

DESIGNING FOR AUTISM SPECTRUM DISORDERS

KRISTI GAINES, ANGELA BOURNE, MICHELLE PEARSON, AND MESHA KLEIBRINK



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Designing for Autism Spectrum Disorders explains the influence of the natural and man-made environment on individuals with autism spectrum disorders (ASD) and other forms of intellectual/developmental disabilities (IDD). Drawing on the latest research in the fields of environmental psychology and education, the authors show how architecture and interior spaces can positively influence individuals with neurodiversities by modifying factors such as color, lighting, space organization, textures, acoustics, and ventilation. Now you can design homes, therapeutic environments, work environments, and outdoor spaces to encourage growth and learning for the projected 500,000 children with ASD (in the United States alone) who are expected to reach adulthood by 2024.

Topics discussed include:

- Environmental design theories
- Symptoms of ASD
- Sensory processing deficits
- Design needs of individuals on the spectrum at all ages
- Design methods and solutions for spaces, including residential, learning, work, and therapeutic environments encompassing a wide range of budgets
- Designing for self-actualization, well-being, and a high quality of life for the duration of an individual's life
- Avenues for healthy living and aging in place
- Biophilic design
- Environmental impact on well-being
- Strategies to promote active living as an integral part of the welfare focus.

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"Designing for Autism Spectrum Disorders is a much-needed resource for administrators, teachers, care givers, and designers. It will be an invaluable asset that ultimately will improve the built environment for countless children and adults."

RUPAL ENGINEER

Principal, Design Plus LLC, Albuquerque, USA

"Designing for Autism Spectrum Disorders displays inventive environmental designs for people with disabilities, using a unique and sensitive understanding of their strengths and challenges to see these spaces from a different perspective. This attention to detail envisions beautiful spaces that allow those with autism to thrive. My organization will utilize this sensitivity as we grow our community for adults with intellectual disabilities, planning the living and working spaces we will build in the years to come."

CAROL WHITMORE

Director, Admissions and Education Programs,
The Brookwood Community, Texas, USA

DESIGNING FOR
**AUTISM SPECTRUM
DISORDERS**

Kristi Gaines, Angela Bourne,
Michelle Pearson, and Mesha Kleibrink

First published 2016
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Routledge is an imprint of the Taylor & Francis Group,
an informa business

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Library of Congress Cataloguing in Publication Data
Names: Gaines, Kristi, author.

Title: Designing for autism spectrum disorders / Kristi Gaines,
Angela Bourne, Michelle Pearson and Mesha Kleibrink.

Description: New York : Routledge, 2016. | Includes
bibliographical references and index.

Identifiers: LCCN 2015046509 | ISBN 9780415725279 (hardback :
alk. paper) | ISBN 9781315856872 (ebook)

Subjects: LCSH: Senses and sensation in architecture. |
Architecture—Psychological aspects. | Design—Human
factors. | Autism spectrum disorders.

Classification: LCC NA2543.S47 G35 2016 | DDC 720/.47—dc23
LC record available at <http://lccn.loc.gov/2015046509>

ISBN: 978-0-415-72527-9 (hbk)
ISBN: 978-1-315-85687-2 (ebk)

Acquisition Editor: Wendy Fuller
Editorial Assistant: Grace Harrison
Production Editor: Hannah Champney

Designed and typeset by Alex Lazarou

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DEDICATIONS

KRISTI GAINES

To Taylor, for his positive attitude and “can-do” approach to life that makes the world a better place.

To Bruce, Constance, Brandon, Matthew, Brian, Natalie, Connor, and Carson for their love, support, and encouragement.

To my mother, Jo Scott. Throughout her life she modeled a hard work ethic and a desire for excellence. She believed that I could do anything. This book is part of her legacy.

ANGELA BOURNE

To my brother Ted, and all his friends, who made me aware of the needs of people with intellectual and developmental disabilities.

To Greg, my husband, who was always there for me while I spent many hours working on this book and my dissertation.

To Donnie and Vanessa, our children, who also were behind me all the way during the book writing process.

To many supportive friends and family members who accepted me back into their lives after I missed many events to fulfill this challenge.

I love you all.

~Angie and Mom

MICHELLE PEARSON

To Derik for being my biggest supporter and best friend.

To my family, new and old, for all the love and encouragement.

To Capri and Madison for being there through it all. I couldn't have done this without you.

