Schools & Autism

December 16, 2016

1-AIA HSW|LU

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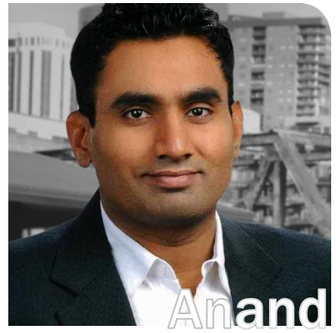

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SCHOOLS & AUTISM

1-LU|HSW

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

LEARNING OBJECTIVES

- Gain a basic knowledge of Autism Spectrum Disorder.
- Identify aspects of indoor environmental quality that are relevant to inclusive design.
- Learn what research supports regarding ASD and the built environment.
- Apply lessons from research to the design of schools.

“ *I might get distracted by the functions of levers. However, I pull my attention from there and wonder about the function of that yellow, large rectangular object, with levers of the first order, called a hinge.*

Why is that yellow, large rectangular object with levers there? I mentally answer the question, “It has allowed me to come inside that room, and can be opened or closed. And what else can that be, other than a door.” My labeling is complete.

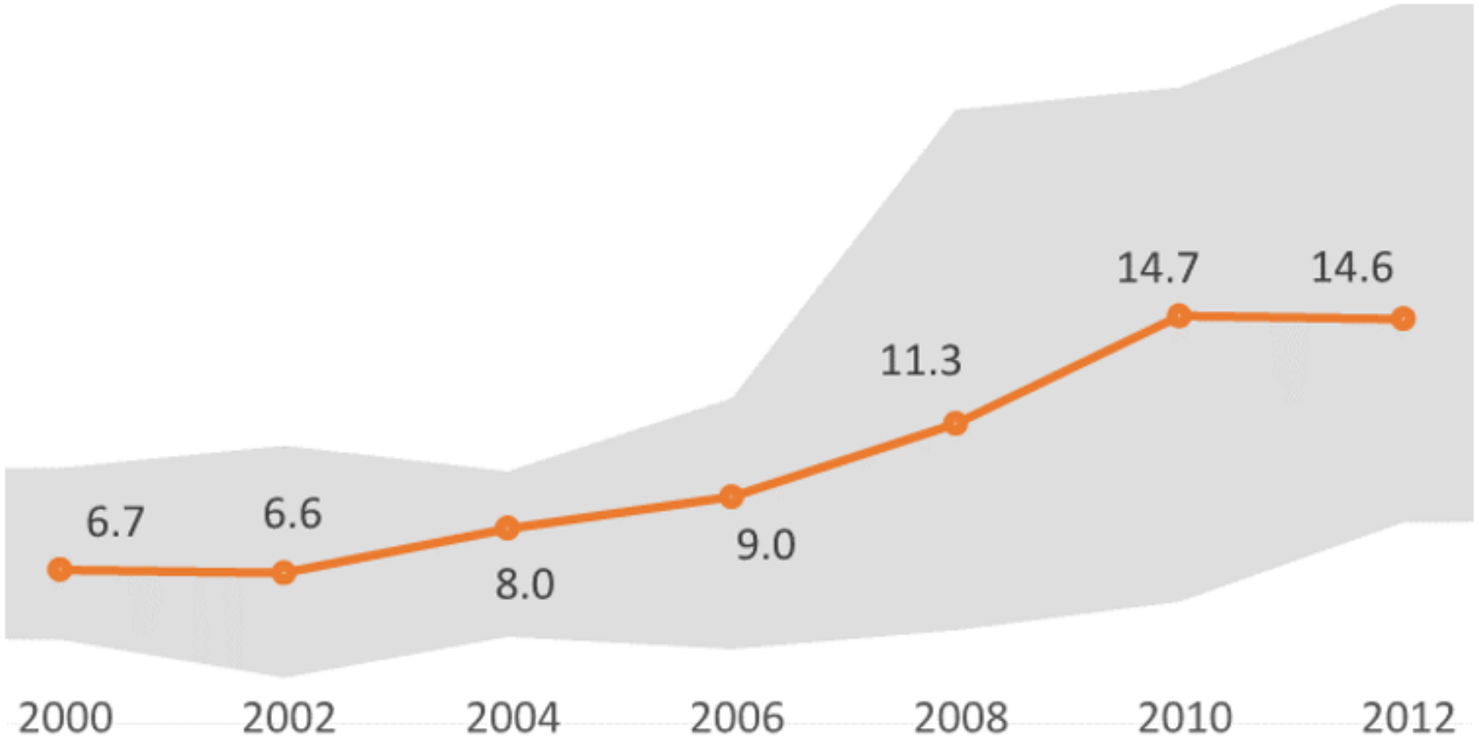
Mukhopadhyay, T. R. (2013). *How can I talk if my lips don't move?: inside my autistic mind*. Skyhorse Publishing, Inc..

