EXPANDING INCLUSIVENESS- INTEGRATING STUDENTS WITH ASD

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ABSTRACT: A significant increase of children diagnosed with autism means that as a society we must better understand and appropriately consider the needs of people with ASD. Autism spectrum disorder (ASD) is characterized by a range of disorders and a group of multifaceted developmental disabilities. As a result, the needs of affected people may vary widely. A broadening of the requirements and attributes of inclusive design is necessary. This paper is an introduction to the problematic of designing learning environments for school-aged children with ASD. While people at every age suffer from autism, supporting children on the spectrum and helping them to develop to their best potential should be of priority for our society. This paper outlines recommendations for educational environments that consider the needs of students with autism. It briefly explains some of the key markers and symptoms of the disorder and the perception or the experience of space by people on the autism spectrum as documented by various research studies. Lastly, a set of preliminary design criteria and recommendations will provide guidance for designers and educators to help them design and/or adjust educational environments for school and daycare spaces that help better integrate children on the spectrum into the learning environment.

KEYWORDS: Architectural design, autism spectrum disorder (ASD), built environment, learning environments, spatial awareness, spatial interaction

INTRODUCTION

Autism spectrum disorder (ASD) and autism are broad terms for a group of multifaceted and complex neuro-developmental disabilities, often characterized by a range of autism-related conditions that occur in a continuum of different forms and gradations. According to estimates from the U.S. Centers for Disease Control and Prevention's *Autism and Developmental Disabilities Monitoring* (ADDM) Network, in 2012 about 1 in 68 children had been identified with autism spectrum disorder (ASD), an increase from 1 in 150 a decade earlier (Christensen, 2012). The disorder occurs in every racial and ethnic group and across all social and economic levels, but boys are 4.5 times more likely to develop ASD than girls. While some children and adults with ASD are able to participate in all or most every-day activities, others require substantial support to perform essential activities. Scientists believe that both genetics and environmental influences likely play a role in ASD, however to date no specific environmental causes or triggers have been identified with certainty. ASD is today often diagnosed in children between the ages of 1 and 4. Thorough neurological assessment and in-depth cognitive, behavioral and language testing is available and comprehensive evaluations with multidisciplinary clinical teams including psychologists, neurologists, psychiatrists, speech therapists and other professionals can provide guidance and help (NIH, 2016). The rapid rise in diagnosed children can be attributed to a better awareness and thus more frequent diagnosis of ASD. However, it also means that as a society we must better understand and appropriately consider the needs of people with ASD, needs that may vary widely. A broadening of the requirements and attributes of inclusive design is necessary. A new understanding of diversity is a key principle in the development of theories, tools and techniques of design for inclusion (Baumers, 2010).

While people at every age suffer from autism, supporting children on the spectrum and helping them to develop to their best potential should be of priority for our society. There is no cure for ASD, but behavioral interventions and coordinated therapy can remedy and significantly improve specific symptoms. Early behavioral/educational interventions with the use of highly structured and intensive skill-oriented training sessions can help children to develop social and language skills. Applied behavioral analysis can encourage positive and discourage negative behaviors (NIH, 2016). Typically, early detection and intervention gives children the most positive prognosis to attend regular school and participate in a typical classroom with the goal to eventually—while usually still faced with certain impairments—live independently or semi-independently in community settings. Engaged caretakers and health professional can provide helpful environments, but regular educational setting too often still fall short of providing autism-friendly spaces that address the distinct needs of this specific user group. On the contrary, many well-intended "child-friendly" designs actually have unsettling or irritating effects on autistic people.

1.0 THE AUTISTIC USER AND THE BUILT ENVIRONMENT

While embarking on this research, we found contradicting studies and publications that lead to inconclusive results

and not always empirically support design recommendations. While an increasing number of researchers work toward producing better and more rigorous autism design studies, at this point data often is based on anecdotal evidence that is easily influenced by cognitive biases and usually lacks necessary controls (Henry, 2011). This paper gives a general perspective on the perception by people on the autism spectrum of the built environment. It outlines initial recommendations for environments that consider the needs of children with autism, with the hope of raising awareness to the cognitive styles and challenges of people and especially children with autism. While more rigorous studies have to be designed to obtain more objective data to fully underpin any design recommendations, we hope to raise an awareness that designing autism-friendly spaces can play an important role in providing environments that have the potential to improve the life of children and adults with autism; and as a result of anyone around them.

