

Sensory Sensitivity and the Built Environment

Rethinking their design palette can help architects and lighting professionals create better classrooms and other environments for those with autism

BY ASHA HEGDE

We use our senses to receive external information, and the brain processes that information to form appropriate responses. However, individuals diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD) and Sensory Processing Disorder (SPD) have difficulty processing and interpreting sensory input due to neurological differences which affect their day-to-day activities. These sensory difficulties may be exacerbated in children, as renowned scientist Temple Grandin indicated in her book *The Autistic Brain: Thinking Across the Spectrum*. The American Psychiatric Association states that 5 percent of children have ADHD; one in 68 children is diagnosed with ASD, according to the Center for Disease Control and Prevention; while one in 20 children are identified with SPD (Ahn, Miller, Milberger and McIntosh, 2004).





There is a great deal of research underway regarding the causes of ADHD, ASD and SPD. Even though a direct causal relationship has not been found, the leading contenders are genetics and environmental factors. There are no cures for these disorders, but therapies and behavioral interventions may reduce specific symptoms. The symptom that overlaps all three disorders is *sensory sensitivity*, meaning the individual is extremely sensitive to stimulation from sound, light, color, smell and texture.

A review of research and design standards pertaining to this specific population informs us of the sensory messages in an individual's environment that are distracting, alarming or uncomfortable and can trigger a negative behavior, while also identifying attributes of light that can help mitigate such problems. Note that the majority of the readings, research findings and design guidelines, speak specifically to the ASD (autism) group, especially children.

SCHOOLS AND ASD

While there is limited research regarding architecture and individuals with ASD, most focuses on what caregivers and teachers deem as important architectural elements that impact the behavior of children with autism in school environments. Mostafa's (2008) research indicates acoustics, spatial sequencing, light and color are important, while Vogel (2008) came up with eight design standards—flexible and adaptive; non-threatening; non-distractive; predictable; controllable; sensory-motor attuned; safe; and non-institutional. McAllister and Maguire's (2012) research indicates that threshold and entrance; sight-lines; high-level glazing; volumetric expression; and quiet rooms with low stimulus are important classroom attributes to teachers. Scott's (2009) research based on architect interviews and case studies suggests providing spaces that are comprehensible and simple with reduced detailing.

From the perspective of an individual with autism, Donna Williams, an internationally known author, writes in her book about an ideal educational environment—“one where the room had very little echo or reflective light, where the lights were soft and glowing upward rather than downward projecting light. It would be one where the physical arrangements of things in the room was cognitively orderly and didn’t alter and where everything in the room remained within routinely defined areas. It would be an environment where only what was necessary to learning was on display and there were no unnecessary decorations or potential distractions.”

TWO KEY STANDARDS

The 2010 standards for the U.S. Americans with Disabilities Act focus heavily on physical disability (wheel chair accessibility) with some attention to visual and hearing disability. Little attention is paid to developmental disorders. Two standards that do include the special needs associated with these disorders are the *Building Bulletin 102: Designing for disabled children*

1 in 68 children is diagnosed with Autism Spectrum Disorder

and children with special educational needs (UK) and *TGD-026 School Design Guide: Planning and design guidelines—accommodation for pupils with special educational needs* (Ireland).

- *Building Bulletin 102* acknowledges that each child is unique, however there are key design issues associated with ASD special needs that must be considered: “Simple layout, calm, ordered, low stimulus spaces, no confusing large spaces; indirect lighting, no glare, subdued colors; good acoustics, avoiding sudden/back-

ground noise; robust materials, tamper-proof elements and concealed services; safe indoor and outdoor places for withdrawal and to calm down” (*Annex F: Building Bulletin 102*, p. 199). Specifically, for electric light, it recommends light fittings that are low glare, with no flicker, no noise and the source should not be visible. Glare control is emphasized with regard to daylight. It is also recommended that the window wall should have light color to avoid possible glare and contrast created between the brightly lit window and a dark wall. Bright colors and busy patterns are to be avoided, as they can be confusing and over stimulating for sensory sensitive children.

- *The TGD-026 School Design Guide* accounts for pupils with ASD who may display extreme sensitivity to sensory stimulation by “reducing environmental stimuli through directing attention to the amount and type of visual, aural, tactile and olfactory stimulation; providing visual structure and also by creating a predictable and structured school and classroom environment” (p. 10, *TGD-026*, 2012). The design guidelines touch on a variety of aspects such as layout, access, building elements of walls, floor, color, furniture and equipment, acoustics, daylight, mechanical services and electrical services (lighting).