“Intense World Syndrome”

“World Changing Too Fast”

To not feel at ease

PREVALENCE OF AUTISM PER 1,000*



*Data depicts 8-year-olds at 11 ADDM sites in the United States (Christensen et al., 2016). The range in prevalence rates between the sites is shaded.

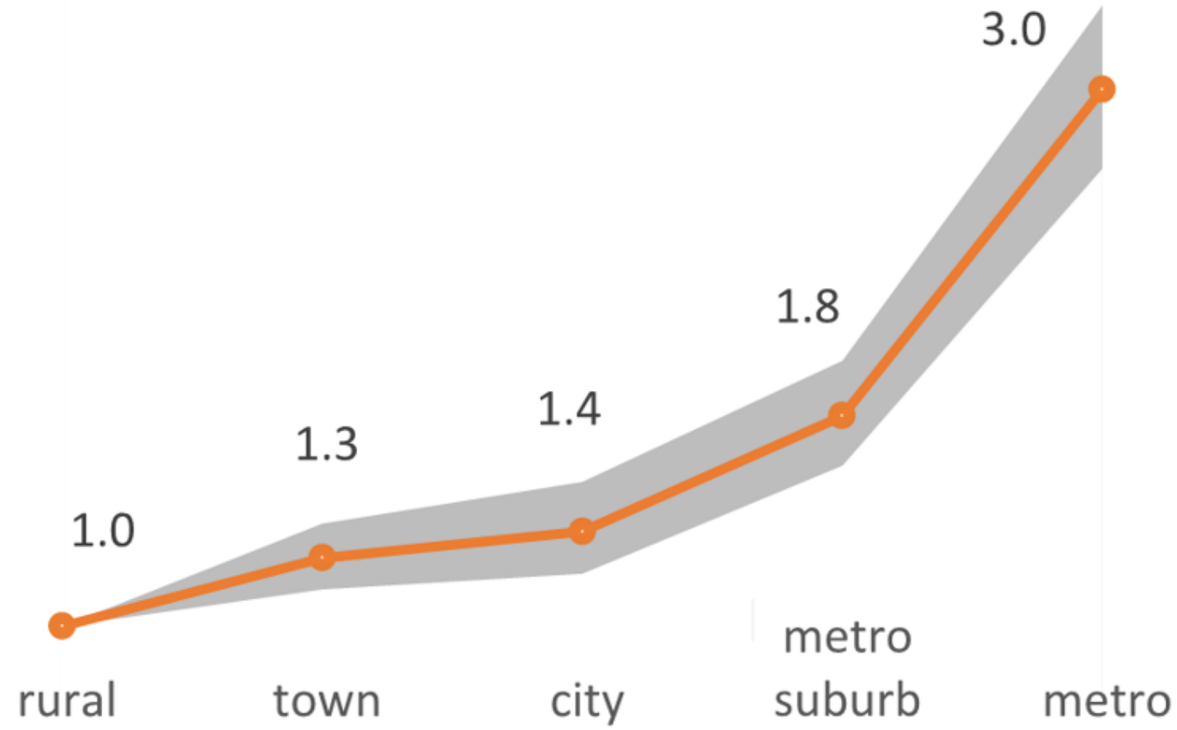
A HISTORICAL PERSPECTIVE

- 1950 Frigid Mother
- 1970 TV Time
- 2013 DSM-5
  - Autism
  - Asperger's
  - Childhood Disintegrative Disorder
  - Pervasive Developmental Disorder – NOS

DIAGNOSIS

- Deficits in social interaction / communication and restrictive, repetitive behavior
- Sensory integration
- Individual presentation
- Focus on behavior
- The “active self” vs. the “thinking self”

AUTISM INCIDENCE RATE AND URBANICITY



This data depicts the incidence rate ratios for children in Denmark with an ASD diagnosis. Children born in a metro area (5520 people/km2) are diagnosed with ASD at three times the rate of rural children (55 people/km2). The shaded area is the 95% confidence interval. Data is from Lauritsen et al. (2014).

SENSORY INTEGRATION CATEGORIES

- Sensory seeking
- Sensory modulation with movement sensitivity
- Sensory modulation with taste/smell sensitivity

Lane, A. E., Young, R. L., Baker, A. E., & Angley, M. T. (2010). Sensory processing subtypes in autism: Association with adaptive behavior. *Journal of autism and developmental disorders*, *40*(1), 112-122.

> *“A 2012 fMRI study found that when autistics were listening to sound cues, their visual cortices remained more active than neurotypicals’.*

Grandin, T., & Panek, R. (2014). *The autistic brain: Helping different kinds of minds succeed*.

