
DESIGN METHODS AND SUGGESTIONS FOR AUTISTIC-FRIENDLY SPACES

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Abstract: In our revolutionary world, it is mandatory to design healthy, non-discriminatory and accessible environments for broadest range of human abilities. For decades, one of the main design considerations that architects and urban planners had the responsibility to address, is the need to remove the so-called ‘architectural barriers’ for people with physical disabilities. While this has been done with utmost attention and care, there has been little to no considerations for individuals with cognitive or mental disabilities.

Autism like other cognitive disabilities, has been excluded from accessibility design guidelines for many years, but as the number of students with autism grows rapidly, the concern for supportive learning environment for these children is starting to increase. Perceptions, experiences, and interactions of autistic individuals with their surroundings are different from their neurotypical peers. Considering that they may not be able to verbally communicate their experience, it often remains unexplored, not heard nor understood.

This study aims to explore how the built environment can act as a stimulant in the improvement of the lives of children with autism. To understand the needs of these children in the learning environment, it is necessary to know more about the symptoms and characteristics of their disablement. Designers need to create better understanding of what happiness, comfort, and satisfaction means for autistic people, so that they can translate it into design solutions. The research focuses on the sensory issue that has an effect on the way that autistic individuals are able to learn. By analyzing relations between their sensory perception, their learning difficulties, building codes and regulations in the field of design and different approaches for designing for autism, this thesis attempts to understand the specific design requirements for these individuals. The study considers many design aspects such as movement, space, color, light, shape, patterns, and wayfinding, in order to build up a design guidance for learning environments of children with autism.

Keywords: Autism, learning environments, neuro-typical, sensory sensitive design

1. INTRODUCTION

Children with autism in Macedonia for years missed regular treatment as a result of parental unconsciousness, lack of adequate institutions, lack of finances, and prejudices in the society. Macedonia has a history of reporting fewer cases of ASD than can reasonably be assumed to exist nationally, (Trajkovski, 2005) so, there are no reliable data about the statistics on how many children with ASD are diagnosed.

Autism Spectrum Disorder (ASD) is a developmental disability causing social, communication and behavioral challenges. (American Psychiatric Association, 2013). Autistic children need help to interact with others, they have difficulties understanding another person’s point of view, understanding other people’s actions or predicting what will happen when a familiar timetable or activity is changed.

The major symptoms of Autism are: *social communication difficulties* (inappropriate body language, gestures, and facial expressions, unlikely to approach others or to pursue social interaction, difficulty understanding other people’s feelings, reactions, and nonverbal cues, resistance to being touched, etc.), *language disabilities* (delay in learning how to speak or doesn’t talk at all, speaking in an abnormal tone of voice, repeating words or phrases over and over, difficulty communicating needs or desires, doesn’t understand simple statements or questions, missing humor, irony, and sarcasm) and *repetitive behaviors* (repetitive body movements, moving constantly, obsessive attachment to unusual objects, a strong need for sameness, order, and routines, fascinated by spinning objects, moving pieces), with many related signs and symptoms including sensory problems, emotional difficulties and uneven cognitive abilities. (Bogdashina, 2003)

Often individuals with ASD may be exposed to the same sensory information but interpret the material differently, they perceive space differently than individuals without autism who have a neuro-typical, or “normal”, perception of the world. (Daly J. , Daneski, Ellen, Sue, & Hawkins, 2007) Although the physical medium, such as the eyes or ears, is functioning properly, the process of perception is different. Some of the most common difference in sensory perception are intensity, sensory overload, gestalt perception, fragmented perception, delayed perception, distorted perception, sensory shutdowns, and compensation. (Leestma, 2015)

Senses enable us to experience and respond to our environment. To feel more comfortable or enhance our levels of wellbeing we continually control, modify, and adjust ourselves to the environment. We may turn the music up and dance to feel happy or sit in a quiet place to feel more comfortable. For many people with autism, whose experiences and perceptions of the physical environment are individual and unique, a sound can feel intolerably loud

but they are unable to turn it down, or the light can feel too bright but they are unable to switch it off. (Gaudion, Hall, Myerson, & Pellicano, 2014)

2. DESIGNING FOR AUTISM

Autism is currently one of the most prominent and widely discussed human conditions. Much discussion surrounds the conceptualization of autism as a disability or as a set of unique skills that can be seen as strengths (Urbanowicz et al., 2019). Although there is truth in both, there is also much verification that the life course for many individuals with autism, from infancy and into adulthood, is challenging for them and their families

