as neutral as possible to avoid overstimulation. Materials like wood, stone, and cotton-based fabrics are preferred for their calming properties, making them ideal for fostering inclusive and sensory-friendly learning environments (Mostafa, 2021).

Designing for Flexibility and Adjustability

Flexibility and adjustability are essential components of designing accessible spaces, as they allow users to customize their surroundings to meet their unique needs. This level of control not only creates an accessible and safe environment but also supports autonomy and comfort. In the context of neurodivergent-friendly design, providing users with the ability to adapt to their environment can significantly reduce sensory stress and promote well-being. For instance, incorporating furniture like ergonomic chairs with adjustable seats and armrests ensures comfort while accommodating diverse body types and preferences.

These features are especially relevant to this study, which examines how materials and furniture can better support sensory needs and enhance inclusivity. By focusing on flexibility and adjustability, this research emphasizes the importance of creating adaptable spaces that prioritize independence and accessibility for neurodivergent individuals. Adjustability in design is not only a practical solution for accommodating sensory preferences but also a critical factor in allowing users to feel comfortable and supported in their environments (Narenthiran, Torero, & Woodrow, 2022).

Sensory Integration Theory in Inclusive Design

Sensory Integration Theory, originally developed by occupational therapist A. Jean Ayres, provides a foundational framework for understanding how individuals process sensory information from their environment. When applied to inclusive design, it emphasizes the importance of engaging multiple senses—particularly touch, proprioception, and visual-auditory input—to create environments that support sensory regulation and promote well-being.

Tactile interaction is one of the most immediate and impactful ways users engage with their environment. Soft or smooth textures are generally more acceptable and comforting for individuals with tactile sensitivities, while rough or sticky surfaces can provoke discomfort or avoidance behaviours (Huang & Lin, 2023). The thoughtful integration of tactile-friendly materials in high contact areas—such as handrails, desks, and upholstery—can therefore enhance a sense of safety and calm for neurodivergent users.

Proprioceptive design focuses on how body movement and spatial awareness contribute to sensory experiences. By incorporating opportunities for subtle body movement—such as rocking chairs, flexible seating, or zones for gentle physical activity—spaces can help users regulate their sensory input through self-directed motion. Huang and Lin (2023) emphasize how proprioceptive cues, including pressure-based furniture and varied spatial layouts, support motor planning and sensory balance, especially for individuals with autism.

Visual and auditory adjustments are equally vital in designing for sensory accessibility. Overhead lighting, visual clutter, and acoustic noise can easily overwhelm users with sensory processing differences. According to Huang and Lin (2023), minimizing high-contrast lighting, using visual boundaries, and incorporating sound-absorbing materials can significantly reduce environmental stressors. These strategies not only make spaces more inclusive but also improve focus, comfort, and engagement.

By applying principles of Sensory Integration Theory, designers can create spaces that are attuned to a wider range of sensory needs. This approach aligns with the broader goals of inclusive design by emphasizing user-centred adaptability and multisensory support.

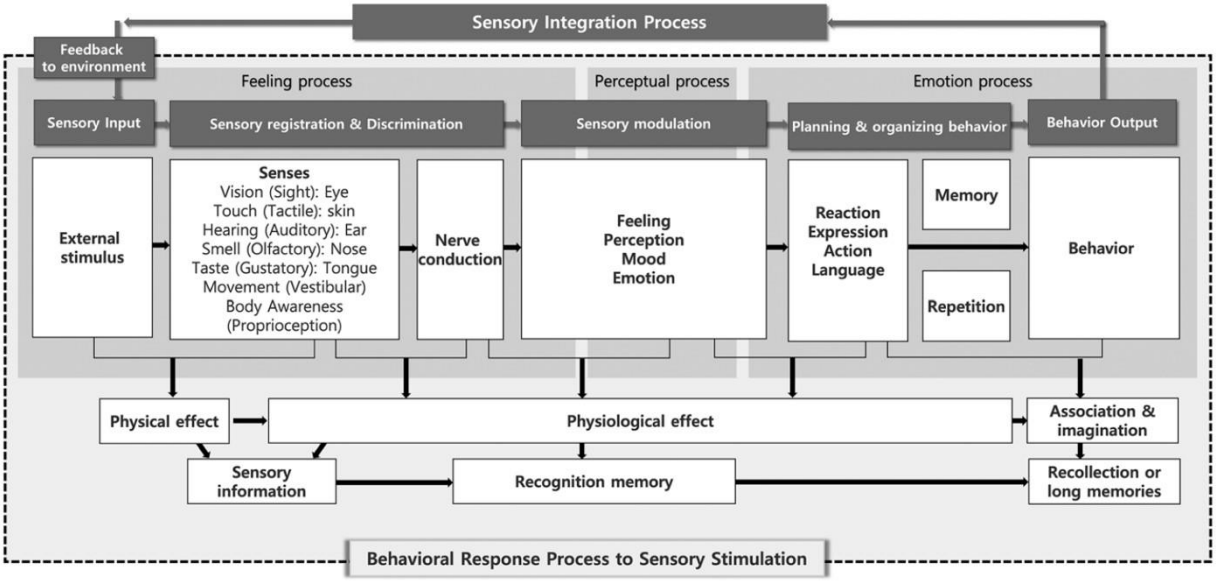


Figure 2: Sensory integration process and responses (Source: Huang and Lin, 2023)

Designing for the Mind: Neurodiversity and the Built Environment

Design for the Mind is one of the most comprehensive and widely referenced guides available today for designing inclusive spaces that support neurodiversity. Developed by Buro Happold in collaboration with the British Council for Offices (BCO), HOK, and the BBC, the guide outlines critical environmental strategies aimed at improving inclusivity for people with cognitive and sensory differences (BSI, 2023). It emphasizes that environments must move beyond conventional accessibility to address less visible needs such as sensory regulation, emotional well-being, and cognitive clarity.

One of the guide's key recommendations is the importance of managing environmental stressors through zoning, sensory gradients, and the use of calming materials. It suggests that reducing high sensory input, such as through sound dampening, non-reflective surfaces, and low-arousal colour palettes, can significantly benefit individuals who are hypersensitive to their surroundings (BSI, 2023). Furthermore, it promotes the use of adaptable, flexible spaces that allow for individual choice and control, recognizing that what is calming for one person may be overwhelming for another. For instance, breakout spaces or designated quiet zones within interior environments can provide users with the option to retreat when feeling overstimulated. Offering this kind of spatial flexibility gives users a sense of reassurance and control, an essential consideration for

neurodivergent individuals who may experience sensory overload. These environments function as calming zones that support emotional regulation, reduce anxiety, and contribute to a more inclusive and supportive built environment.

Understanding Sensory Processing in Design

A foundational concept in designing for neurodiversity is understanding sensory processing and how it differs from person to person. The Design for the Mind guide outlines that sensory processing refers to how individuals perceive, interpret, and organize information received through their senses—namely sight, sound, touch, taste, smell, and movement. Neurodivergent individuals may respond differently to sensory stimuli, experiencing either heightened sensitivity (hypersensitivity) or reduced sensitivity (hyposensitivity) (BSI, 2023). For example, a person might be highly sensitive to noise but relatively unbothered by bright lighting, or they may engage in sensory-seeking behaviors to meet their sensory needs.

The guide stresses the importance of recognizing that sensory inputs do not operate in isolation but rather as a multisensory experience. This suggests that environmental design must account for the interplay between sensory elements—such as light, sound, and texture—to prevent overstimulation and promote sensory balance. This principle was central to the development of both the sensory scale and the digital sensory assessment toolkit in this study, where materials were evaluated not only for their individual properties (e.g., texture or reflectivity) but also for their combined effect on users across multiple sensory dimensions (BSI, 2023).

Methodology

To investigate the inclusivity gaps for neurodivergent individuals in interior architecture, this research employs a mixed-methods approach. This study incorporates methods such as sensory analysis, interviews, and surveys, as well as the development of a digital sensory assessment toolkit to evaluate materials' sensory qualities. These methods provide a structured framework for examining materials and furniture in relation to sensory-friendly design and refining a dynamic and user-centred rating system.