IDEA

- Individuals with Disabilities Education Act (IDEA).
- Provides for “free and appropriate education” in the “least restrictive environment.”
- Determined by an Individualized Education Program (IEP).
- Provisions for infants and toddlers

> “ 20 U.S.C §1412 (a)(5)(A) **LEAST RESTRICTIVE ENVIRONMENT**
> To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled, and special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily.

ACCOMMODATION

Alliesthesia

Humans are very sensitive to changes in the environment – much more so than absolute states.

The pleasure associated with alliesthesia may be related to the voluntary behavior of an individual seeking homeostasis, as opposed to involuntary responses such as sweating and pupil dilation.

Executive Functions

Humans like to interact with their surroundings – both to remove uncomfortable stimuli and to create sensory pleasure.

Emotional regulation and cognitive control are two foundational capacities of executive functions*.

*Mischel, W., & Ayduk, O. (2002). Self-Regulation in a Cognitive -Affective Personality System: Attentional Control in the Service of the Self. *Self and Identity*, *1*(2), 113-120.

RESOURCES

- Mostafa, M. (2014). Architecture for autism: autism ASPECTSS™ in school design. *International Journal of Architectural Research, 8*(1), 143-158.

- Sánchez, P. A., Vázquez, F. S., & Serrano, L. A. (2011). Autism and the built environment. *INTECH Open Access Publisher*.

			SENSORY ISSUE														
			Auditory			Visual			Tactile			Olfactory			Proprioceptive		
			Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference	Hyper	Hypo	Interference
ARCHITECTURAL ATTRIBUTE	Structure	Closure	1	2		1	2	1	2	1		1	2		2	1	1
		Proportion	3	4	3	3	4								4	3	
		Scale	5	6	5	5	6	5	6	5					6	5	5
		Orientation					7									7	7
		Focus	8			8										8	8
	Balance	Symmetry	9	10		9	10	9							9	10	9
		Rhythm					11									11	11
		Harmony				12	13	13	12							13	13
		Balance				14	15	14							14		14
	Quality	Colour				17	16			18							
		Lighting	19			19	20										
		Acoustics	21	21	21												
		Texture		22					22	23							
		Ventilation										24	25	24			
	Dynamic	Sequence				26	26	26		26						26	26
		Proximity				27		27								27	27
		Routine	28			28		28								28	28

Figure 1: Sensory Design Matrix (Source: Author).

4. Synopsis of design criteria

In this section we will outline several responses that architectural design may –by means of project and design mechanisms– give to the needs of people with autism. Whilst it may not be an exhaustive compilation, we will group these strategies according to different impairments that may be aided by them, for the purpose of systematising our discourse.

4.1 Imagination

Resistance to changes and a limited ability to imagine are, as has been stated above, two of the most common symptoms present on individuals with ASD. These characteristics lead to difficulties or extreme nervousness when switching tasks or even when walking from a given space to another. The main issue is that they may be unable to imagine, i.e., to elaborate a mental image, what lays behind a door or a wall, even if they know the room they are entering. In their school or home environments this issue is usually faced up to through *anticipation* of activities that are to be held soon, and avoiding or mitigating, as much as possible, unexpected changes in scheduled tasks and routines.

From the architectural design point of view, the inability to construct a mental image of the environment, as well as to integrate parts in a whole, can be addressed by providing the building with a clear structure, along with elements[14] that endow it with certain order and unity, in such a way that it becomes easily readable, predictable, *imaginable*.

SPATIAL CONFIGURATION

- Attention to human-habitat relationship can inspire greater affordance in spaces[1].
- One-way circulation patterns are more navigable[2].
- Furniture organization can improve focus through intentional interactions[3].
- Clutter is a problem[4].

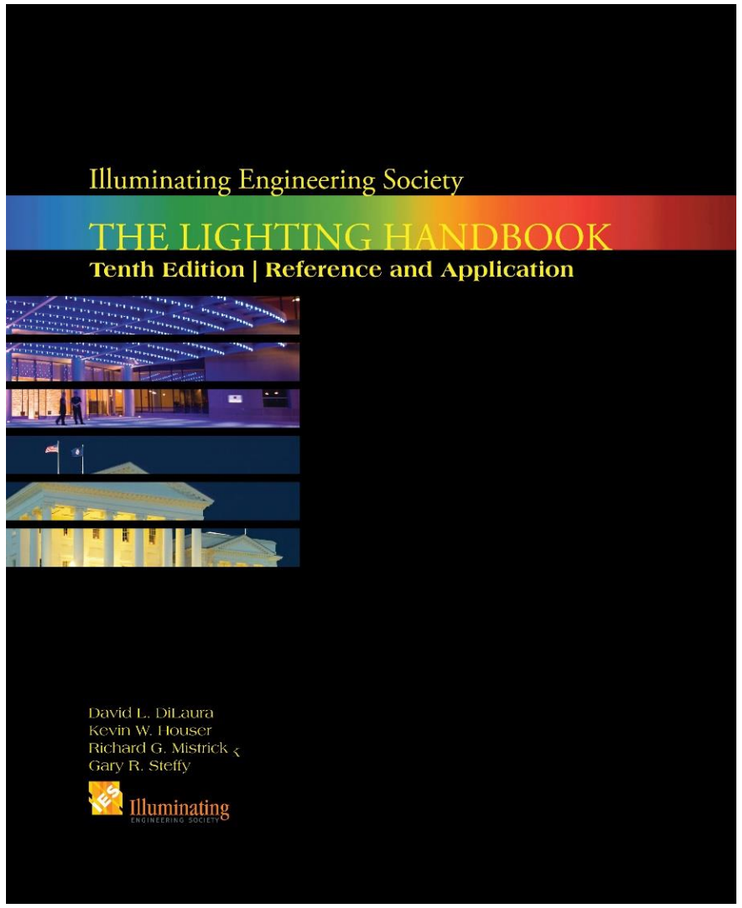
1. Kellert, S. R., Heerwagen, J., & Mador, M. (2011). *Biophilic design: the theory, science and practice of bringing buildings to li* John Wiley & Sons.

