Material Finish & Visual Sensitivity in Autism-Friendly Interior Design

[1]Sai Sirisha Ivvala, [2]Dr. Nischay N
[1]Student, [2] Associate Head,
[1]Department of Interior Design, [2]Department of Interior Design,
[1,2]JD School of Design, Bengaluru, Karnataka, India
doi.org/10.64643/JATIRV1I1-140048-001

Abstract -This study examines how material finish characteristics—Light Reflectance Value (LRV), gloss level, contrast intensity, and pattern complexity—impact visual sensitivity and behavioural comfort in individuals with autism spectrum disorder (ASD). Field observations from autism schools and therapy centres revealed that glossy surfaces, high-LRV walls, sharp contrast transitions, and visually dense patterns frequently triggered glare, eye strain, anxiety, and avoidance behaviours. A perception-based survey further confirmed that medium-LRV matte surfaces and low-contrast palettes are perceived as significantly more comfortable. Existing literature highlights visual hypersensitivity as a core sensory challenge for individuals with autism, yet provides limited empirical evidence linking fine motor attributes to behavioural outcomes. The results of this study establish that material finishes have a measurable impact on visual comfort and emotional regulation in autism-friendly spaces. The paper concludes with design recommendations aimed at reducing visual overstimulation through evidence-based selection of interior material finishes

Index-Terms: Autism-Friendly Design; Material Finish Properties; Light Reflectance Value (LRV); Visual Hypersensitivity; Sensory Architecture; Low-Stimulus Interiors; Neurodiversity-Inclusive Environments; Contrast Sensitivity; Pattern Complexity; Behavioral Comfort; Evidence-Based Design; Therapeutic Interior Spaces; Sensory Modulation; Environmental Psychology; Matte and Gloss Finishes; Glare Reduction; Perception-Based Assessment; Adaptive Interior Materials; Emotional Regulation; Autism Spectrum Disorder (ASD).

I.INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by atypical sensory processing, where individuals may present heightened or reduced sensitivity to environmental stimuli. Visual sensitivity, in particular, has been reported as a major factor

influencing comfort, emotional regulation, and functional participation in daily activities. Autistic individuals may experience intensified glare, difficulty with brightness transitions, and overstimulation caused by high contrast, saturated colors, or visually complex surfaces.

Interior spaces, especially learning and therapeutic environments, therefore function not just as physical enclosures but as sensory fields that can either support or challenge autistic users. While there is notable research on lighting, acoustics, and spatial planning in autism-friendly design, material finish properties—such as Light Reflectance Value (LRV), gloss level, pattern density, and contrast—remain underexplored. These properties directly affect luminance distribution, visual noise, and glare, yet are often addressed only at a descriptive level in design guidelines.

Preliminary observations conducted in autism-specific schools and therapy centers revealed recurring visual triggers: high-gloss flooring, bright white walls, reflective panels, and heavily patterned surfaces often coincided with behaviors such as squinting, avoidance of certain zones, agitation, and difficulty maintaining focus. In contrast, spaces incorporating matte finishes, medium-LRV surfaces, low-contrast transitions, and muted color palettes tended to support calmer behavior, better orientation, and improved engagement in tasks.

Existing literature recognizes the impact of visual overstimulation on autistic individuals, with emphasis on glare and illumination, but offers limited empirical evidence linking specific material finish attributes to behavioral outcomes. This highlights a clear research gap in finish-specific, measurable design parameters. The present study aims to address this gap by investigating how interior material finish characteristics—particularly LRV, gloss level, contrast, and pattern complexity—affect visual sensitivity and comfort in autism-friendly learning and therapeutic environments.

II.LITERATURE REVIEW

II.1. Studies on autism-friendly environments often highlight the need to reduce sensory overload but seldom quantify material finish attributes.

II.1.1. Built environment design and people with autism spectrum disorder (ASD): A scoping review. International Journal of Environmental Research and Public Health, 18(6), 3203

This scoping review synthesizes research addressing the relationship between ASD and the built environment. The authors identify consistent themes such as spatial clarity, sensory zoning, and minimization of overstimulation. While the study highlights visual comfort concerns, it identifies a lack of empirical detail regarding specific interior material finishes. The review's emphasis on qualitative guidelines underscores the need for quantitative finish-based research, directly supporting the focus of the present study(Tola et al., 2021)

II.1.2. Indoor environment perception of people with autism spectrum condition: A scoping review. Building and Environment, 243, 110545.