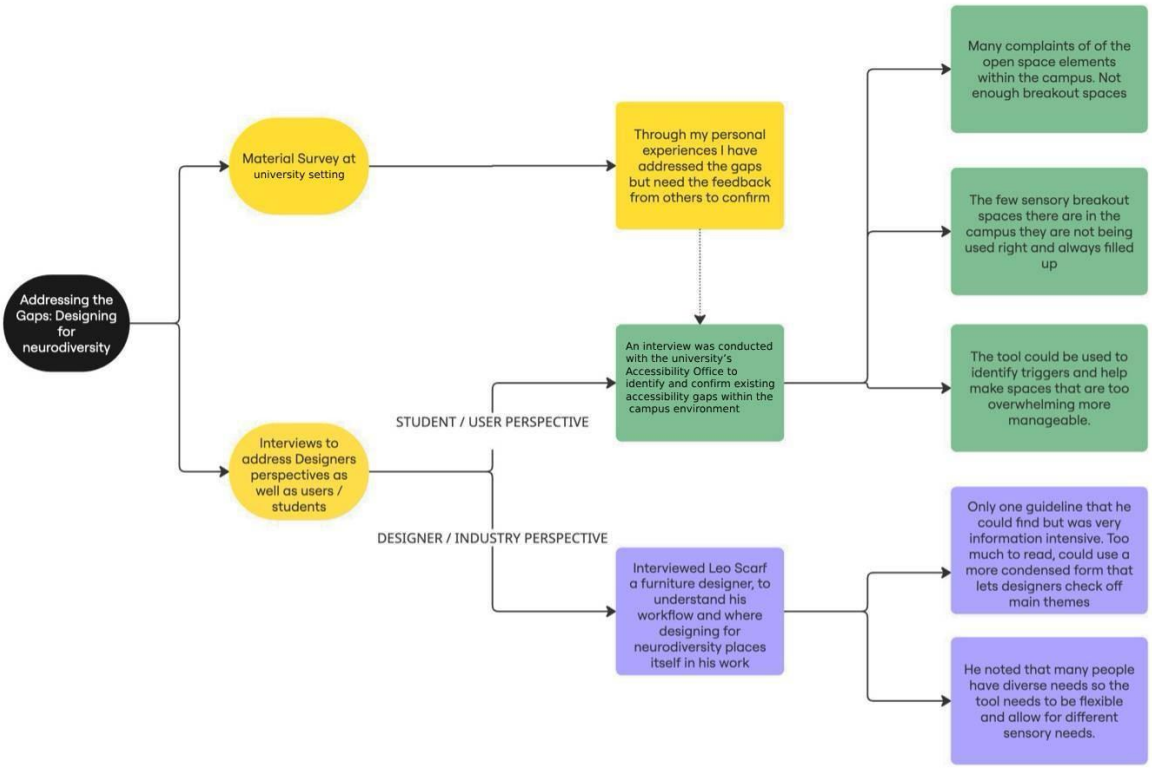


Figure 3: Mind map explaining the direction and the perspectives needed. (Source: Author, 2025)

Investigatory process

Development of the Sensory Rating Scale

To evaluate the sensory inclusivity of materials and furniture, I designed a sensory rating scale informed by my research. This scale rates items on a range from 1 (very unfriendly) to 5 (highly sensory-friendly):

1. **Very Unfriendly (Score - 1/5):** Likely to cause discomfort, overstimulation, or distraction. Examples include rough textures, sharp edges, harsh colours, or excessively bright and reflective surfaces—minimal consideration for sensory comfort. For example, stainless steel typically has a rough edge and is highly reflective and would typically score a 1.
2. **Somewhat Unfriendly (Score - 2/5):** Features mild sensory challenges, such as slight roughness, hard surfaces, or loud colours. May cause mild discomfort or

overstimulation, particularly over extended periods. Some plastics or stone may be placed in this category due to the texture.

3. **Neutral (Score - 3/5):** Neither overstimulating nor actively calming. Examples include smooth plastic, polished wood without padding, neutral colours, and average firmness. Suitable for general use but not optimized for sensory inclusivity.
4. **Sensory-Friendly (Score - 4/5):** Aligned with sensory-friendly principles. Typically features softer, natural materials (e.g., wood, soft fabric), muted colours, and smooth textures. Few sensory issues make it appropriate for most neurodivergent users.
5. **Highly Sensory-Friendly (Score - 5/5):** Exceptionally calming and comfortable, actively supporting sensory comfort and focus. Examples include natural materials like cotton or wool, padded upholstery, muted colours, and nonreflective surfaces.

Development of the Digital Sensory Assessment Toolkit

Preliminary research and material assessments conducted in a university setting revealed that a fixed, rigid sensory scale was insufficient, as individual sensory sensitivities vary significantly between users. This highlighted a need for a more adaptable and user-centered approach. In response, the sensory assessment toolkit was reimagined as a dynamic digital platform, transforming a static system into one capable of responding to diverse user needs in real time.

The development of the Digital Sensory Assessment Toolkit marked a key evolution in the project, allowing for personalized evaluation of materials across three distinct sensory categories:

- Tactile Sensation
- Visual Sensation
- Auditory Sensation

Users are guided to assess materials by choosing which sensory domains are most relevant to their project or personal sensitivities. This flexible structure empowers users to engage selectively or holistically with the tool. Once input is provided, the system automatically

generates a sensory rating—categorizing materials as high-risk, neutral, or sensory-friendly based on the user's responses.

This shift into a digital realm required the development of an interactive, coded system that could accommodate nuanced sensory data. Unlike the original fixed scale, this version prioritizes individual experience, enabling users to dynamically engage with sensory criteria rather than applying a one-size-fits-all evaluation. The coding process involved:

- Developing dropdown menus for material selection
- Creating an algorithm that automatically adjusts the rating based on the user responses
- Ensuring the tool's usability by gathering feedback in the early stages of development

```
// ===== FULL SCRIPT =====
// ===== FULL WORKING CODE =====
$w.onReady(function () {
    $w("#tactileDropdown, #visualDropdown, #auditoryDropdown").onChange(() => {
        // Get tactile value and score
        const tactileValue = $w("#tactileDropdown").value;
        console.log("Raw Tactile Selection:", tactileValue); // Debug raw input
        const tactileScore = getTactileScore(tactileValue);
        console.log("Tactile Score:", tactileScore); // Debug score

        // Get other scores
        const visualScore = getVisualScore($w("#visualDropdown").value);
        const auditoryScore = getAuditoryScore($w("#auditoryDropdown").value);

        // Calculate average
        const totalScore = (tactileScore + visualScore + auditoryScore) / 3;
        updateResultText(totalScore);
    });
});

// ===== HELPER FUNCTIONS =====
function updateResultText(score) {
    $w("#resultText").value = `Rating: ${score.toFixed(1)}/5 - ${getRating(score)}`;
}

function getRating(score) {
    if (score >= 4) return "✅ Sensory-Friendly";
    else if (score >= 3) return "⚖️ Neutral";
    else return "🚨 High Risk";
}
```

Figure 4: The full working code of the averaging system of the toolkit. See the appendices for more information (Source: Author, 2025)

Material Assessments and Testing in a University Setting

The university setting provided a relevant site for testing the sensory rating scale, as the institution has actively taken steps to become more autism friendly. Findings revealed that the majority of assessed materials and furniture scored 3 or lower on the scale, indicating a significant gap in sensory inclusivity within the environment.