1.1 Sensory sensitive approach or neuro-typical approach

An examination of recent publications on autism-friendly design reveals two widely and competing disparate attitudes to designing for autism. We are presented with plausible arguments for a sensory sensitive approach and a competing neuro-typical approach.

Leo Kanner, who first described the disorder, implied in his earliest reports that autistic people process sensory information in a special way. At times this leads to unusual reactions to stimuli including hypersensitivity, hyposensitivity or inability to distinguish certain stimuli (Kanner, 1968). *The sensory sensitive approach* maintains that adjustments to the multi-sensory environment can be beneficial for individuals with autism and lead to positive and constructive behavior. 'Sensory Design Theory' presents a flexible and adjustable tool that can help generate architectural design criteria for environments based on their sensory qualities, while considering the needs of autistic users (Mostafa, 2003, 2008 & 2014; Henry, 2011 & 2012). While more prescriptive than descriptive, it can be applied in different ways and adjusted to the skill levels of the autistic user, which is especially important in learning environments that must be zoned for various activities (Mostafa, 2014). Similar to the neuro-typical approach, the sensory sensitive approach addresses the concern of generalization of skill by "using graduated sensory spaces, from the highly adapted to the typical, to allow for gradual skill development (Mostafa, 2008, p. 204)" (Mostafa, 2014). According to sensory sensitive theory, difficulties in processing and integrating stimuli from the surrounding physical environment, especially when faced with multi-sensory experiences, disturbs the ability to make sense of the environment and underlie the atypical behavior in autism (Iarocci, 2006).

The *neuro-typical approach* "proposes the immersion of the autistic user in as typical and stimulating an environment as possible, in order to encourage adaptation to the overstimulation so typical of the disorder and to replicate the level of stimulation found in the real world. The conceptual basis behind this design approach is that it would best prepare the autistic user for the generalization of his or her skills, particularly those acquired in a learning environment, to the outside world" (Mostafa, 2014). Supporters of this theory suggest that best help can be given if generalization rather than sensory sensitivities are addressed first. However, Mostafa warns that "it assumes that the user has received a certain quality of care and a consequent minimum level of baseline skill, whereby the autistic user is able to adapt to a degree that allows them to even use such environments. This, however is not always the case, particularly in the more severe instances of the disorder, in the early stages of intervention and in cases where intervention has been delayed or not been made available to the autistic individual, as is the case in most of the developing world. A further limitation of this approach is that it has not been empirically investigated and is based on a hypothesis rather than evidence based research (Marion, 2006)" (Mostafa, 2014).

1.2 Key markers and symptoms of the disorder

Autism, as a group of pervasive, multifaceted developmental disabilities, shapes every part of life for the people affected. One of the key characteristics of autism spectrum disorder and autism is that no two (or ten or twenty) people with autism will be completely alike and that autism-related conditions in different combinations occur in a continuum of different forms and gradations. Thus, every autistic person has a distinctive set of abilities and disabilities and as such, "every [autistic] child will be at a different point on the spectrum. And, just as importantly, every parent, teacher and caregiver will be at a different point on the spectrum. Child or adult, each will have a unique set of needs" (Notbohm, 2002). Known as a 'spectrum disorder', autism can become noticeable through a variety of symptoms that may range from a mild form of learning disorder or a barely noticeable social disability to a gamut of severe impairments and highly unusual behaviors. These conditions include, for example, intellectual disability, difficulties in motor coordination, attention and physical health issues that can lead to significant communication and behavioral challenges, and great difficulties in social interaction or isolated interests (US Centers for Disease Control Prevention, 2016). Often autism manifests itself with difficulties to interact or communicate verbally as well as non-verbally with others. Many people with autism exhibit restricted mental flexibility that reveals itself in overly rigid adherence to daily activities or routines.