This review analyses the perception of indoor environmental quality among autistic individuals, covering thermal, acoustic, visual, and air-quality elements. Visual discomfort related to glare, illumination, and colour intensity is widely reported. However, the review notes the absence of design thresholds or finish-specific guidance. It establishes a scientific foundation for

understanding sensory sensitivities while also highlighting the lack of detailed material finish research.(Zaniboni & Toftum, 2023)

II.1.3. Evaluation of the main sensitivity drivers in relation to indoor comfort for individuals with autism spectrum disorder. Energy Reports, 8, 1907–1920.
Through a structured questionnaire administered to caregivers and professionals, this study identifies environmental stimuli that contribute to sensory stress in autistic individuals. Visual stressors such as glare and abrupt light contrasts are found to be significant. Although the study provides valuable insights into environmental discomfort, it does not quantify or differentiate specific material finish properties. This limitation reinforces the necessity for focused examination of finishes, supporting the direction of the present research.(Caniato et al., 2022)

II.2. Research Gap
II.2.1. Limited focus on finish-specific sensory triggers
II.2.2. Absence of quantitative metrics linking finishes to behavioural responses
II.2.3. Minimal inclusion of pattern density or contrast in sensory comfort studies
II.2.4. Lack of studies focusing on interior materials within Indian ASD environments
II.2.5. Few behaviour-based studies assessing environmental triggers

III.MATERIAL AND METHODS

III.1. Research Design
A mixed-methods research design was used, combining qualitative field observations, a quantitative perception-based survey, and a literature review. This triangulated approach enabled comprehensive evaluation of material finish attributes and their effects on visual sensitivity.

III.2. Data Collection
III.2.1. Primary data included field observations and a structured survey.
III.2.2. Secondary data consisted of academic research on sensory processing and interior finishes.

III.3. Variables
III.3.1. Independent Variables: LRV, gloss level, pattern density, contrast, reflectivity.
III.3.2. Dependent Variables: Visual discomfort, anxiety, focus difficulty, navigation comfort.

III.4. Data Analysis
Survey responses were analyzed descriptively, and observational findings were coded for behavioral patterns. Literature evidence was used to cross-validate empirical insights and support the formation of design recommendations.

III.5. Hypothesis

Medium-LRV matte surfaces with low contrast significantly reduce visual discomfort in individuals with autism.

IV.RESULTS

Survey findings confirm that glossy and reflective materials cause discomfort in most respondents. Highly patterned surfaces reduce focus, while muted colors and matte finishes improve behavioral stability. These findings align with existing sensory processing research and demonstrate the importance of controlled material specifications in autism-supportive environments.

IV.1. Brightness and LRV Sensitivity

IV.1.1. 75% of respondents lacked prior knowledge of LRV but showed perceptual sensitivity to brightness.

IV.1.2. High LRV surfaces (>70) were frequently associated with brightness overload and visual discomfort.

IV.1.3. Medium-LRV surfaces (50–65) were perceived as significantly more comfortable.

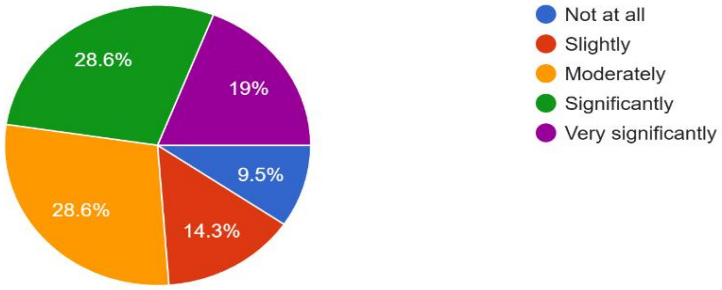

Figure 1 Effect of brightness levels on comfort

IV.2. Gloss and Reflective Surfaces

IV.2.1. 56.3% reported discomfort due to glossy surfaces.

IV.2.2. High gloss increased glare, luminance spikes, and visual overstimulation.

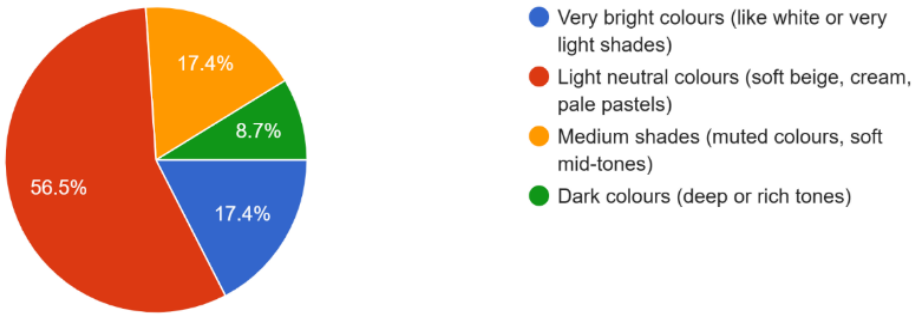

Figure 2 Preferences for Autism-Friendly Interior Materials

IV.3. Pattern Density and Visual Complexity

IV.3.1. Busy patterns caused difficulty focusing in 50% of respondents.