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

3. Hirasawa, N., Fujiwara, Y., & Yamane, M. (2009). Physical arrangements and staff implementation of function-based interventions in school and community settings. *Japanese Journa of Special Education, 46*(6), 435-446.

4. Kinnaer, M., Baumers, S., & Heylighen, A. (2016). Autism-friend architecture from the outside in and the inside out: An explorative study based on autobiographies of autistic people. *Journal of Housing and the Built Environment*, *31*(2), 179-195.

LIGHTING



Parents who are Vitamin-D deficient experience greater likelihood of having children with ASD (Kinney et al., 2010).

Dynamic lighting is important for circadian patterns, especially blue light in melatonin suppression (Reinhart, 2013).

Occupants show improved mood when provided control of lighting conditions (Newsham et al., 2003)

Daylight reduces the incidence of depression and views from windows increase occupant comfort (Aries et al., 2015)

Use the Daylighting Pattern Guide

Specify addressable, dimmable LED systems

Consider color tunable luminaires

ACOUSTICS

Sensory rooms are popular in autism-friendly spaces because they provide a controllable environment as a retreat from overwhelming stimuli.

Background noise and positive soundscapes increased relaxation in 24 patients (Mackrill et al., 2014).

Tonal prominence of background noise impacts level of annoyance in adults (Ryherd & Wang, 2008).

Occupied BNL predicted pre-reading skills for 90 children ages 3-5 (Maxwell & Evans, 2000).

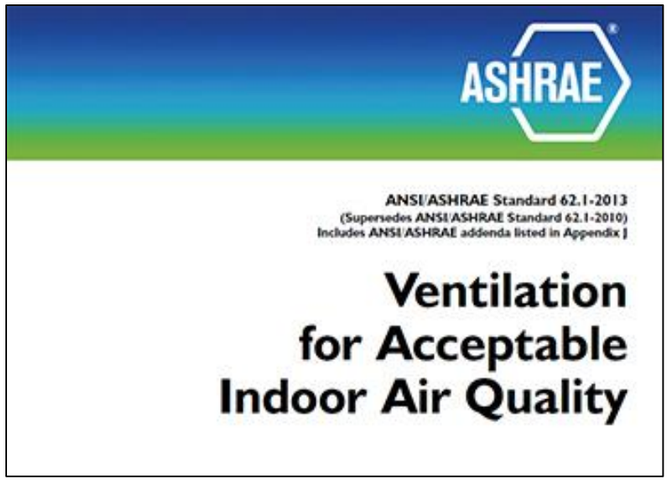
Outdoor noise levels over 60 dBA predict student reading achievement (Shield & Dockerell, 2008).

Consider background noise, distracting conversation, privacy, and speech intelligibility as separate parameters.

ASA S12.60 (free guide for classrooms)

Specify RT60, STC, BNL. Limit occupants in one room.

AIR QUALITY



A study of children diagnosed with ASD in Los Angeles between 1998 and 2009 showed that their mothers experienced elevated levels of ozone, respirable particulate matter, and nitric oxide (Becerra et al., 2013).

Test scores across 87 school were higher when ventilation rates were higher (Haverinen-Shaughnessy et al., 2011).

Subjects in a controlled experiment drank more water and had elevated skin temperature when not allowed to open windows (Schweiker et al., 2013).

Students ages 10 to 12 were less hungry and performed better with higher ventilation rates (Wargocki & Wyon, 2007).