Individuals with ASD, have trouble in understanding the environment around them. Due to their difference in sensory perception, they may demonstrate sensitivity to bright light, an adverse response to certain textures or sound, etc. Imbalance between the environment and an individual's ability to adapt to it can cause frustration and strange behavior. (Bogdashina, 2003)

The unique perceptual experiences of people with autism first was explored by (Frith, 1989), she describes how a person tends to focus on the small details of the environment rather than perceive it as a whole. Or the gestalt psychology, which describes how people first see an object as a whole before seeing it in parts. Frith's theory was followed by (Mottron & Burack, 2001), an autistic person may have not only excellent focus on details but also superior abilities in various aspects of perception – recognizing, remembering, and detecting objects and patterns. They have a heightened sense of details and aspects of the environment in comparison to a neurotypical person. Lastly, (Pellicano & Burr, 2012) describe how the perceptual experience of autistic people is one that is less influenced by prior knowledge about the sensory world. As a result, autistic people have a tendency to perceive the world more accurately rather than affected by prior experiences.

While all people have individual needs with regard to their environment, those with autism spectrum disorder have spatial and sensory needs that are often excluded from various building codes of practice. Research in the area of architectural design for autistic users, though limited, is available, usually, with generic reference to acoustics for special needs (Hawkings, et al., 2014). According to more recent literature, most researchers agree that the sensory environment, with its colors, textures, patterns, lights, shapes and spatial qualities, can affect positively or negatively the disorder (O'Neill & Jones, 1997), but this requires further investigation.

(Habib & Altamirano, 2019) in their paper present the development of an adaptability evaluation metric for classrooms that accommodate ASD students. Looking at the results of the weighting questionnaires it was evident that all classroom aspects need to be able to adapt and not just one since none dominate. Lights was the aspect with the highest weighting mainly due to the seriousness of its dysfunction on the students and teaching.

For the environment to respond to autistic sensory needs, the level of stimulation needs to be controlled, which differs extremely from the level of stimulation found in the real world. The question that arises among architects is: should we prepare the individual for the outside world or provide the ideal autism-friendly environment? Is there a way that we can do both? Providing the ideal autism-friendly building for children enhances their development and well-being, but then they go out into the world and have to face noise, confusion and many dangers for which they are not prepared. "Designers must be aware of this and try to find the right balance for the particular user group that will inhabit his/her building." (Beaver, 2010). As a result, two seemingly polar opposite positions are emerging among the approaches of designing for autism: Sensory-sensitive and "Neuro-Typical" approach.

3. THE SENSORY-SENSITIVE DESIGN THEORY

The Sensory Design Theory was developed by Magda Mostafa. Sensory Design Theory explores the manipulation of environment to the benefit of autistic people. The application of this theory has resulted in positive outcomes, evidence seems to indicate that autistic users, show increased attention span, faster response time and improved behavioral temperament (Leestma, 2015).

When designing the first education center for autism in Egypt, Magda Mostafa started to analyze common sensory environment problems and ended up Mostafa developing a set of design principles summarized by the acronym ASPECTSS: Acoustics, Spatial sequencing, Escape spaces, Compartmentalization, Transition Zones, Sensory Zoning, and Safety. (Mostafa, 2014)

3.1. Acoustics

By reducing noise levels, echo and reverberation in spaces for children with autism, their attention spans and response times and behavioral temperament are improved. The level of acoustical control should vary according to the level of focus required, for activities of higher focus, 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. On the other hand, for activities that require lower focus, the level of noise and echo does not have to be so strictly

minimized, they can handle a higher level of acoustics. Research proposes different levels of acoustical control in various rooms, so students can slowly progress from one level to another. (Mostafa, 2014)

3.2. Spatial sequencing

Spaces should flow as seamlessly as possible from one activity to the next, be organized in a logical order to reflect the schedule of the students and how they move throughout the day. This movement is advised to be accompanied with minimal disruption and distraction, in one-way circulation whenever possible. (Mostafa, 2014)

3.3. Escape Spaces

The purpose is to provide relief from the overstimulation of the environment. Learning environments need to include spaces with minimal stimulation, in the form of a small corner in a quiet section of a room, or a special room throughout a building. These spaces should provide the necessary sensory input. (Ghazali, Sakip, & Samsuddin, 2018)