MESHA KLEIBRINK

To Jack, thank you for the impact you made so many years ago. This book is for you.

To Kyler, thank you for your overwhelming amount of support and love. I couldn't do it without you.

To Mom and Dad, thank you for teaching me to believe in myself. Your love and sacrifice have made everything in my life possible.

I love you all.

Illustration credits

FRONT COVER PHOTO

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Sunnyvale, California
- 14.11 Illustrated by Virginia Burt Designs, Ontario, Canada

Acknowledgements

Funding Sources/Grants

American Society of Interior Designers Foundation
Organization for Autism Research
Office of the Vice President for Research, Texas Tech University
College of Human Sciences, Texas Tech University

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Highland High School, Albuquerque, NM, Design Plus, Architects, Albuquerque, NM
Faison School for Autism, Richmond, VA
Intensive Support Hub District Prototype, Albuquerque, NM
Whitton School Kingston Upon Thames, London Borough of Richmond, in London, UK
Acland Burghley School, London Borough of Camden, in London, England
Newmark School, Scotch Plains, NJ
Sunfield 24-Hour Residential School for Children with Severe Learning Disabilities and Autism, London, UK
Little City Foundation, Palatine, IL
Nottingham Regional Society for Autistic Children and Adults, Langley Mill, Nottingham, UK

Housing Communities Designed for People with ASD

Brookwood Community, Berkshire, TX
Bittersweet Farms, Whitehouse, OH
Caphill Village, Copake, NY
Marbridge Foundations, Manchaca, TX
TERI Inc., Oceanside, CA

Introduction to Autism Spectrum Disorders (ASD)

CHAPTER

1

Individuals with Autism Spectrum Disorders are part of a growing population that is usually ignored in design. The needs of those with ASD are excluded entirely from all building codes and design guidelines.¹ This is a serious concern, since these individuals are more sensitive to their physical surroundings than the average person. When an individual is unable to understand or adapt to their environment, negative behaviors typically ensue.² Although the surrounding environment has such a strong influence over people with ASD, there is very little information on how to design spaces for these individuals.

Another prominent challenge involved in designing spaces for individuals with ASD is that no two cases are alike. ASD is referred to as a spectrum disorder because each individual has different symptoms, different sensitivities, and a different level of functioning.³ Symptoms vary from mild to severe; some children on the spectrum have intellectual disabilities or impaired speech, while others do not.⁴ Ideally, spaces would be designed for each individual case and the space would accommodate each unique symptom but also help individuals with ASD build a tolerance to environmental stimuli. McCallister states that environments for individuals on the spectrum should prepare them for the challenges and problems they will face in everyday life: “Cocooning the ASD pupil from all external factors will not necessarily help them reach their full potential in life.”⁵ Therefore, designers should not overly cater to users with ASD and create unrealistic environments that will leave them unprepared to face other environments.

Individuals with Autism Spectrum Disorders (ASD) are particularly sensitive to the surrounding environment, primarily because of sensory processing deficits. For many, sensory processing deficits, such as sensitive eyesight or hearing, can make the built environment a distracting and even frightening place. In her autobiography, Temple Grandin described autism as “seeing the world through a kaleidoscope and trying to listen to a radio station that is jammed with static at the same time. Add to that a broken volume control, which causes the volume to jump erratically from a loud boom to inaudible.”⁶ Many individuals on the spectrum employ coping mechanisms in the form of rigid and repetitive behaviors to deal with incoming sensory stimuli. To an outsider, these behaviors appear like an inappropriate tantrum when in actuality, they are the result of an “imbalance between the environment and an individual’s ability to adapt to it.”⁷ Architecture and interior spaces can be modified to positively influence the behavior individuals

with ASD often exhibit by modifying factors such as color, texture, sense of closure, orientation, acoustics, ventilation, etc.⁸

Background/History

Autism is a developmental disorder that affects the functioning of the brain. Individuals with ASD are identified as having difficulty with social interaction, communication skills, and as having a small range of interests.⁹ IQ levels of individuals on the spectrum can vary in range from gifted to severe mental disabilities. At the mild end of the spectrum, ASD may be nearly indistinguishable from the general public. These individuals are commonly referred to as high functioning. Others with ASD exhibit severe or life-threatening behaviors. Self-injurious behavior is uncommon in individuals with ASD, but may include head banging or biting oneself.¹⁰