1.3 The effect of ASD on perception and experience of space

Autistic people are often either highly sensitive or under-responsive to sensory experiences like sound, light or touch. Mostafa notes that

> The key to designing for autism seems to revolve around the issue of the sensory environment and its relationship to autistic behavior. [...] Simply stated this dialogue hypothesizes that autistic behavior [...] may be a result of a malfunction in sensory perception. This malfunction may take the form of hyper-sensitivity or hypo-sensitivity, in its various degrees and across the scope of all the senses, leaving individuals with autism with an altered sensitivity to touch, sound, smell, light, color, texture etc. In other words, this leaves them with an altered sense of the world around them (Mostafa, 2014).

Mostafa, who also developed a sensory design matrix in an attempt to track sensory impulses within the built environment, further notes that "autism is a spectrum with each individual exhibiting a different sensory profile with variant response to stimuli (Anderson, 1998) (her) matrix generating different, and sometimes conflicting, design guidelines for each sensory profile examined" (Mostafa, 2014). Mostafa then warns that, while a customized design may work exceedingly well in environments that only cater to the needs of one autistic user, would be much more difficult to transfer to group settings where users may have greatly varying needs (Mostafa, 2014).

Besides the many deficits there are also significant differences in perception of senses associated with autism that impairs the way of thinking and perceiving the world. Stijn Baumers and Ann Heylighen (2010), who analyzed written reflections of spatial experiences and challenges of people with autism, maintain that characteristic behavior is tied to these different spatial experience, which is based on a special way of sense-making or organizing spaces or spatial environments in the autistic mind. This in return also influences the way the autistic adult or child interacts with or is able to de-code their environment. They note:

> Different theories confirm that people with autism are characterized by a particular view on the environment, be it restricted to what is directly perceptible (Lawson, 2003) or just fragmentary (Happé, 1999). Due to a fundamentally different way of information processing, adequate sense-making needs to be consciously constructed step by step (Noens & van Berckelaer-Onnes, 2004). The conscious experiences of people with autism show that bringing a space into use can signify much more than only performing a certain action on a given place. Even the smallest details of the built environment can attract the attention, and in this way, using space includes seeing, hearing, feeling, smelling, ... and thoroughly experiencing different dimensions of that space (Baumers, 2010).

Further the authors report that an acute awareness of detail and heightened sensory awareness that exceeded the perception of the average person must be considered when designing spaces.

> A term used to characterize the appropriateness of a particular person-behavior-environment transaction is "congruence" or "fit". Fit is a state of equilibrium where an individual's capabilities are in balance with the demands of the environment. Equilibrium may not be a specific pivot point but rather "zones of adaptation" within which individuals are sufficiently challenged yet not so challenged or deprived that they are under pathological stress. Perception of users plays a role in "fit." Enabling environments, designed to achieve the best fit, should be congruent with the functional requirements of users (Baumers, 2010).

Through their analysis of written '*auti*-biographies,' Baumers and Heylighen (2010) also uncover ways autistic people have found for dealing with the built environment and better understanding the importance of the physical surroundings to their user. They state:

> In the study of the world of experience of people with autism, the attention was attracted by the grip offered by physical space and the sense of certainty and confidence this can bring about. The predictability and regularity of the physical space even turn out to cause objects, as immovable entities, to qualify the spatial behavior of people with autism. This notion of grip, offered by physical space in an autistic perspective on the world, can value the physical entity of objects. Even banal objects are essentially physical anchor points of the built environment, which can draw attention to what is undeniably here (Baumers, 2010).