3.4. Compartmentalization

Each space or environment should include a single and clearly defined function, sensory qualities that define its function should separate it from its neighboring compartment. (Leestma, 2015)

3.5. Transition zones

As students move from one level of stimulus to the next, the presence of transition zones helps them recalibrate their senses. These transition zones can take on a variety of forms from an open space to a full sensory room. (Mostafa, 2014)

3.6. Sensory Zoning

This criterion proposes that instead of organizing spaces in accordance with their programmatic function, as is typical in architectural design, spaces should be organized in accordance with their allowable stimulus level. Applying this theory to a treatment facility for people with autism means to rigorously separate the space into two distinct areas: high-stimulus (areas requiring high alertness and physical activity) and low stimulus zones (spaces for speech therapy, computer skills and libraries). (Mostafa, 2014)

3.7. Safety

Due to their impairments, children with autism, could easily injure themselves, so safety is important when designing for those with ASD. Soft materials are less likely to cause harm if the child falls, behaves violently, or has an accident, when designing showers and toilets, pipes must not remain exposed, and fittings must be firmly fixed – otherwise they could be pulled out of their place. (Mostafa, 2014)

By altering the space according to this approach, students feel secure and comfortable in their surroundings, the levels of focus and concentration rise, which makes learning process more efficient. Additionally, it helps individuals receive a certain quality of care and basic skills, whereby the autistic user is able to adapt to and use such environments. However, this approach is based on hypothesis rather than evidence-based research, and in cases where intervention has been delayed or not been made available to the autistic individual, this approach is not as successful as expected. (Leestma, 2015)

4. NEURO-TYPICAL THEORY

As a design philosophy, the Neuro-Typical Approach insists that individual needs to learn in ‘real’ world settings, the approach suggests creating a real-life environment, instead of controlling the stimulus in an area and designing not to overload the senses of the users.

According to the “neuro-typical” theory, sensory sensitive environments actually cause less, not more, universal access and integration into the larger population. Individuals with autism often struggle with applying previously learned behavior to new situations. If an individual learns a skill in one particular setting, they may not be able to generalize that skill and use it in another setting. In this case they become attached to the autism specific environments where they acquired the skills. (Henry, 2011)

Sensory perception distinguishes from child to child, so if the perception is not universal, how can one design sensory sensitive environments that meet the needs of all individuals on the autism spectrum. The Neuro-Typical Design Theory focuses on improving autistic people’s skills to generalize space and its function. By creating environments that are similar to usual urban and public places, that autistic individuals would come across in their everyday use of space, they are bound to adapt over time to variations of the same kind of space and highly stimulating context. (Henry, 2011)

Architects and designers who support this approach, design facilities in such a manner that they mimic usual outside spaces: corridors look like streets and alleys, therapy rooms look like classrooms or libraries, the cafeteria looks like a restaurant and so on.

Because it is not directly involved in the process of therapy sessions, this design method focuses on the overall development of skills. In contrast with the sensory design theory, the Neuro-Typical Approach doesn’t have any

empirical evidence of its effectiveness. A criticism for the Neuro-Typical method is its inability to accommodate people with severe autism or with very high sensory disabilities.

5. NEURO-TYPICAL VERSUS SENSORY-SENSITIVE APPROACH

The sensory sensitive and ‘neuro-typical’ approach have polar opposite aims and the results have different consequences. Currently researchers are mainly focused on the therapy process, so the sensory design theory is more accepted by the scientific community.

Proponents of ‘neuro-typical’ approach claim that by designing sensory sensitive environments instead of including these children in the real-world circumstances, we detach and isolate them. (Henry, 2011) As a response, proponents of the sensory sensitive approach argue that individuals with autism are not able to generalize skills that they do not possess, first they need an environment that helps them acquire a skill. Should individuals with disabilities be required to habituate themselves to the ‘typical’ standard if they want access and acceptance into the larger society? If we demand ramps and lifts for individuals with limited mobility, why not demand environments that are more accommodating for individuals with autism? Moreover, the benefits of lower stimulus environments should also be beneficial to everyone else. (Leestma, 2015)

Sensory design approach has the ability to adapt the space to the users’ needs, it can provide autistic people safety and comfort, but it can also become an environment that forces them to adapt to certain situations. The fact that skills and knowledge can be acquired in this type of space does not necessarily mean that they can be used in any other environment. If the therapy schedule does not take into consideration the adaptation to new circumstances or higher stimulus spaces, autistic individuals may form a stronger bond to sensory controlled environments, making it harder and harder for them to conduct activities in places such as public schools and classrooms.