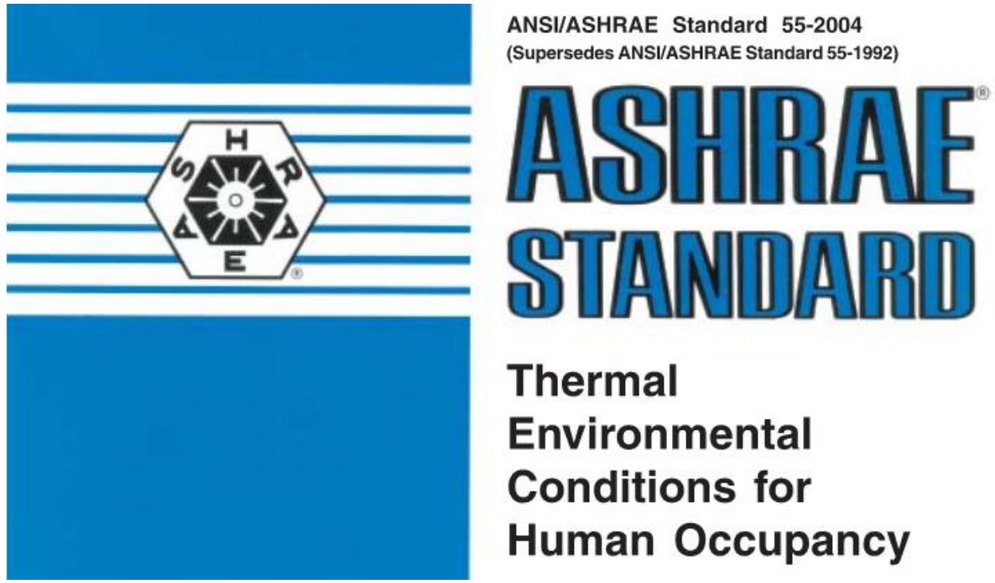
Evaluate environmental air quality. Provide operable windows.

Provide UV air cleaners.

Consult international ventilation standards (CR 1752). Design the breathing zone.

Evaluate dedicated ventilation (DOAS w/ DCV)

THERMAL COMFORT



Increased control of thermal variables improves occupant satisfaction.

Provide ceiling fans.

Use adaptive model of comfort for design.

Experience of physical warmth is related to experience of social warmth, based on mixed-methods study including bathing habits of college students (Bargh & Shalev, 2012).

Adaptive model may approximate comfort better than the heat balance model in uneven conditions (Schellen et al., 2012).

SBS symptoms increase by 12% for every 1 degrees C increase. Temperatures outside a range of 68-73.5 F correspond to reduced outcomes of approximately 10% (Seppanen & Fisk, 2006).

ERGONOMICS

182 receptionists at medical clinics arrived to work on time more often when provided more space (May et al., 2005)

215 workers from five companies reported higher job satisfaction when they had convenient access to meeting spaces (Lee & Brand, 2005)

Research supports the role of spatial layout, density, furniture, and technology on behavior.

Seek out design guides based on academic research. Perform an occupant survey. Consider an ergonomist consultant.

IEQ MODELS

Children diagnosed with ASD experienced greater sensitivity to touch when in classroom environments than when at home.

Fernández-Andrés, M. I., Pastor-Cerezuela, G., Sanz-Cervera, P., & Tárraga-Mínguez, R. (2015). A comparative study of sensory processing in children with and without autism spectrum disorder in the home and classroom environments. *Research in developmental disabilities, 38*, 202-212.

Effect size of IEQ is an order of magnitude smaller than demographics characteristics

(Shendell et al, 2004).

Even when automated controls optimize IEQ, occupants are more satisfied when they have the perception of control (Toftum, 2010).

Comfort is a process, not product (Nicol & Roaf, 2005). There's no ToE

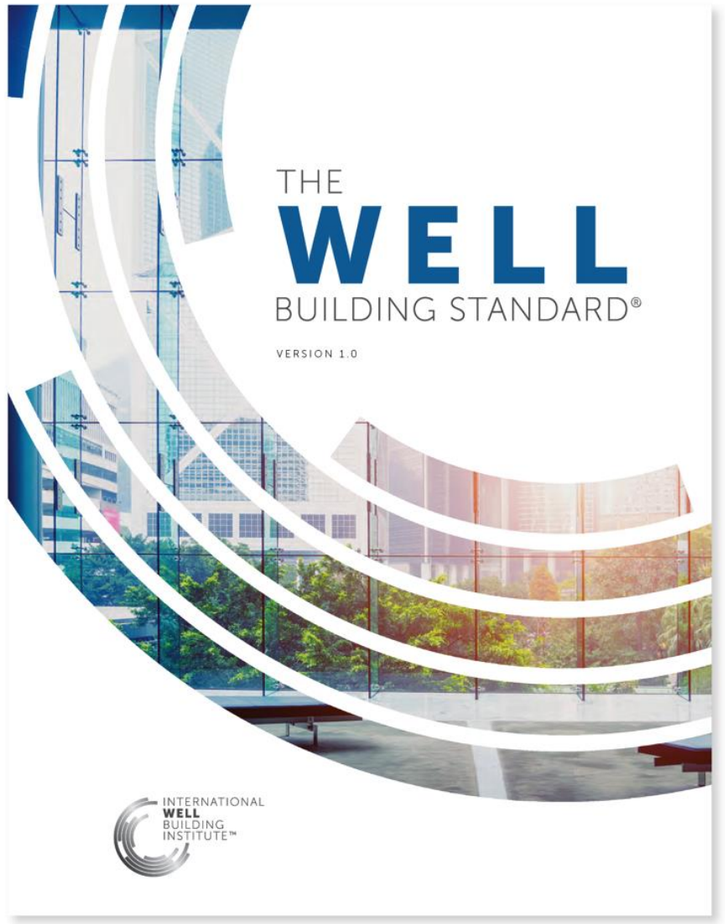
Sensory domains are interconnected (Hedge & Gaygen, 2010)