Initial Findings and Reflections

Initial research revealed that most materials and furniture within the university environment did not meet the criteria for sensory inclusivity:

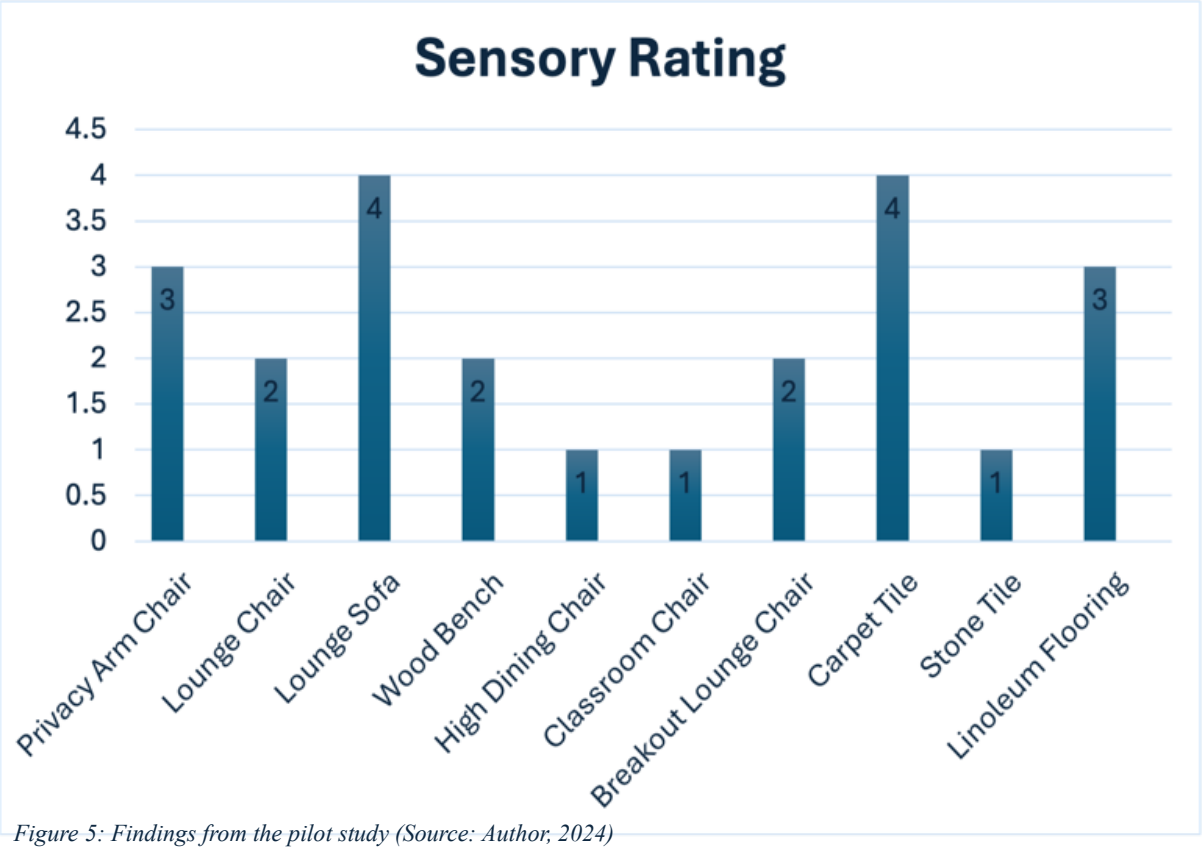


Figure 5: Findings from the pilot study (Source: Author, 2024)

- **Low Scorers:** Classroom (Figure 3) and dining (Figure 4) chairs scored lowest (1) due to bright colors, reflective surfaces, and lack of adjustability.
- **High Scorers:** Library lounge sofas (Figure 5) scored a 4, attributed to their soft texture, muted colours, non-reflective surfaces, and flexibility afforded by their large size. However, even these lacked adjustability.

These assessments validated the necessity of a more structured sensory evaluation process and informed the refinements of the digital sensory assessment toolkit.

Figure 8: Classroom chair (Source: Author, 2024)

Figure 7: Dining chair (Source: Author, 2024)

Figure 6: Library lounge chair (Source: Author, 2024

Interviews & Industry Insights

The material assessment confirmed that there were gaps within the university setting; more qualitative feedback was needed to correctly confirm. To fully validate the gaps within the interior architecture, two perspectives are needed: the User / Student perspective and the Industry / Designer perspective.

The first interview was with Atlanta McGloin (Accessibility Office), who was able to give me feedback on the student and user perspective. Atlanta provided insight into institutional approaches to accessibility, and furniture/materials are selected for neurodivergent students. She also identified challenges in funding and implementation, which designers must consider when advocating for inclusive materials. Atlanta has received many complaints about the building not being accommodating to those who are neurodivergent, with the main complaints being crowding, with the few breakout spaces there are in the college being used improperly, as well as general overstimulation in classrooms and spaces. When discussing the toolkit, Atlanta mentioned, "Your tool could help students articulate needs privately. Imagine them checking boxes like ‘I need low-noise zones’ or ‘I avoid bright lights’—it’d empower them to self-advocate.” (Atlanta McGloin 2025), which was an unexpected direction could, however, be another use for the digital sensory assessment toolkit.

The second interview with Leo Scarff, a furniture designer (designer/industry perspective), provided valuable insight into the mind of a designer when thinking of accessibility in a project. Leo mentioned, "Architects designing schools rarely prioritize neurodivergent needs. It’s becoming important, but it’s still at the bottom of their list unless they specialize.” (Leo Scarff,

2025) This shows that it's not at the forefront and is often forgotten about when designing. Leo also exclaimed that he knew of one guide called "Design for the Mind"; however, it is roughly 200 pages long, and he exclaimed that what is needed is something more digestible and can keep up with the fast-paced environment of design.

User Feedback & Future Refinements

To assess the effectiveness of the digital sensory assessment toolkit, a questionnaire was distributed to interior designers, students, neurodivergent individuals, and industry professionals. The survey aimed to gather feedback on:

- The intuitiveness of the rating system (was it easy to use?) • Ease of customization (Could users adjust it for their needs?)
- Relevance of the dropdown options (Did they find the rating criteria comprehensive?)
- Effectiveness in identifying sensory-friendly materials (Did the toolkit help them make better selections?)
- Suggestions for improvements

Key Findings from the Survey

- Most participants found the scale easy to use, but some suggested more visual guidance.
- Designers expressed a need for material examples and case studies within the digital sensory assessment toolkit.
- Some requested more questions and prompts, which would lead to a more accurate rating

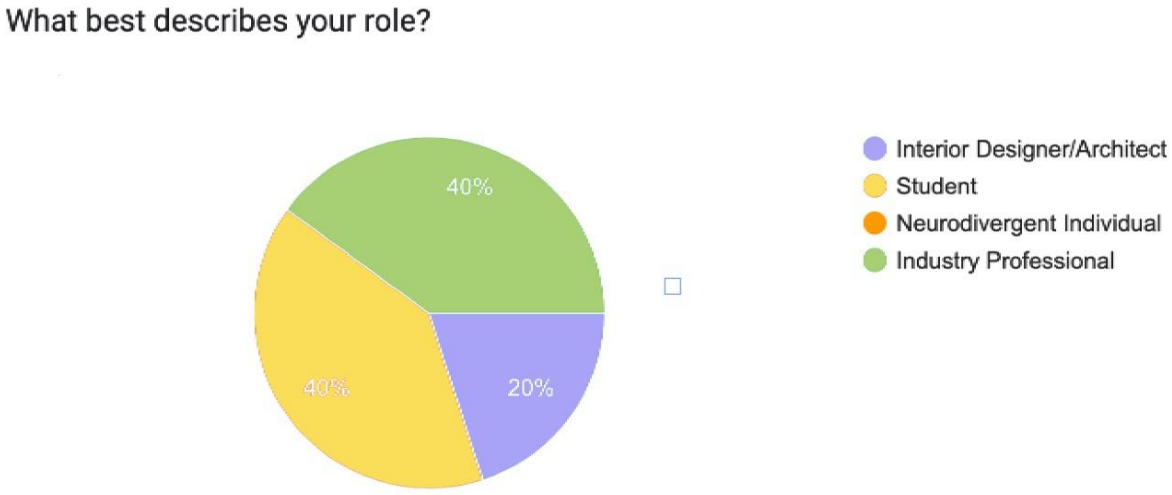


Figure 9: Roles of users who took the feedback survey, see appendices all information that was gathered (Source: Author, 2025)

With the feedback from this survey, the digital sensory assessment toolkit is now more accessible and guides the user in a more direct way to rate their material. The future of the digital sensory assessment toolkit has a lot of possibilities, but the main points that need improvement are:

- Providing more questions to allow for a more accurate rating
- Providing case studies to highlight innovative materials and projects that address neurodivergent needs.

Eventually, this could evolve to evaluating entire spaces, which would allow not only designers to assess the space they designed but also users to vocalize their needs in a space. This research highlights the sensory inclusivity gap in interior architecture and introduces a structured, adaptable toolkit to improve material selection. By integrating sensory evaluations, expert insights, and user feedback, the digital sensory assessment toolkit has been iteratively refined to ensure practicality for designers and accessibility advocates alike.