According to recent reports, cases of Autism Spectrum Disorders are on the rise. Some of the more recent statistics indicate that one in 68 children is diagnosed with ASD.¹¹ This number has risen from approximately three per 1,000 children in the 1990s.¹² Similar increases have also been documented in Japan, Europe, and the UK.^{13, 14} Whether the increase is due to ASD becoming more prevalent or because autism awareness and detection has broadened is unknown. Some researchers believe the rise is because the diagnostic criteria for ASD now include pervasive developmental disorder (PDD) and Asperger's syndrome.¹⁵ Whatever the reason, the increase in reported cases qualifies as a serious public health concern.¹⁶ Some fear the rise in cases could lead to an ASD epidemic.¹⁷ There are a variety of treatments but, at present, no known cure. Experts do not yet fully understand how or why the disorder even occurs.

Sensory Processing

Individuals with ASD often have abnormal responses to incoming sensory information from the surrounding environment. Typically, people receive information about a space based on all of their senses collectively: smell, sight, taste, sound, and touch. This ability is known as sensory integration and is essential to achieve a coherent perception of a situation and to decide how to act.¹⁸ However,

people with ASD have deficits in sensory integration due to the inability to process information from several senses at once. This may be manifested through being hyper-sensitive to stimuli or being hypo-sensitive (under-reactive) to stimuli. Rapid shifting of attention between two different stimuli is difficult, and abnormal sensory processing can cause individuals with ASD to demonstrate unusual behaviors. Additionally, a dysfunction in this sensory integration may result in language delays and academic under-achievement.^{19, 20, 21} There are some reports of sensory perception deficits in which sounds are perceived as smells or colors.²²

Hypo- and Hyper-sensitivity

Generally, individuals with ASD are either hypo-sensitive or hyper-sensitive to certain information pertaining to smell, sight, taste, sound, or touch. There are also instances of hyper- or hypo-sensitivities in vestibular movement and proprioception, or the ability to sense the position of the body in space. Hypo-sensitive cases appear to be under-responsive, as if certain sensory information goes unnoticed or certain senses are impaired. Young children who were later diagnosed with ASD and had hypo-sensitive auditory tendencies were often thought to be deaf as infants.²³ Hypo-sensitive cases are often qualified as "sensory-seeking," meaning they often create or generate their own sensory experiences either for pleasure or to block out other unpleasant stimuli. Conversely, hyper-sensitive cases are over-responsive to sensory stimuli. Children with hyper-sensitivity can be easily overwhelmed by incoming sensory information. The environment can be terrifying at times because loud or sudden noises feel physically painful to hyper-sensitive individuals.²⁴ Some experts believe that this kind of sensory overload is experienced more among individuals with Asperger's syndrome than other individuals on the spectrum.²⁵ A common occurrence among people with ASD is the inability to use all of the senses at one time and when attempting to use more than one sense, sensory overload occurs. Sometimes these individuals need an "anchor" for their environment: "I had to feel something that stood still, something anchored, in a world that had suddenly become totally unpredictable."²⁶ Individuals with ASD are often slow in shifting focus between visual stimuli and auditory stimuli.²⁷ One individual on the spectrum reported a similar dilemma in that he was unable to use more than one sense at a time: "Most

people have a mind like a flashlight, with an area of high focus, and a larger area of partial awareness; my mind is more like a laser pointer, that highlights only a single small dot.”²⁸

Table 1.1 lists examples of symptoms that individuals with autism may face related to sensory processing and whether the symptoms qualify as hypo-sensitive or hyper-sensitive. Out of the list of sensory processing deficits in Table 1.1, children with ASD appear to exhibit auditory and tactile processing difficulties the most.²⁹

Repetitive and Restricted Behaviors

Individuals with ASD also exhibit repetitive, rigid behaviors. These kinds of behaviors are defined as repetitive, sometimes self-injurious body movements, compulsive behaviors, and limited, almost obsessive interests.³⁰ Self-injurious behaviors, like head banging, are also called “stimming.” These can be dangerous both to the individual and to other individuals nearby.^{31,32} Other examples of

Table 1.1 Hyper- and Hypo-Sensitive Symptoms of ASD.