Try narrative approach to occupant experience (Lehman, 2013)

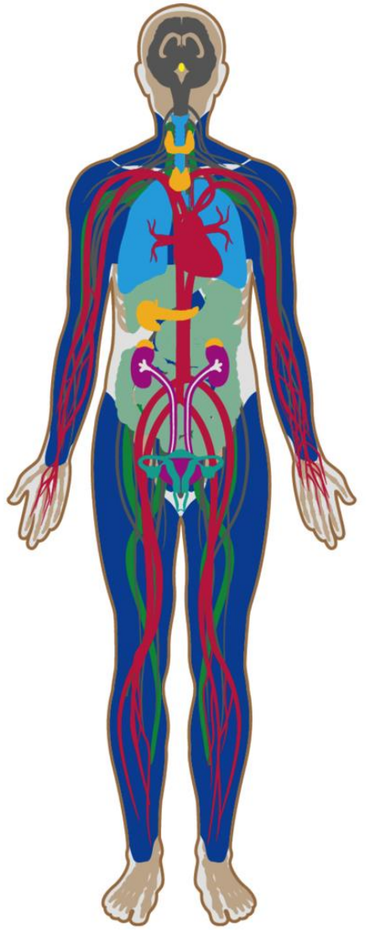
WELL BUILDING STANDARD

- Provides a model for design and construction to integrate human health features in the built environment

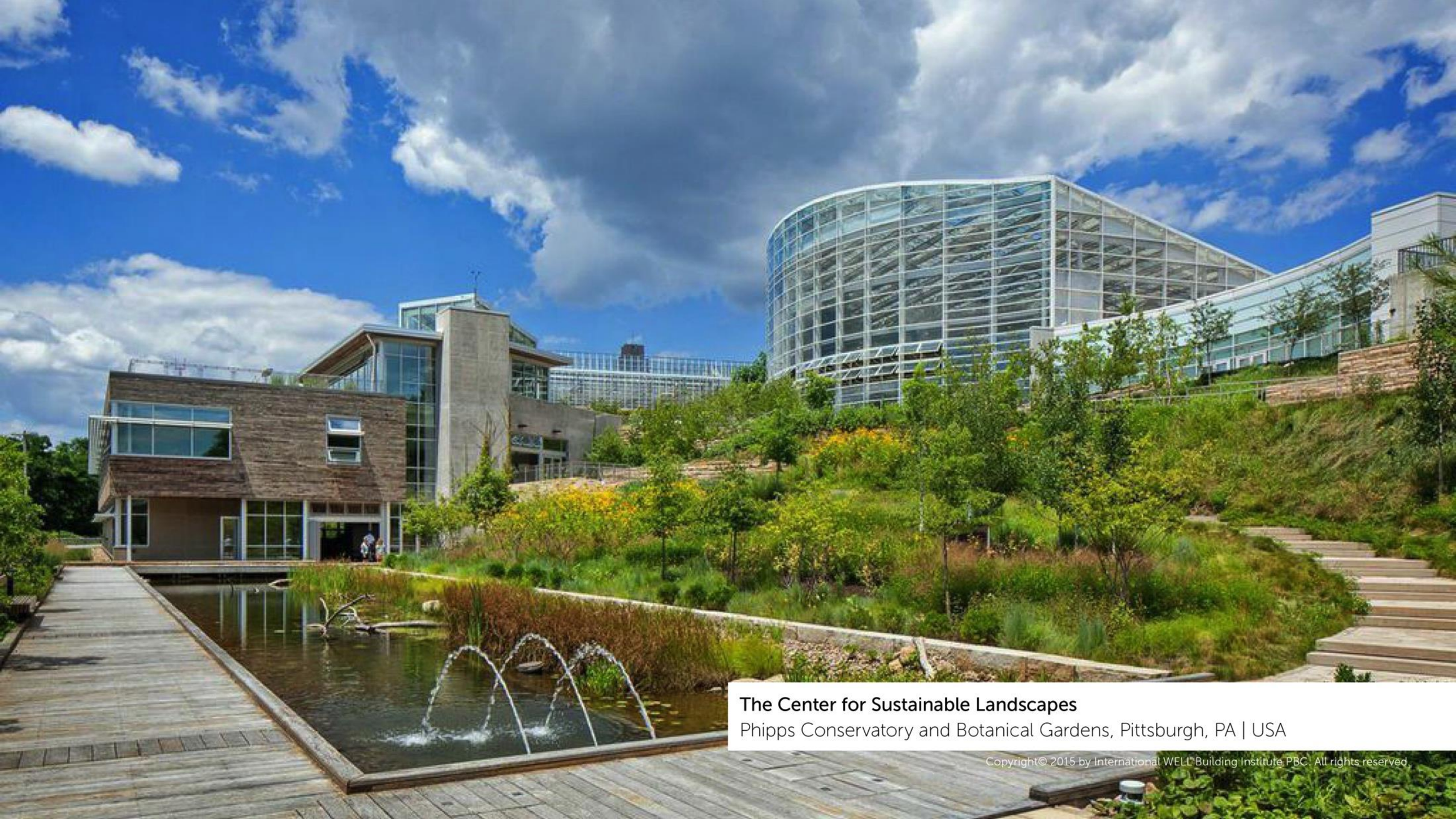
- Is a performance-based system to measure impact of built environment on human health