2.0 DESIGN CRITERIA AND RECOMMENDATIONS

Despite the obvious opportunities, the consideration of specific design features may bring, autism and other cognitive disabilities have generally been excluded from architectural design codes and universal design guidelines (Mostafa, 2014). After considering perception with its various sensory triggers as exercised by the built environment, and equipped with the knowledge about two competing approaches to autism-friendly design and an awareness of the imperfect nature of any recommendations that have not yet been able to be studied in an empirical setting, we can now better gauge how responses to this input from the environment and architectural design are linked to autistic behavior. Many considerations need to be made when designing environments for people with ASD. The recommendations listed below lean on but expand those suggested by Magda Mostafa with her Autism ASPECTSSTM. They should, however, not be considered an exhaustive list but rather provide initial guidance for designers and educators to help them design and/

or adjust educational environments for school and day-care spaces. They are meant to help better integrate children on the spectrum into the learning environment so that they may reach maximal independence, a sense of security, and their fullest integration into society. The following parameters are particularly relevant when designing or adapting spaces for autistic users (National Autistic Society: Environments & Surroundings, 2016). They are listed briefly and shall contribute to enhancing well-being and ensuring the safety of residents and staff (National Autistic Society: Building Design Factors, 2016).

2.1 Safety
Safety may be the biggest concern for children with autism who may have an altered sense of their environment and little or no awareness of danger. So, the key focus is to provide a low-risk and safe environment that is also proofed against escapes. In general, the layout and organization of the facilities and the intent of the design should be to allow the greatest possible freedom and independence for all users while minimizing hazards, security risks or behavioral triggers for those with ASD.

2.2 Context and Community
Inclusion and respect in society gains importance with rising numbers of diagnosis of children with ASD. The necessity to provide community-linked services to support families and individuals but also to afford the opportunity for student interaction with society should be considered. Including services for people on the autism spectrum within neighborhoods helps develop social and vocational skills in the students as well as promote a positive productive image of autism to the community at large (Mostafa, 2014).

2.3 Zoning and Compartmentalization
The clear organization of functions with respect to one another is of surpassing importance as it has great impact on the comfort of the user, the conducive quality of the learning environment and the possible independence enjoyed by students within a building (Beaver, 2003, Whitehurst, 2012; Mostafa, 2008, 2014; et al.). The sensory environment should be clearly defined and limited so that each activity, within shared spaces, a classroom or even an entire building, is organized into discrete compartments, each housing a single and clearly defined function and consequent sensory quality. It is vitally important that functions are visually and spatially separate and organized.

2.4 Spatial Sequencing
Considering the affinity of individuals with ASD to routine and predictability it is sensible to organize spaces in a logical order and involve sensorial compatible function. Ideally the spatial sequence is based on the typical scheduled use of spaces and allow a seamless transition from one activity to the next through one-way circulation. This can alleviate disruption and distraction throughout the day. Areas that require a high level of alertness but provide low stimulus, can be grouped together. Services, which are usually high-stimulus, including bathrooms, kitchens, staff-rooms and administration, should be separated from the student areas. Buffer areas such as gardens, free-play, sensory curriculum rooms and some other open spaces may act as transitional areas between the low-stimulus "focus" zones and the high-stimulus "alertness" zones" (Mostafa, 2014).

2.5 Thresholds
The separation between individual zones or compartments does not need to be abrupt but must still clear transitions are preferable. It has been found helpful to clearly distinguish the sensory qualities of each space. This will help provide sensory cues as to what is expected of the user in each space, with minimal ambiguity (Mostafa, 2014). These thresholds or transition zones help the user adjust their senses as they move from one level of stimulus to the next and are especially important as users transition from high-stimulus areas to those of low stimulus.

2.6 Way-finding, Navigation & Circulation
The lack of a comprehensive organization and anticipated logic behind the organization of space can easily cause confusion and distress when autistic users lose their spatial orientation, either within buildings or in the outside environment (Baumers, 2010). Mostafa and others stress the importance of conducive wayfinding and navigation that can assist the special needs user when coupled with sensory zoning in gaining various skills and independence while freeing staff and faculty. Some researchers have gained positive experiences with transition zones such as gardens and sensory curriculum rooms may assist when this one-way circulation is not possible. Others (Assirelli; Beaver (2003); Whitehurst (2006, 2012) further suggests to steer away of corridors but rather develop well designed circulation space that afford opportunities for socializing or being to themselves and a range of other activities such as various types of play or story-telling. These inviting but more open-ended spaces can foster a sense of independence (Assirelli, 2016).