Sense	Hypo-sensitive	Hyper-sensitive
Auditory (Sound)	Does not respond when name is called; Enjoys strange noises; Enjoys making loud, excessive noises	Overly sensitive to loud noises; Appears to hear noises before others; Cannot function well with background noise
Tactile (Touch)	Touches people and objects unnecessarily; Has abnormally high pain threshold (does not appear to be hurt after a hard fall); Does not appear to feel extreme temperatures	Avoids wearing certain fabrics; Becomes distressed during grooming; Does not like being wet or going barefoot; Reacts negatively to being touched
Visual (Sight)	Disregards people or objects in environment; Can see only outlines of certain objects; Likes bright colors and bright sunlight	Bothered by bright lights (covers eyes or squints); Easily distracted by movement; Stares at certain people or objects
Vestibular (Motion)	Moves around unnecessarily; Enjoys spinning in circles; Becomes excited about any task involving movement	Seems unbalanced; Becomes distressed when upside-down or when feet leave the ground
Smell/Taste (Olfactory)	Some reports of Pica or eating non-food substances; “Feels” objects with mouth; Seeks out strong smells; Oblivious to some scents	Picky eater; Will only eat foods with certain textures, with particular smells, or at a certain temperature
Proprioception (Sense of body's location)	Unaware of body position in space and body sensations like hunger; Often lean against people or objects	Odd bodily posture; Uncomfortable in most positions; Difficulty manipulating small objects

these kinds of repetitive behaviors are finger and hand flicking, rocking, or tapping objects.³³ Many children with high-functioning autism or Asperger's syndrome seem to exhibit more repetitive, self-injurious behaviors and tantrums than other individuals on the autism spectrum.³⁴ One study found that children who exhibit unusual sensory responses were much more likely to also have repetitive behaviors. These behaviors could be the child's attempt to either generate a sensory experience or to try to maintain control over their environment after sensory overload has taken place.³⁵ Often, these behaviors are comforting to the child when an environment is overwhelming.³⁶ In Asperger's syndrome, where difficulty with auditory processing is a common occurrence, repetitive behaviors may be the child's way of staying in control or keeping a grip on their environment when they miss an important auditory clue and become distressed.³⁷ Also quite common among individuals on the spectrum is the desire for a predictable environment. Stimming is repetitive and predictable and may be a way to block out complex and confusing sensory stimuli.³⁸

Narrow interests also fall under the category of repetitive behaviors. A fascinating occurrence is that children with ASD sometimes show remarkable talent and mastery of particular interests, including music, math, or chess.³⁹ Younger children or children that are on the lower functioning end of the spectrum may show an almost obsessive preference for a particular object such as dinosaurs, trains, or baseball. Though these interests can often be a distraction, they can also be used to calm a child or used as a reward for successfully completing homework or doing a chore. Repetitive, rigid behaviors also include insistence on sameness in routine and physical environment. This involves adherence to certain routines or rituals, insistence on the same foods, and wearing only certain types of clothing.⁴⁰ Insistence on sameness can translate to details as small as the order of items on a bookshelf.

Individuals with ASD can become quite upset if their routine is disrupted. Like communication problems, these strong preferences for predictability may also be caused by sensory processing abnormalities. People on the spectrum may dislike being touched or trying new foods because it is uncertain or unreliable but might enjoy touching others or eating only foods with certain textures because it is predictable and familiar.⁴¹ Similarly, younger children might have strong preferences for theme songs, certain melodies, or other sounds and desire to hear them repeatedly.⁴² One explanation for this insistence on sameness and other rigid thinking is the Theory

of Executive Function. Executive functions have to do with cognitive processes like concentration, planning, and attention, and most individuals with ASD are thought to have a lack of control over their executive functions.⁴³ Executive dysfunction in ASD is the reason many individuals on the spectrum have trouble reorienting attention from one task to another and become distressed when routine is disrupted. Poor executive functions lead to poor impulse control, disorganized and inflexible thoughts or actions, and inappropriate, out-of-context behavior.⁴⁴