Future developments will focus on expanding assessment criteria, integrating case studies, and evolving the digital sensory assessment toolkit into a broader space evaluation tool to enhance neurodivergent-friendly design.

Analysis and Communication of Findings

The findings of this research reflect a growing awareness of the gaps in sensory inclusivity within interior architecture, particularly regarding materials and furniture. Through a combination of material testing, interviews, user feedback, and digital sensory assessment toolkit development, several key themes and areas for further innovation have emerged.

The Evolution of the Sensory Rating Scale

The original sensory rating scale provided a fixed 5-point evaluation system, while this scale offered a foundational structure for assessing materials feedback, revealing that sensory perception is highly subjective and context-dependent. As a result, a major finding was the need to move beyond a rigid scoring model and evolve the digital sensory assessment toolkit into a more interactive and customizable experience. Now split into three sensory categories: tactile, visual, and auditory and prompting the user with a question for each:

- Tactile - Does the material feel soft, smooth, or rough to the touch?
- Visual - Is the material highly reflective or matte?

- Auditory - Does the material absorb or amplify sound?

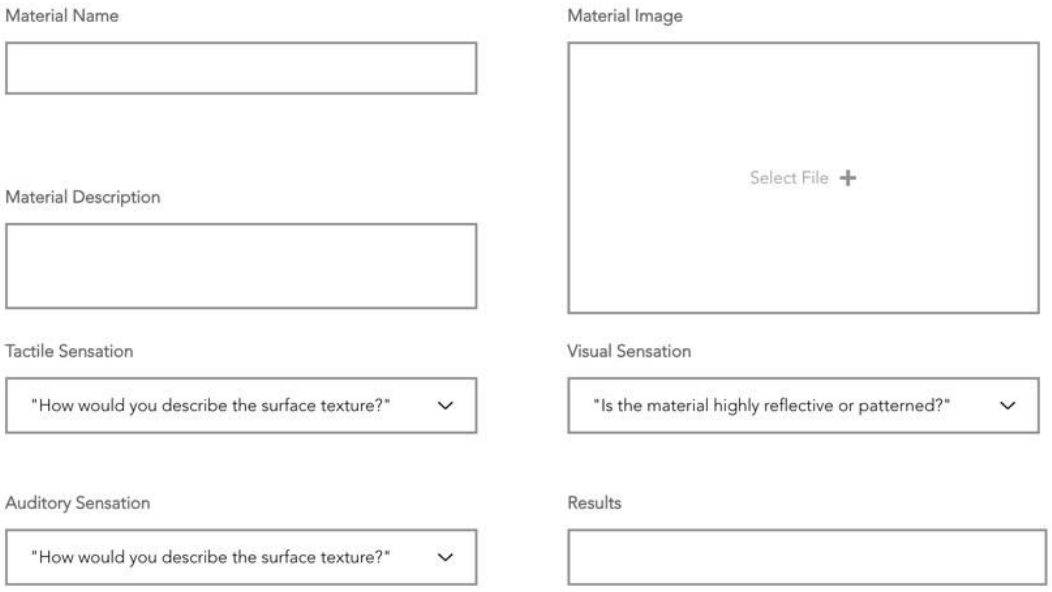


Figure 10: Current state of the website in which the digital sensory assessment toolkit inhabits (Source: Author, 2025)

Instead of asking users to rate a material outright, the digital sensory assessment toolkit now incorporates tailored questions to support more informed decision-making. However, with user feedback, it was understood that more questions would be needed to accurately test a material. Listed are some examples of questions that will be added to the toolkit in the future:

- Tactile Sensation ○ Is it likely to cause discomfort after prolonged contact?
    - Would someone with tactile defensiveness find this texture overstimulating?
- Visual Sensation ○ Does it feature busy patterns or muted, neutral tones?
    - Would it contribute to visual clutter or calmness in a space?
- Auditory Sensation ○ Would it reduce background noise in a busy setting?
    - Does it produce noise (e.g., creaking, clicking) when interacted with?

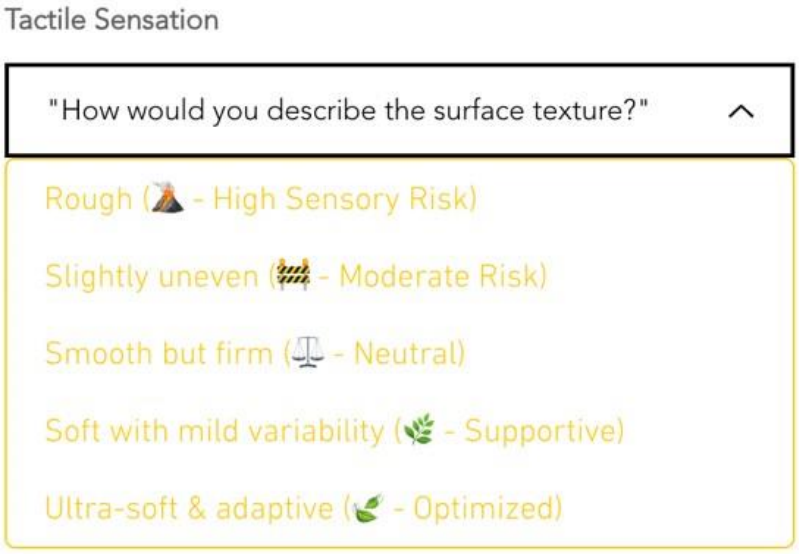


Figure 11: Sample interface of the updated digital sensory assessment toolkit with dropdown questions and real-time scoring - see Appendices for more details

These questions allow the tool to provide a more detailed assessment, promoting inclusive thinking in material selection

From Materials to Spaces: Expanding the Digital Sensory Assessment Toolkit

Although the digital sensory assessment toolkit currently focuses on materials and furniture, a significant outcome of the research is the recognition that sensory comfort is not experienced in isolation; the entire spatial context influences it.

This idea emerged prominently in the interview with Atlant McGloin from the university's Accessibility Office. She highlighted that students face difficulties expressing sensory discomfort in academic environments. She commented, "Your tool could help students articulate needs privately…it'd empower them to elf an advocate." This sparked the idea that the toolkit could eventually serve as a personalized spatial assessment tool.

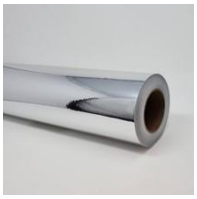
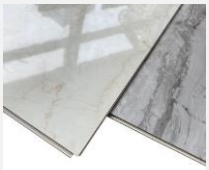
This evolution would allow users to evaluate entire environments using the same guided sensory lens, rating zones of a space based on their level of comfort or overstimulation. Designers could then use this feedback to implement targeted approaches, such as breakout spaces, acoustic panels, or replacing certain materials.

Case Studies and Real-World Examples

Grounding the digital sensory assessment toolkit providing real-world examples allows for fastpaced material inspiration for designers. Users from the feedback survey also agreed that material examples and different case studies would provide good insight into material selection. These practical examples reinforce how specific choices can significantly impact sensory comfort.

Material Examples:

Table 1: Examples of material case studies for the digital sensory assessment toolkit

Material	Sensory Category	Common Use	Toolkit Rating	Notes	Image
Cork Wall Panels	Tactile & Auditory	Aesthetic / acoustic walls	5 (Highly sensory friendly)	Soft texture, noise absorbing, natural finish	
Polished Chrome	Visual	Fixtures, furniture	1 (Very unfriendly)	Reflecting, distracting glare	
Glossy Vinyl Flooring	Visual & Auditory	Classrooms, all-purpose flooring	2 (Somewhat Unfriendly)	Visually reflective, amplifies sound	

These examples further validate the rating scale's real-world applicability and demonstrate the importance of material specification during the early design phases.

The digital sensory assessment toolkit's development has moved from a technical material rating system to a broader, inclusive design support tool. Its adaptability and potential application to full spatial environments represent a meaningful shift in how designers might begin to consider neurodiversity, not just as a checklist but as a fundamental aspect of human-centred design. As it

stands, the toolkit continues to evolve with feedback, and its flexibility allows it to serve both professionals and end-users in their shared goal of creating more accommodating environments.