SEVEN CONCEPTS



Cardiovascular
Digestive
Endocrine
Immune
Integumentary
Muscular
Nervous
Reproductive
Respiratory
Skeletal
Urinary



The Center for Sustainable Landscapes
Phipps Conservatory and Botanical Gardens, Pittsburgh, PA | USA

FEATURE 89: ADAPTABLE SPACES

PART 1: STIMULI MANAGEMENT

- | ○ | ○

Seating and spatial layouts are organized into separate workplace zones and provide differing degrees of sensory engagement. Regularly occupied spaces that are 372 m² [4000 ft²] or larger provide separate zones for the following (the remaining 50% is attributed as desired):

a. Collaboration zones taking up at least 25% of the space, no more than 4 seats per 19 m² [200 ft²] and at minimum, one visual vertical surface area for sharing ideas or work.

b. Focus zones taking up at least 25% of the space, enclosable or semi-enclosable rooms with no more than 2 seats per 19 m² [200 ft²].

PART 2: PRIVACY

- | ○ | ○

Areas greater than 1860 m² [20,000 ft²] provide at least one privacy room to unwind, focus and meditate. Space(s) meet three of the following requirements:

a. Are at least 7 m² [75 ft²] for every 372 m² [4000 ft²].

b. Provide ambient lights at 200 lux [19 fc] or less and 2700 K or less.

c. Include a plant wall covering at minimum 50% of a wall or potted plants covering at minimum 15% of the floor area.

d. Include a water feature at least 60 cm [2 ft] in height.

e. Have Noise Criteria (NC) at 30 or better as measured from within the space.

f. Provide an audio device with a selection of nature sounds and volume control.

g. Provide at least 3 different types of seats; cushioned reclining chair, floor chair with back support and at least 3 meditation cushions of varying sizes.

h. Provide storage cabinets with closeable doors for shoes, mats, blankets and cushions.

PART 3: SPACE MANAGEMENT

- | ○ | ○

To minimize clutter and maintain a comfortable, well-organized environment, minimal storage requirements are addressed through the provision of:

a. Allow at minimum 1.5 m² [15 ft²] built in, overhead storage cabinet spaces per 20 m² [215 ft²].

b. A locker for each regular occupant with 1 or more shelves, at least 0.25 m³ [9 ft³] in volume.

PART 4: WORKPLACE SLEEP SUPPORT

- | ○ | ○

Short naps are an effective and healthy means for improving mental and physical acuity, even more so than caffeine, which can disrupt sleep. To facilitate occupant alertness, provide adequate space to accommodate one or more of the following furniture options; at least one of which must be provided for the first 30 regular building occupants and an additional one for every 100 regular building occupants thereafter:

a.[52] Couch.

b.[52] Cushioned roll-out mat.

c.[52] Sleep pod.

d.[52] Fully reclining chair.

e.[52] Hammock.