Difficulties in Communication and Social Interaction

Difficulties with communication and social interactions are another problem experienced by individuals with ASD. Struggles can begin as early as infancy when babies begin communicating with their parents. Signs of ASD in babies can be the delay of speech or babbling and a lack of early uses of gesture, as well as failure to respond to their own name.⁴⁵ Parents of babies later diagnosed with ASD might feel dejected because of the non-communicative behaviors of their infant, which may lead to further complications in teaching and learning communication between parents and children.⁴⁶ Children learn social norms and cultural norms, such as intimacy and the appropriate distance to keep from others, primarily through social play.⁴⁷ Without positive friendships or appropriate play, even more communication and social deficits arise, since having friends provides benefits for all children with or without ASD. Having close friendships can be important for future development, building self-esteem, and helping a child better cope with stressful events.⁴⁸ Children with ASD may struggle to make friends because their play does not attract or engage others, usually due to their highly structured and inflexible nature.⁴⁹ Children often shy away from social interaction, and without consistent, sustained interactions with others, social skills fall even more behind. Frequently, communication deficits lead to extreme isolation or loneliness.⁵⁰

Individuals with ASD may experience problems with social interactions partly because of their repetitive behaviors, as they do not welcome social interaction from others. These kinds of difficulties are more common among individuals with Asperger's

syndrome who have additional difficulty with social and emotional responsiveness.⁵¹ There is also evidence that social engagement is made even more difficult by sensory processing deficits. Some individuals with ASD have revealed that a sensory distraction in the environment has caused them to miss a social cue, making the current situation more confusing and stressful.⁵² Often, children may avoid social interaction, especially in larger groups, because they fear unwanted tactile contact or want to avoid uncomfortable volume levels if they have auditory sensitivities. However, one study disagreed, stating that there was no relationship between sensory deficits and social and communicative symptoms of autism.⁵³

Despite their struggles, individuals on the spectrum can be taught social skills step by step. Most people learn social norms and practices intuitively or through observation; however, individuals with ASD do not easily pick up hidden meanings or unspoken social cues. Many higher functioning individuals learn some social norms and rules for interacting with others, but they do not work for every situation, since other people break these rules or change them.⁵⁴ Children with ASD who have more play dates in their homes then show more initiative and success in social situations at school.⁵⁵ For some children, practicing during play dates can help develop and fine tune social skills.

Many higher functioning individuals, such as those with Asperger's syndrome, are more aware of their own behaviors and more readily notice differences between themselves and others.⁵⁶ Some individuals describe this awareness in autobiographical accounts as a "wide, unbridgeable gap between themselves and other people."⁵⁷ These same autobiographical accounts also describe how individuals on the spectrum feel as if they are outsiders observing the actions of others and trying to understand.⁵⁸ Some individuals with ASD feel lonelier and have lower quality relationships with others because they are more aware of their social limitations and therefore shy away from social communication.⁵⁹ Awareness of being different is not necessarily negative for some of these individuals. Some describe some of their abilities and symptoms, such as picking up on small details that go unnoticed by others or strong memory and recall, with pride.⁶⁰

The Importance of Designing for Autism Spectrum Disorders and Other Developmental Disabilities

ASD is a complicated neurological disorder, and there may never be a time where it is completely understood. Individuals on the spectrum are part of a growing population that is usually ignored in design, even though architects and designers are responsible for accommodating the needs of all users.⁶¹ This book applies evidence-based design methods to a wide range of everyday environments. Designing spaces for individuals with Autism Spectrum Disorders (ASD) can be a way to improve quality of life, foster independence, and ensure safety. The methods outlined in this book will help individuals on the spectrum despite their level of functioning or prevalence of particular symptoms and make the environment safer, more organized, and more comfortable for the user. These symptoms of ASD should not be stifled by parents and designers. These symptoms do not necessarily need to be embraced, but accepted and, if possible, turned into something positive. For example, individuals that are sensory-seeking should not always be discouraged. Instead they should be well-supervised and allowed to play, touch, feel, taste, and smell. Individuals with ASD can be taught what is safe and appropriate and still be allowed to be themselves.

Design professionals, educators, and parents must be aware of the sensory dysfunction experienced by individuals with ASD in order to provide appropriate environments. The underlying premise of this book is that systemic, empirical research combined with pragmatic approaches to design development can contribute to the planning and management of environments that enhance organizational effectiveness. This book will serve as a valuable tool for professionals involved in designing, building, developing, and administering the design of physical environments for individuals with ASD throughout the lifecycle. Educators and parents will also benefit from the contents. Environmental design theories, symptoms of ASD, and design solutions for a variety of spaces will be addressed. Chapters will focus on sensory processing deficits and the design needs of individuals on the spectrum. The remainder of the book will outline a variety of design methods and solutions for spaces, including residential, learning, work, therapeutic, and outdoor environments.

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