Discussion of Findings: Considering Theory in the Literature

This research reveals a clear gap in how neurodivergent sensory needs are addressed in interior architecture. While accessibility is increasingly acknowledged, it often overlooks the sensory feelings that affect comfort, engagement, and well-being. Drawing on the principles of Sensory Integration Theory (Huang & Lin, 2023). and insights from Design for the Mind (BSI, 2023) and Autism Autism-Friendly University Design Guide. By integrating interviews, material assessments, and toolkit feedback, this research demonstrates how environments can move to be more inclusive, adaptable, and user centred.

Sensory Integration Theory in Practice

Sensory Integration Theory proposes that the senses work together to help individuals interpret and navigate their environments. For neurodivergent individuals, who may be hypersensitive or hypersensitive to specific stimuli, the built environment can either support or disrupt this process (Huang & Lin, 2023). The digital sensory assessment toolkit directly applies this theory, dividing material assessment into three sensory categories: tactile, visual, and auditory.

Tactile Design: Comfort through Texture

The tactile rating section of the digital sensory assessment toolkit builds on research by Huang and Lin (2023), which emphasizes that soft and smooth textures often reduce discomfort for those with tactile defensiveness. This was also reiterated by Moustafa, who exclaimed that surfaces that come in direct contact with the users should be as neutral as possible. Materials like wood and cotton-based fabrics are preferred (Mostafa, 2021). These findings directly influenced the digital sensory assessment toolkit's tactile assessment criteria, reinforcing the importance of specifying finishes that are not only functional but also emotionally supportive.

Proprioceptive Design: Movement and Self-Regulation

The proprioceptive design considers how body movement and physical awareness contribute to emotional and sensory regulation. The literature, including Huang and Lin (2023), supports the use of adaptive furniture, which allows the user to change body positions, change posture, and have a dynamic change of movement to promote calmness and regulation.

Although not yet implemented in the digital sensory assessment toolkit's current version, these principles point toward a future evolution of using the tool to assess not only static materials but also furniture or entire spaces. This would allow designers to evaluate how multiple elements, such as lighting, layout, acoustics, and materials work together to influence the overall sensory experience of a room. In doing so, the toolkit could become a more complete resource, guiding decisions on special zoning, adaptive furniture selection and sensory areas. This broader application also reflects feedback from interviews, particularly the suggestion that the tool could empower users to identify their own sensory needs within a space.

Visual and Auditory Adjustments

Findings also strongly support existing literature that emphasizes visual and auditory considerations as key to reducing sensory overload. According to Design for the Mind (BSI, 2023), reflective materials, bright lighting, and loud acoustics can severely impact neurodivergent users. The *Autism Friendly University Design Guide* echoed this by encouraging the use of muted tones and a neutral palette when choosing colours.

The digital sensory assessment toolkit incorporates this theory by prompting users to evaluate the reflectivity, light absorption and sound behaviour of materials. These align with findings from Narenthiran et al. (2022), who argue that autonomy in adjusting one's environment, such as controlling lighting or accessing quiet zones, leads to improved comfort and engagement for neurodivergent users.

Broader Cultural and Global Implications

The research aligns with the global conversation on equity in design. While awareness around physical accessibility has grown, cognitive and sensory inclusion remains under-addressed in many institutional standards (Mostafa, 2008; Ellison & Gliadkovskaya, 2024). The lack of formal codes or building regulations specifically for neurodivergent needs reflects a broader issue, one that the digital sensory assessment toolkit, in its small way, begins to address by offering a practical and customizable tool for material evaluation.

Furthermore, the adaptability of the tool allows it to be applied across a wide range of contexts and project types, making it highly scalable and versatile. Whether used in educational settings, healthcare environments, or commercial interiors, the digital sensory assessment toolkit offers a flexible framework that can be tailored to specific user needs. It bridges the gap between

accessibility theory and day-to-day design practice by providing a fast, intuitive resource that any designer can quickly understand and implement. In doing so, it encourages a more inclusive design mindset without slowing down the creative process.

Conclusion

This research has addressed a critical gap in interior architecture by developing a flexible, user centred digital sensory assessment toolkit aimed at enhancing inclusivity for neurodivergent individuals. Through a mixed-methods approach, the study identified significant shortcomings in current design practices, which often overlook the sensory experiences of neurodivergent users. The findings underscore the necessity of integrating sensory inclusivity into material and furniture selection to create environments that are not only functional and aesthetically pleasing but also supportive of diverse sensory needs.

The evolution of the sensory rating scale from a fixed system to an interactive, customizable digital sensory assessment toolkit represents a pivotal advancement in inclusive design. By dividing assessments into tactile, visual, and auditory categories, the tool allows users to prioritize their unique sensitivities, fostering a more personalized approach to material evaluation. Feedback from designers, accessibility professionals, and neurodivergent individuals highlighted the tool's potential to bridge the gap between design intentions and user experiences while also empowering users to advocate for their needs.

Looking ahead, the digital sensory assessment toolkit has the potential to expand beyond material assessment to evaluate entire spatial environments, further embedding sensory inclusivity into the design process. Future developments could incorporate additional sensory categories, case studies, and real-world examples to enhance their applicability and impact.

In conclusion, this study advocates for a shift in direction in interior architecture, making sensory inclusivity an essential consideration in design. By continuing to refine and implement tools like the digital sensory assessment toolkit, the field can move toward creating spaces that truly accommodate the diverse needs of all users, fostering comfort, engagement, and well-being for neurodivergent individuals.

Reference List

Cleveland Clinic, C.C.M., 2024. Neurodivergent. Available at: https://my.clevelandclinic.org/health/symptoms/23154-neurodivergent

Ellison, A. and Gliadkovskaya, A., 2024. Designing with neurodiversity in mind. *FierceHealthcare*, p.N.PAG.

Love, J.S., 2022. Sensory spaces: sensory living–studio teaching the design of autism-friendly adult accommodation. *Archnet-IJAR: International Journal of Architectural Research*, 16(3), pp.595-619.

Mickovski, N., 2022. *Design enabled: the everyday refuge for a neuro-inclusive city*. Doctoral dissertation, Laurentian University of Sudbury.

Morgan, H., 2019. Connections between sensory sensitivities in autism: the importance of sensoryfriendly environments for accessibility and increased quality of life for the neurodivergent autistic minority. *PSU McNair Scholars Online Journal*, 13(1), p.11.

Mostafa, M., 2008. An architecture for autism: Concepts of design intervention for the autistic user. *International Journal of Architectural Research*, 2(1), pp.189-211.

Mostafa, M., 2021. *The autism friendly university design guide*. Dublin City University, Dublin.

Narenthiran, O.P., Torero, J. and Woodrow, M., 2022. Inclusive design of workspaces: Mixed methods approach to understanding users. *Sustainability*, 14(6), p.3337.

Lee, J. H. et al. (2025) ‘Development of sensory-friendly inclusive design based on sensory integration theory’, The Design Journal, pp. 1–19. doi: 10.1080/14606925.2025.2461927.

Design for the mind -Neurodiversity and the built environment -Guide https://www.housinglin.org.uk/_assets/Resources/Housing/OtherOrganisation/Design-for-the-mindNeurodiversity-and-the-built-environment-Guide.pdf.