Both the Neuro-typical and sensory sensitive approach have valid point in the design of schools and how the built environment can have an impact on individuals with autism. The ideal solution lies in finding a way to implement both theories.

6. DESIGN GUIDELINES FOR LEARNING ENVIRONMENTS BASED ON SENSORY DYSFUNCTION OF AUTISTIC INDIVIDUALS

In spite of the fact that everyone is impacted differently by autism, their education is enhanced by well- designed environment and negatively affected by ill-conceived spaces. After studying differences in sensory perception, analyzing design criteria from different authors, as (Mostafa, 2014) (Humphreys, 2008) (Beaver, 2010) and considering building codes (Hawkings, et al., 2014), similarities in the ways that learning environments are designed became apparent. Many of the buildings shared similar feature in terms of materiality, color, lighting, acoustics, and required facilities.

6.1. Space

The size of schools/environments designed for autism are different from a typical school. Due to the extra spaces associated with an autism education program, as facilities for physical therapy, occupational therapy, speech therapy, psychomotor therapy, sensory rooms, a school designed for autism has a more generous square footage per student. Another reason for the increase in square footage per student is that crowded spaces make autistic individuals uncomfortable which affect their behavior negatively. A generous space standard may help them deal with social stimulus comfortably.

6.2. Adaptability

In classrooms, each function or activity should be physically and visually separated from the remainder of the classroom by low partitions, levels or different flooring materials and colors. (Beaver, 2010) Schools need to be flexible for everyday use and adaptable over time to meet the current and future needs of students and teachers. Flexibility can be then defined as the ability of the space to respond to the students’ new needs and usage patterns through physical rearrangements The environment could also change stimulus level based on the activity, spaces should be allowed to change, furniture and equipment may have to be re-arranged to suit varied activities and diverse needs. However, too much flexibility might cause fear that the environment will suddenly be changed. Which is problematic for individuals with gestalt perception. (Leestma, 2015)

6.3. Sensory zoning and transitions

In accordance with Mostafa (2014) spaces should be organized due to their sensory quality rather than the typical architectural approach of functional zoning. With transitions between areas of high stimulus to areas of low stimulus or from one activity space to the next, there should be a space which allows the student to recalibrate their senses. Gardens, free-play, sensory rooms and some other open spaces may act as transitional areas between the low-stimulus “focus” zones and the high-stimulus “alertness” zones. When moving, for example, from a high stimulus function such as music and movement therapy in the high stimulus zone, to a low-stimulus high focus activity such

as communication therapy the student can pass through the outdoor area and be allowed a few minutes to perform a sensory readjustment to prepare for the upcoming task. (Mostafa, 2014)

6.4. Predictability and way-finding

Classrooms and schools should be easy to read with clear signage, numbering, and configuration, as students with ASD feel nervous when navigating spaces that are unfamiliar to them. The use of contrasting materials in various elements-floor, wall, ceiling, doors- helps visually define and differentiate circulation areas. Providing a physical segregation not only enhances their predictability of the environment and improves their clarity about the space but also helps them in reducing their anxiety and distracted behavior. Straightforward circulation, the use of landmark to assist in wayfinding and picture symbols in all signage promote independence and improve confidence. (Leestma, 2015)

6.5. Escape Spaces

Autistic individuals may feel overwhelmed by other students or classroom settings, the use of these spaces, even if not regularly, is sufficient to reduce the tantrums and outbursts of over-sensitive children, increasing their productivity in class. (Mostafa, 2014). This space is intimate and partially enclosed, located in the lowest stimulus area of the classroom. Here the student can calm down while still remaining in the classroom. Essentially it is a small partitioned area with different items as cushions of various textures, brushes, sand paper, small tents, blankets, fiber optic lights, music headphones and perhaps aromatherapy oils. (Mostafa, 2014). This area can also be used at the beginning and end of classes to help children calm down and prepare to be more receptive to the upcoming tasks. Children show a natural predisposition to want to play outdoors, in the garden, with animals, or simply playing with plants and flowers. Outdoor play environments for children should be more stimulating. This includes the integration of unusual play equipment, water, vegetable or herb gardens (to be grown by the children themselves), and different types of themed spaces. (Hebert, 2003) A sensory garden comprised of textured pathways, water-play, ball pools, sand pits and an aromatherapy herbal garden offers an ideal escape space and provides them with skill training.