Much of the information provided within both the UK and Ireland design guidelines can be related to lighting design. For example, the wall and floor covering requirements state that “geometric or repeating patterns should be avoided on both wall and floor finishes,” since such choices introduce a high level of visual complexity and can be viewed as visual overload by children with sensory processing difficulties. This knowledge can be applied to lighting design by creating a visually simple and clear lighting layout to mitigate visual overload.

Specifics of daylight in *TGD-026 School Design*

Guide, 2012, p.17, include: “The control of natural daylight penetration needs to be carefully considered. The creation of strong contrast between light and shade can cause confusion and anxiety for certain pupils with special educational needs and in particular some pupils with Autistic Spectrum Disorders. Strong shadow lines may create fear and pupils will be unwilling to venture beyond the obstacle. Windows with exterior views may provide pupils with undesirable distractions. Clerestory windows and skylights may also be counterproductive because shifting patterns of daylight can complicate the visual environment. These drawbacks mean that Design Teams must carefully evaluate the locations of windows and skylights when and where they are used. Large expanses of glazing must be carefully designed and suitable provision made for the control of daylight entering the space should be provided.”

REDUCING STIMULI

Architects who plan and design for adults and children with sensory related needs have also detailed the need to pay close attention to attributes such as light, sound and complexity of space. The firm USA Architects Planners + Interior Designers states that “Traditional educational design, where the classroom is designed to stimulate students does not apply. ... Sensory stimulation—sound, light, color, pattern—should be controlled. The architect must use a different palette for the design aesthetics and built environment.” Regarding the design of residences for adults with autism, Dennis Kowal Architects adds that “the users told us that the two most important considerations for them were light and sound. While ASD is complex and can’t be narrowed to two senses, it is sometimes helpful to at least address the most significant requests of the users.”

In general, to reduce triggers of negative behavior, repeated emphasis is placed on the need



A Checklist for Sensitive Design

- ✓ Design visually simple and clean lighting layout (avoid ceiling clutter)
- ✓ Avoid glare
- ✓ Make use of indirect lighting strategies and uplight
- ✓ Specify light sources and fittings that operate at high frequency (eliminate light flicker, hum and pulsing effects)
- ✓ Understand the drawbacks—strong contrast, strong shadow lines, shifting patterns and undesirable distractions—of using daylight incorrectly
- ✓ Pay extra attention to window, clerestory and skylight size, location
- ✓ Develop empathy for the user

to provide spatial organization, which entails spaces that are uncluttered and organized, predictable and orderly, simple with reduced detailing, clear and non-distracting. Another aspect that is emphasized is catering to the emotional aspects of the individual by eliminating non-threatening and over-stimulating features, thereby enabling a safe, calm and secure environment. Using light and color to create such meaningful spaces becomes important.

As lighting designers, we are familiar with Flynn’s lighting cues that enable us to create spaces that give the impressions of intimacy, spaciousness and relaxation. Although Flynn’s cues are based on neurotypical individuals, would it be possible for designers to use the same cues with sensory sensitive individuals? To mitigate the sensory problems encountered with “light,” research and design standards suggest that glare associated with daylight and electric light should be avoided by considering appropriate window size, location and glazing. Electric fixture sizes and design, as well as use of uplight, might be considered to avoid direct glare. Attention to shadows and light patterns also needs to be considered. Light sources and fittings

that operate at high frequency should be used to eliminate flicker or pulsing effects.

MORE WORK TO DO

The majority of the writings in books and current blogs regarding light by therapists and parents of kids with autism revolve around fluorescent light. There seems to be a universal aversion to fluorescent light regarding its flicker and hum. Without any proper documentation of the lamp age, lamp type or ballast type, the writers voice their personal views and recommend readers not use fluorescent light and switch to incandescent or full spectrum light. I do believe this is an area the lighting industry needs to work on, clearly articulating the advances in both fluorescent and LED technologies, specifically with regard to flicker, to enable therapists, parents and designers to make wise choices based on tested data rather than on anecdotal information and inherent biases.

The built environment with its elements can send messages to the perceiver and impact their

behavior, emotions and learning. If the perceivers are individuals who organize the sensory signals in their environment differently—which in turn triggers undesirable behavior—then the burden falls squarely on the designer to understand the mind of the user with autism and focus on designing spaces that are safe with no over-stimulating or threatening features (Beaver, 2010). □

This article was adapted from a presentation at the 2013 IES Annual Conference.

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