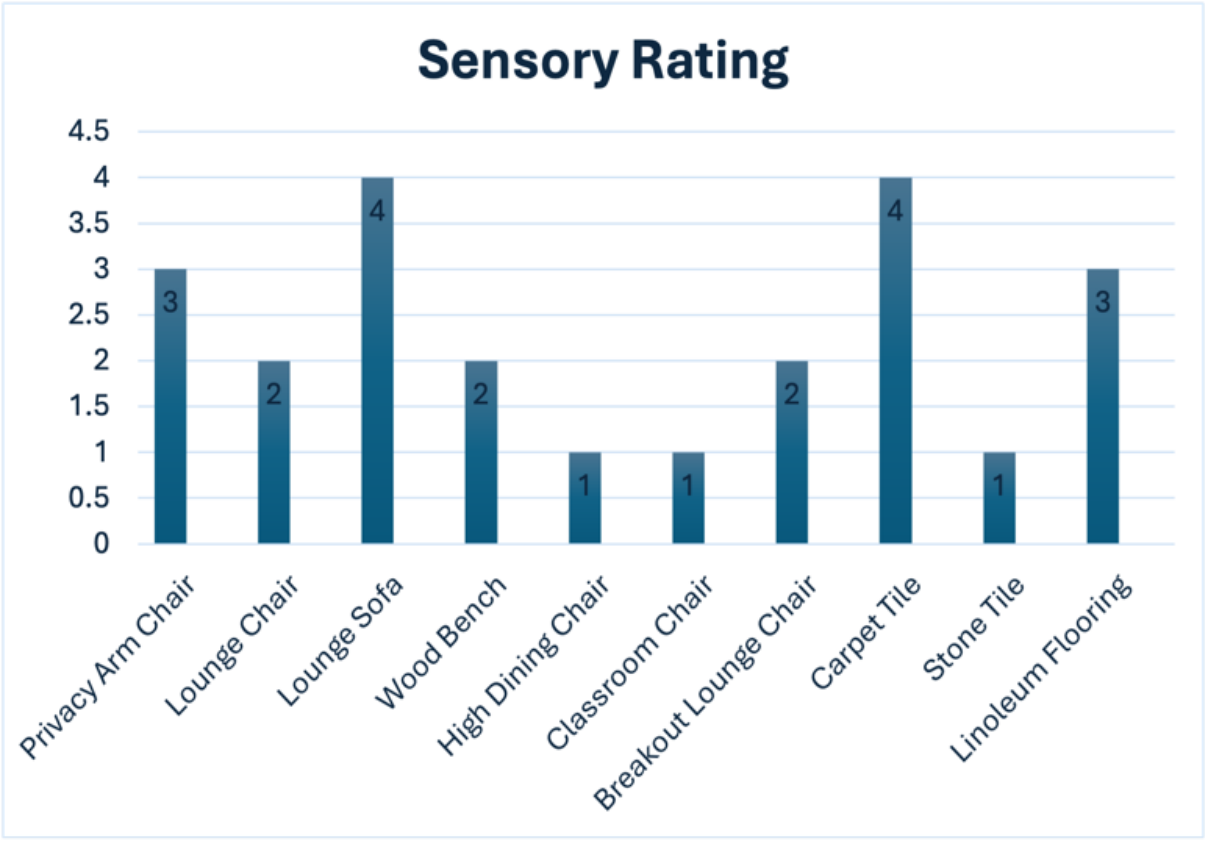
Bibliography

Appendices

Furniture Item	Location	Material	Texture	Flexibility / Adjustability	Sensory Friendly Rating	Additional Notes	Photo
Privacy Arm Chair	Outside of Library (First Floor)	Fabric – 100% polyester	Rough	Fixed	3	Rough texture, no adjustability, does not provide room to move. Made from a synthetic fibre. provides acoustic privacy	
Lounge Chair	School entrance	Fabric - 100% Polyester Trevira CS	Rough	Fixed	2	Rough texture, no adjustability, does not provide room to move. Made from a synthetic fibre.	
Lounge Sofa	Ground Floor Library	Fabric - 60% Polypropylene, 30% Wool, 10% Viscose	Soft	Fixed	4	Softer texture, does not offer any adjustability but are larger seats allowing users to be flexible when sitting.	
Wood Bench	Outside of Library	Plywood	Smooth	Fixed	2	Although it does use a natural material it is a cold and hard surface which will most likely cause discomfort during prolonged use.	
High Dining Chair	Common area - L Building	Plastic	Smooth / Hard	Fixed	1	Cold, Hard, Bright and reflective, very minimal sensory comfort considerations	
Classroom Chair	L Building	Plastic - molded Polypropylene	Rough	Fixed	1	Cold, Hard, Bright and reflective, very minimal sensory comfort considerations,	
Breakout Lounge Chair	L Building	Fabric – Faux Leather (vinyl)	Smooth	Fixed	2	Cold, Smooth, reflective surface, no adjustability may cause discomfort for prolonged use	
Carpet Tile	Library Flooring	Fabric	Low-Pile, Firm, Slightly Soft	N/A	4	Softens sound, provides slight cushioning, low pile may still feel slightly rough	
Stone Tile	Entrance of School and first floor	Stone - Granite	Hard/ Smooth	N/A	1	Cold and hard underfoot, may cause echo, potentially overstimulating in noisy areas	
Linoleum Flooring	General Linoleum flooring can be found throughout the		Smooth & Firm	N/A	3	Softens sound more than hard tile, smooth surface but can feel slightly cold	

Rating	Description
1	**Very Unfriendly**: The material or design is likely to cause discomfort, overstimulation, or distraction. Examples include very rough or hard textures, sharp edges, harsh colors, or excessively bright and reflective surfaces. Minimal sensory comfort considerations.
2	**Somewhat Unfriendly**: The material or design has some sensory challenges, such as slight roughness, cold or hard surfaces, or loud colors. May cause mild discomfort or overstimulation, especially with prolonged use.
3	**Neutral**: The item is generally acceptable but does not actively contribute to a sensory-friendly environment. It's neither overstimulating nor especially calming. Examples include smooth plastic or polished wood without padding, neutral colors, and average firmness.
4	**Sensory-Friendly**: The material or design is comfortable and aligns well with sensory-friendly principles. Typically includes softer, more natural materials (e.g., wood, soft fabric), muted colors, and smooth textures. Few sensory issues are expected, making it suitable for most neurodivergent users.
5	**Highly Sensory-Friendly**: The material or design is exceptionally calming, soothing, and comfortable for neurodivergent individuals. Examples include natural, soft materials like cotton or wool, padded upholstery, muted colors, and non-reflective surfaces. Actively supports sensory comfort and focus.

First pilot study of material/furniture survey university setting with the first iteration of the sensory scale.



Interview Questions

General Accessibility at The University:

1. Can you describe some of the key accessibility challenges the university has faced in terms of its buildings and interior spaces?
2. What standards or guidelines does the institution follow to ensure accessibility in interior spaces?

3. Have there been any significant upgrades or redesigns the university to improve accessibility in recent years?

Design and Furniture Considerations:

4. In your opinion, what role do furniture and spatial design play in making an environment truly accessible for all users?
5. Are there specific types of furniture or design elements that you've found particularly effective in improving accessibility on campus?
6. Have you encountered examples of poorly designed furniture or layouts that posed barriers to accessibility? If so, how were they addressed?

Collaboration and Input:

7. Does the Accessibility Office work with interior architects or designers when planning or renovating spaces on campus?
8. How does your team gather feedback from students or staff with disabilities about the accessibility of interior spaces?
9. Are there opportunities for students studying design, like myself, to collaborate with your office on projects related to accessibility?

Future Improvements:

10. What improvements would you like to see implemented in terms of accessible design at the university?
11. Are there any upcoming projects or initiatives at the institution that focus on improving accessibility?
12. What advice would you give to a designer or architect aiming to create spaces that prioritize accessibility and inclusion?

Broader Insights:

13. Based on your experience, what are some common mistakes designers make when addressing accessibility?
14. Can you recommend any resources or case studies that showcase exceptional examples of accessible design?
15. In what ways do you think accessibility considerations intersect with sustainability or aesthetics in design?