2.7 Escape Spaces & Sensory Rooms
Secluded retreats are important features in educational facilities to provide relief for the autistic user in case of overstimulation through their environment. (Mostafa, 2008, 2014; Whitehurst, 2006, 2012). When no separate rooms are available, small partitioned areas and corners throughout the building can provide these quiet escape spaces.

Provisions of distraction-free, generally neutral sensory rooms as leisure facilities and possible retreat areas are further recommended. These rooms should per se provide only minimal stimulation to provide an important respite but can be equipped with adaptable and flexible equipment that can be changed to be either stimulating or calming to meet the needs of individual users.

2.8 Control of Sensory Stimuli

A tight control of all sensory stimuli is necessary throughout learning environments for children with ASD. These include aspects of acoustics (Mostafa, 2008, 2014; Beaver, 2006), lighting (Mostafa, 2008, 2014; Beaver, 2006) and also the use of color (Beaver, 2006, Whitehurst, 2006), heating, ventilation and the control of scents (Whitehurst, 2014, Clements and Zarkowska, 2000).

Acoustics

Among the sensory stimuli within the built environment, acoustics is the most influential factor on autistic behavior (Mostafa, 2014, Beaver, 2006). Mostafa reports on significant improvements to attention spans, response time, self-regulation and behavioral temperament, if children with autism learn in environments that strictly control noise levels, reverberation and echo (Mostafa, 2008). She recommends further adjusting acoustical control in response to the level of focus and activity in the respective zones and to consider "the skill level and consequently severity of the autism of its users. For example, activities of higher focus, or according to Sensory Design Theory, those taking place in "low stimulus zones", should be allowed a higher level of acoustical control to keep background noise, echo and reverberation to a minimum" (Mostafa, 2014).

Lighting

Similar to acoustic stimuli, visual stimuli and adjusted lighting levels can create active and calm zones throughout the schools and should be designed appropriately to their activities. Access to natural daylight for both people with ASD and their caretakers have proven beneficial. However, careful control of reflections, glare and shadow patterns is necessary. Artificial lighting should be equipped with dimming controls to allow for adjustments or designed as indirect light source to create a glowing interior (National Autistic Society: Building Design Factors, 2016). The use of harsh fluorescent fittings is strongly discouraged.

Color

Neutral and calming colors and the use of natural materials are best suited for autism-friendly learning environments. Disturbing and overly stimulating colors should be avoided. Beaver (2006) recommends careful choices to ensure a good balance between the shared and private spaces.

CONCLUSION

This paper summarizes first explorations of research in the field of autism-friendly environments and uncovers the need and the possibilities of further investigation that will be necessary to better understand the complexity of issues related to the perception of and interaction with the built environment by people on the autism spectrum in general and the implications for educational environments specifically. At this moment though we feel that we have raised more questions than we are able to answer. More rigorous studies have to be designed to obtain objective data to underpin possible design recommendations. As Henry (2011) states concerning any design parameters, "the effectiveness of any of the aforementioned measures remains unknown" (Henry, 2011). We also want to add that the success of architecture always requires us to look at the building as a whole and not only the sum of its parts. Especially, when tackling a complex and sensitive challenge as autism, one must look both at the individual elements and the building, its context and the pedagogy as a whole. While we are aware that our research is in its infancy, we believe that designing autism friendly spaces can play an important role in providing buildings, spaces, furnishings and technologies that have the potential to improve the life of children and adults with autism, and as a by-product anyone in their environment. Failing to consider the needs of this user group can easily result in more frequent episodes of behavioral incidents and social insulation (Henry, 2011). We do not claim to give a complete and empirically grounded assessment or all-inclusive design guidelines but want to inspire designers, to engage in the challenge of dealing with the profound complexity that the design process for autism-friendly spaces implies. We hope to create awareness that to design these environments and consider the needs of all users, architects and designers must surrender their own notions on the built environment and be open to other ways of perceiving and interacting with space.

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