GUIDELINES

General	Use multiple methods to understand group needs (ethnography). Involve occupants in initial design discussions. Focus on flexibility over 'getting it right.' Provide ornamentation in select locations.
Spatial Configuration	Provide more floor area than typical. Do not create large spaces for small group or individual work. Anticipate layout of furnishings to reinforce the intended occupation. Create a strategy for wayfinding that uses landmarks.
Acoustics	Identify and validate best practices for background noise level and reverberation time. Limit sound transmission from outdoors and adjacent spaces. Provide biophilic soundscapes in selected spaces. Identify and remove noise sources, especially those with tonal dominance or intermittent occurrence.
Lighting	Provide sufficient daylight and artificial light for health benefits. Provide lighting controls. Use natural, low-saturation colors and avoid large areas of intense color. Green and blue and good choices. Adjust lighting at night to minimize interference with circadian rhythm. Provide dimmers for each lighting area, based on task. Conceal lamps from direct view and set limits for luminance contrast.

GUIDELINES

Thermal Comfort	Provide ceiling fans and operable windows. Vary temperature set points for transient and collaborative spaces. Limit expansive areas of glass. Provide thermostats for occupant control.
Materials	Identify materials to be avoided in the space, such as heavy metals and halogenated flame retardants. Avoid PVC, especially in flooring materials.
Air Quality	Provide 40 cubic feet per minute of ventilation air to each occupant. Monitor outdoor ozone and PM2.5, especially in urban settings. Provide UVGI and activated carbon filters. Use MERV-13 filters. Isolate contaminant sources, such as copy machines. Avoid air fresheners, toxic cleaners, and fragrant hygiene products. Provide separated spaces for food preparation and consumption.
Safety	Design appropriate risk and eliminate hazards. Anchor large, unstable items and avoid sharp corners. Limit hot water temperatures.

Sensitive people need help

We are sensitive

QUESTIONS

www.forte.megroup.com

WHY BUILDINGS FOR AUTISTIC PEOPLE ARE BETTER FOR EVERYONE

By Stuart Shell, AIA, WELL AP, LEED AP BD+C
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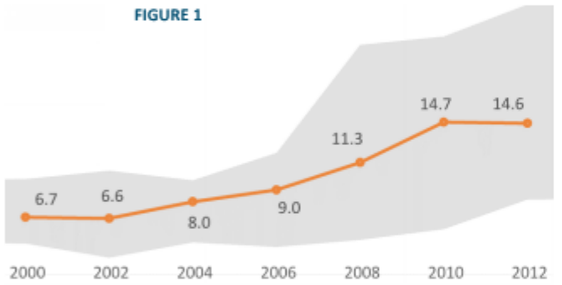
402 403 5791

If people who own, operate and design buildings are not thinking about people with autism, they will be soon. Individual diagnosed with autism spectrum disorder, or ASD have the same rights to functional, accessible spaces that the non-ASD world enjoys. Also, with 1 in 68 children diagnosed with autism in 2012 – up from 1 in 150 in 2000 (Christensen et al., 2016; See Figure 1) – it is time for the United States to expand its idea of accessibility.

FIGURE 1



***Data depicts 8-year-olds at 11 ADDM sites in the United States (Christensen et al., 2016). The range in prevalence rates between the sites is shaded**

Unfortunately, creating responsive buildings for people with ASD is difficult. Most architects, engineers, and building owners have limited knowledge of ASD. Its broad range in sensitivity also means that each individual needs different qualities in their surroundings. Even with the "perfect" building design, inhabitants must be empowered to interact with and modify spaces to meet their immediate needs.

Creating responsive buildings for people with ASD is difficult. Most architects, engineers, and building owners have little exposure and/or understanding of ASD. Its broad range in sensitivity means that each individual needs different qualities in the surrounding environment. Even with the "perfect" building design, inhabitants must be empowered to interact with and modify spaces to meet

> *"Occupants not only sense the quality of their surroundings – they take part in it.*

caused by complicated genetic and environmental interactions, and there is no cure. The evidence of effective interventions is limited (Rodger et al, 2010). In fact, many view ASD as a part of natural variation in human biology, not requiring a 'cure' (Kapp et al., 2013). The DSM-5 lists the primary criteria as deficits in social interactions and restricted, repetitive behaviors and interests. Sensory integration deficits are a second-tier criterion. Nonetheless, most individuals with ASD do experience sensory hypersensitivity or hyposensitivity, especially in hearing and touch (Fernández-Andrés et al, 2015). Alarmingly, the of ASD is around 1 percent of the population, with more males affected than females. (Mostafa, 2008; Sanchez et al, 2011).

Architecture can address the needs of occupants with ASD. That is because buildings accommodate the needs of their occupants through spatial configuration, acoustics, lighting, temperature, air quality, furnishings and finishes. A common hypothesis in the literature is that modulating these features of the physical environment can help all occupants relax and focus.

However, interventions that only address design will be of limited value because the physical environment is intertwined with the social environment (Sanchez et al, 2011). For example, a study by Fernández-Andrés et al. (2015) found that children diagnosed with ASD experienced greater sensitivity to touch when in classroom environments than when at home. The authors proposed that the combination of social and environmental context of classrooms make physical contact more intrusive.

Occupants not only sense the quality of their surroundings