General Accessibility Practices

1. **What is the Accessibility Office's role in shaping physical spaces (e.g., classrooms, libraries) in a university setting?**
2. **How do you collaborate with architects, designers, or facilities teams to ensure spaces meet accessibility standards?**
3. **What existing guidelines or policies does the university follow for inclusive design (e.g., Universal Design, Building Regulations)?**

Neurodivergent-Specific Accessibility

4. **How does the office address the needs of neurodivergent students/staff (e.g., autism, ADHD) in campus design?** ○ ***Probe*****: Are there specific sensory-friendly accommodations (lighting, acoustics, furniture)?**
5. **Have you received feedback from neurodivergent individuals about sensory challenges in campus spaces? What were the most common issues?**

6. **Are there designated low-stimulation or sensory-friendly zones on campus? How were they designed?**

Material & Furniture Selection

7. **How are materials and furniture chosen for campus spaces? Is sensory comfort a consideration?**
    - ○ ***Probe*****: Do you avoid glossy surfaces, harsh lighting, or noisy materials?**
8. **Do you work with suppliers who specialize in sensory-friendly or adaptive furniture?**
9. **What barriers exist to implementing more neurodivergent-inclusive materials/furniture (e.g., cost, maintenance, awareness)?**

Collaboration & Training

10. **Do you involve neurodivergent students/staff in campus design decisions? If so, how?**
11. **Are there training programs for staff or designers on neurodiversity and sensory accessibility?**
12. **How do you balance aesthetics with sensory functionality in public spaces (e.g., cafeterias, lecture halls)?**

Challenges & Barriers

13. **What's the biggest challenge in creating sensory-inclusive environments in a university setting?**
14. **Are there spaces on campus you feel are *not* meeting neurodivergent needs? What limits improvement?**
15. **How does budget allocation impact accessibility upgrades?**

Feedback on Your Research/Tool

16. **How could a sensory rating scale for materials/furniture support your work?** ○ ***Probe*: Would it help with vendor negotiations, design briefs, or audits?**
17. **What criteria would make this tool actionable for the university's accessibility goals?** ○ ***Examples*: Cost-effectiveness, ease of maintenance, alignment with existing policies.**

18. **Would you be open to piloting the scale in a campus renovation project?**

Policies & Future Goals

19. **Does the university have a roadmap for improving neurodivergent accessibility in physical spaces?**
20. **What emerging trends or technologies in accessibility excite you (e.g., smart classrooms, biophilic design)?**

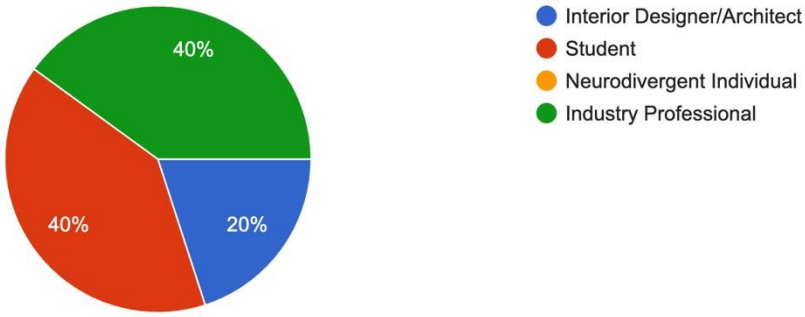
Closing & Collaboration

21. **How can students/researchers like me collaborate with the Accessibility Office to advance sensory inclusivity?**
22. **Is there anything I haven't asked about that's critical to understanding accessibility at the university?**

This QR code leads to the transcripts for both interviews with Leo Scarff and Atlant Mcgloin.

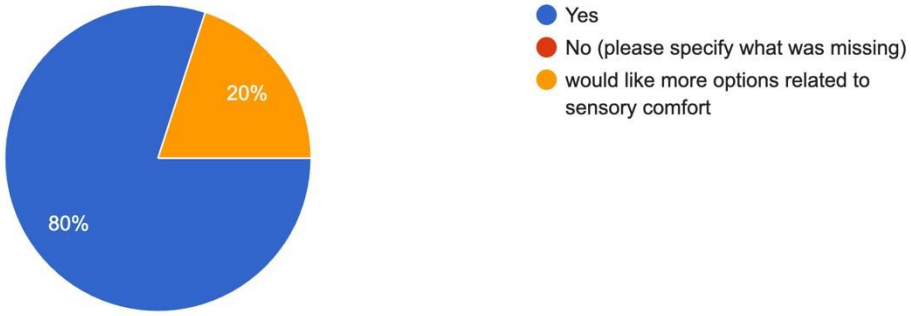
What best describes your role?

5 responses



Did you find the dropdown options relevant for rating materials?

5 responses

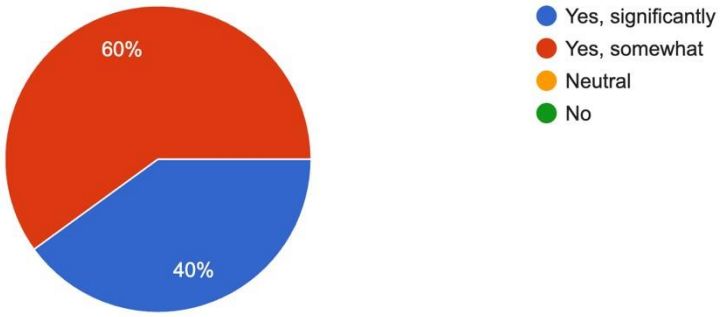


How intuitive was the sensory rating scale

5 responses

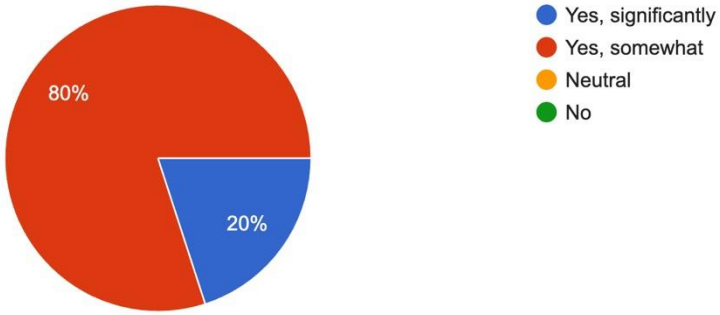
Did the toolkit help you identify sensory-friendly materials/furniture?

5 responses



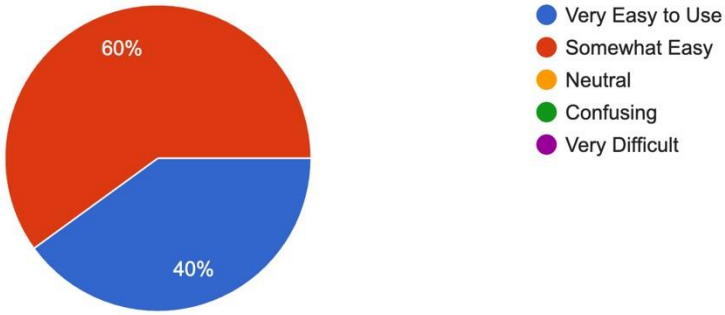
How likely are you to use this tool in your own work?

5 responses



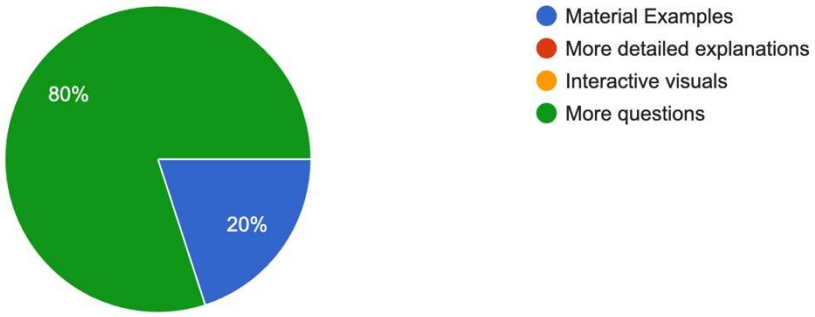
How easy was it to customize the toolkit for your project (e.g., weighting attributes)?

5 responses



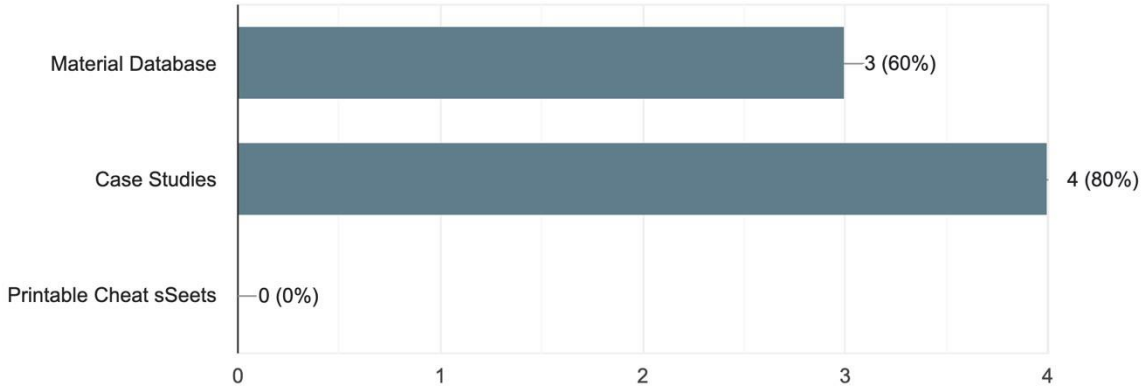
What features would improve the tool?