6.6. Acoustics

A quality acoustic environment should be a priority. Background and infiltrating noise can be distracting for the pupils. Classrooms should be placed an appropriate distance from road to reduce the noise from traffic. Hard surfaces should be avoided in the classrooms. (Montiel, Mayoral, Navarro Pedreno, & Maiques, 2019) Carpets on the floor reduce the impact of foot traffic and absorb sound. Natural ventilation should be used as much as possible to reduce noise of HVAC systems. (Bettarello, Caniato, Scavuzzo, & Gasparella, 2021)

6.7. Lighting

Having good levels of natural daylight in the classroom is important. Natural light should be provided in all rooms and used as much as possible, windows should be placed above eye level, to reduce the view to the exterior. However, a more important issue is the quality and type of artificial light in use. The use of direct fluorescent lighting should be avoided. Individuals with autism are very vulnerable to the sub-visible flicker, which can cause headaches, eyestrain, and increased repetitive behavior. Lighting also needs to be controllable because different activities require different amounts of light. (Humphreys, 2008) (Beaver, 2010)

6.8. Colors and materiality

Because autistic individuals may see colors with far greater intensity than a neurotypical student, small changes in color can dramatically affect their behavior. Using subtle colors as background and contrasting color as main activity will help to draw their attention. Cooler colors such as blues, greys and purples have a calming effect on students. Visual aids such as color and pattern may be employed in circulation areas to assist way finding. This should be done discreetly to avoid visual over-stimulation. When continuously viewing and understanding a pictorial sign with written words next to each symbol, eventually some written words may begin to be understood by association. (Leestma, 2015)

6.9. Safety

Autistic children are unaware of safety and precautions due to their mental deficits. They are often prone to displaying aggressive behaviors and tantrums making them dangerous to themselves and others. (Leestma, 2015) They are attracted to different objects and sometimes are obsessed with them, forgetting their own safety. Considering that constant supervision not only is difficult, but also hinder independence, the environment itself should be carefully designed avoiding sharp edges, slippery surfaces, electrical outlets, breakable objects and enhancing railing heights, visual cues for harmful objects, secured boundary etc. (Beaver, 2010) (Mostafa, 2014)

7. CONCLUSION

The reason behind then lack of literature and design guidelines for autism, lies in the difficulty of understanding how the user experiences space. It is a difficult task to design for someone whose perception you do not understand.

Furthermore, if we consider the range of sensory perceptions between individuals with autism, designing an environment that is suitable for all seems impossible. However, an effort (even if not ideal) towards designing more inclusive environments, is always better than a withdrawal because of the challenges we face.

Many designers and architects, have been working on building up a methodology that is expected to guide environmental design for education of children with autism, but beside the similarities, they have been facing even polar opposite ideas, as the neurotypical and sensory sensitive approach. As a matter of fact, there is still no genuine research that accurately presents the final results of these two approaches and for this reason we are not able to point out that one approach is better than the other. Currently, the sensory design theory is more accepted by the scientific community. By designing an environment that can “relate to the perceptual world of everyone” designers enable students to express themselves, learn and develop through their surroundings, thereby leading to a celebration of differences and an extension of wellbeing. A flexible design invites different types of action opportunities and encompasses a subjective way of experiencing the world. In general, it is preferable to make the environment compatible with human needs rather than trying to direct and make people fit in a neurotypical perspective.

By studying design references of previous researches in this field, we made an attempt to develop a flexible set of design directives that meet the needs of various abilities and behavioral patterns of autistic individuals and enhance learning. By creating flexible environments that relate to the perceptual world of everyone, designers can help progress our conventional attitudes to the point where different ways of seeing, doing, and behaving are embraced, accepted, and celebrated and wellbeing extended. Designers, need to interact with and listen to these individuals, so they can observe and accurately interpret information derived from the design methods. The future course of study plans to advance in research on this matter.

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