IV.3.2. High visual complexity correlated with cognitive fatigue and reduced engagement.

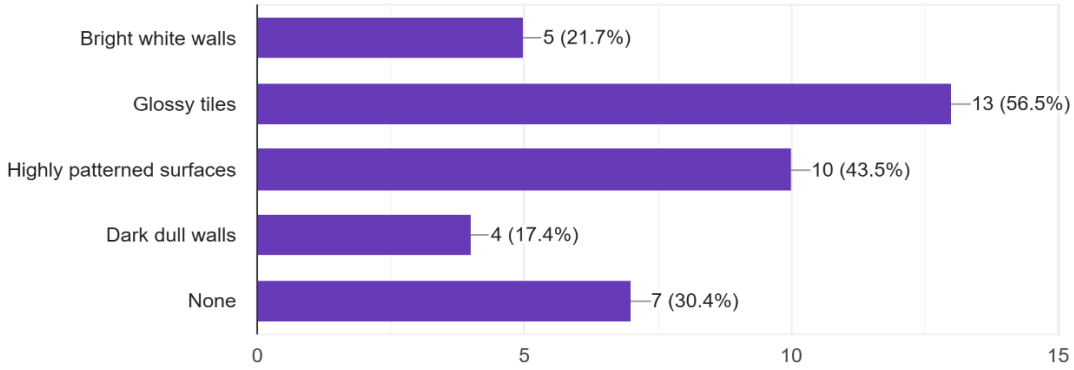

Figure 3 Effect of surface on visual comfort

IV.4. Contrast Levels

IV.4.1. High contrast was rated as the strongest sensory trigger (68.8% discomfort).

IV.4.2. Low-contrast environments improved predictability and reduced stress.

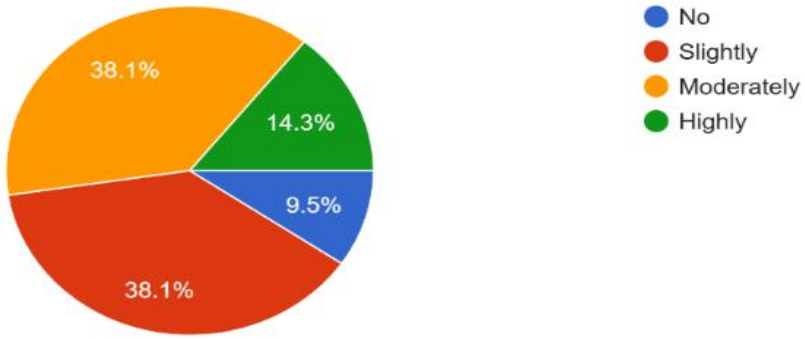

Figure 4 Effect of high contrast on sensory overload

IV.5. Behavioral Outcomes

IV.5.1. Muted neutral spaces produced calming effects in 73.3% of respondents.

IV.5.2. Medium-tone flooring improved spatial navigation for autistic individuals.

IV.6. Table 1. Material Finish Attributes and Sensory Responses

SN	Finish Attribute	Impact	Observed Behaviors
1	High Gloss	Increases glare	Eye strain, avoidance
2	High LRV White	Brightness overload	Agitation, overstimulation
3	Busy Patterns	High visual load	Difficulty focusing
4	Medium LRV Matte	Balanced luminance	Calm behavior