5 responses



What's MISSING from the toolkit? (Select all)

5 responses



How could the toolkit better support sensory-inclusive design?

4 responses

Provide a more clear tutorial on how to use the rating system

Accessibility of the overall site, direct users how to use

Include real-world examples of materials used in neurodivergent-friendly spaces.

More prompts and questions

The next set of images are of the sensory toolkit website.

Sensory Toolkit

Tactile Auditory Visual

Material Name

Material Image

Select File +

Material Description

Tactile Sensation

"How would you describe the surface texture?"

Visual Sensation

"Is the material highly reflective or patterned?"

Auditory Sensation

"How would you describe the auditory qualities?"

Results

Tactile Sensory Table

Rating	Description	Impact on Sensory Experience
1	Very rough, scratchy, cold, or sticky. High sensory risk.	Likely to cause discomfort, anxiety, or avoidance for users with tactile defensiveness.
2	Coarse, slightly irritating, firm, or cool to touch. Moderate sensory risk.	May trigger mild stress or distraction; tolerable only in short interactions.
3	Neutral texture and temperature, balanced firmness. Low sensory risk.	Comfortable for most users; neither soothing nor distressing—offers a neutral experience.
4	Soft-touch materials, warm, cushioned, lightly textured. Minimal sensory risk.	Encourages touch and interaction; calming and pleasant for most users.
5	Velvety, plush, warm, adaptive to the hand. Very low sensory risk.	Provides deep tactile comfort and soothing stimulation; ideal for calming, focus, and security.

Auditory Sensory Table

Rating	Description	Impact on Sensory Experience
1	Highly absorptive, quiet, zero echo or sound feedback. Very low sensory risk.	Ideal for sensory-sensitive environments; enhances comfort, safety, and peacefulness.
2	Soft, sound-absorbing, muffled response to touch or movement. Minimal sensory risk.	Helps reduce ambient noise and promotes calm; supports focus and emotional regulation.
3	Balanced acoustic quality, some dampening but noticeable response. Low sensory risk.	Acceptable in most settings; unlikely to cause discomfort but not especially soothing.
4	Moderate sound reflection, hollow or clunky when interacted with. Moderate sensory risk.	Can disrupt concentration or induce mild sensory stress in quiet environments.
5	Highly reflective, sharp echoes, loud or high-pitched when touched. High sensory risk.	Causes discomfort, overstimulation, or distress; likely to overwhelm sensitive users.

Visual Sensory Table

Rating	Description	Impact on Sensory Experience
1	Matte, non-reflective surfaces in cool, soft tones (e.g., blues, greens). Very low sensory risk.	Visually soothing; enhances comfort, spatial clarity, and emotional balance.
2	Muted tones, low-reflectivity, uniform color. Minimal sensory risk.	Promotes relaxation and focus; helps reduce environmental stress.
3	Neutral or mid-tone colors with soft contrast; semi-matte finish. Low sensory risk.	Generally calming and accessible; suitable for mixed-sensitivity environments.
4	Some shine or strong color hues, mildly reflective or patterned. Moderate sensory risk.	Can increase visual fatigue or reduce focus in sensitive users over time.
5	Highly reflective, bright, high-contrast colors or busy patterns. High sensory risk.	May cause visual overstimulation, eye strain, or distraction; unsuitable for calming spaces.

Final Website (Digital Sensory Assessment Toolkit)

Scan QR code.

This is the full running script for the average scoring system of the toolkit:

HOME

```
3   $w.onReady(function () {
12
13      // Click "Run", or Preview your site, to execute your code
14  // ===== FULL SCRIPT =====
15  // ===== FULL WORKING CODE =====
16  $w.onReady(function () {
17      $w("#tactileDropdown, #visualDropdown, #auditoryDropdown").onChange(() => {
18          // Get tactile value and score
19          const tactileValue = $w("#tactileDropdown").value;
20          console.log("Raw Tactile Selection:", tactileValue); // Debug raw input
21          const tactileScore = getTactileScore(tactileValue);
22          console.log("Tactile Score:", tactileScore); // Debug score
23
24          // Get other scores
25          const visualScore = getVisualScore($w("#visualDropdown").value);
26          const auditoryScore = getAuditoryScore($w("#auditoryDropdown").value);
27
28          // Calculate average
29          const totalScore = (tactileScore + visualScore + auditoryScore) / 3;
30          updateResultText(totalScore);
31      });
32  });
33
34  // ===== HELPER FUNCTIONS =====
35  function updateResultText(score) {
36      $w("#resultText").value = `Rating: ${score.toFixed(1)}/5 - ${getRating(score)}`;
37  }
38
39  function getRating(score) {
40      if (score >= 4) return "✅ Sensory-Friendly";
41      else if (score >= 3) return "⚖️ Neutral";
42      else return "🚨 High Risk";
43  }
```

HOME

```
3   $w.onReady(function () {
45  // ===== TACTILE SCORING (FOCUS HERE) =====
46  function getTactileScore(selection) {
47      // Normalize input to fix hidden mismatches
48      const normalizedSelection = selection
49          .trim() // Remove leading/trailing spaces
50          .replace(/\s+/g, ' ') // Replace multiple spaces with one
51          .replace(/[“”‘’]/g, '"'); // Fix "smart quotes" or special characters
52
53      console.log("Normalized Tactile Selection:", normalizedSelection); // Debug normalized value
54
55      switch (normalizedSelection) {
56          case "Rough (🪵 - High Sensory Risk)": return 1;
57          case "Slightly uneven (🚧 - Moderate Risk)": return 2;
58          case "Smooth but firm (⚖️ - Neutral)": return 3;
59          case "Soft with mild variability (🌿 - Supportive)": return 4;
60          case "Ultra-soft & adaptive (🍃 - Optimized)": return 5;
61          default:
62              console.log("NO MATCH FOR:", normalizedSelection); // Explicit debug
63              return 0;
64      }
65  }
66
67  // ===== HELPER FUNCTIONS =====
68  function updateResultText(score) {
69      $w("#resultText").value = `Rating: ${score.toFixed(1)}/5 - ${getRating(score)}`;
70  }
71
72  function getRating(score) {
73      if (score >= 4) return "✅ Sensory-Friendly";
74      else if (score >= 3) return "⚖️ Neutral";
75      else return "🚨 High Risk";
76  }
```


HOME
3 $w.onReady(function () {
78 // ===== SCORING FUNCTIONS =====
79 function getTactileScore(selection) {
80 // Normalize input (fix hidden characters/whitespace)
81 const normalized = selection.trim().replace(/\s+/g, ' ');
82 switch (normalized) {
83 case "Rough (🪵 – High Sensory Risk)": return 1;
84 case "Slightly uneven (🚧 – Moderate Risk)": return 2;
85 case "Smooth but firm (⚖️ – Neutral)": return 3;
86 case "Soft with mild variability (🌿 – Supportive)": return 4;
87 case "Ultra-soft & adaptive (🌱 – Optimized)": return 5;
88 default: return 0; // Fallback for mismatches
89 }
90 }
91
92 function getVisualScore(selection) {
93 const normalized = selection.trim().replace(/\s+/g, ' ');
94 switch (normalized) {
95 case "Highly reflective (🚨 – High Risk)": return 1;
96 case "Moderate glare or complex pattern (⚠️ – Medium Risk)": return 3;
97 case "Matte or minimal contrast (✅ – Low Risk)": return 5;
98 default: return 0;
99 }
100 }
101
102 function getAuditoryScore(selection) {
103 const normalized = selection.trim().replace(/\s+/g, ' ');
104 switch (normalized) {
105 case "Loud / Echoes (🔊 – High Risk)": return 1;
106 case "Moderate sound (🎵 – Medium Risk)": return 3;
107 case "Silent / Absorbs sound (🔇 – Low Risk)": return 5;
108 default: return 0;
109 }

Final Exhibit and Poster