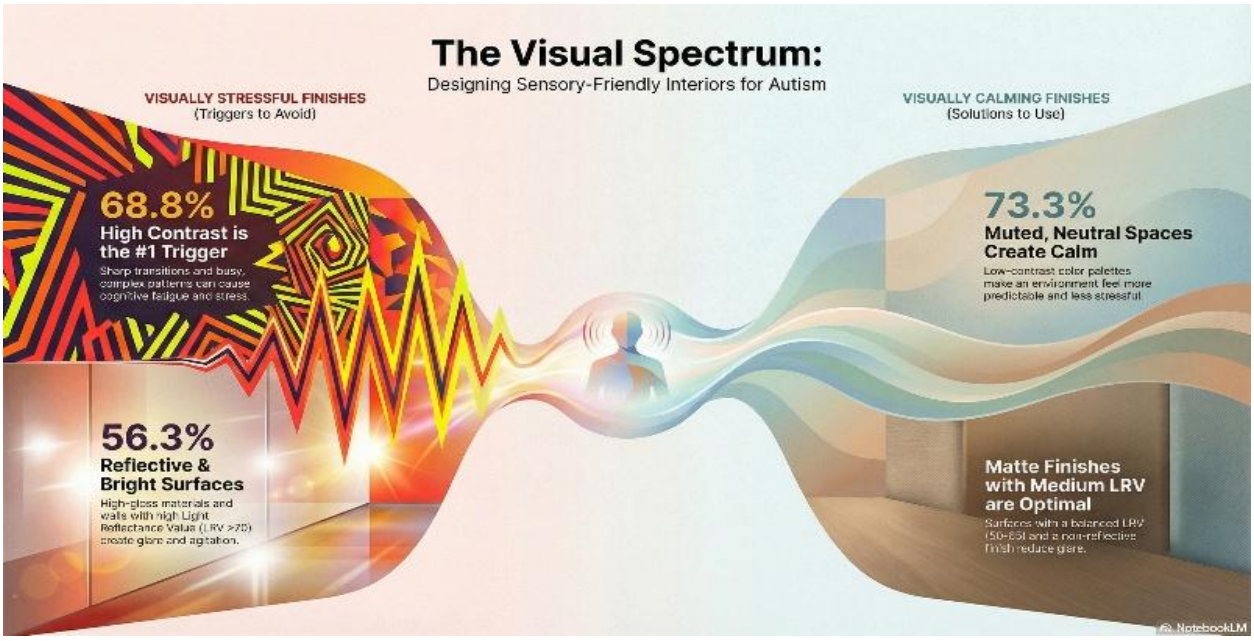

Figure 5 Material Finish Attributes and Sensory Responses

V.DISCUSSIONS

The survey findings reinforce observations from field visits: material finish characteristics — beyond just lighting — play a significant role in influencing visual comfort and behavioural responses for autistic individuals.

Glossy and highly reflective finishes contribute to unpredictable luminance spikes and glare, which many respondents identified as sensory triggers. This aligns with studies that highlight glare and luminance imbalance as discomfort drivers in sensitive populations.
Similarly, busy patterns and high-contrast combinations create visual “noise,” increasing cognitive load for individuals with sensory sensitivity. Such environmental complexity may overwhelm visual processing and trigger stress or avoidance, consistent with neurological sensitivity theory in ASD-oriented design literature.

On the contrary, matte surfaces, medium-LRV finishes, low pattern density, and soft colour palettes create visually stable, predictable environments. These conditions support sensory regulation, calm behaviour, and improved focus or task engagement — essential for therapy, learning, or even everyday living spaces for autistic users.

Hence, material finish should be considered as critically as lighting, acoustics, and spatial layout while designing autism-friendly interiors. The data validates the need for finish-specific design guidelines rather than generic sensory design advice.

VI.CONCLUSION

This research substantiates that interior material finishes — specifically LRV, gloss level, pattern complexity, and contrast — have a measurable impact on visual sensitivity and behavioural comfort among individuals with autism. Glossy, high-reflectance, high-contrast, and patterned surfaces emerge as common visual triggers causing discomfort, overstimulation, and avoidance behaviors. Conversely, matte, medium-reflectance, low-contrast surfaces with neutral/muted colour palettes contribute to calmer behaviour, better engagement, and sensory comfort.
By systematically documenting these effects and correlating them with survey responses and literature, this study bridges a critical gap in sensory-inclusive design research. The findings underline the importance for designers and architects to adopt finish-specific guidelines when creating autism-friendly spaces. For future research, it is recommended to expand sample size, include direct observation of autistic individuals (with consent), and employ controlled experiments to quantify thresholds for LRV, gloss, and pattern complexity for optimal sensory comfort.

Compliance with ethical standards

Acknowledgements
The author would like to thank the teachers, caregivers, interior designers, and survey respondents who generously contributed their time, insights, and experience to this research. Their observations from real-world autism-supportive environments were invaluable in shaping the findings of this study.

Conflict of interest statement
The author states that no conflict of interest exists regarding the research, authorship, or publication of this manuscript. All findings and interpretations are based solely on the data collected and the author's independent analysis.

Statement of ethical approval
The present research work does not contain any studies performed on animals or human subjects by any of the authors. Only perception-based survey data and non-invasive observations were used.

Statement of informed consent
Informed consent was obtained from all individual participants included in the survey. No personally identifiable information has been disclosed in this article.

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